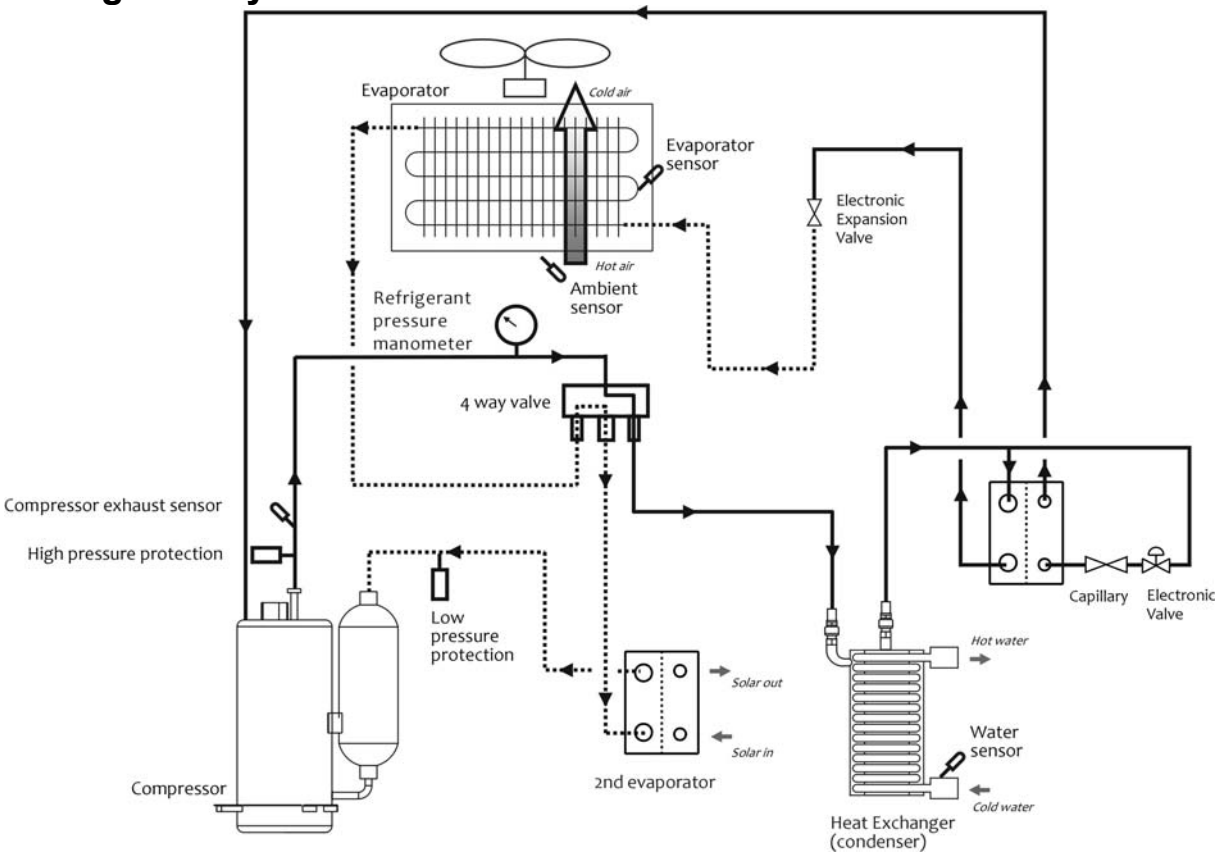
# Air to Water Heat Pump

## User Manual

*Before operating this product, please read the instructions carefully and save this manual for future use.*

# 1. System and Main Components

## 1.1 refrigerant system




## 1.1 Working principle of a Heat Pump :

The refrigerant system consists of 6 main compoments :
Scroll type compressor、4-way-valve、heat exchanger(refrigerant to water)、electronic expansion valve、1st evaporator(air to refrigerant)、2nd evaporator (solar to refrigerant).

A heat pump can absorb the heating from natural heat sources (air, solar , ground). This makes the heat pump a very environmentally friendly and economically sound alternative for space heating.

* 1st evaporator: the low temperature, low pressure refrigerant go through evaporator, to boil and turn from liquid to gas.

* 2nd evaporator : the low temperature, low pressure refrigerant will absorb heating from solar.

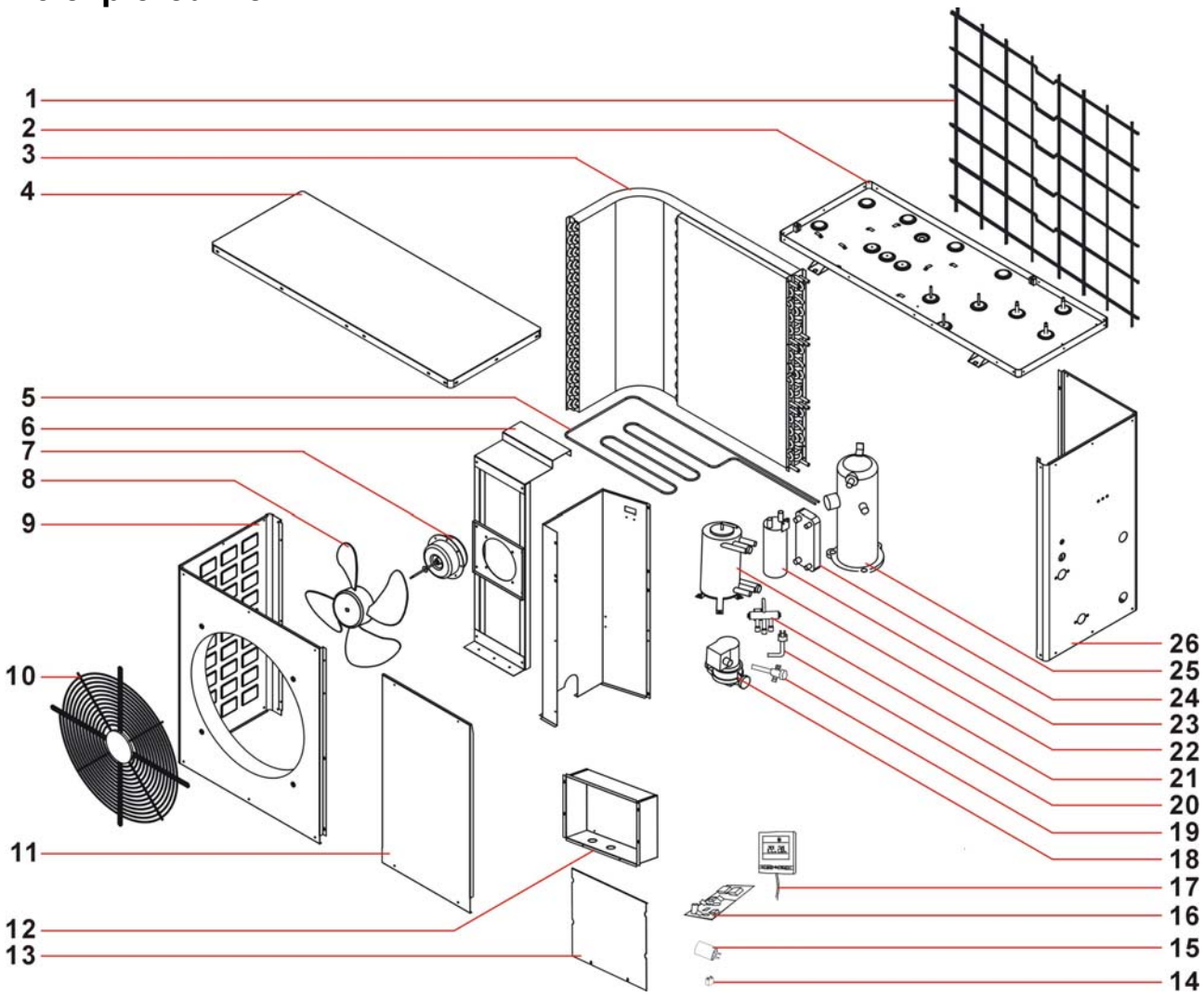
* compressor: compressor absorb refrigerant, and compress to high temperature, high pressure status.

* condenser: the refrigerant continues to the condenser. refrigerant release heat energy to the heat exchanger. the refrigerant temperature reduce, and it return to liquid status.

The heat energy is absorbed by water, circulated by a water pump to indoor radiator or floor heating systems.

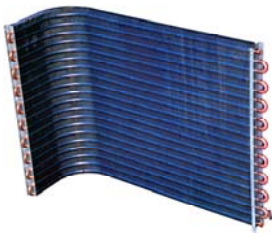
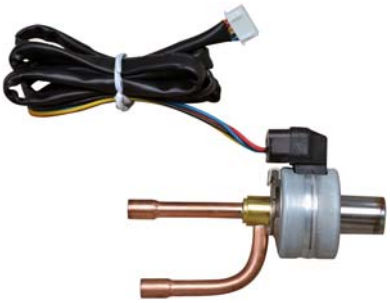
* EEV: at last the refrigerant go through the electronic expansion valve, where its pressure is reduced, and then continues to the evaporator.

## 1.3 explored view



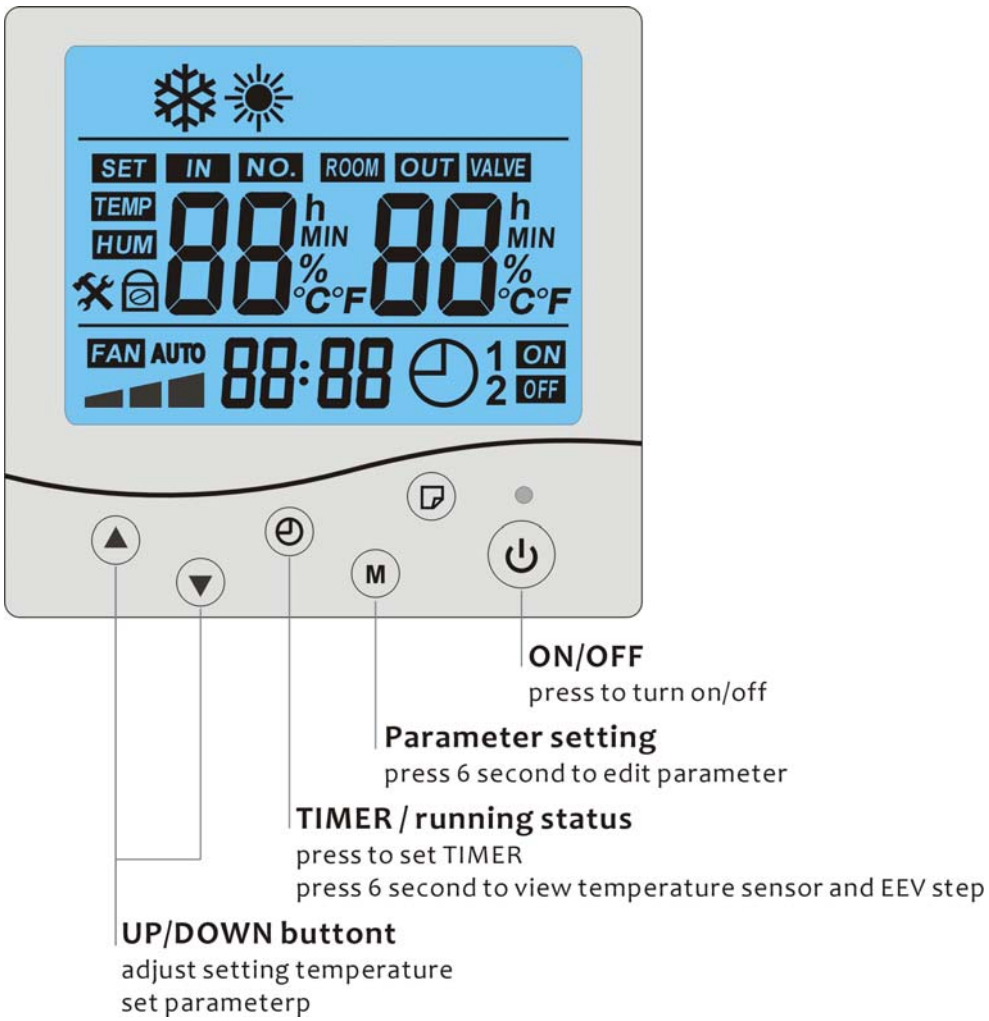

| | | | | |
|---|---|---|---|---|
| 1 | Back net | | 14 | Capacitor for motor |
| 2 | Bottom board | | 15 | Capacitor for compressor |
| 3 | Evaporator | | 16 | PCB |
| 4 | Top board | | 17 | Wire controller |
| 5 | Bottom heater | | 18 | Water pump |
| 6 | Motor bracket | | 19 | Service valve ( vacuum, filling R410a ) |
| 7 | Motor | | 20 | High/low pressure switch |
| 8 | Fan blade | | 21 | 4-way-valve |
| 9 | Front board | | 22 | Heat exchanger |
| 10 | Front net | | 23 | Receiver |
| 11 | Service board | | 24 | Plate exchanger for EVI |
| 12 | Electronic control box | | 25 | Compressor |
| 13 | Cover | | 26 | Right board |

## 1.4 Main Components

| | | |
|---|---|---|
|  compressor |  heat exchanger |  evaporator |
|  Pressure switch |  Fan motor |  Electronic expansion valve |
|  4-way-valve |  PCB |  Wire controller |
|  sensor |  water pump |  Water flow switch |
|  Fan blade |  Electrical heater and holder | |

# 2. Operation Instructions

## 2.1 Introduction of Wire Controller

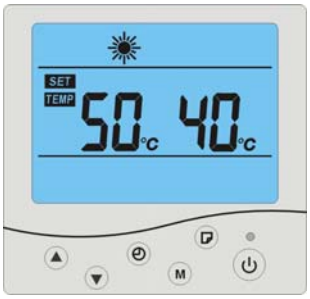



## 2.2 Start and Standby


the display will show mode and current water temperature. The unit is standby.

## 2.3 ON/OFF


Only current water temperature shows.
Press ON/OFF button to turn on the unt.



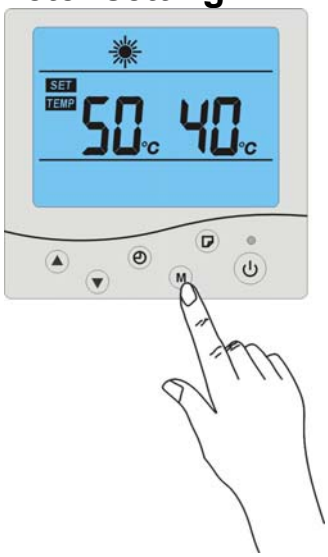

The display shows setting temperature and current water temperature.

## 2.4 temperature setting


Press ▲ button to increase setting temperature by 1 °C .

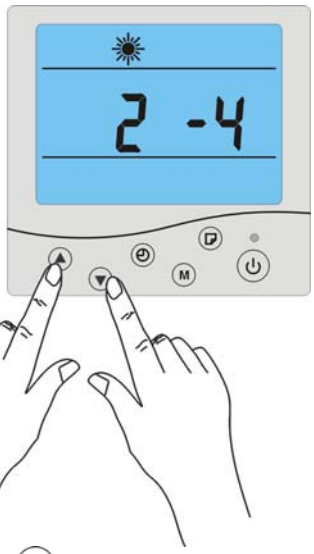
Press ▼ button to reduce setting temperature by 1 °C.

## 2.5 parameter setting



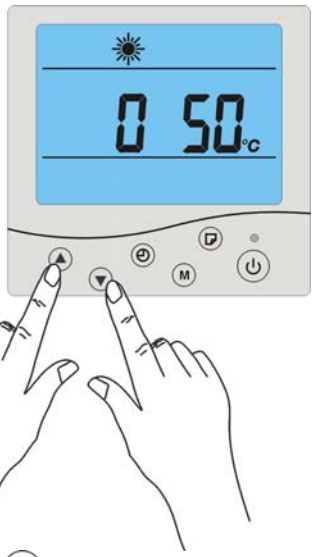

Press (M) button 6 seconds to enter parameter setting interface.


The left data and right data flash at the same time.




Press (▲) and (▼) button to other parameter.


Press (M) button to edit the value of parameter, only right data flash.




Press (▲) and (▼) button to change the value on right data.

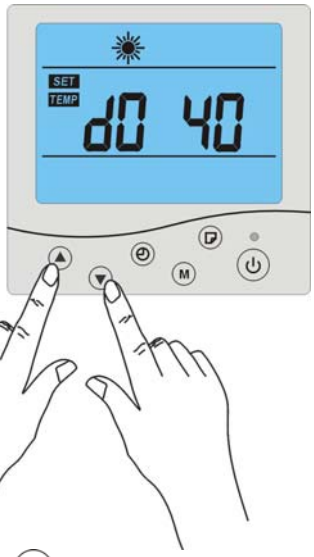

Press (M) button again to exit edit mode of parameter.
Left data and right data flash at the same time.

◎ No press in 30 seconds, it will exit the parameter setting interface.

| Parameter | Description | Range | remarks | Factory setting |
|---|---|---|---|---|
| 0 | Max. setting temperature for HEATING | 7 ~ 65°C | | 50°C |
| 1 | Defrosting start temperature | -20 ~ 10°C | | -4°C |
| 2 | Defrost exit temperature | 5 ~ 45°C | | 8°C |
| 3 | Defrosting period | 30 ~ 150 min | | 30 min |
| 4 | Max defrosting running time | 1 ~ 15 min | | 8 min |
| 5 | Fan stop when compressor temp high than | | | -- |
| 6 | Fan mode :<br>* 0 stop when compressor stop<br>* 1 continue running when compressor stop.<br>stop when press ON/OFF button | | | 0 |
| 7 | Circulation pump mode :<br>* 0 continue running when compressor stop<br>Stop when press ON/OFF button<br>* 1 stop when compressor stop | | | 1 |
| 8 | Automatic restart:<br>* 0 without AUTO-RESTART<br>* 1 with AUTO-RESTART | | Not change | 1 |
| 9 | Mode (heat/coo & heat/cool/2 tank) | 0/1/2/ | Not change | 0 |
| 10 | Setting temperature difference to restart | 1 ~ 10°C | Adjustable | 5°C |
| 11 | Anti-freeze function : 0 without. 1 with | 0/1 | Not change | 1 |
| 12 | Control of electrical expansion valve (EEV) :<br>0 AUTO. 1 manual | 0/1 | Not change | 1 manual |
| 13 | Super heat of EEV on AUTO | -10 ~ 10 | No use | 1 |
| 14 | HEAT : air < 0°C and water < 45°C | 10 ~ 47 | | |
| 15 | HEAT : 1 < air < 10°C and water < 45°C | 10 ~ 47 | | |
| 16 | HEAT : 11 < air < 25°C and water < 45°C | 10 ~ 47 | | |
| 17 | HEAT : air > 26°C and water < 45°C | 10 ~ 47 | | |
| 18 | HEAT : air < 0°C and water > 45°C | 10 ~ 47 | | |
| 19 | HEAT : 1 < air < 10°C and water > 45°C | 10 ~ 47 | | |
| 20 | HEAT : 11 < air < 25°C and water > 45°C | 10 ~ 47 | | |
| 21 | HEAT : air > 26°C and water > 45°C | 10 ~ 47 | | |
| 22 | COOL : air < 35°C and water < 35°C | 10 ~ 47 | | |
| 23 | COOL : air < 35°C and water > 35°C | 10 ~ 47 | | |
| 24 | COOL : air > 35°C and water < 35°C | 10 ~ 47 | | |
| 25 | COOL : air > 35°C and water > 40°C | 10 ~ 47 | | |

## 2.6 check temperature sensor


Press button 6 seconds to check running status.




Press button to check other parameter.

| Parameter | Description |
|---|---|
| d0 | Water temperature sensor |
| d1 | Air inlet temperature sensor |
| d2 | Compressor exhaust tempeature sensor |
| d3 | Evaporator inlet temperature sensor |
| d4 | Evaporator outlet temperature senor |
| d5 | Air outlet temperature sensor |
| d6 | Current step of EEV |

## 2.7 Lock the wire controller



press button 6 seconds at the same time,
one buzzing will be heared to indicate that all buttons are locked. Press again to unlock button.

# 3. Maintenance

## 3.1 Automatic defrosting

defrosting only run in heating mode.

● Start of defrosting :

The defrosting will start when all following conditions are at the same time fulfilled:

- the evporator sensor temperature goes down to -4°C *( parameter 01 )*
- the compressor continue to runs 30 minutes *(parameter 03 )*

● Action of defrosting :

- The compressor and the fan stop
- After 20 seconds, the 4 way valve switch ON.
- 1 minute later, the compressor starts alone, and hot refrigerant will enter into evaporator, the ice on evaporator will be melt, that is generally with a steam.

● Stop of defrosting:

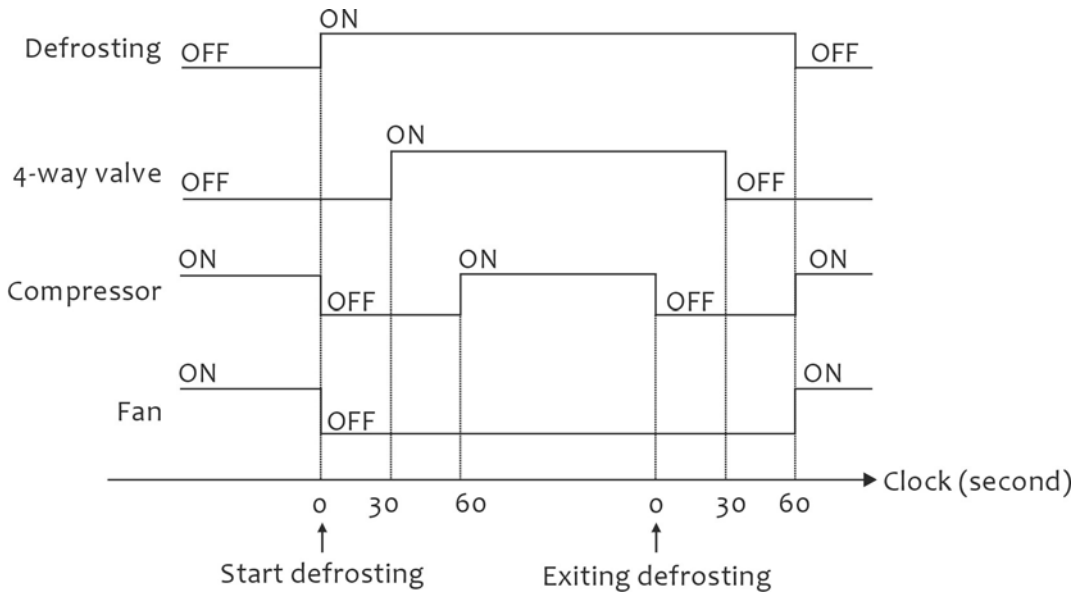
The defrosting stops when one of the following conditions is fulfilled:

- evaporator sensr increase to 8°C *( parameter 01 )*
- compressor run totally 8 minutes *( parameter 04 )*

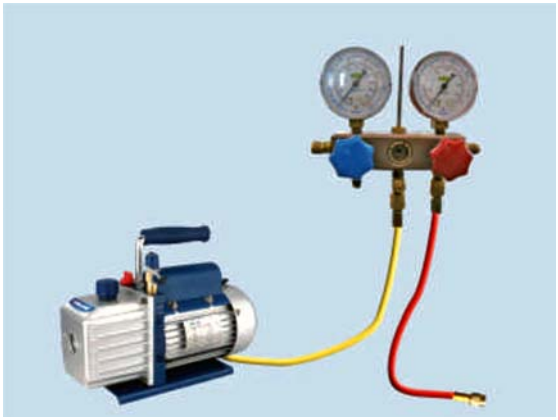
● Action of exist defrosting :

- The compressor stops
- the 4 way valve switch off 30 seconds
- 1 minute later, compressor and fan start for restarting in heating mode.

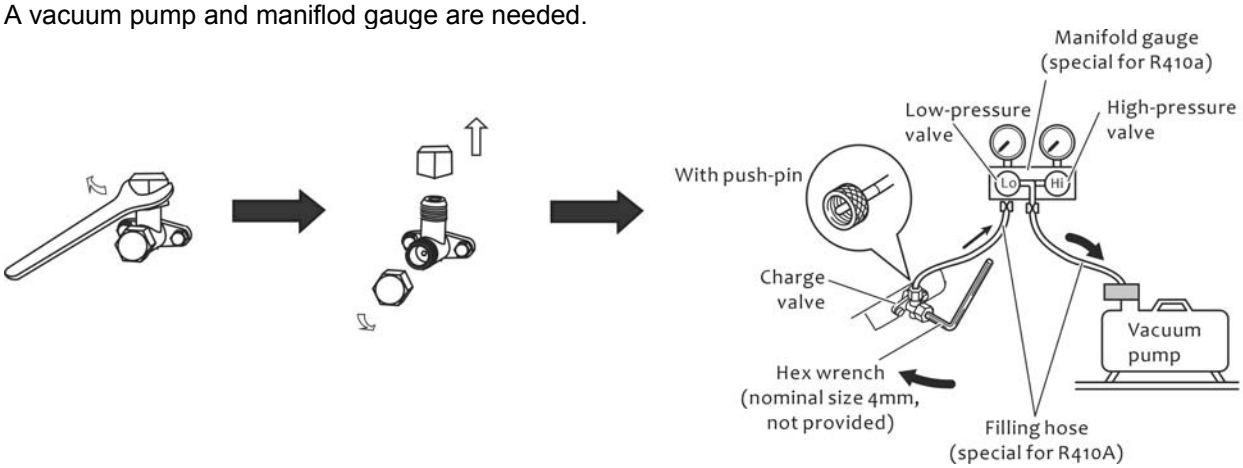
**⚠WARNING** if not necessary, please do not change defrosting parameter setting.




## 3.2 Vacuum



A vacuum pump and maniflod gauge are needed.

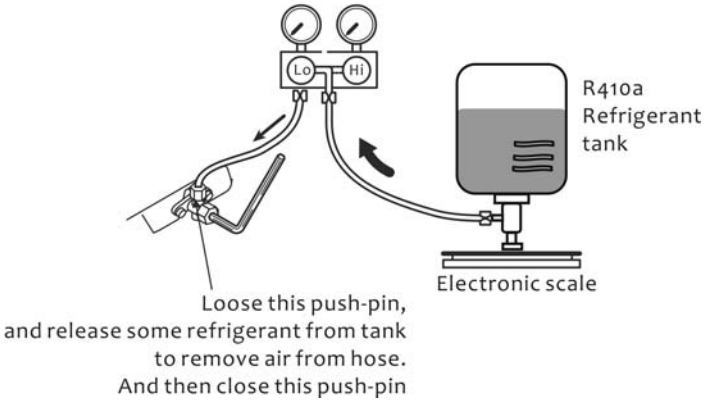



Remove the copper nut. Connect the pressure gauge to the vacuum pump.Vacuum heat pump at least 15 minutes till negative value shown on the pressure gauge, and close the charge valve.

## 3.3 Filling refrigerant

Refrigerant is very stable and should not degrade or break down even under severe operating conditions. If the unit has a leak in the sealed refrigeration system, please locate the leakage and repaired before charge refrigerant.

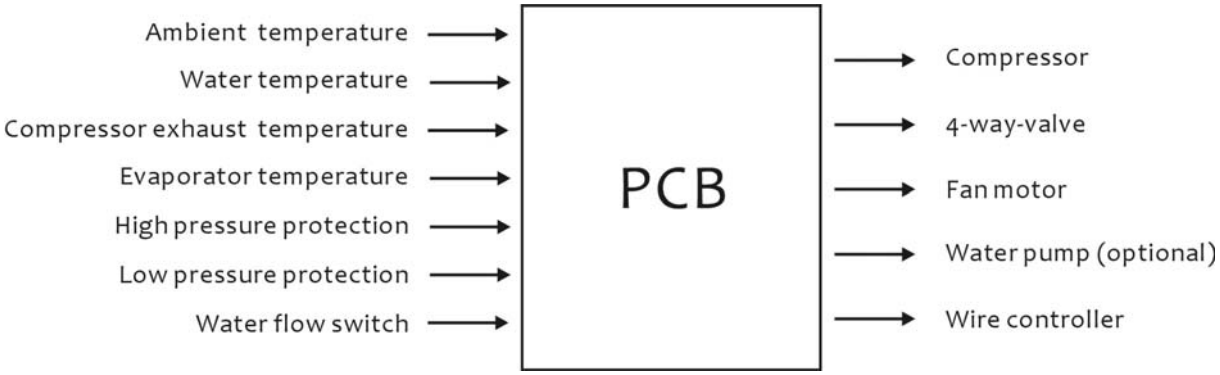
**⚠WARNING** refrigerant charging must be performed by qualified person.




Loose the push-pin, and release some refrigerant from tank to remove air from hose. And then close push-pin.

Open the charge valve by hex wrench, fill refrigerant into heat pump. And close the charge valve when fill enough refrigerant into heat pump.

## 3.4 Working of PCB




This PCB is specially designed for ventilation air to water heat pump, if can offer :
1. operation mode : heating
2. parameter adjustable for easy operation
3. water pump controlled
4. auto-protecting, alarming function
5. with a lots of protections : compressor 3 minutes delay protection, high/low pressure protection, over-heat protection, sensor protection.

## 3.5 Water Heating

Hot water setting temperature can be set in range 7 ~ 55°C.

# 4. Trouble Shoot

## 4. 1 Regular maintenance

(1) Check and clean air filter regularly.
(2) The unit is installed in clean, dry, and well-ventilated places, and should not be blocked on its air inlet and outlet.
(3) Clean regularyly the evaporator in order to keep it in good performance.
(4) Watch the functioning of each part and check the gas pressure regularyly

## 4.2 Not enough heating

The unit works normally but there is no or insufficient cooling.
(1) first check the air inlet temperature, water inlet temperature.
(2) Check if it has ventilation obstacle.
(3) Check the general power supply is correct and if the refrigerant inside is enough.
solution : find the gas leakage and recharge the unit.

## 4.3 unit do not work

The display do not light up and the fan, compressor do not start.
Possible reason : no electrical power supply
Solution : check the power supply, wiring, fuses...

### Figure 1 : Error code, failures and solutions

| Code | Error | Analyse | Solution |
|---|---|---|---|
| E 01 | Water temperature sensor failure | Sensor fail.<br>Sensr is disconnected, or short-circuit | Check the value of sensor and change it<br>Check the wiring connection of sensor |
| E 02 | Ambient temperature sensor failure | | |
| E 03 | Compressor exhaust temperature failue | | |
| E 04 | Defrosting temperature sensor failure | | |
| E 05 | Evaporator outlet sensor failure | | |
| E 06 | Sensor for anti-freeze | | |
| E 07 | Water flow protection | | |
| E 08 | Wire control communication error | Signal cable of wire control is loose | Check the connection of signal cable |
| E 09 | High pressure protection | protector is disconnected, or defective.<br>Refrigerant pressure abnormal<br>Water inlet temperature is too high<br>Air inlet temperature is too high<br>EEV step setting is wrong | Call a refrigerating engineer to check refrigerant pressure |
| E 10 | Low pressure protection | protector is disconnected, or defective.<br>Refrigerant pressure abnormal<br>Water inlet temperature is too high<br>Air inlet temperature is too high<br>EEV step setting is wrong | Call a refrigerating engineer to check refrigerant pressure |
| *E 11* | Compressor over-heat protection<br>Compressor exhaust temperature is more than 115'c. | Environment problem<br>Refrigerant leakage<br>EEV step setting is wrong. | Call a refrigerating engineer to check refrigerant pressure |
| *E12* | Anti-freeze protection | | |
| *E13* | Phase protection | | |

**1) Alarm sensor ( E01, E02, E03, E04, E05, E06 )**

| Cause | Troubleshooting | remedy |
|---|---|---|
| Sensor fault alternatively cable fault. | * When reading the resistance of the sensors, the sensor leads must first be disconnected from the control equipment or terminal block. | If the sensor gives a correct value, the cable is defective, check if cable is broken.<br><br>If the sensor does not give a correct value, the |

| | | |
|---|---|---|
| | * First take a reading from the sensor including cable and check against the temperature sensor resistance table.<br>* If the read off value does not correspond with the table, only measure the sensor and check the table. | sensor is defective, replace it. |

3) Message: E08 ( communication error between wire controller and PCB )

| Cause | Troubleshooting | remedy |
|---|---|---|
| Cable is broken or connector is loose or wet. | | Check cable and loose. |

4) Message: E09 ( high pressure protection ).

| Cause | Troubleshooting | remedy |
|---|---|---|
| EEV step setting is wrong | Press button 6 second to check d3, d4, d6. | Change value of parameter 22, 23, 24, 25. |
| Cable break or loose cable to high pressure switch | * Check that both cables are connected to the pressure switch.<br>* Using the buzzer, check that there are no cable breaks. In order to do this, disconnect the cables from the pressure switch and circuit board. | If a cable has come loose, reconnect it.<br><br>If there is a cable break, replace the cable. |
| Overfilled refrigerant circuit. | Using manometer apparatus and thermometer, check that the unit's overheating is correct for the specific refrigerant. | Follow the correct procedure (depending on type of refrigerant) to add/remove the correct amount of refrigerant. |
| Blocked on the water side. | If there is no strainer in water system, there is a risk of dirt sticking in heat exchanger and value ; and blocking it. Unfortunately<br>there is no easy way of checking if the condenser is blocked. | If the heat exchanger or water-adjust-valve is blocked, try flushing it. If this does not work, it must be replaced. |
| Blocked on the refrigerant side. | Using manometer apparatus and thermometer, check that the unit's overheating is correct for the specific refrigerant. | |

5) Message: E 10 ( low pressure protection )

| Cause | Troubleshooting | remedy |
|---|---|---|
| Lack of refrigerant. | Using manometer apparatus and thermometer, check that the unit's overheating is correct for the specific refrigerant. | Follow the correct procedure (depending on type of refrigerant) to add the correct amount of refrigerant.<br><br>If there appears to be a leak in the refrigerant circuit, carry out leak tracing and any necessary corrective action. |
| EEV step setting is wrong | * Using manometer apparatus and Thermometer check what the over heating reading of the unit is.<br><br>* Also check EEV is damaged. | If the overheating reading does not correspond with the instructions for the specific refrigerant, adjust the EEV step until the correct value is obtained.<br><br>If overheating cannot be adjusted with EEV , replace another EEV. |
| Cable break or loose cable on low pressure switch | * Check that both cables are connected to the pressure switch.<br>* Using the buzzer, check that there are no cable breaks. In order to do this, | If a cable has come loose, reconnect it.<br><br>If there is a cable break, replace the |

| | | |
|---|---|---|
| | disconnect<br>the cables from the pressure switch and circuit board. | cable. |

**5) Message: E 11 ( compressor over-heat protection )**

| Cause | Troubleshooting | remedy |
|---|---|---|
| Lack of refrigerant, not enough refrigerant in the system. | Using manometer apparatus and thermometer, check that the unit's overheating is correct for the specific refrigerant. | Follow the correct procedure (depending on type of refrigerant) to add the correct amount of refrigerant.<br>If there appears to be a leak in the refrigerant circuit, carry out leak tracing and any necessary corrective action. If leak tracer is not available, brush soap water on the suspected leak and look for bubbles.<br>Also check for oil as this can come out from the refrigerant circuit. |

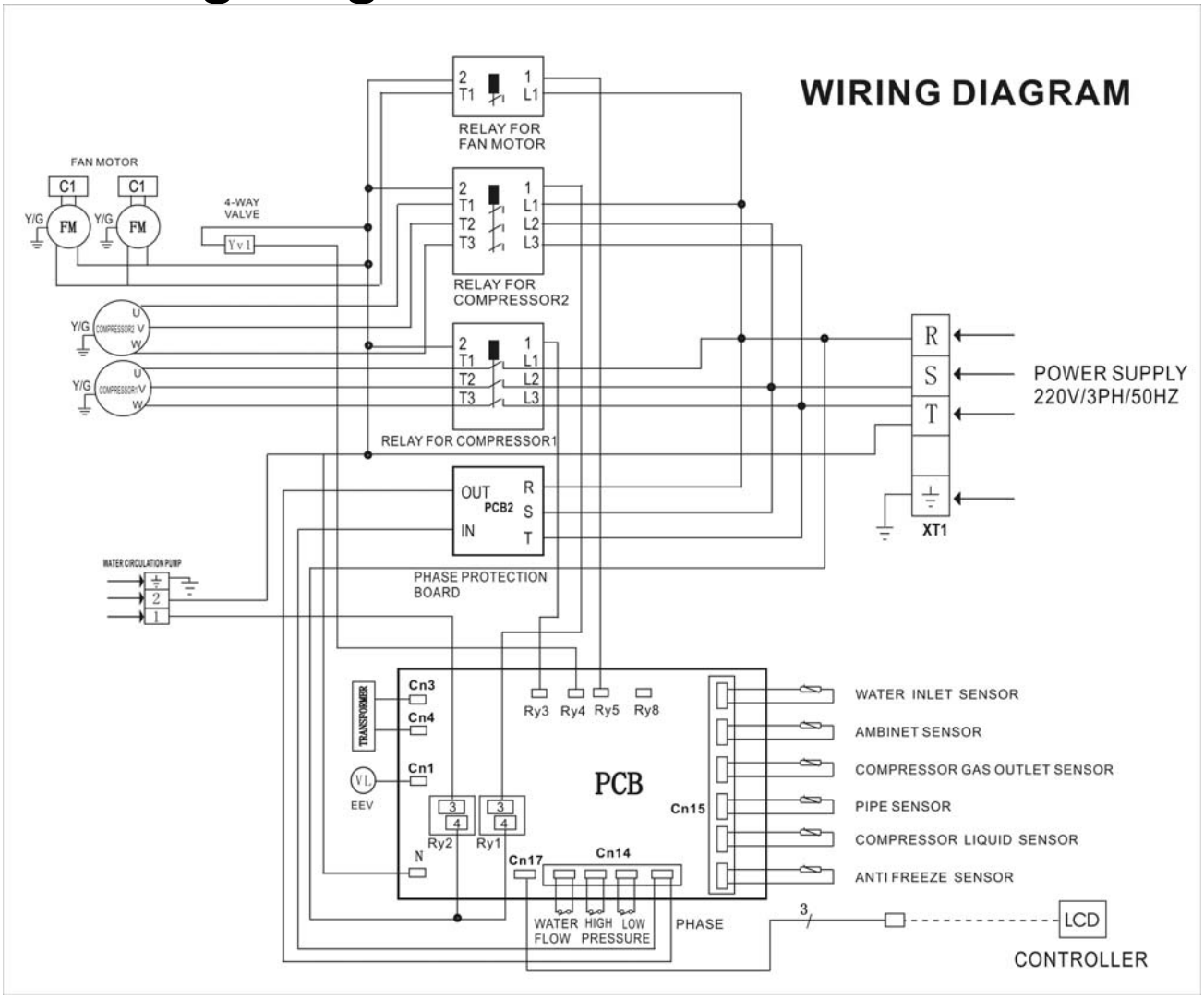
★ unit noise

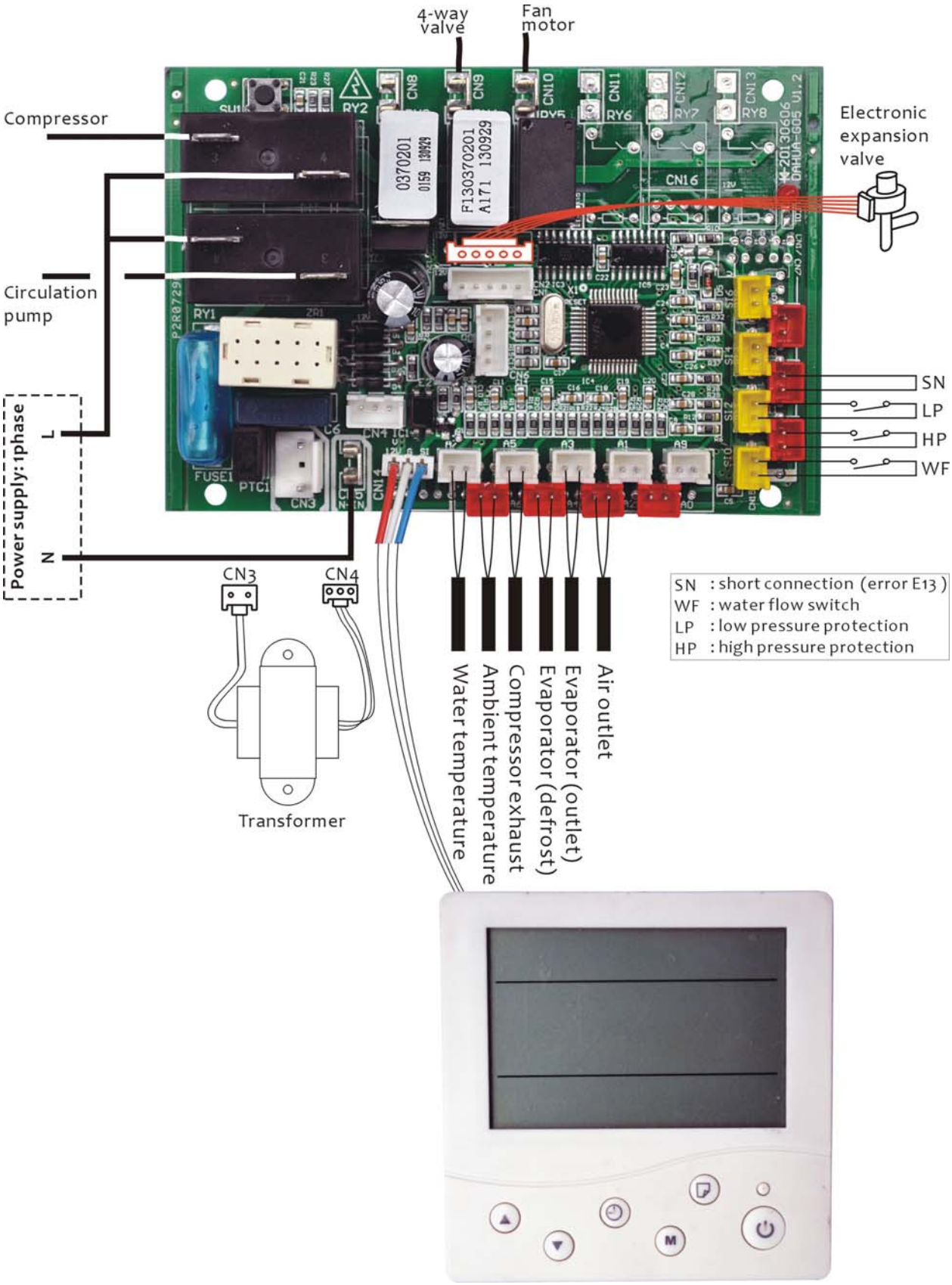
Solution : check if the unit is installed properly, and with the rubber vibration absorbing mountings.

Check if there is no rubber gasket between the outdoor fan and the front panel.

Check if the water circulating system works properly.

# 5 Wiring Diagram






Note:
This diagram is correct at the time of publication, manufacturing changes could lead to modifications. Always refer to the diagram supplied with the heat pump.

# 6. temperature sensor resistance table :

## 6.1 compressor exhaust temperature sensor resistance t °c -- kΩ 50 k

| t °c | R(KΩ) | AD | t °c | R(KΩ) | AD | t °c | R(KΩ) | AD | t °c | R(KΩ) | AD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **-20** | 542.7 | 3 | **20** | 68.66 | 26 | **60** | 13.59 | 95 | **100** | 3.702 | 175 |
| **-19** | 511.9 | 3 | **21** | 65.62 | 28 | **61** | 13.11 | 97 | **101** | 3.595 | 177 |
| **-18** | 483 | 4 | **22** | 62.73 | 29 | **62** | 12.65 | 99 | **102** | 3.492 | 178 |
| **-17** | 455.9 | 4 | **23** | 59.98 | 30 | **63** | 12.21 | 101 | **103** | 3.392 | 180 |
| **-16** | 430.5 | 4 | **24** | 57.37 | 31 | **64** | 11.79 | 103 | **104** | 3.296 | 181 |
| **-15** | 406.7 | 4 | **25** | 54.89 | 32 | **65** | 11.38 | 106 | **105** | 3.203 | 183 |
| **-14** | 384.3 | 5 | **26** | 52.53 | 34 | **66** | 10.99 | 108 | **106** | 3.113 | 184 |
| **-13** | 363.3 | 5 | **27** | 50.28 | 35 | **67** | 10.61 | 110 | **107** | 3.025 | 186 |
| **-12** | 343.6 | 5 | **28** | 48.14 | 36 | **68** | 10.25 | 112 | **108** | 2.941 | 187 |
| **-11** | 325.1 | 6 | **29** | 46.11 | 38 | **69** | 9.902 | 114 | **109** | 2.86 | 188 |
| **-10** | 307.7 | 6 | **30** | 44.17 | 39 | **70** | 9.569 | 117 | **110** | 2.781 | 190 |
| **-9** | 291.3 | 6 | **31** | 42.33 | 40 | **71** | 9.248 | 119 | **111** | 2.704 | 191 |
| **-8** | 275.9 | 7 | **32** | 40.57 | 42 | **72** | 8.94 | 121 | **112** | 2.63 | 193 |
| **-7** | 261.4 | 7 | **33** | 38.89 | 43 | **73** | 8.643 | 123 | **113** | 2.559 | 194 |
| **-6** | 247.8 | 8 | **34** | 37.3 | 45 | **74** | 8.358 | 125 | **114** | 2.489 | 195 |
| **-5** | 234.9 | 8 | **35** | 35.78 | 47 | **75** | 8.084 | 127 | **115** | 2.422 | 196 |
| **-4** | 222.8 | 8 | **36** | 34.32 | 48 | **76** | 7.82 | 129 | **116** | 2.357 | 198 |
| **-3** | 211.4 | 9 | **37** | 32.94 | 50 | **77** | 7.566 | 132 | **117** | 2.294 | 199 |
| **-2** | 200.7 | 9 | **38** | 31.62 | 52 | **78** | 7.321 | 134 | **118** | 2.233 | 200 |
| **-1** | 190.5 | 10 | **39** | 30.36 | 53 | **79** | 7.086 | 136 | **119** | 2.174 | 201 |
| **0** | 180.9 | 10 | **40** | 29.15 | 55 | **80** | 6.859 | 138 | **120** | 2.117 | 202 |
| **1** | 171.9 | 11 | **41** | 28 | 57 | **81** | 6.641 | 140 | **121** | 2.061 | 203 |
| **2** | 163.3 | 12 | **42** | 26.9 | 59 | **82** | 6.43 | 142 | **122** | 2.007 | 204 |
| **3** | 155.2 | 12 | **43** | 25.86 | 60 | **83** | 6.228 | 144 | **123** | 1.955 | 206 |
| **4** | 147.6 | 13 | **44** | 24.85 | 62 | **84** | 6.033 | 146 | **124** | 1.905 | 207 |
| **5** | 140.4 | 13 | **45** | 23.89 | 64 | **85** | 5.844 | 148 | **125** | 1.856 | 208 |
| **6** | 133.5 | 14 | **46** | 22.89 | 66 | **86** | 5.663 | 150 | **126** | 1.808 | 209 |
| **7** | 127.1 | 15 | **47** | 22.1 | 68 | **87** | 5.488 | 152 | **127** | 1.762 | 210 |
| **8** | 121 | 15 | **48** | 21.26 | 70 | **88** | 5.32 | 154 | **128** | 1.717 | 211 |
| **9** | 115.2 | 16 | **49** | 20.46 | 72 | **89** | 5.157 | 156 | **129** | 1.674 | 211 |
| **10** | 109.8 | 17 | **50** | 19.69 | 74 | **90** | 5 | 157 | **130** | 1.632 | 212 |
| **11** | 104.6 | 18 | **51** | 18.96 | 76 | **91** | 4.849 | 159 | | | 256 |
| **12** | 99.69 | 19 | **52** | 18.26 | 78 | **92** | 4.703 | 161 | | | 256 |
| **13** | 95.05 | 20 | **53** | 17.58 | 80 | **93** | 4.562 | 163 | | | 256 |
| **14** | 90.66 | 20 | **54** | 16.94 | 82 | **94** | 4.426 | 165 | | | 256 |
| **15** | 86.49 | 21 | **55** | 16.32 | 84 | **95** | 4.294 | 167 | **B(25/50) = 3950K ± 3%** | | 256 |
| **16** | 82.54 | 22 | **56** | 15.73 | 86 | **96** | 4.167 | 168 | **R(90°c) = 5KΩ ± 3%** | | 256 |
| **17** | 78.79 | 23 | **57** | 15.16 | 88 | **97** | 4.045 | 170 | | | 256 |
| **18** | 75.24 | 24 | **58** | 14.62 | 90 | **98** | 3.927 | 172 | | | 256 |
| **19** | 71.86 | 25 | **59** | 14.09 | 93 | **99** | 3.812 | 173 | | | 256 |

## 6.2 water/ambient/evaporator temperature sensor resistance t °c – kΩ 10 k

| t °c | R(KΩ) | AD | t °c | R(KΩ) | AD | t °c | R(KΩ) | AD | t °c | R(KΩ) | AD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **-20** | 115.266 | 16 | **20** | 12.6431 | 99 | **60** | 2.35774 | 197 | **100** | 0.62973 | 236 |
| **-19** | 108.146 | 17 | **21** | 12.0561 | 102 | **61** | 2.27249 | 198 | **101** | 0.61148 | 237 |
| **-18** | 101.517 | 18 | **22** | 11.5 | 105 | **62** | 2.19073 | 200 | **102** | 0.59386 | 237 |
| **-17** | 96.3423 | 19 | **23** | 10.9731 | 107 | **63** | 2.11241 | 202 | **103** | 0.57683 | 237 |
| **-16** | 89.5865 | 21 | **24** | 10.4736 | 110 | **64** | 2.03732 | 203 | **104** | 0.56038 | 238 |
| **-15** | 84.219 | 22 | **25** | 10 | 113 | **65** | 1.96532 | 205 | **105** | 0.54448 | 238 |
| **-14** | 79.311 | 23 | **26** | 9.55074 | 116 | **66** | 1.89627 | 206 | **106** | 0.52912 | 239 |
| **-13** | 74.536 | 24 | **27** | 9.12445 | 119 | **67** | 1.83003 | 207 | **107** | 0.51426 | 239 |
| **-12** | 70.1698 | 26 | **28** | 8.71983 | 122 | **68** | 1.76647 | 209 | **108** | 0.49989 | 240 |
| **-11** | 66.0898 | 27 | **29** | 8.33566 | 125 | **69** | 1.70547 | 210 | **109** | 0.486 | 240 |
| **-10** | 62.2756 | 29 | **30** | 7.97078 | 128 | **70** | 1.64691 | 211 | **110** | 0.47256 | 240 |
| **-9** | 58.7079 | 30 | **31** | 7.62411 | 131 | **71** | 1.59068 | 212 | **111** | 0.45957 | 241 |
| **-8** | 56.3694 | 31 | **32** | 7.29464 | 133 | **72** | 1.53668 | 214 | **112** | 0.44699 | 241 |
| **-7** | 52.2438 | 34 | **33** | 6.98142 | 136 | **73** | 1.48481 | 215 | **113** | 0.43482 | 241 |
| **-6** | 49.3161 | 35 | **34** | 6.68355 | 139 | **74** | 1.43498 | 216 | **114** | 0.42304 | 242 |
| **-5** | 46.5725 | 37 | **35** | 6.40021 | 142 | **75** | 1.38703 | 217 | **115** | 0.41164 | 242 |
| **-4** | 44 | 39 | **36** | 6.13059 | 144 | **76** | 1.34105 | 218 | **116** | 0.4006 | 242 |
| **-3** | 41.5878 | 41 | **37** | 5.87359 | 147 | **77** | 1.29078 | 219 | **117** | 0.38991 | 243 |
| **-2** | 39.8239 | 42 | **38** | 5.62961 | 150 | **78** | 1.25423 | 220 | **118** | 0.37956 | 243 |
| **-1** | 37.1988 | 45 | **39** | 5.39689 | 152 | **79** | 1.2133 | 221 | **119** | 0.36954 | 243 |
| **0** | 35.2024 | 47 | **40** | 5.17519 | 155 | **80** | 1.17393 | 222 | **120** | 0.35982 | 244 |
| **1** | 33.3269 | 49 | **41** | 4.96392 | 157 | **81** | 1.13604 | 223 | **121** | 0.35042 | 244 |
| **2** | 31.5635 | 51 | **42** | 4.76253 | 160 | **82** | 1.09958 | 224 | **122** | 0.3413 | 244 |
| **3** | 29.9058 | 54 | **43** | 4.5705 | 162 | **83** | 1.06448 | 225 | **123** | 0.33246 | 244 |
| **4** | 28.3459 | 56 | **44** | 4.38736 | 165 | **84** | 1.03069 | 226 | **124** | 0.3239 | 245 |
| **5** | 26.8778 | 58 | **45** | 4.21263 | 167 | **85** | 0.99815 | 226 | **125** | 0.31559 | 245 |
| **6** | 25.4954 | 61 | **46** | 4.04589 | 169 | **86** | 0.96681 | 227 | **126** | 0.30754 | 245 |
| **7** | 24.1932 | 63 | **47** | 3.88673 | 172 | **87** | 0.93662 | 228 | **127** | 0.29974 | 245 |
| **8** | 22.5662 | 67 | **48** | 3.73476 | 174 | **88** | 0.90753 | 229 | **128** | 0.29216 | 246 |
| **9** | 21.8094 | 68 | **49** | 3.58962 | 176 | **89** | 0.8795 | 229 | **129** | 0.28482 | 246 |
| **10** | 20.7184 | 71 | **50** | 3.45097 | 178 | **90** | 0.85248 | 230 | **130** | 0.2777 | 246 |
| **11** | 19.6891 | 74 | **51** | 3.31847 | 180 | **91** | 0.82643 | 231 | **131** | 0.27078 | 246 |
| **12** | 18.7177 | 76 | **52** | 3.19183 | 182 | **92** | 0.80132 | 231 | **132** | 0.26408 | 246 |
| **13** | 17.8005 | 79 | **53** | 3.07075 | 184 | **93** | 0.77709 | 232 | **133** | 0.25757 | 247 |
| **14** | 16.9341 | 82 | **54** | 2.95896 | 186 | **94** | 0.75373 | 233 | **134** | 0.25125 | 247 |
| **15** | 16.1156 | 85 | **55** | 2.84421 | 188 | **95** | 0.73119 | 233 | **135** | 0.24512 | 247 |
| **16** | 15.3418 | 87 | **56** | 2.73823 | 190 | **96** | 0.70944 | 234 | **136** | 0.23916 | 247 |
| **17** | 14.6181 | 90 | **57** | 2.63682 | 192 | **97** | 0.68844 | 234 | **137** | 0.23338 | 247 |
| **18** | 13.918 | 93 | **58** | 2.53973 | 193 | **98** | 0.66818 | 235 | **138** | 0.22776 | 247 |
| **19** | 13.2631 | 96 | **59** | 2.44677 | 195 | **99** | 0.64862 | 236 | **139** | 0.22231 | 248 |