TC3221 Defrost Controller Installation Guide

Controller for refrigerated cabinets, undercounters and islands, with energy-saving strategies

PLEASE READ CAREFULLY and save this document

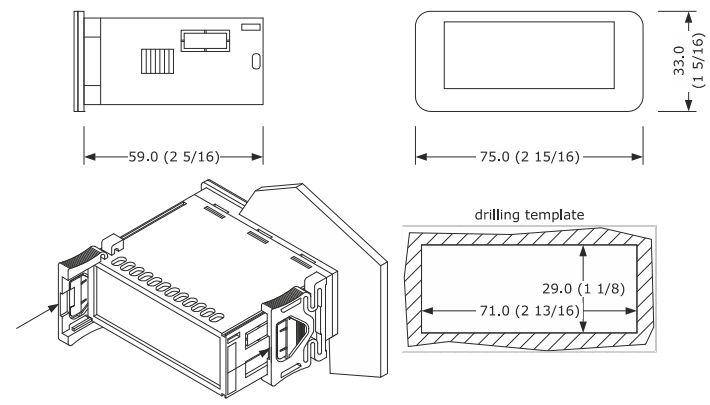
CONSIDER THE ENVIRONMENT

E ENGLISH

- Controller for normal temperature units
- Power supply for TC3221N5x: 115 VAC
- Power supply for TC3221N7x: 230 VAC
- Cabinet probe with a negative temperature coefficient (NTC), 10,000 ohm at 77°F
- Door switch or multi-purpose input
- Alarm buzzer
- TTL MODBUS® subordinate port for Building Management System (BMS)
- Cooling or heating operation

1 MEASUREMENTS AND INSTALLATION

Measurements in mm (inches). Fit the controller to a panel with the snap-in brackets supplied.

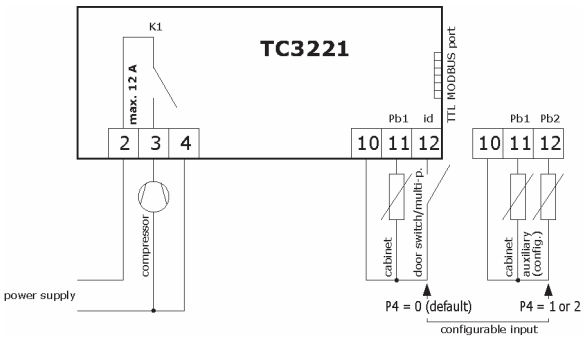


INSTALLATION PRECAUTIONS

- Ensure that the thickness of the panel is between 0.8 mm and 2.0 mm (1/32 in. and 1/16 in.)
- Ensure that the working conditions are within the limits stated in the *TECHNICAL SPECIFICATIONS* section.
- Do not install the device close to heat sources, equipment with a strong magnetic field, in places subject to direct sunlight, rain, damp, excessive dust, mechanical vibrations or shocks.
- In compliance with safety regulations, install the device correctly to ensure adequate protection from contact with electrical parts. Fix all protective parts in such a way so as to need the aid of a tool to remove them.

2 ELECTRICAL CONNECTION

Important
- Use cables of an adequate wire gauge for the current running through them.
- To reduce any electromagnetic interference, connect the power cables as far away as possible from the signal cables.



- Power supply for TC3221N5x: 115 VAC.
- Power supply for TC3221N7x: 230 VAC.

PRECAUTIONS FOR ELECTRICAL CONNECTION

- If you use an electrical or pneumatic screwdriver, adjust the torque to a maximum of 0.5 N•m (4 in. lb).
- If you move the device from a cold to a warm place, the humidity may cause condensation to form inside. Wait an hour before you switch on the power.
- Make sure that the supply voltage, electrical frequency, and power are within the set limits. See *TECHNICAL SPECIFICATIONS*.
- Disconnect the power supply before you do any type of maintenance.
- Do not use the device as safety device.
- For repairs and further information, contact the Penn sales network.

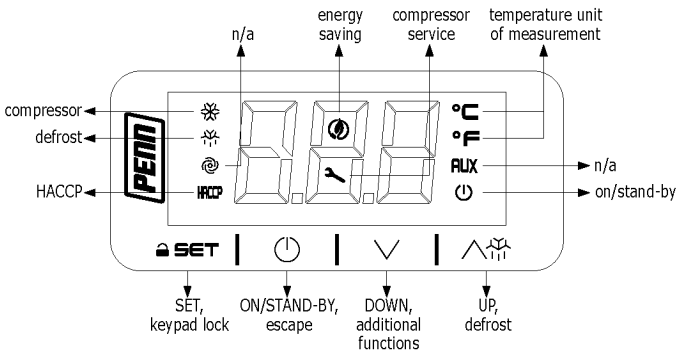
3 FIRST-TIME

1. Follow the instructions in *MEASUREMENTS AND INSTALLATION* to install the controller.
2. Power up the device as shown in *ELECTRICAL CONNECTION* and an internal test runs. The test normally takes a few seconds. When it finishes the display switches off.
3. Configure the device as shown in Table 6.1 in the section *SETTINGS*.
   For recommended configuration parameters for first-time use, see the following table.

PAR.	DEF.	PARAMETER	MIN. - MAX.
SP	**32**	Setpoint	r1 to r2
P2	**1**	Temperature unit of measurement	0 = °C 1 = °F

   Check that the remaining settings are appropriate. See *CONFIGURATION PARAMETERS*.
4. Disconnect the device from the mains.
5. Make the electrical connection as shown in *ELECTRICAL CONNECTION* without powering up the device.
6. Power up the device.

4 USER INTERFACE AND MAIN FUNCTIONS



4.1 Switching the device on or off

1. | ON/STAND-BY | If POF = 1, tap the ON/STAND-BY key for 4 s.

If the device is switched on, the display shows the P5 value, cabinet temperature by default. If the display shows an alarm code, see *ALARMS*.

LED	ON	OFF	FLASHING
❄	Compressor on	Compressor off	- Compressor protection active - Setpoint setting active
❄	Defrost active	-	Dripping active
HACCP	Saved Hazard Analysis and Critical Control Point (HACCP) alarm	-	New HACCP alarm saved
	Energy saving active	-	-
	Request for compressor service	-	- Settings active - Access to additional functions active
°C/°F	View temperature	-	Overcooling or overheating active
	Device off	Device on	Device on or off active

If 30 s elapse and you do not press the keys, the display shows the "**Loc**" label and the keypad locks automatically.

4.2 Unlocking the keypad

Tap any key for 1 s. The display shows the label "**UnL**".

4.3 Setting the setpoint

Check that the keypad is not locked.

1.	SET	Tap the SET key.
2.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the value within the limits r1 and r2.
3.	SET	Tap the SET key or do not operate for 15 s.

4.4 Activating manual defrost (if r5 = 0, default)

Check that the keypad is not locked and that overcooling is not active.

1. | UP | Tap the UP key for 2 s.

If P4 = 1, the defrost activates if the evaporator temperature is lower than the d2 threshold.

4.5 Silencing the buzzer (if A13 = 1)

Tap any key.

5 ADDITIONAL FUNCTIONS

5.1 Activating or deactivating the overcooling, overheating, and manual energy saving

Check that the keypad is not locked.

1. | DOWN | Tap the DOWN key.

FUNCTION	CONDITION	CONSEQUENCE
Overcooling	r5 = 0, r8 = 1 and defrost not active	The setpoint becomes "setpoint - r6", for the r7 duration
Overheating	r5 and r8 = 1	The setpoint becomes "setpoint + r6", for the r7 duration
Energy saving	r5 = 0 and r8 = 2	The setpoint becomes "setpoint + r4", at maximum for HE2 duration

5.2 Navigating the additional functions menu

Before you begin, check that the keypad is not locked.

1.	FNC DOWN	To access the additional functions menu, tap the DOWN key for 4 s.
2.	FNC UP/DOWN	To navigate to a label, tap the UP or DOWN key within 15 s.
3.	SET	To select a label, tap the SET key.
4.	FNC UP/DOWN	If you cannot edit the parameter, the value displays. If you can edit the parameter, tap the UP or DOWN key to navigate to the value that you want.
5.	SET	To set the parameter value, tap the SET key.
6.	ON/STAND-BY	To exit the procedure, tap the ON/STAND-BY key, or do not operate the controller for 60 s.

5.3 Additional functions menu

Use the additional functions menu to cycle through the labels in the following table.

LABEL	VALUE	DESCRIPTION
LS		View HACCP alarm information
	AL	Low temperature alarm information
	AH	High temperature alarm information
	id	Door switch alarm information
	PF	Power failure alarm information, available when you connect a TCIF23TSX accessory
rLS		Delete HACCP alarm information
	149	Command to delete HACCP alarm information
CH		View compressor functioning hours in hundreds
rCH		Delete compressor functioning hours
	149	Command to delete compressor functioning hours
nS1		View compressor start-up number in thousands
Pb1		Cabinet temperature
Pb2		Auxiliary temperature, if P4 = 1 or 2
PrJ		View the project number
rEU		View the firmware revision

5.4 Alarm information example

The following table shows examples of alarm information for a high temperature alarm.

LABEL	SAMPLE VALUE	DESCRIPTION
	8.0	The critical value was 8.0°F or 8.0°C. The critical value can be cabinet temperature or calculated product temperature (CPT).
Sta		The time at which the alarm signaled, for example: 26 March 2015 at 16:30 **Sta** is available when you connect a TCIF23TSX accessory.
	y15	2015
	n03	March
	d26	26 March 2015
	h16	16:xx
	n30	16:30
dur		The alarm duration, for example 1 h 15 min
	h01	1 h
	n15	1 h 15 min

6 SETTINGS

6.1 Setting configuration parameters

1.	SET	Tap the SET key for 4 s. The display shows the label "**PA**".
2.	SET	Tap the SET key. The display shows the label "**PAS**".
3.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the password.
4.	SET	Tap the SET key or do not operate for 15 s. The display shows the label "**SP**".
5.	UP/DOWN	Tap the UP or DOWN key to select a parameter.
6.	SET	Tap the SET key.
7.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the value.
8.	SET	Tap the SET key or do not operate for 15 s.
9.	SET	Tap the SET key for 4 s, or do not operate for 60 s, to exit the procedure.

6.2 Setting the date, time, and day of the week

Note: This feature is available if you connect a TCIF23TSX accessory

Important
Do not disconnect the device from the mains within 2 minutes of setting the time and day of the week.

Check that the keypad is not locked.

1.	DOWN	Tap the DOWN key for 4 s.
2.	UP/DOWN	Tap the UP or DOWN key within 15 s to select the label "**rtc**".
3.	SET	Tap the SET key. The display shows the label "**yy**" followed by the last two figures of the year.
4.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the year.
5.	Repeat actions 3. and 4. to set the next labels.	

LAB.	DESCRIPTION
n	Month (01 to 12)
d	Day (01 to 31)
h	Time (00 to 23)
n	Minute (00 to 59)

6.	SET	Tap the SET key. The display shows the label for the day of the week.
7.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the day of the week.

LAB.	DESCRIPTION
Mon	Monday
tuE	Tuesday
UEd	Wednesday
thu	Thursday
Fri	Friday
Sat	Saturday
Sun	Sunday

8.	SET	Tap the SET key. The device exits the procedure.
9.	ON/STAND-BY	Tap the ON/STAND-BY key to exit the procedure beforehand.

6.3 Restoring the default factory settings and storing customized settings as default

Important
- Check that the factory settings are appropriate; see the section *CONFIGURATION PARAMETERS*.
- When you store customized settings, you overwrite the default.

1.	SET	Tap the SET key for 4 s. The display shows the label "**PA**".
2.	SET	Tap the SET key.
3.	UP/DOWN	Tap the UP or DOWN key within 15 s to set the value.

VAL.	DESCRIPTION
149	Restores the default factory settings
161	Stores customized settings as default

4.	SET	Tap the SET key, or do not operate for 15 s. The display shows the label "**dEF**" when you set the value "**149**" or the label "**MAP**" when you set the value "**161**".
5.	SET	Tap the SET key.
6.	UP/DOWN	Tap the UP or DOWN key within 15 s to set "**4**".
7.	SET	Tap the SET key or do not operate for 15 s. The display shows "- - -" flashing for 4 s, then the device exits the procedure.
8.	Interrupt the power supply to the device.	
9.	SET	Tap the SET key 2 s before step 6. to exit the procedure beforehand.

7 CONFIGURATION PARAMETERS

PAR.	DEF.	SETPOINT	MIN. - MAX.
SP	**32**	Setpoint	r1 to r2
PAR.	**DEF.**	**ANALOG INPUTS**	**MIN. - MAX.**
CA1	**0**	Cabinet probe offset	-25°F/°C to 25°F/°C
CA2	**0**	Auxiliary probe offset	-25°F/°C to 25°F/°C
P0	**1**	Probe type	0 = n/a 1 = NTC
P1	**1**	Enable °C decimal point	0 = No 1 = Yes
P2	**1**	Temperature unit of measurement	0 = °C 1 = °F
P4	**0**	Configurable input function	0 = Door switch/multi-purpose input 1 = Evaporator probe 2 = Condenser probe
P5	**0**	Value displayed	0 = Cabinet temperature 1 = Setpoint 2 = Auxiliary temperature
P8	**5**	Display refresh time	0 to 250 s : 10
PAR.	**DEF.**	**CONTROL**	**MIN. - MAX.**
r0	**4**	Setpoint differential	1°F/°C to 15°F/°C
r1	**-50**	Minimum setpoint	-99°F/°C to r2
r2	**100**	Maximum setpoint	r1 to 199°F/°C
r4	**0**	Setpoint offset in energy saving	0 to 99°F/°C
r5	**0**	Cooling or heating operation	0 = Cooling 1 = Heating
r6	**0**	Setpoint offset in overcooling/overheating	0 to 99°F/°C
r7	**30**	Overcooling/overheating duration	0 min to 240 min
r8	**0**	DOWN key additional function	0 = Disabled 1 = Overcooling or overheating 2 = Energy saving
r12	**0**	Position of the r0 differential	0 = Asymmetric around setpoint 1 = Setpoint + r0 differential
PAR.	**DEF.**	**COMPRESSOR**	**MIN. - MAX.**
C0	**0**	Compressor on delay after power-on	0 min to 240 min
C2	**3**	Compressor off minimum time	0 min to 240 min
C3	**0**	Compressor on minimum time	0 s to 240 s

C4	**10**	Compressor off time during cabinet probe alarm	0 min to 240 min
C5	**10**	Compressor on time during cabinet probe alarm	0 min to 240 min
C6	**176**	Threshold for high condenser temperature warning	0 °F/°C to 199 °F/°C differential = 4°F/2°C
C7	**194**	Threshold for high condenser temperature alarm	0°F/°C to 199°F/°C
C8	**1**	High condenser temperature alarm delay	0 min to 15 min
C10	**0**	Compressor hours for service	0 h to 999 h x 100 0 = disabled
PAR.	DEF.	DEFROST (if r5 = 0)	MIN. - MAX.
d0	**8**	Automatic defrost interval	0 h to 99 h 0 = Only manual If d8 = 3, maximum interval
d2	**46**	Threshold for defrost end	-99°F/°C to 99°F/°C
d3	**30**	Defrost duration	0 min to 99 min If P4 = 1, maximum duration
d4	**0**	Enable defrost at power-on	0 = No 1 = Yes
d5	**0**	Defrost delay after power-on	0 min to 99 min
d6	**2**	Value displayed during defrost	0 = Cabinet temperature 1 = Display locked 2 = dEF label
d7	**0**	Dripping time	0 min to 15 min
d8	**0**	Defrost interval counting mode	0 = Device on hours 1 = Compressor on hours 2 = Hours evaporator temperature < d9 3 = Adaptive 4 = Real time
d9	**32**	Evaporation threshold for automatic defrost interval counting	-99°F/°C to 99°F/°C
d11	**0**	Enable defrost timeout alarm	0 = No 1 = Yes
d18	**40**	Adaptive defrost interval	0 min to 999 min If compressor on and evaporator temperature < d22 0 = only manual
d19	**6**	Threshold for adaptive defrost, relative to optimal evaporation temperature	0°F/°C to 40°F/°C Optimal evaporation temperature - d19
d20	**180**	Compressor on consecutive time for defrost	0 min to 999 min 0 = disabled
d21	**200**	Compressor on consecutive time for defrost after power-on and overcooling	0 min to 500 min If (cabinet temperature - setpoint) > 20°F/10°C 0 = disabled
d22	**-4**	Evaporation threshold for adaptive defrost interval counting, relative to optimal evaporation temperature	-10°F/°C to 10°F/°C Optimal evaporation temperature + d22
PAR.	DEF.	ALARMS	MIN. - MAX.
AA	**0**	Select sensor for high and low temperature alarms	0 = Cabinet temperature 1 = Auxiliary temperature
A1	**-20**	Threshold for low temperature alarm	-99°F/°C to 99°F/°C
A2	**1**	Low temperature alarm type	0 = Disabled 1 = Relative to setpoint 2 = Absolute
A4	**20**	Threshold for high temperature alarm	-99°F/°C to 99°F/°C
A5	**1**	High temperature alarm type	0 = Disabled 1 = Relative to setpoint 2 = Absolute
A6	**12**	High temperature alarm delay after power-on	0 min to 99 min x 10
A7	**15**	High and low temperature alarms delay	0 min to 240 min
A8	**15**	High temperature alarm delay after defrost	0 min to 240 min
A9	**15**	High temperature alarm delay after door closing	0 min to 240 min
A10	**10**	Power failure duration for alarm recording	0 min to 240 min
A11	**4**	High and low temperature alarms reset differential	1°F/°C to 15°F/°C
A12	**2**	Power failure alarm notification type	0 = HACCP LED 1 = HACCP LED + PF label + buzzer 2 = HACCP LED + PF label + buzzer (if duration > A10)
A13	**0**	Enable alarm buzzer	0 = No 1 = Yes
PAR.	DEF.	DIGITAL INPUTS	MIN. - MAX.
i0	**1**	Door switch or multi-purpose input function	0 = None 1 = Compressor off 2 = n/a 3 = n/a 4 = n/a 5 = n/a 6 = n/a 7 = Energy saving 8 = iA alarm 9 = Device on or off 10= Cth alarm 11= th alarm
i1	**0**	Door switch or multi-purpose input activation	0 = With contact closed 1 = With contact open
i2	**30**	Open door alarm delay	-1 min to 120 min -1 = Disabled
i3	**15**	Regulation inhibition maximum time with door open	-1 min to 120 min -1 = Until the closing
i7	**0**	Multi-purpose input alarm delay	-1 min to 120 min -1 = disabled If i0 = 10 or 11, compressor on delay after alarm reset
i10	**0**	Door closed consecutive time for energy saving	0 min to 999 min After regulation temperature < SP 0 = disabled
i13	**180**	Number of door openings for defrost	0 to 240 0 = disabled
i14	**32**	Door open consecutive time for defrost	0 min to 240 min 0 = disabled
PAR.	DEF.	ENERGY SAVING (if r5 = 0)	MIN. - MAX.
HE2	**0**	Energy saving maximum duration	1 min to 999 min 0 = Until the door opening
PAR.	DEF.	REAL TIME ENERGY SAVING (if r5 = 0)	MIN. - MAX.
H01	**0**	Energy saving time	0 h to 23 h
H02	**0**	Energy saving duration	0 h to 24 h
HEd	**7**	Energy saving day	0 = Monday 1 = Tuesday 2 = Wednesday 3 = Thursday 4 = Friday 5 = Saturday 6 = Sunday 7 = none
PAR.	DEF.	REAL TIME DEFROST (if d8 = 4)	MIN. - MAX. (h- = disabled)
Hd1	**h-**	First daily defrost time	h-, 1 to 24
Hd2	**h-**	Second daily defrost time	h-, 1 to 24
Hd3	**h-**	Third daily defrost time	h-, 1 to 24
Hd4	**h-**	Fourth daily defrost time	h-, 1 to 24
Hd5	**h-**	Fifth daily defrost time	h-, 1 to 24
Hd6	**h-**	Sixth daily defrost time	h-, 1 to 24
PAR.	DEF.	SAFETIES	MIN. - MAX.
POF	**1**	Enable ON/STAND-BY key	0 = no 1 = yes
PAS	**0**	Password	-99 to 999 0 = Disabled
PAR.	DEF.	REAL TIME CLOCK	MIN. - MAX.
Hr0	**0**	Enable clock	0 = no 1 = yes
PAR.	DEF.	MODBUS	MIN. - MAX.
LA	**247**	MODBUS address	1 to 247
Lb	**2**	MODBUS baud rate	0 = 2,400 baud 1 = 4,800 baud 2 = 9,600 baud 3 = 19,200 baud Parity even

8 ALARMS

COD.	DESCRIPTION	RESET	REMEDIES
Pr1	Cabinet probe alarm	Automatic	- Check P0 - Check probe integrity - Check electrical connection
Pr2	Auxiliary probe alarm	Automatic	
rtc	Clock alarm	Manual	Set date, time, and day of the week
AL	Low temperature alarm	Automatic	Check AA, A1, and A2
AH	High temperature alarm	Automatic	Check AA, A4, and A5
id	Open door alarm	Automatic	Check i0 and i1
PF	Power failure alarm	Manual	- Tap any key - Check electrical connection
COH	High condenser temperature warning	Automatic	Check C6
CSd	High condenser temperature alarm	Manual	- Switch the device off and on - Check C7
iA	Multi-purpose input alarm	Automatic	Check i0 and i1
Cth	Compressor thermal switch alarm	Automatic	Check i0 and i1
th	Global thermal switch alarm	Manual	- Switch the device off and on - Check i0 and i1
dFd	Defrost timeout alarm	Manual	- Tap any key - Check d2, d3 and d11

9 ELECTRICAL RATINGS

Output	Units	cULus (UL 60730)		CE (EN 60730)
	Applied voltage at 60 Hz	120 VAC	240 VAC	240 VAC
K1 compressor relay	Resistive amperes	12	12	12
	Inductive amperes	—	—	2
	Full load amperes	10	10	—
	Locked rotor amperes	60	60	—

10 TECHNICAL SPECIFICATIONS

Purpose of the control device			Function controller
Construction of the control device			Built-in electronic device
Container			Black, self-extinguishing
Category of heat and fire resistance			D
Measurements			2 15/16 in. x 1 5/16 in. x 2 5/16 in. (75 mm x 33 mm x 59 mm)
Mounting methods for the control device			Fit the controller to a panel with the snap-in brackets supplied
Degree of protection provided by the covering			IP65 in front
Connection method			
Fixed screw terminal blocks for wires up to 2.5 mm²			Micro-MaTch® connector
Maximum permitted length for connection cables			
Power supply: 32.8 ft (10 m)			Analog inputs: 32.8 ft (10 m)
Digital inputs: 32.8 ft (10 m)			Digital outputs: 32.8 ft (10 m)
Operating temperature			From 32°F to 131°F (from 0°C to 55°C)
Storage temperature			From -13°F to 158°F (from -25°C to 70°C)
Operating humidity			Relative humidity without condensate from 10% to 90%
Pollution status of the control device			2
Compliance			
United States			cURus Recognized; File SA516 CCN SDFY2; FCC Compliant to CFR47, Part 15, Subpart B, Class A limits
Canada			cURus Recognized; File SA516 CCN SDFY8; Industry Canada (IC) compliant to Canadian ICES-003, Class A limits
Europe			CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive, Low Voltage Directive, and RoHS Directive
Power supply	TC3221N5x		115 VAC (+10% -15%), 50/60 Hz (+/- 3Hz), max. 2 VA
	TC3221N7x		230 VAC (+10% -15%), 50/60 Hz (+/- 3Hz), max. 2 VA
Grounding methods for the control device			None
Rated impulse-withstand voltage			4 KV
Over-voltage category			III
Software class and structure			A
Analog inputs			1 for NTC probes (cabinet probe)
NTC probes	Sensor type		ß3435 (10 KΩ at 77°F, 25°C)
	Measurement field		-40°F to 221°F (-40°C to 105°C)
	Resolution		1°F (0.1°C)
Other inputs		Input configurable for analog input (auxiliary probe) or digital input (door switch/multi-purpose, dry contact)	
Dry contact		Contact type	5 VDC, 1.5 mA
		Power supply	None
		Protection	None
Digital outputs		1 electro-mechanical relay (compressor relay)	
Type 1 or Type 2 actions			Type 1
Additional features of Type 1 or Type 2 actions			C
Displays			3 digits custom display with function icons
Alarm buzzer			Incorporated
Communication ports			1 TTL MODBUS subordinate port for BMS

11 PRODUCT WARRANTY

This product is covered by a limited warranty, details of which can be found at www.johnsoncontrols.com/buildingswarranty

12 SOFTWARE TERMS

Use of the software that is in (or constitutes) this product, or access to the cloud, or hosted services applicable to this product, if any, is subject to applicable end-user license, open-source software information, and other terms set forth at
www.johnsoncontrols.com/techterms. Your use of this product constitutes an agreement to such terms.

13 SINGLE POINT OF CONTACT

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIJANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS WESTENDHOF 3 45143 ESSEN GERMANY	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

14 CONTACT INFORMATION

Contact your local branch office:
www.johnsoncontrols.com/locations
Contact Johnson Controls:
www.johnsoncontrols.com/contact-us

Important
The device must be disposed of according to local regulations governing the collection of electrical and electronic waste.

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