NGS-20 Instruction Manual

Intelligent refrigerator integrated temperature controller

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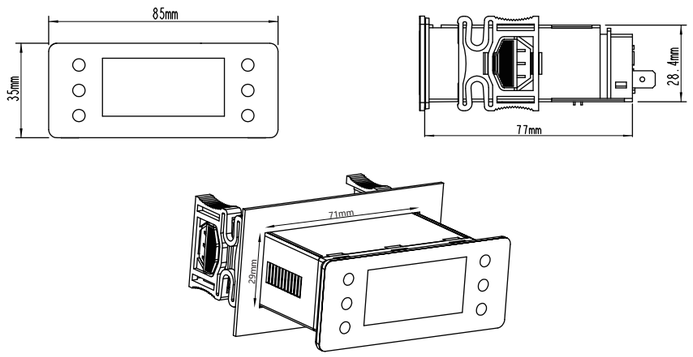
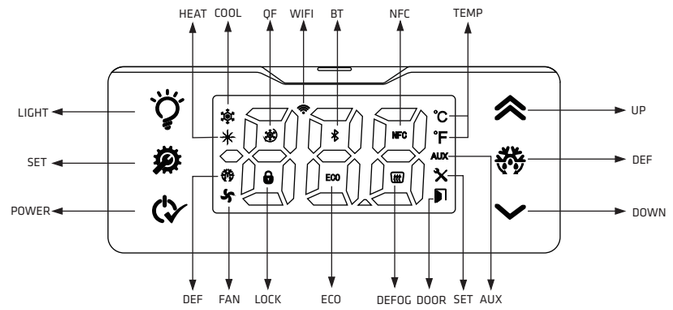
1. Product Overview

- Suitable for various scenarios such as glass display cabinets, air curtain cabinets, island cabinets, convenience cabinets, wine cabinets, etc.
- The refrigeration relay can achieve a maximum output of 30A/240VAC and can directly drive a single-phase 2HP compressor.
- Supports fast configuration via WiFi/Bluetooth/NFC parameters
- Front panel waterproof rating: IP65
- The controller supports 485 communication. It can be used to read and write controller parameters through the upper computer software, as well as to read the working status and fault status. It also supports the standard ModbusRTU protocol.

2. Installation



3. User interface and key operation



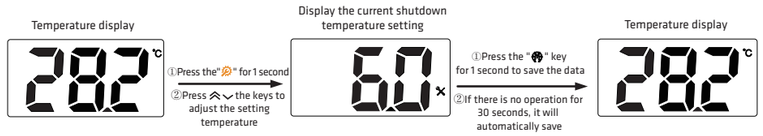
3.1 Indicator status

Icon	Light on	light off	Flicker
	Cooling work	Cooling stops	Cooling delay
	Defrosting work	Defrosting stops	Defrosting dripping
	Fan on	Fan off	——
	Door open	Door off	——
	Parameter Settings	--	——
	Key Locked	Key Unlocked	——
	WIFI connected	WIFI not connected	WIFI connection in (flash) WIFI connection in progress (slow flash)
	Bluetooth connected	Bluetooth not connected	Bluetooth waiting to connect
NFC	NFC works	NFC doesn't work	——

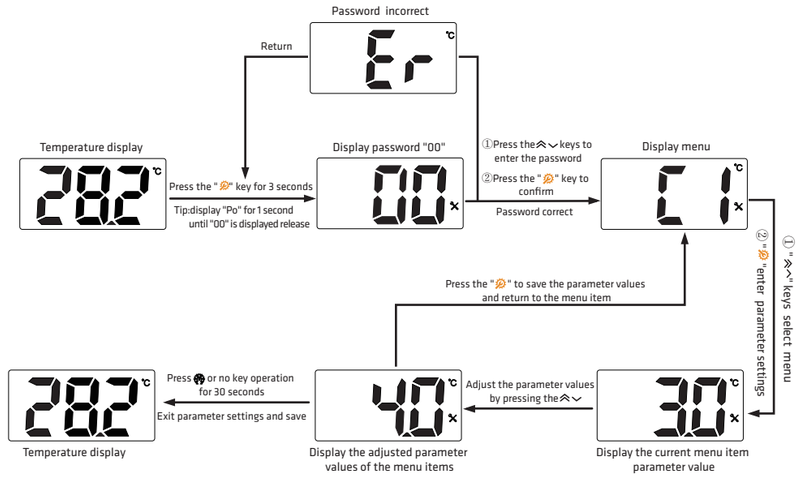
3.2 Key Operation

1) Button unlock: Press and 3 seconds to unlock (will lock automaticall,if no operation in 30s).

2) View and modify cabinet temperature setting values



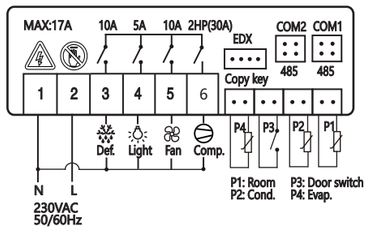
3) Parameter Settings



Note: ① The password for the manager menu can be set through the "Po" parameter in the menu;
② When Po=0, cancel the password, that is, no password is required when entering the manager menu, and"c1" will be displayed directly 3 seconds after pressing the key in the measurement and control state;
③ When you forget the set value of Po, you can use the universal password 125 to enter the manager menu;
④ The password input for the Manager menu is valid only once. When exiting parameter Settings by pressing key or without a key for 30 seconds, the correct password must be entered again for the next adjustment.

4) Check the temperature of the defrosting sensor
In the measurement and control state, press the key to view the current temperature measurement of the defrosting sensor.
5) Manual forced operation
a. In the measurement and control mode, hold down the key for 3 seconds to forcibly switch between cooling, defrosting/defrosting delay, and defrosting drip mode;
b. When the thermostat is in the measurement control or off state, the lighting can be turned on or off by pressing the keys (only for models with light control) , while the rest of the keys are ineffective;
c. When the thermostat is in the measurement control state, hold down the key for 3 seconds, the controller will shut down, all outputs will be turned oFF, and the digital tube will show "OFF";
d. When the thermostat is off, hold down the key for 3 seconds and the controller is restarted;
e. Power-off memory on/off status.

4. Wiring



5. Set the parameters

Icon	Menus	Menu Description	Set the range	Default	Units
	St	Temperature setting values	C5 to C6	4 ℃	℃
	C1	Control hysteresis	0.5～9.0	3.0 ℃	℃
	C2	Minimum interval for compressor startup	0～60	3	min
	C3	Minimum interval for the first start of the compressor	0～90	3	min
	C4	Cabinet temperature sensor calibration	-10.0～10.0	0.0 ℃	℃
	C5	Lower limit of the temperature setting value	-50 ~ St	1 ℃	℃
	C6	Upper limit of temperature setting value	St ~ 85	10 ℃	℃
	C7	Press start Minimum interval time after completion Maximum standby time (Note ①) 0= Prohibition of maximum standby time calculation	0～90	9	min
	C8	Minimum running time for cooling 0= Prohibition of cooling minimum running time calculation	0～90	0	min
	C9	Press forced start time	0～90	0	min
	d1	Evaporator sensor selection: 0= Disabled, 1= Enabled	0～1	0	/
	d2	Evaporator sensor temperature correction	-10.0～10.0	0.0 ℃	℃
	d3	Defrosting cycle calculation method: 0= cumulative cooling time, 1= natural time	0～1	1	/
	d4	Defrosting cycle: 0-90,0 = No defrosting	0～90	4	hour
	d5	Timed Defrosting time (reserved)	0.0～23.5 OFF:Turn off the timed defrosting function	0.0	time
	d6	The defrosting process shows: 0: Shows cabinet temperature; 1: Show dEF during defrosting, delay d9 after defrosting drip is turned on to show cabinet temperature; 2: Display cabinet temperature when defrosting starts, delay d9 after defrosting drip starts to show cabinet temperature; 3: Display temperature setting value during defrosting, delay d9 after defrosting drip is turned on to show cabinet temperature 4: Display dEF during defrosting, and display cabinet temperature when the cabinet temperature is ≤ the set temperature after the defrosting drip is turned on 5: Display the cabinet temperature when defrosting starts and when defrosting dripsstarts, display the cabinet temperature when the cabinet temperature is ≤ the set temperature value 6: Display the set temperature during defrosting, and show the cabinet temperature after the defrosting drip is turned on when the cabinet temperature is ≤ the set temperature	0～6	1	/
	d7	Maximum defrosting time	1～90	25	min
	d8	Defrosting termination temperature	0 ° C to 50	12 ℃	℃ / ℉
	d9	Drip time after defrosting: 0= No drip time after defrosting	0～60	2	min
	d10	Cabinet temperature display delay after defrosting	0～90	10	min
	d11	Delay output time after defrosting start: 0= Cancel defrosting start delay	0～60	0	min
	d12	Defrosting method: 0= electric defrosting, 1= hot air defrosting,2= Natural defrosting	0～2	0	/
	d13	The early start time of the defrosting heating wire	0-30	5	min
	F1	Fan operation mode 0: Starts and stops with refrigeration 1: Work continuously and turn off when defrosting 2: Keep working, defrosting and defrosting dripping off 3: Work continuously, stop during defrosting, delay after defrosting 4: Defrosting probe temperature control, stop when defrosting 5: The fan keeps running 6: Keep working and shut down when dripping 7: Start and stop in conjunction with cooling, and run the fan while defrosting 8: During the refrigeration cycle stage, the fan works while the compressor is working, and when the compressor is off, the fan runs at working time F6 and stops the cycle at F7 9: During the refrigeration cycle, the fan also works when the compressor is working, the fan operates at working F6 time when the compressor is shut down, stops the cycle at F7 time, stops when defrosting, and delays after defrosting	0～9	5	/
	F2	Delay for the first start of the fan after power-on	0～60	0	min
	F3	Fan start delay after defrosting :0= Cancel fan delay	0～60	0	min
	F4	Minimum operating temperature of the fan	-50 ° C to F5	-50	℃
	F5	Maximum operating temperature of the fan	F4 to 85 ℃	50	℃
	F6	Fan proportional start time	1～300	135	Sec
	F7	Wind turbine proportional shutdown time	1～300	75	Sec
	A1	Proportional start-stop in case of cabinet temperature sensor failure: 0= Cancel proportional start-stop, 1= start proportional start-stop	0～1	1	/
	A2	Proportional cooling stop time	1～60	10	min
	A3	Proportional cooling on time	1～60	30	min
	A5	Alarm buzzer delay output	0～30	0	min
	A6	Cabinet temperature exceeds the lower limit alarm value	-50 ℃ to A6	- 5 ℃	℃
	A7	Cabinet temperature exceeds the upper limit alarm value	A5 to 85 ℃	15 ℃	℃
	A8	Cabinet temperature over-temperature alarm delay	0～180	60	min
	A9	Delay of the first cabinet temperature over-temperature alarm when powered on	0～180	120	min
	A10	Over-temperature alarm deviation	1 ℃ to 30 ℃	5 ℃	℃
	A11	Deviation under over-temperature alarm	1 ℃ to 30 ℃	5 ℃	℃
	A12	Over-temperature alarm mode :0= absolute temperature point, 1= Set value+ over-temperature alarm deviation	0～1	0	/
	A13	Light/Alarm relay selection: 0= Light output, 1= Alarm output	0～1	0	/

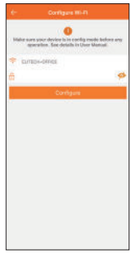
	do1	Door switch control output: 0= Cancel the door switch 1= Turn off the fan when the door is open 2= Turn on the lights when the door is open and turn off the lights when the door is closed 3= Turn off the fan when the door is open, turn on the lights, turn off the lights when the door is closed 4= As a synchronous defrosting signal input when the door is open, start defrosting	0～4	0	/
	do2	Buzzer alarm when the door opens: 0= Disabled, 1= Enabled	0～1	1	/
	do3	The polarity of the door switch :0= closed valid, 1= open valid	0～1	0	/
	do4	Door switch alarm delay	0～60	10	min
	do5	Maximum time to turn off the fan after the door is open (when do1=1,do1=3) 0= Disabled	0～60	10	min
	cd1	Condenser sensor selection, 0= disabled, 1= enabled	0～1	0	/
	cd2	Condenser high temperature alarm start value	30 °C to 90 °C	55 ℃	℃
	cd3	Condenser high temperature alarm lower hysteresis	1～15	5 ℃	℃
	cd4	Condenser high temperature protection start value	30 °C to 90 °C	70 ℃	℃
	cd5	Fahrenheit/Celsius selection (Note ②), 0= Fahrenheit, 1= Celsius	0～365 0: Disable the condenser cleaning reminder function	0	day
	u0	Fahrenheit/Celsius selection (Note ②), 0= Fahrenheit, 1= Celsius	0:Temperature value decimal display 1: Integer display of temperature value	0	/
	u1	Fahrenheit/Celsius selection (Note ②), 0= Fahrenheit, 1= Celsius	0～1	1	/
	u2	Temperature smooth display	0: Turn off smooth display 1:0-20 [represents a change of 0.x units per data update]	0	0
	u3	0: Press, defrosting, fan, lights/alarm 1: Press, fan, defrosting, light/alarm 2: Press, light/alarm, defrosting, fan 3: Press, fan, light/alarm, defrosting 4: Press, defrosting, heating wire, light/alarm	0-4	0	/
	adr	Controller address	1～99	1	/
	Po	Manager menu password (fixed at 55 and not changeable)	0～255	55	/
	Fid	Model code		00	/

Note **①：** Effective only when the cabinet temperature sensor is functioning properly.
Note **②：** After the Celsius/Fahrenheit conversion, the user needs to adjust the values of other relevant parameter items by themselves to ensure the correct parameter configuration.

6. Internal WiFi Provisioning operation (For use with optional built-in WIFI module)

Keep pressing the + key until starts flashing to bring the controller into the reconfiguration state, at which point the WiFi reconfigures (for reconnecting the wifi hotspot)
Indicator light " " status:
Unconnected: Light " " off;
Start networking: The indicator light " "flashes, on for 0.25S, off for 0.25S;
In the network: The indicator light " " flashes slowly, on for 0.5 seconds, off for 0.5 seconds;
Connection successful: Indicator light " " remains on.

The specific distribution steps are as follows:
1. First turn on the Bluetooth on your phone, then open the "Elitech iCold " APP, click the "+" in the upper right corner to scan the QR code (Note 2), and enter the WiFi password.

2. Click [Device has entered distribution mode, Start], the APP pops up the WiFi configuration successful, click OK.

3. Go to Add Device, enter the device name, click Confirm Add, and you can see the added device. You can check the working status and set parameters, etc. through the APP.

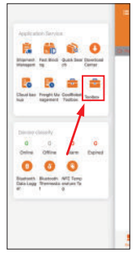

Note 1: This device does not support 5G frequency bands!
Note 2: The distribution network scans the NGS-20 QR code as shown in the picture:

7. NFC function and operation

The device has built-in NFC functionality, allowing the phone to read and write device parameters via NFC and modify them at any time, even when the power is off.

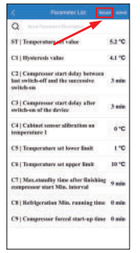
1. Click to enter the toolbox page

2. Open the "toolbox" of the current page



3 After clicking the "NFC" icon, bring the phone close to the thermostat. Once the reading is successful, click the "Parameter List", which shows the configuration parameters of the device.

4. After reading the configuration parameters above, select and modify them, click "Send" and bring the phone's NFC area close to the thermostat, the APP begins to write device parameters via NFC. Once the writing is successful, if the device is powered on, a prompt tone will be emitted indicating that the parameters have been successfully received.

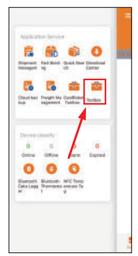


8. Bluetooth operation

If the Bluetooth icon is not lit, you need to manually turn on the Bluetooth. While the key is unlocked, keep pressing the + key until starts flashing and then release.

1. Click to enter the toolbox page

2. Open the Toolbox on the current page



3. Click "Bluetooth" and the currently connected Bluetooth devices will be displayed. Select the operable device and click "OK" to establish a connection between the app and the device. At this point, the thermostat Bluetooth icon is constantly on.

4. For the first connection, the app will get the device status and parameters via Bluetooth.

5. Click on the "Configuration Template", modify any of these parameters, and the APP will automatically send parameters to the device immediately.

6. Click "Device Configuration", the device will scan for 2.4GHz wifi hotspots and display them in a list. Click to select the hotspot you need to connect to, enter the password, and the device will try to connect. At this point, the WIFI icon on the panel will start flashing, and the APP will display the connection result.

7. Click "Fault Diagnosis", and the APP reads and displays the device's fault information.

8. Click "Fault Diagnosis", and the APP reads and displays the device's fault information.

9. Click "Product Test" and the thermostat will display "BLE" indicating that the device is currently under the Bluetooth control of the APP, in which the user can test cooling, defrosting, fan, light relay, horn, display board all on/off, icon on/off, and text display functions. Click Back to exit the mode.

10. Click "Firmware Upgrade", and the APP will compare the version numbers of the device and server. After the user confirms the update, the APP will issue the upgraded firmware.

Note: It is only recommended to use it when there is no hotspot around the device. If the Wi-Fi connection is normal, the device will be updated via Wi-Fi first.

9. Control function

9.1 Refrigeration:

Under normal circumstances:
The cabinet temperature is higher than the temperature set value (St) + control hysteresis (C1), and the refrigeration output is completed after the minimum interval time for the compressor to start;
Refrigeration is off when the cabinet temperature is below the temperature setting value (St) and the continuous refrigeration on time is longer than the C8 setting value.
When the cabinet temperature is between the temperature setting value (St) and the temperature setting value (St) + control hysteresis (C1), if refrigeration is off, the refrigeration output will be completed after the minimum interval time for compressor startup and the maximum standby time (C7) after the minimum interval time for compressor startup is completed.

Note: 1. The minimum interval time for compressor startup is calculated as the minimum interval time (C3) for the first start of the compressor after the controller is powered on, and then as the minimum interval time (C2) for the start of the compressor on.

In case of cabinet temperature sensor failure:
A1=0, when the proportional on/off is cancelled, the refrigeration is off; When A1=1 and proportional start/stop is initiated, the cooling operates periodically according to the set proportional cooling start time (A3) and proportional cooling stop time (A2).

9.2 Defrosting:

1) Do not defrost when d4 = 0.
2) When d4 is not 0, in non-defrosting and non-defrosting dripping state:
① Defrosting cannot be initiated when the evaporator sensor is activated (d1 = 1) and the temperature of the evaporator sensor is higher than the defrosting termination temperature (d7);
② When the evaporator sensor is enabled (d1 = 1) and the evaporator sensor temperature is lower than the defrosting termination temperature (d7) or the evaporator sensor is disabled (d1 = 0) (defrosting can be initiated under any of the following conditions) :
a. When the defrosting cycle (d4) is completed;
Note: The defrosting cycle is calculated based on the selected natural time (d3 = 1) or the cumulative refrigeration time (d3 = 0).
b Press the key continuously for 3 seconds to start defrosting;
c. When the door switch serves as the external synchronous defrosting signal input interface (d01 = 4), defrosting is initiated when the door opens and the external synchronous defrosting signal is input.

Note: Defrosting output after defrosting start delay output time (d10) runs out.

3)Defrosting state (defrosting can be turned off under any of the following conditions) :
① When the evaporator sensor is enabled (d1 = 1), defrosting is turned off when the temperature of the evaporator sensor is higher than the defrosting termination temperature (d7);
② Defrosting is closed when the longest defrosting time (d6) runs out;
③ Hold down the key for 3 seconds to turn off defrosting;
4) After defrosting, enter defrosting dripping state. During the dripping time after defrosting (d8), the cooling output is prohibited. During this period, the dripping produced during defrosting is discharged.
After the defrosting drip time runs out, enter the refrigeration cycle state.

Note: Defrosting method: d11 = 0: Electric defrosting; d11 = 1: Hot air defrosting; d11 = 2: Natural Defrosting.

9.3 Fan:

Fan operation mode:
F1 = 0: The fan starts and stops simultaneously with the refrigeration cycle state; F1 = 1: The fan keeps running and defrosts off;
F1 = 2: The fan keeps running, defrosting and dripping off;
F1 = 3: Fan keeps running, Defrosting off, after Defrosting run after defrosting fan start delay (F3) on;
F1 = 4: Defrosting probe temperature control, stops during defrosting (defrosting sensor temperature > maximum operating temperature of the fan (F5), defrosting sensor temperature < minimum operating temperature of the fan (F4), defrosting sensor failure, defrosting sensor disabled (d1=0), fan stops when the controller is in defrosting state).
F1 = 5: The fan is running continuously
F1=6: Keep working and shut down when dripping
F1=7: Start and stop simultaneously with cooling, and the fan runs during defrosting F1=8: During the refrigeration cycle stage, the fan works while the compressor is working, and when the compressor stops, the fan operates for F6 time and stops for F7 time
F1=9: During the refrigeration cycle, the fan also works while the compressor isworking, the fan operates at F6 time and stops at F7 time when the compressor is shut down, stops during defrosting and delays after defrosting

Note: When the output parameter of the door switch control is selected as 1 or 3, the fan is turned off when the cabinet door is opened, and the fan resumes its working state before the cabinet door was opened when the cabinet door is closed. When the door switch control output parameter is selected as 1 or 3, when the cabinet door is opened and the fan is turned off, if the door is open for more than do5, the fan automatically returns to its previous state.
Note: The fan is allowed to operate only after the first start delay (F2) of the fan after power-on is completed.

9.4 Lighting:

do1=0 or 1 or 4: The light turns on when the key is pressed and turns off when the key is pressed again.
do1=2 or 3: The light turns on when the cabinet door is open and turns off when the cabinet door is closed.

10. Alarm

10.1 Temperature sensor failure Alarm:

Code	Reasons
E1	The cabinet temperature sensor is faulty
E2	Evaporator sensor failure
E3	Condenser sensor failure
CP	Condenser heat protection
cH	Condenser high temperature alarm
rH	Cabinet temperature high alarm
rL	Cabinet temperature low alarm

10.2 Condenser high temperature alarm:

When the condenser temperature exceeds the condenser high temperature alarm start-up value (cd2) while the condenser temperature sensor is activated (cd=1), the condenser high temperature alarm is triggered, the digital tube shows cH without affecting the control output, and the alarm is released after the temperature falls back to the condenser high temperature alarm start-up value (cd2) - condenser high temperature alarm lower hysteresis (cd3).

1) A11=0, the over-limit alarm mode is selected as absolute temperature point;
a. High temperature alarm for cabinet temperature:
When the cabinet temperature is higher than the upper limit of cabinet temperature alarm value (A6) and the delay operation of the cabinet temperature over-limit alarm is completed, the digital tube shows rH, and the alarm is released when the cabinet temperature is lower than the upper limit of cabinet temperature alarm value (A6);
b. Cabinet temperature ultra-low temperature alarm:
When the cabinet temperature is less than the lower limit of cabinet temperature alarm value (A5) and the delay operation of the cabinet temperature over-limit alarm is completed, the digital tube shows rL, and the alarm is released when the cabinet temperature is greater than the lower limit of cabinet temperature alarm value (A5).

2) A11=1, the over-limit alarm mode is selected as set value + over-temperature alarm deviation;
a. High temperature alarm for cabinet temperature:
When the cabinet temperature is higher than the temperature set value (St) + the upper deviation of the over-temperature alarm (A9), and the delay operation of the cabinet temperature over-limit alarm is completed, the digital tube shows rH, and the alarm is released when the temperature is lower than the temperature set value (St) + the upper deviation of the over-temperature alarm (A9);
b. Low temperature alarm for cabinet temperature:
When the cabinet temperature is less than the temperature set value (St) - lower deviation of the over-temperature alarm (A10), and the cabinet temperature over-limit alarm is delayed until the operation is completed, the digital tube shows rL, and the alarm is released when the cabinet temperature is greater than the temperature set value (St) - lower deviation of the over-temperature alarm (A10).
Note: The delay of the cabinet temperature over-limit alarm is calculated as the delay of the first cabinet temperature over-temperature alarm after the controller is powered on for the first time (A8), and then as the delay of the cabinet temperature over-limit alarm (A7) thereafter.

3) When the buzzer sound is selected as allowed output (A4=1), the controller
alarms and the buzzer sounds when the door switch opens (do2 when the door opens whether the buzzer response is required is set to be required);
Mute the buzzer when all alarms are cleared and when the door switch is closed (set to mute the buzzer response when do2 door is opened), or mute by pressing any key.
Note: The buzzer sounds at a frequency of: 0.5S on, 0.5S off.

10.3 External alarm output (A12 = 1) :

The external alarm relay closes when an alarm occurs or when the door switch opens (whether a buzzer response is set to be required when do2 door opens), and opens when all alarms are cleared and when the door switch closes (whether a buzzer response is set to be required when do2 door

11. Technical Specifications

Measurement range	-50 ° C to 99 ° C or -58 ° F to 210 ° F (only when the sensor calibration value is set to 0)
Temperature control range	-50 ℃ to 85 ℃ or -58 ℉ to 185 ℉
Temperature resolution	±1 ° C for -40 ° C to 50 ° C, ±2 ° C for 51 ° C to 70 ° C, and ±3 ° C for others ±2 ℉ for -40 ℉ to 122 ℉, ±4 ℉ for 123 ℉ to 158 ℉, and ±6 ℉ for other purposes
Power supply voltage	110-240VAC 50/60Hz
Overall power consumption	<5W
Working environment temperature	-15 ° C to 60 ° C
Storage temperature:	-15 ° C to 60 ° C
Relative humidity	20% to 85% (no condensation)
Analog input:	3 channels of NTC
Switch quantity input	1 Door switch
Relay output	Press: 30A/2HP/240VAC/ normally open output
	Fan: 10A/240VAC/ normally open output
	Defrosting: 10A/240VAC/ normally open output
	Lighting: 5A/240VAC/ on output

12. Safety Rules

★ DANGER:
- Strictly distinguish the wiring for power supply, relay outputs, sensors, and data lines, etc. Connections must not be misconnected.

Relays must not be overloaded.
- The relay outputs of this product are not isolated contacts. It is strictly forbidden to touch the main control board of the controller while it is powered on.
- All wiring changes must be performed with the power supply disconnected.

★ WARNING:
- This controller must not be used in water or excessively humid environments. It is prohibited to use it in high-temperature environments, areas with strong electromagnetic interference, or highly corrosive environments. Do not immerse temperature sensors in organic solvent solutions.

★ CAUTION:
- The supply voltage must match the voltage labeled on the controller, and the stability of the supply voltage must be ensured.
- To avoid potential interference, it is recommended to maintain an appropriate distance between sensor/data line wiring and power lines.
- When removing a sensor, gently pull it out with slight downward pressure on its tail end.

13.Character Set