ZL-6x0A-R Temperature Controller

Instruction Manual, V4.4

1. Introduction

ZL-6x0A-R Series are thermostat with RS485 communication function. The devices are suitable for control of cold storage, seafood storage, water heater, and so on.

2. Main Function

Cooling or heating mode
Periodic or intellectual defrost
Fan control
Temperature calibration
High/low over temp. warning
Temp. output delay protection
Sensors failure warning
Buzzer warning
External warning input
RS485 communication

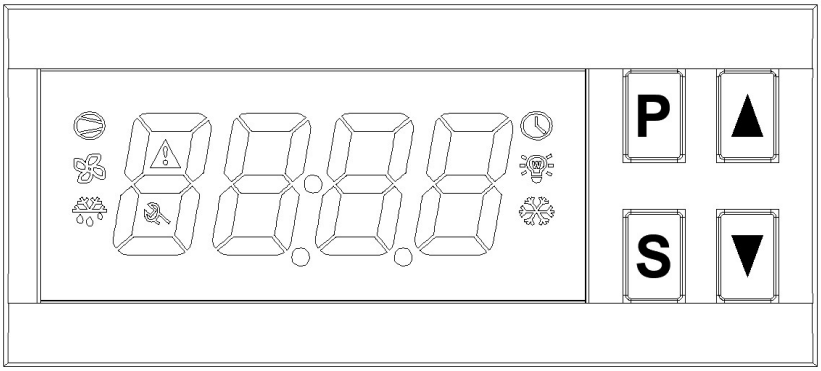
3. Models

Model	Function				
ZL-610A-R	Cooling/heating	Periodic defrost		External warning input	RS485 communication
ZL-620A-R		Intellectual defrost			
ZL-630A-R		Intellectual defrost	Fan control		

4. Main Specification

Sensor wire: 1.5 meters long (sensor included)
Sensor: NTC
Setting range: -40~120℃
Display range: -50~130℃
Power supply: 185~245Vac, 50/60Hz
Terminal wire: ≤ 2*1.5mm^2, or 1*2.5mm^2
Load: 3A, 10A, 250Vac (resistance)
Storage: -30~70℃
Working: -10~45℃
Working: 5~85%RH without dew
Case materials: PC + ABS fire proof
Protection level: IP65 (Front side only)
Dimension: L78 x W34.5 x D71 (mm)
Installation drilling: L71 x W29 (mm)

5. Operation



5.1 Display Icon

Icon	Function	On	Off	Blink
	Temp. Output	Energized	Deenergized	Delay protecting
	Defrost	Defrosting	Not defrosting	Dripping water
	Mode	Cooling mode	----	----
	Mode	Heating mode	----	----
	Maintenance	Need maintenance	No failure found	----
	Warning	Has warning	No warning	----

5.2 Digital Display

Four digits display values in normal condition. They also display warnings as below:

Warning Code	Remark
E01	Room sensor failure (short or open)
E02	Pipe sensor failure (short or open)
Hi	Room temp. Is higher than the high limit
Lo	Room temp. Is lower than the low limit
EE	Memory error
Err	Password error
iA	Internal warning
dEF	Defrosting
UnL	Will restore to factory default settings. For example, the password will be “1111”

5.3 Set Set-Point

Keep〖S〗depressed for 3 seconds to enter into the status. Press〖▲〗or〖▼〗 to set the value (keeping depressed can fast set).

Press 〖S〗to exit, and save the settings.

The status will exit, and the settings will not be saved, if no key operation within 30 seconds.

5.4 Set Parameters

Password:

Keep 〖P〗depressed for 3 seconds, digits show “---0”. Press 〖▼〗to select the digit of the password, press 〖▲〗to set the value of the digit, press 〖S〗 to confirm. If the password is correct, enter into the parameter setting status, else display “Err”, and exit.

Parameter Set:

The display will show “U10”. Press 〖▲〗or 〖▼〗to select the parameter code (see table below), press 〖S〗 to display the value of the code, press 〖▲〗or 〖▼〗to set its value, press 〖S〗to return.

Keep 〖P〗depressed for 3 seconds to exit, and save the settings.

The status will exit, and the settings will not be saved, if no key operation for 30 seconds.

Parameter Code Table

Code	Function	Range	Remark	Factory default	ZL-610A-R	ZL-620A-R	ZL-630A-R
U10	Temp. output stop protection time	0~100 min		3	●	●	●
U11	Temp. output run protection time	0~100 min		3	●	●	●
U12	Temp. output run frequency	0~8	Only for cooling mode, 0 = disable	5	●	●	●
U20	Room sensor calibration	-9.9~+9.9℃		0	●	●	●
U21	Pipe sensor calibration	-9.9~+9.9℃ di	di = disable pipe sensor (also disable defrost function)	0	/	●	●
U22	Hysteresis	0.1~+10.0℃	See paragraph 6.1 and 6.2	1	●	●	●
U30	Defrost period	0~180 hour	0 = disable defrost	12	●	●	●
U31	Defrost time	1~180 min		30	●	●	●
U32	Defrost finish temp.	0.5~50℃		15	/	●	●
U33	Dripping time	0~180 min		5	●	●	●
U34	Over temp. warning delay after defrost	0~180 hour	0 = disable	2	●	●	●
U35	Defrost after online	0~1	0 = disable, 1 = enable	0	●	●	●
U36	Delay for *defrost after online*	0~180 min	0 = disable	0	●	●	●
U37	Remote (host) forced defrost	0~1	1 = remote forced defrosting	0	●	●	●
U38	Defrost type	0~1	0 = Electrical, 1 = Gas or pump	0	/	●	●
U40	Fan start temp.	-45~+120℃		-10	/	/	●
U41	Fan start delay	0~600 sec		60	/	/	●
U42	Fan stop delay	0~600 sec		0	/	/	●
U43	Fan control mode	0~1	0 = controlled, 1 = free	0	/	/	●
U50	Deviation for high temp. warning	0~60℃	0 = disable	0	●	●	●
U51	Deviation for low temp. warning	0~60℃	0 = disable	0	●	●	●
U52	Over temp. warning delay	0~180 min		30	●	●	●
U53	Over temp. warning delay after online	0~180 hour	0 = disable	2	●	●	●
U60	External warning input mode	0~4	0 = disable; 3 = NC, locked 1 = NO, locked; 4 = NC, unlocked 2 = NO, unlocked	0	●	●	●
U61	External warning delay	0~120 min		0	●	●	●
U62	Buzzer warning	0~1	0 = disable, 1 = enable	0	●	●	●
U90	Working mode	CO / HE	CO = cooling, HE = heating	CO	●	●	●
U91	On/offline	On / OFF		On	●	●	●
U96	Controller ID code	0~31	For classification in net	0	●	●	●
U97	Baud rate	0~3	0 = 2400bps; 2 = 9600bps 1 = 4800bps; 3 = 19200bps	3	●	●	●
U98	Modbus slave address	1~ 200		1	●	●	●
U99	Password	0000 ~ 9999		1111	●	●	●

6. Control Function

6.1 Cooling Control

If **Troom** ≥ **Set-point** + U22, and **Temp._output** has stopped for U10, then **Temp._output** energized;
If **Troom** ≤ **Set-point** - U22, and **Temp._output** has run for U11, then **Temp._output** de-energized.

Temp._output forced energized

Keep 〖▼〗 depressed for 5 seconds can force **Temp._output** energized under following conditions:

- **Temp._output** has de-energized for U10;
- **Troom** is between **Set-point** + U22 and **Set-point** - U22;
- Not in defrosting and dripping status.

The forced energized status will end when **Troom** arrives at **Set-point** - U22.

6.2 Heating Control

If **Troom** ≤ **Set-point** - U22, and **Temp._output** has stopped for U10, then **Temp._output** energized;
If **Troom** ≥ **Set-point** + U22, and **Temp._output** has run for U11, then **Temp._output** de-energized.

Temp._output forced energized

Keep 〖▼〗 depressed for 5 seconds can force **Temp._output** energized under following conditions:

- **Temp._output** has de-energized for U10;
- **Troom** is between **Set-point** + U22 and **Set-point** - U22;

The forced energized status will end when **Troom** arrives at **Set-point** + U22.

6.3 Temp._output delay protection

After power supply, **Temp._output** could be energized after U10;
After **Temp._output** de-energized, it could be energized again after U10;
After **Temp._output** energized, it could be de-energized after U11.

6.4 Fan Control Mode (for ZL-630A-R)

Controlled Mode (U43 = 0)

When cooling, if Tpipe ≤ U40, and **Temp._output** has run for U41, fan energized;
If U41 = 0, fan will be energized right after the **Temp._output** energized.
After **Temp._output** has de-energized for U42, fan de-energized.
If U42 = 0, fan will be de-energized right after the **Temp._output** de-energized.

Free Mode (U43 = 1)

Fan will always be energized, except during defrosting.
U40, U41 and U42 have no function in this mode.

6.5 Protecting Run When Room Sensor Fails (for Cooling Mode)

When room sensor fails, **Temp._output** will be energized and de-energized periodically.
For every 30 minutes, **Temp._output** will be energized for Trun = U12 * 3 minutes, de-energized for (30 -Trun) minutes.

6.6 Run When Pipe Sensor Fails

When pipe sensor fails, the defrost function will be canceled (for ZL-620A-R and ZL-630A-R).
When pipe sensor fails, and the fan works in controlled mode, fan will be only works according to U41 and U42 (for ZL-630A-R).

6.7 Defrost (for Cooling Mode)

Defrost Start: After **c** energized for U30, and Tpipe ≤ U32, defrost starts.
Defrost End: When Tpipe ≥ U32, or the defrosting has lasted for U31, defrost ends.
Note: for ZL-610A-R, only acts according to U30 and U31.

Electrical Defrost (U38 = 0): during defrost, **Temp._output** de-energized, defrost relay energized.
Gas or Pump Defrost (U38 = 1): during defrost, **Temp._output** energized, defrost relay energized.

Manually Forced Defrost:

During none-defrost status, keeping 〖▲〗 depressed for 7 seconds will start forced defrost;
During defrost status, keeping 〖▲〗 depressed for 7 seconds will stop forced defrost;

Dripping Water: after defrost finished, the device will be dripping for U33, then start cooling again.
Note: No dripping function: when the manual forced defrost finished, or when the pipe sensor fails.

Check for Tpipe, Left Time of Defrosting, Left Time of Dripping Water:

When Troom displayed, press 〖▲〗 will show Tpipe. ZL-610A-R has not this function
Attention: when this key is depressed for 7 seconds, it will start forced defrost.
When defrosting, press 〖▼〗 will show the left time of defrost.
When dripping, press 〖▼〗 will show the left time of dripping.

7. Buzzer

Every press of key, there will be a short beep. Every confirmation press, there will be a long beep. Every error operation, there will be three short beeps.
When the device has failure, or external warning input:

If U62 = 0, no buzzing warning.
If U62 = 1, there will be continuous buzzing for warning.
Press 〖P〗 can stop warning, if warning condition disappears.

8. Over Temp. Warning

When Troom ≥ **Set-point** + U50, there will be warning if the following condition meets:

U50 > 0 (U50 is not set to 0):
If power just supplied, U53 has passed;
If defrost just finished, U34 has passed;
The Troom keeps up condition for U52.

When Troom ≤ **Set-point** – U51, there will be warning if the following condition meets:

U51 > 0 (U50 is not set to 0):

If power just supplied, U53 has passed;

If defrost just finished, U34 has passed;

The Troom keeps up condition for U52.

9. External Warning Input

NO: normal open. If open, no warning; if closed, warning.

NC: normal close. If closed, no warning; if open, warning.

Locked: Warning keeps after the external warning disappeared. Press〖P〗 to stop warning.

Unlocked: Warning stops after the external warning disappeared.

Note: When there is external warning, the outputs de-energized.

10. Sensor Calibration

The room sensor and pipe sensor can be calibrated by U20 and U21.

11. Restore To Factory Default Settings

Keep〖P〗and〖▲〗depressed simultaneously for 5 sec, there will be a short beep, and “UnL” displays.

Press〖▼〗twice, there will be a beep, all setting will be restored to factory default settings.

12. Checking Controller Information

Keep〖S〗and〖▲〗depressed simultaneously for 5 sec, the controller’s model and version will display.

13. Installation

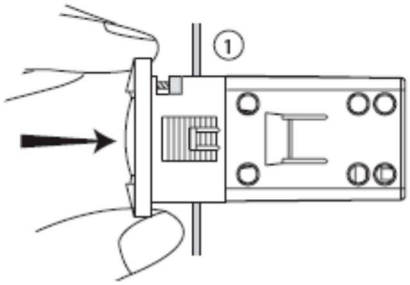
Warning!

Avoid to install controller in the following environment:

- More wet than 90%RH, or easily dew;
- Vibrating, or be shocked;
- Possible sprayed;
- Under erosive air;
- Under explosive air.

Installation

1st: Insert into drilling hole



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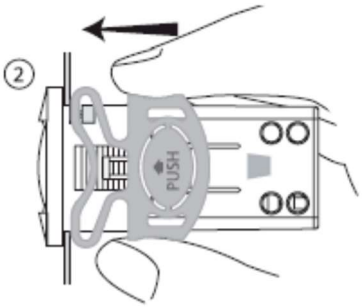
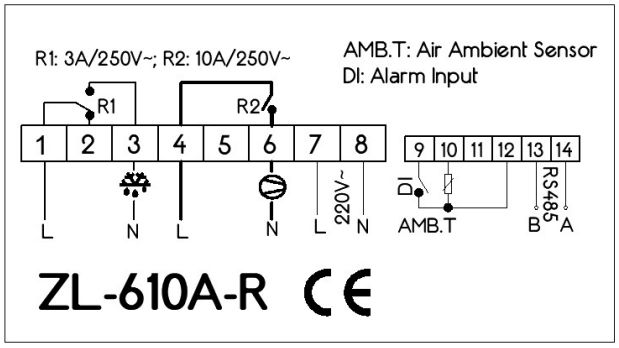


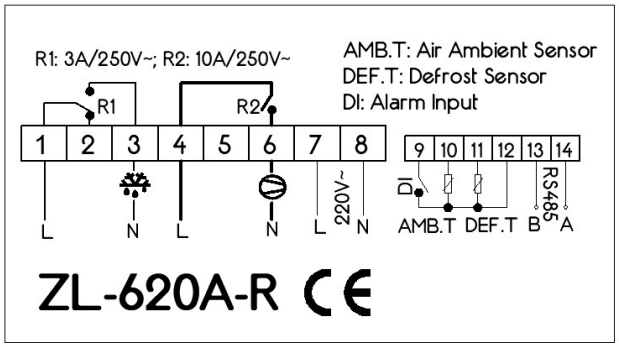
14. Electrical Wiring

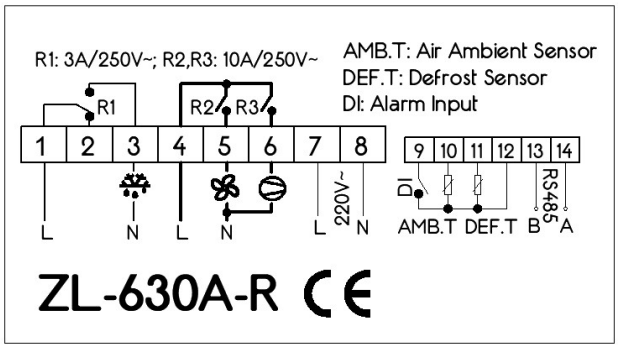
Warning!

- Wiring work should be manipulated by certified technicians;
- Supplied power should within specification requirement;
- Sensor and input signal bundles should not be laid together with power supply bundles, in same pipe;
- Sensor's bundle is better as short as possible. Not wind the redundant length bundle to electrical noise equipment.
- Don't touch inside components;
- Equip safety devices for equipment for equipment protection and human safety. Before supply power, check wiring again.

Electrical Wiring







15. Communication

The controller has RS485 interface, based on Modbus-Rtu protocol:

Communication: serial half duplex;

Baud rate: 2400bps，4800bps，9600bps or 19200bps (default);

Data bit：8 bits (LSB 1st);

Parity: none;

Start bit: 1 bit;

Stop bit: 1 bit.

16. MODBUS-RTU function table

Coils:

Address	Name	RW	Range	Function Code	Remark	ZL-610A-R	ZL-620A-R	ZL-630A-R
Failure								
0	Room sensor failure	R	0~1	0x01	0 = no fail, 1 = fail	●	●	●
1	Pipe sensor failure	R	0~1	0x01	0 = no fail, 1 = fail	/	●	●
2	For future use							
3	For future use							
4	For future use							
5	For future use							
6	For future use							
7	For future use							
8	High temp. warning	R	0~1	0x01	0 = no fail, 1 = fail	●	●	●
9	Low temp. warning	R	0~1	0x01	0 = no fail, 1 = fail	●	●	●
10	External warning input	R	0~1	0x01	0 = no fail, 1 = fail	●	●	●
Coil output								
20	Temp. output	R	0~1	0x01	0 = off, 1 = on	●	●	●
21	Fan output	R	0~1	0x01	0 = off, 1 = on	/	/	●
22	Defrost output	R	0~1	0x01	0 = off, 1 = on	●	●	●
Misc								
50	Remote force defrost	RW		0x01/0x05	0 = off, 1 = on	●	●	●
51	System on/offline	RW		0x01/0x05	0 = off, 1 = on	●	●	●
52	Defrost status	R	0~1	0x01	0 = off, 1 = on	●	●	●

Registers:

Address	Name	RW	Range	Remark	Function Code	ZL-610A-R	ZL-620A-R	ZL-630A-R
0	Room Temp.	R	-50.0~130.0℃	real ×10	0x03	●	●	●
1	Pipe Temp	R	-50.0~130.0℃	real ×10	0x03	/	●	●
7	Temp. output stop protection time	RW	0~100 min		0x03/0x06/0x10	●	●	●
8	Temp. output run protection time	RW	0~100 min		0x03/0x06/0x10	●	●	●
9	Temp. output run frequency	RW	0~8		0x03/0x06/0x10	●	●	●
10	Room sensor calibration	RW	-9.9~+9.9℃	real ×10	0x03/0x06/0x10	●	●	●
11	Pipe sensor calibration	RW	-9.9~+9.9℃ di(0xFF00)	real ×10 disable = 0xFF00	0x03/0x06/0x10	/	●	●
12	Hysteresis	RW	0.1~+10.0℃	real ×10	0x03/0x06/0x10	●	●	●
15	Defrost period	RW	0~180 hour	0 = disable	0x03/0x06/0x10	●	●	●
16	Defrost time	RW	1~180 min		0x03/0x06/0x10	●	●	●
17	Defrost finish temp.	RW	0.5~50℃	0 = disable	0x03/0x06/0x10	/	●	●
18	Dripping time	RW	0~180 min		0x03/0x06/0x10	●	●	●
19	Over temp. warning delay after defrost	RW	0~180 hour		0x03/0x06/0x10	●	●	●
20	Defrost after online	RW	0~1	0 = disable, 1 = enable	0x03/0x06/0x10	●	●	●
21	Delay for *defrost after online*	RW	0~180 min		0x03/0x06/0x10	●	●	●
22	Defrost Mode	RW	0~1	0 = auto, 1 = remote	0x03/0x06/0x10	●	●	●
23	Fan start temp.	RW	-45~+120℃	real ×10	0x03/0x06/0x10	/	/	●
24	Fan start delay	RW	0~600 秒		0x03/0x06/0x10	/	/	●
25	Fan stop delay	RW	0~600 秒		0x03/0x06/0x10	/	/	●
26	Fan control mode	RW	0~1	0 = controlled, 1 = free	0x03/0x06/0x10	/	/	●
31	Deviation for high temp. warning	RW	0~60℃	real ×10	0x03/0x06/0x10	●	●	●
32	Deviation for low temp. warning	RW	0~60℃	real ×10	0x03/0x06/0x10	●	●	●
33	Over temp. warning delay	RW	0~180 min		0x03/0x06/0x10	●	●	●
34	Over temp. warning delay after online	RW	0~180 hour		0x03/0x06/0x10	●	●	●
35	Defrost type	RW	0~1	0 = electrical, 1= gas	0x03/0x06/0x10	●	●	●
36	Controller ID code	RW	0~31		0x03/0x06/0x10	●	●	●
39	External warning input mode	RW	0~4	0 = disable 1 = NO, Locked 2 = NO, Unlocked 3 = NC, Locked 4 = NC, Unlocked	0x03/0x06/0x10	●	●	●
40	External warning delay	RW	0~120 min		0x03/0x06/0x10	●	●	●
41	Buzzer warning	RW	0~1	0 = disable, 1 = enable	0x03/0x06/0x10	●	●	●
42	Remote forced temp. output on	RW	0x0000 / 0xFF00	0xFF00 = forced on	0x03/0x06/0x10	●	●	●
47	Set-point	RW	-40.0~+120.0℃	real ×10	0x03/0x06/0x10	●	●	●
49	Working mode	RW	0~1	0 = cool, 1 = heat	0x03/0x06/0x10	●	●	●
50	Remote (host) forced defrost	RW	0x0000 / 0xFF00	0xFF00 = forced on	0x01/0x05/0x06/0x10	●	●	●
51	Remote On/Off	RW	0x0000 / 0xFF00		0x01/0x05/0x06/0x10	●	●	●
52	Restore to factory default	RW	0~1	1 = restore settings	0x06/0x10	●	●	●
53	Password	RW	0~9999		0x03/0x06/0x10	●	●	●