WORKING PROGRAM OF THE INVERTER CONTROLLER (AVH-24)

VERSION： V1.6

Edition Information:

Version Number	Date	Description
V1.0	2009-8-4	First edition
V1.1	2009-9-3	4.5.1.1 Compressor discharge temperature protection：Modify temperature protection setting value, and modify the compressor frequency recover time to 10 minutes.
		5.5.5:Limit on Water outlet temperature
		Add 7.3: Display in outdoor unit
V1.2	2010-6-3	4.4.1: Control of water pump: Delete the condition for “water pump works for 1 minute in every 6 minutes till compressor starts”: if set temperature higher than 45 degree C.
		5.5.4: Defrosting function in heating mode: Modify T3 (existing temperature) to 17 degree C. Modify”3 minutes” in “If defrosting operation lasts for less then 3 minutes, then 10 minutes will be added to preset defrosting interval” to “2 minutes”.
		7.2:Increase “indoor coil anti-freezing protection”
V1.3	2010-9-27	Add 4.5.9 Quality control testing
V1.4		Add 5.5.4: Fixed defrosting interval time (trial version)
V1.5	2010-12-21	Add 5.5.4: Fixed defrosting interval time
V1.6	2011-9-26	Use JP4 to choose ideal

		defrosting logic.

1、Application Scope

1.1 This Inverter controller is applied to the DC inverter air to water units AVH-24V1D.

2、Applied Standards and Technical Data

2.1This Inverter controller complies with following standards.

QB/T2263-1996: Room Air Conditioner Electronic Controller

GB/T14536.1-93: Automatic electrical controls for household and similar use Part1: General requirements

GB5956-91: safe requirement of air conditioner

GB4343.2-1999: Electromagnetic compatibility Requirements for household appliances, electric tools and similar apparatus Part2: Standard of Immunity - Product family

GB17625.1-1998: The limits for the harmonic current emissions caused by low-voltage electrical and electronic equipments (equipment input current≤16A per phase).

GB17625.2-1999: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current≤16A

GB4706.1-1992 Safety of household and similar electrical appliances

2.2 Tolerances of the controller：

2.2.1 Remote controller transmission distance is ≥8M，angle is ≥60°.

2.2.2 Temp. control tolerance ≤±0.5℃，measurement tolerance is ±0.5℃.

2.2.3 Power current control tolerance ≤0.3A.

2.2.4 Power voltage control tolerance is ≤5V.

2.2.5 Time control tolerance：≤2min/24h

2.2.6 Rated power supply： 220V 50/60Hz。

2.2.7 Working power supply：160～260V 50/60Hz

2.2.8 Working ambient temp. range: -20℃～65℃，Relative Humidity ≥90%

3. Input and Output of Controller

3.1 Input and output signals：

Indoor side		Outdoor side	
Signals inputs	Signals outputs	Signals inputs	Signals outputs
Water inlet temp.	Indoor pump signals	Ambient temp.	Comp. control signal
Water outlet temp.	Elec. Heater signals	Outdoor Coil temp.	Fan motor control
Indoor coil temp.	communication signals with Wired thermostat	Compressor Discharge Temperature	Rev. valve control
Wired thermostat communication signals	Indoor unit communication signal	communication signals from indoor unit	Outdoor unit communication signals

Outdoor communication signals	Indoor display	Inverter module protection signal	Condenser elec. Heater signal
		High pressure switch signal	Comp. preheat signal
			EEV signal

3.2 components to be controlled

3.2.1 Compressor：Matsushita 5KD240X CA，rated power input ≤3500W

3.2.2 Outdoor fan motor：AC220V－240V 50Hz，rated input power ≤180W

3.2.3 Reversing valve coil：AC220V 50/60Hz，rated power input ≤10W

3.2.4 Indoor water pump：AC220V－240V 50/60Hz，rated power input ≤400W

3.2.5 Four-way valve coil: AC220V－240V 50/60Hz，rated power input ≤10W

3.2.7 Electronic Expansion Valve: DC12V, Four phase eight manner stepping motor

3.2.8 Water Pump: AC220V－240V 50/60Hz，rated power input ≤400W

3.2.9 Electric Heater: AC220V－240V 50/60Hz，rated power input ≤3000W

4、Functions

4.1 Basic Operation Functions

The two basic operation functions are cooling and heating operations, either of which can be controlled by either room temperature or water temperature. (For details, please see Chapter 5: Operation Modes

4.2 Temperature Setting

Temperature is set by wired controller or remote controller. Both room temperature and water outlet temperature can be chosen to control the system's operation. In cooling mode, room temperature can be set within range 10℃－31℃, while water outlet temperature within range 7℃－25℃. In heating mode, room temperature locates in range 16℃ - 31℃, while water temperature comes within range 20℃ - 50℃. User changes the temperature value through button "Temp. Up" and "Temp Down" on remote controller or wired controller (water temperature setting work can only be finished through wired controller).

4.3 Compressor's Running Frequency

Compressor's running frequencies are divided into 10 bands, according to the temperature difference between current one and preset value (room temperature or water temperature as selected for control). Refer to EEPROM table for Maximum Frequency of each band.

Sl. No	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Frequency in											
Frequency in											

4.4 Other Functions of Controller

4.4.1 Control of water pump

In cooling mode:

No matter whether the port is short-circuit or not, water pump starts 10 seconds before compressor starts, and stops 30 minutes after compressor stops.

In heating mode:

Water pump working mode

If JP202-2=ON, when unit stops after it gets set temp, pump works for 1 minute in every 6 minutes.

If 2=OFF, when unit stops after it gets set temp, pump starts/stops after compressor starts/stops

4.4.2 Control of outdoor fan motor

Fan motor starts 5 seconds before compressor starts, and stop 15 seconds after compressor stops (except defrosting operation).

4.4.3 Electronic Expansion Valve:

4.4.3.1 Initialization and action

Open degree of EEV is 0~500P, and the speed of open the valve is 31.25 PPS

When unit is powered: EEV initialized. It closed to 520P, and turn to P0 after 2 seconds.

When unit is turned ON: EEV closed to P0+30, stays for 2 seconds, and turn to P0 till compressor starts.

When compressor starts: EEV stays at P0 when unit runs in first stage. After first stage finished, it adjust its open degree according to the unit frequency and ambient temperature.

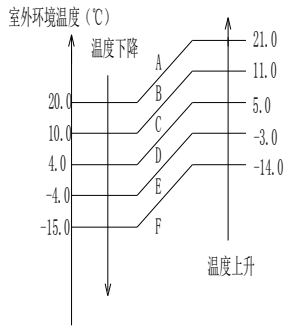
When compressor stops: When compressor stops (except when unit is defrosting_, EEV opens to 500P and stays for 60 seconds, and turn to P0.

4.4.3.2 When the unit is working:

EEV open degree changes as per ambient temperature and compressor speed:

In cooling operation: Open degree is determined by the compressor working speed.

In heating operation: Open degree is determined by the ambient temperature as shown in following chart:



（Ambient Temperature ℃） Temperature Increase

When compressor working frequency changes:

When compressor working frequency increases: EEV will adjust its open degree immediately. It

adjusts once every 60 seconds, and no more than 30P in every adjustment.

When compressor working frequency decreases: EEV will adjust its open degree by 60 seconds latter. It adjusts once every 60 seconds, and no more than 30P in every adjustment.

4.4.3.3 EEV in defrosting:

When unit works in defrosting, EEV open degree will be set to 210P.

Note：0p=fully open; 500P=fully closed; P0=270P.

4.4.4 Control of motorized valve（CN218：VALVE）

When working mode is set to heating, motorized valve is open (CN218 open); In all other working modes,motorized valve is always closed (CN218 close).

4.5 Other Functions

4.5.1 Auto-restart Function

This controller has auto-restart function, which is defaulted as valid. When system is re-fed with power after disconnected from it, it will proceed with its previous operation. But,

1) Compressor protecting program will run at first for 3 minute;

2) If EEPORM data can not be read, then the system will runs with target room temperature of 23℃.

4.5.2 Condenser auxiliary electrical heating belt

When ambient temperature is 4℃ or lower, electrical heating belt will turn on; while ambient temperature is above 6℃, this heating belt turns off.

4.5.3 Sleeping Mode

Sleeping mode can be chosen with wired controller.

4.5.4 Timer Function

Timer can be chosen with wired controller.

4.5.5 Compressor pre-heating (optional, defaulted as valid, to cancel it by set JP5 to OFF)

This pre-heating function works in cooling & heating units only, and it can be changed as invalid by switch JP5 on outdoor PCB. When it is selected as valid, outdoor air on coil is below -5℃, and compressor has been off for 3 hours, or outdoor air on coil is below -3℃ and unit is re-fed with power, compressor will be pre-heated.

When compressor is pre-heated, small power around 25~30W is put into compressor coil, while compressor doesn't run. When outdoor temperature is above 0℃, this pre-heat work will be cancelled automatically.

4.5.6 Normal Testing Operation

If JP201-4=ON, unit works in Normal Testing Operation.

After system enters into testing process in cooling mode, when room temperature is set as 30℃, the compressor runs at rated frequency Fcool; while it is set as 31℃, the system runs at Highest Speed F10; and when set is at 29℃, compressor runs at frequency Fcm.

When system enters into testing work in heating mode, and room temperature set as 1℃, compressor runs at rated working frequency Fheat; when it is set as 18℃, compressor runs at Medium frequency Fhm; or it set as 16℃, it runs at highest speed F10.

In system testing work, all general protections are functional.

4.5.7 Crank Heater

When outdoor air temperature≤-2℃ and compressor has been off for more than 3 hours, or outdoor air temperature≤0℃ and unit is fed with power, the crank heater turns on to preheat the compressor.

After the Crank Heater turns on, it heats the compressor's body with power 30~60W before it begins to run. When outdoor air temperature≥2℃ or compressor begins to run, this crank heater stops.

4.5.8 Auxiliary Electrical Heater

When system runs in heating mode (heat pump), the controller will check the system every 15 minutes. When ambient temperature is below 10℃, and compressor has been running for 25 minutes, the auxiliary electrical heater turns on when below conditions are met,

A. Compressor has been running at its highest speed;

B. The difference between actual temperature and preset value is bigger than 3℃;

C. In the last 15 minutes (1 testing cycle) before testing, actual temperature increases by less than 1℃.

When actual temperature reaches the preset value, and keeps stable for 1minute or compressor stops running, this auxiliary electrical heater turns off, when system begins to check above conditions.

4.5.9 Flow switch

If JP201-1=OFF, unit won't check signal from flow switch.

If JP201-1=ON, unit will check signal from flow switch, and if anything below happens, unit take it as water flow failure:

Flow switch is off for 20 seconds after water pump works for 2 minutes.

Flow switch is on for 5 seconds after water pump stops for 2 minutes.

Flow switch is on for 5 seconds in 20 seconds after controller is power on.

When unit has flow switch failure, FF failure cose will shown on display, and unit stops.

4.5.10 Quality control testing

When in Quality control testing mode, controller works in heating and the port to condenser coil heater is powered for 10 seconds, and then port to compressor crankcase heater is powered for 10 seconds. After done, controller works in regular working mode.

4.6 General Protections（Refer to EEPROM table for details）

4.6.1 Protection on Compressor

4.6.1.1 Compressor discharge temperature protection

When compressor discharge temperature exceeds TP2, the controller will forbid its running frequency to rise. When this temperature exceeds TP3, the controller will record the compressor's running frequency, and lower it down towards F1. If compressor discharge temperature drops below TP1, then this process stops and controller adjusts compressor's running speed according to difference between room temperature and preset temperature; however, its maximum running frequency will be 1 level lower than recorded value. When compressor discharge is below TP2 and lasts for 10 seconds, its maximum running frequency will increase by 1 level. If this discharge temperature exceeds TP4, the compressor stops, and outdoor fan motor turns off in 15 seconds. And the system turns on until discharge temperature drops below 90 DegC and compressor has been off for 3 minutes.

4.6.1.2 Delayed Start-up of Compressor

After compressor stops, it can only restart in 3 minutes (this protection is functional in cooling mode or when system changes its operation mode between dehumidification and heating). However, when the unit is powered by first time, compressor starts up in 1 minute instead, so to make sure proper communication between indoor and outdoor unit.

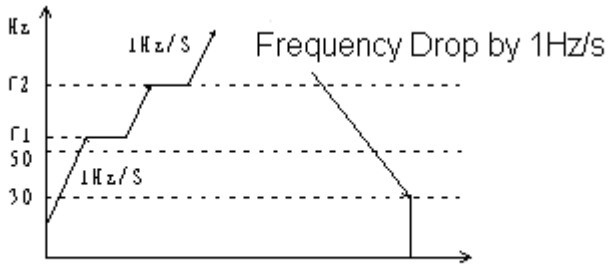
4.6.1.3 Control on Compressor Running Speed

In the process of start-up, compressor should run at two speeds for a certain time, specifically 1 minute at frequency f1 and 2 minutes at f2 (12 seconds in certain conditions). However, during this process,

frequency limit against high compressor discharge temperature still functions.

When compressor' s target running frequency is lower than f1, it increases its speed after start-up by 1Hz/s to f1, and keep running at this speed for 1 minute before lowering down to target frequency.

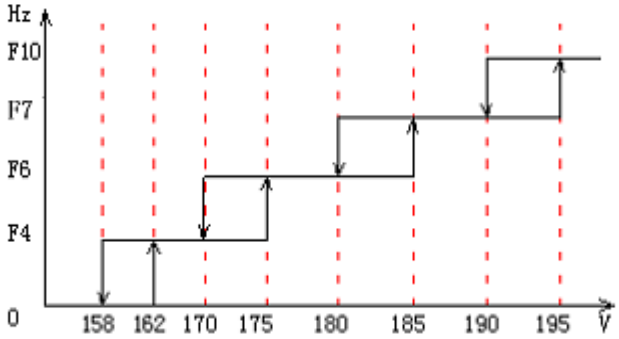
In compressor' s running, its speed increases/decreases by 1 Hz/s.



4.6.2 Protection against Improper Voltage

4.6.2.1Protection against Low Voltage

When voltage supplied to compressor is too low, it runs following below speed diagram.



When voltage supplied is lower than 190V and this condition lasts for 30 seconds, limits will be imposed on compressor' s running speed, as shown by above diagram. When voltage drops below 158V, the system turns off and relevant error code will be shown in the wired controller. When voltage rises back above 162V, the system recovers its operation, and compressor' s running speed follows above diagram.

4.6.3 Protection against Improper Current

When system running current is bigger than I_{limit}, controller will impose relevant limits on compressor' s running frequency, then its running speed will stop rising.

When this current is bigger than I_{down}, system' s running speed drops by 1Hz/s towards F1,until running current is smaller than $I_{limit.}$

When this current is bigger than I_{stop}, controller will stop the compressor no matter at what speed it runs.

Refer to EEPROM table for value of above specified currents

Operation Mode	Inormal	Idown	Istop

Cooling / Dehumidification			
Heating			

4.6.4 Protection against Compressor’ s improper operation

In compressor’ s start-up or running, if the controller detects no feedback from compressor, or improper load on compressor, or improper start-up, compressor will stops for 3 minutes and then re-start. (Compressor can re-start at most three times when fed with power; if this problem still exists, the controller will judge it as compressor drive failure, and relevant protection will be offered. Then compressor can only be turned on after problem solved and system re-fed with power.

4.6.5 IPM Module Protection

IPM module has self-protection against high temperature and over-current. In compressor’ s operation, if protection signals are detected from IPM module, the unit will stops and restarts the compressor in 3 minutes.

4.6.6 System Pressure Protection

In compressor’ s operation, when system pressure rise too high and pressure switch turns off, (in system’ s normal operation, pressure switch keeps on), the controller will lower compressor’ s running speed by 1Hz/s until pressure switch reconnects. Meanwhile, it records the compressor’ s current running speed, and takes the value one level lower as the maximum speed. This limit will be released automatically after compressor keeps on running for 2 hours. However, if during this process, similar pressure protection happens again, the controller will records the new running frequency and takes 1 level lower than this new frequency as the maximum speed. And it will release this protection in 2 hours since the time when this new protection happens. If compressor is off, but pressure switch is disconnected for 5 seconds, the controller will judge it as “Pressure Switch Failure” and relevant error code will be shown in wired controller.

4.6.7 Coil Temperature Protection

When temperature sensor detects that the coil temperature reaches 60℃, the compressor will lower down its running speed till F4 (if its running speed has already been F4 or lower, it will keep running at its original frequency; when coil temperature reaches 65℃, the compressor will lower its frequency until F1; when coil temperature reaches 70℃, the compressor stops and error code shows in indoor unit. And this protection will be released if below conditions are met,

1. The compressor has been running at decreased frequency or off for 30 minutes.
2. Coil temperature has dropped below 60℃.

4.6.8 Compressor oil return at low running speed

1. Condition for protection: compressor runs at frequency lower than F3 because of low temperature difference, and it lasts for 20 minutes, then system will enter into this protection.
2. Operation under protection: after unit enters into this protection, the compressor will rise its running speed following below table, and lasts for 1 minute. This protection has lower priority than other protections.

Running Frequency by Temperature Difference (Frst)	Running Frequency during protection	Lasting Time
Frst＞F6	Previous speed	1 minute
Frst≤F6＞	F6	1 minute

3. Quit from protection: the system will quit from protection when below conditions are met,

a) Compressor runs at frequency F3 and lasts for 1 minute

b) Compressor stops

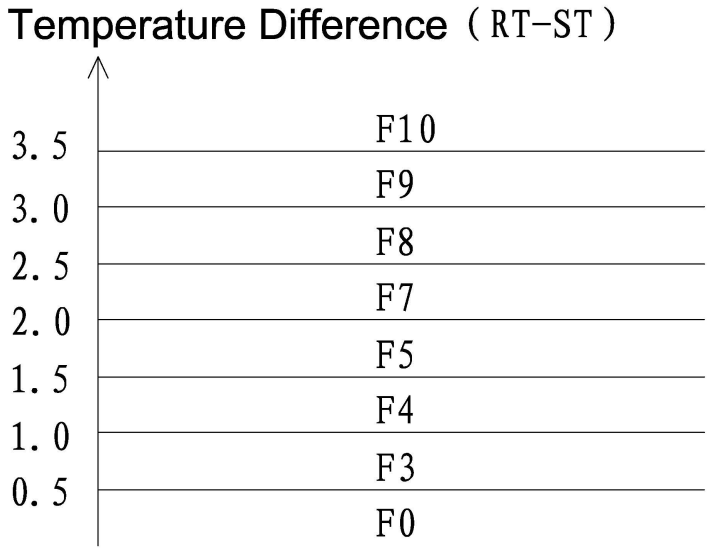
5、Controller’ s Operation

5.1 In cooling Mode

5.1.1 Control on compressor’ s running speed

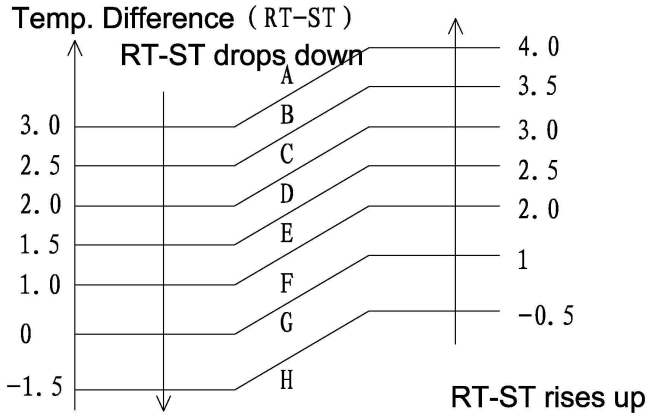
Compressor starts and runs at different speeds with regard to different temperature differences RT - ST (RT: Room Temperature, ST: Preset Temperature). Details refer to following diagram.

5.1.1.1 Target Frequencies at Start-up



5.1.1.2 Control on Compressor’ s Running Speed

a． In system’ s operation, when temperature difference RT-ST becomes larger (from area H to area A), the compressor’ s running speed rises by one level/area. When temperature difference RT-ST lowers down by more than 1 area per 2 minutes, compressor’ s speed drops one level/area; however, if RT-ST drops by less then 1 area per 2 minutes, the compressor will keep its current running speed until RT-ST drops below 1.5 ℃ (within area E), and then drops by 1 level per area.



b．In system’ s operation, when RT-ST stays in an area for 3 minutes, then compressor’ s running speed will,

Within area A-E: rise up by one level, but should not exceed the Max. Frequency Fmax decided by outdoor temperature (if current frequency is F10, it will not change).

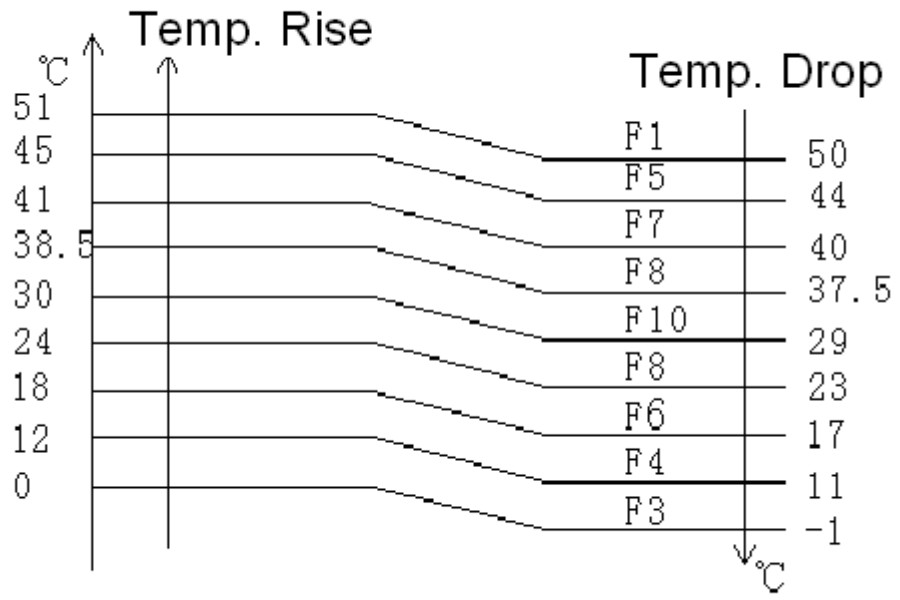
Within area F: keep the same

Within area G：drops by one level with minimum value F1; if RT-ST drops by 0.5℃ or more in 3 minutes, then compressor’ s running speed drops by 1 level at RT-ST decrease by 0.5℃ until F1. And compressor’ s running speed should not rise above F3 when temperature difference RT-ST locates in G area.

Within Area H: Compressor stops.

5.1.1.3 Control on compressor running speed with reference to outdoor temperature

Below is the detailed relationship between compressor running frequency and outdoor return air temperature (refer to EEPROM table for frequency range in each area)

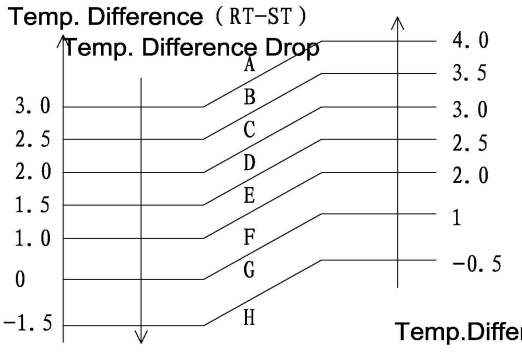


After compressor starts up, it changes its running speed following the situation at temperature rise, as detailed by above diagram (Refer to EEPROM table for frequencies in each area)

In cooling mode, when ambient temperature is below -1℃ or above 65℃, this controller will prevent compressor from start-up, and relevant error code will show in the wired controller. This protection will be released after ambient temperature changes between 0℃ or above 55℃.

5.1.2 Control on Compressor' s running speed in cooling mode (water temperature is chosen as reference for control)

Compressor starts up aiming at different frequencies with reference to temperature difference WOT-ST (WOT: water outlet temperature, ST: presser water temperature) . And controlling details is similar with the procedure when room temperature is chosen as reference.



5.1.3 .

When $_{own}$, the system will enters into sub-cooling protection on indoor heat exchanger, and compressor lowers down its running speed aiming at F1, until IPT rise above $IPT_{down.}$ In this condition, system has its maximum running frequency as 1 level

lower than its running frequency before sub-cooling protection. Then if the situation IPT≥$IPT_{down.}$ lasts for 10 minutes, maximum running frequency will rise back to the same as before this protection.

If indoor heat exchanger temperature IPT< IPT_{down} and lasts for 5 minutes, then compressor turns off. Until IPT rise back above $IPT_{down,}$ system will recover its normal operation.

5.1.4 Overheating protection on outdoor coil

When OPT (outdoor coil temperature) is above TOP2, compressor's running speed is not allowed to rise. When OPT≥TOP3, system enters into overheating protection on condensing coil, and compressor lowers down its running speed aiming at F1, until OPT drops below TOP2. Compressor has its maximum running speed as 1 level lower than its running frequency before protection. If OPT≤TOP1 and lasts for 5 minutes, system will recover its running frequency as before protection.

If OPT(condensing coil temperature)≥TOP4, compressor turns off. Until OPT drops back below TOP1, system will recover its normal operation.

5.1.5 Control on water pump in cooling mode

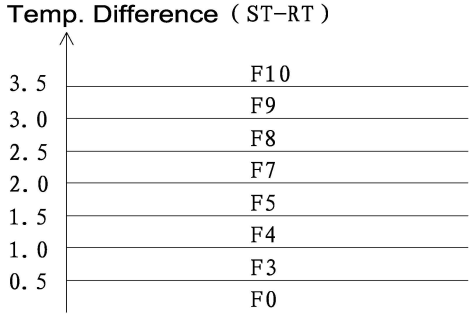
Circulation water pump is usually turned on 10 seconds earlier than compressor starts up. In system's normal operation for cooling, this circulation pump keeps on running, until water temperature reaches the preset value or failure happens and compressor turns off. Then circulation pump stops in 30 seconds. When problem is solved or system is activated, and compressor is requested to work, water pump restarts.

5.2 Heating Mode

5.2.1 Control on compressor's running speed

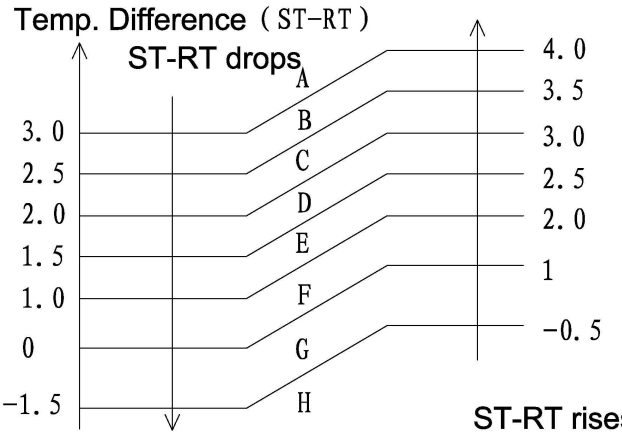
Compressor turns on aiming at different frequencies with reference to temperature difference ST-RT(ST: Preset Temperature, RT: Room Temperature), as detailed in below diagram.

5.2.1.1 Target frequency at start-up



5.2.1.2 Control on Compressor's Running Frequency

a. In system's operation, when temperature difference ST-RT becomes larger (from area H to area A), the compressor's running speed rises by one level/area. When temperature difference ST-RT lowers down by more than 1 area per 2 minutes, compressor's speed drops one level/area; however, if ST-RT drops by less then 1 area per 2 minutes, the compressor will keep its current running speed until ST-RT drops below 1.5 ℃ (within area E), and then drops by 1 level per area.



b. In system's c pressor's running speed w

Within area A-E: rise up by one level, but should not exceed the Max. Frequency Fmax decided by outdoor temperature (if current frequency is F10, it will not change).

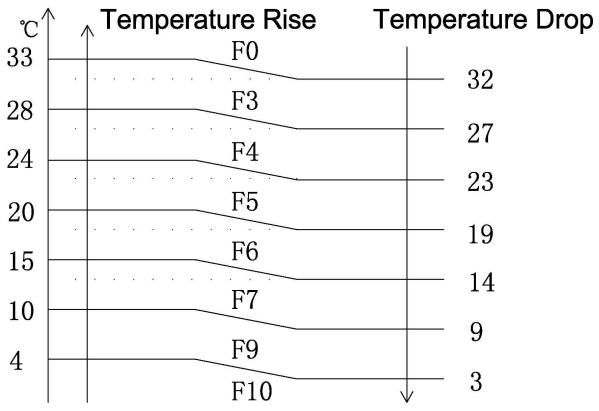
Within area F: keep the same

Within area G：drops by one level with minimum value F1; if ST-RT drops by 0.5℃ or more in 3 minutes, then compressor's running speed drops by 1 level at ST-RT decrease by 0.5℃ until F1. And compressor's running speed should not rise above F3 when temperature difference ST-RT locates in G area.

Within Area H: Compressor stops.

5.2.1.3 Control on compressor running speed with reference to outdoor temperature

Below is the detailed relationship between compressor running frequency and outdoor temperature (refer to EEPROM table for frequency range in each area). After compressor starts up, it runs at different frequencies with reference to ambient temperature, as detailed by above diagram (Refer to EEPROM table for frequencies in each area)

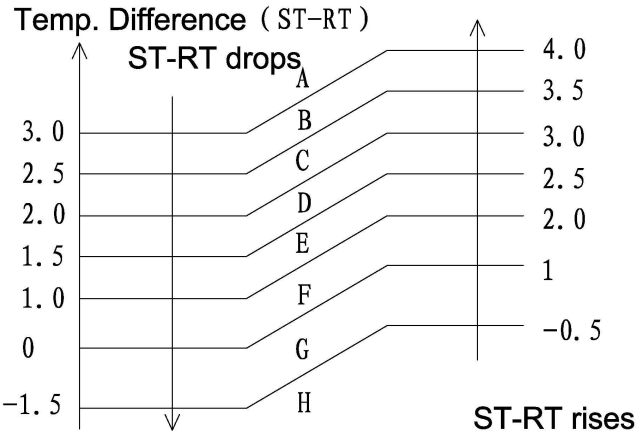


In heating mode, when ambient temperature is above 33℃ or below -25℃, compressor cannot be activated; and relevant error code will be displayed in wired controller. This protection will be released when ambient temperature drops below 32℃ or rise above -20℃.

5.5.2 Control on Compressor's running speed in heating mode (water temperature is chosen as

reference for control)

5.5.2.1 Compressor starts up aiming at different frequencies with reference to temperature difference ST-WOT (ST: presser water temperature; WOT: water outlet temperature).



A: emperature is chosen as reference.

5.5.2

When

When △T= Ts- Tr≥5℃, compressor works in its maximum allowable speed.

When Tr getting close to Ts, compressor starts to lower it frequency towards F3;

When △T= Ts- Tr≤-1℃, compressor stops.

5.5.3 Control on 4-way Reserving Valve in heating Mode

In heating mode, 4-way reserving valve is fed with power 5 seconds earlier than compressor; and after compressor turns off, it is disconnected from power in 2 minutes.

When system enters into heating mode, yet compressor running frequency is set as "0", then 4-way reserving valve will not be fed with power. After 4-way reserving valve is fed with power and compressor turns on, it will not be disconnected from power even compressor stops, until the whole system turns off or system operation mode changes (4-way reserving valve will be disconnected from power in 2 minutes)

Refer to chapter 5.5.4.2 for control on 4-way reserving valve in defrosting mode.

5.5.4 Defrosting function in heating mode

Below is the procedure of defrosting operation in heating mode：(refer to EEPROM table for detailed parameter setting)

a) Defrosting operation starts when below conditions are met, when defrosting light flickers.

1) Condensing coil temperature below T2 (-3℃) and lasts for 3 minutes.

2) Compressor has been running for not less than 5 minutes

3) Total running time of compressor is longer than interval between two defrosting operations

b) When one of below condition is met, the system quits from defrosting operation

1) Defrosting operation lasts for more then TIME1 (8 minutes)；

2) Defrosting operation lasts for more than 10 seconds, and condensing coil temperature is higher than T3 (17℃)

c) Setting of Intervals between defrosting operation：

When unit is fed by power at first time or enters into other operation mode instead of heating, the default defrosting interval is preset as 50 minutes. While in heating mode, when the system quits from its defrosting operation, it will adjust this interval following below policy, but its setting range locates from 45 minutes to 2 hours.

For 9KW unit:

1) If defrosting operation lasts for less then 2 minutes, then 10 minutes will be added to preset defrosting interval;

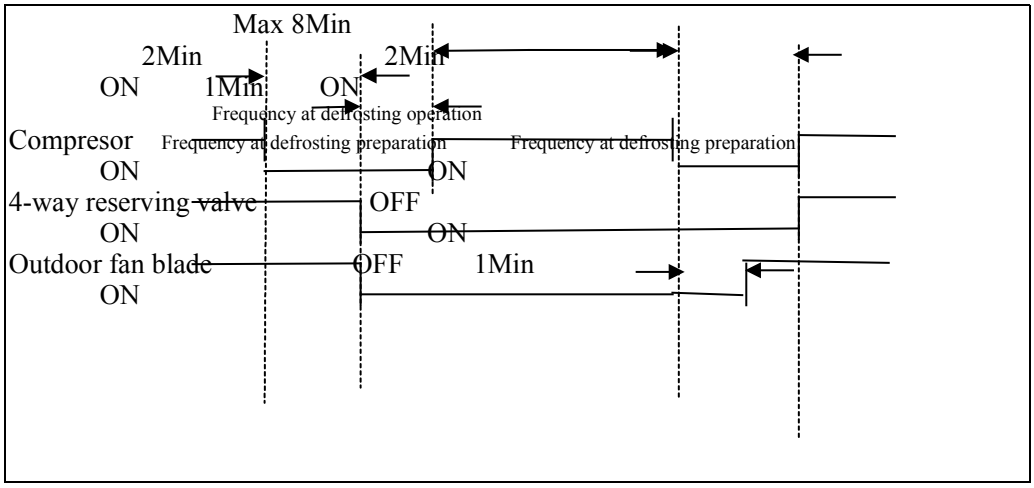
2) If defrosting operation lasts for more then 2 minutes but less than 6 minutes, then defrosting interval will be 10 minutes less.

3) If defrosting operation lasts for more then 6 minutes, then defrosting interval will be 20 minutes less.

Below is the time Sequence of Defrosting Operation： （Refer to EERPOM table for values of frequency at defrosting preparation（Freq1=30HZ）and frequency at defrosting operation（Freq2=74HZ）

After entering defrosting operation, wired controller shows room temperature or water outlet temperature before defrosting operation until 3 minutes after defrosting operation’ s end, and then it tells current room temperature or water outlet temperature.

5.5.5 Limit on Water outlet temperature



In default setting, the maximum water outlet temperature is 50 ℃ when room temperature is chosen for system control. However, by short-circuiting the “test” port on indoor PCB board, the Max water outlet temperature can be changed as 38℃ (valid when room temperature is chosen for system control only).

When (water outlet temperature) WOT ≥34 ℃, the controller will set a limit on compressor’ s running speed, with current running speed as its maximum. When WOT ≥36 ℃, compressor’ s running speed will be lowered down towards F1, until water outlet temperature drop below 34 ℃. Then the controller stops lowering its running speed and begin to rise back, but its maximum speed will be one level lower than the frequency before this lowering process. When WOT≤32 ℃ and compressor keeps on running 60 minutes without any frequency drop or system shutdown for protection, then the limit on compressor’ s running speed will be released.

When WOT≥38℃ or compressor’ s running speed is lowered to F1 but water outlet temperature is still higher than 34℃ after 2 minutes, then compressor stops. After water outlet temperature drops below 32 ℃, compressor restarts.

5.5.6 Indoor heat exchanger overheating protection

When indoor heat exchanger temperature IPT≥TIP3, system enter into indoor heat exchanger overheating protection, and compressor lowers down its running speed towards F1, until this temperature IPT drops lower than TIP2. Then compressor has its maximum running speed as 1 level lower than its running frequency before overheating protection. When IPT drops down to TIP1 and this situation lasts for 5 minutes, the limit on compressor running frequency will be released.

If indoor heat exchanger temperature rise above TIP4 and this situation lasts for 5 seconds, then compressor stops. And it will recover its normal operation until this temperature drops down below TIP1

6、Trouble Shooting of controller

6.1 Improper communication

When unit is firstly fed with power, the controller checks the communication between indoor and outdoor parts first, if no signal can be detected in 12 seconds, this controller judges it as "improper communication". When indoor unit is off, it shows "wrong wiring"; while indoor unit is on, it keeps on running.

After unit been started up, the controller will check the communication between indoor and outdoor parts usually. If no signal can be detected in two seconds, it judges as communication failure, and relevant error codes will be shown in wired controller. When the problem is solved, error codes disappear and system recovers its normal operation.

6.2 Temperature Sensor Failure

After being fed with power, controller begins to detect the temperature of temperature sensor. If the temperature is detected out of range -50℃～100℃, it judges as temperature sensor failure (specially for compressor discharge temperature sensor, the proper range is -50℃～160℃). When temperature sensor fails, system can runs smoothly in any mode, and controller judges its status following the detected temperatures, and correspondent error codes will be shown in indoor and outdoor controllers separately. When the problem is solved, error codes disappear and system recovers its normal operation.

6.3 Inverter Module Failure

Inverter module has self-protection. When its temperature, current or voltage supplied exceeds the preset range, the module will send out self-protection signals to the controller, which will stop the compressor. After 3 minutes, the compressor will restart. If module protection happens 3 times in 30 minutes, it judges as Module failure and controller will turn off the outdoor unit. After the problem is solved, the outdoor unit will recover its operation.

6.4 Compressor drive failure

When protection is imposed on compressor drive, the controller will stop compressor and restart it in 3 minutes. If this failure happens 3 times in 30 minutes, it judges as compressor drive failure and the outdoor unit will be turned off. After the problem is solved, the outdoor unit can recover its operation.

6.5 Current Failure

Current failure happens when,

a. Compressor is off, but detected current I>4A;
b. 5 minutes after compressor starts up, its running frequency is above F4, running current detected as I<1A, and lasts for 1 minute.

After this current failure happens 3 times, system cannot recover its normal operation.

7、Display by wired controller

7.1 All parameters and error codes are displayed on wired controller. Please refer to the user’ s manual.

7.2 Error codes display

When failure or protection happens in the system, error codes will show in LCD screen of wired controller and LED screen on indoor unit.

When more than one failure or protection happens at the same time, their error codes are displayed in order of their serial no in program. See below table for details.

To make sure a proper communication between indoor and outdoor unit, the error codes about protections or failures in outdoor unit will lasts for at most 2 more minutes, after protection has been released (or problem solved).

When failures or protections (except for temperature sensor failure) happen, system can only recover its normal operation after problems being solved and units re-fed with power. (When temperature sensor failure happens, system can recover its operation automatically).

Error Codes display in wired controller

Serial. No	Protection/Failure	Error Code	Remark
1	Indoor temperature sensor failure	F2	
2	Improper communication between indoor and outdoor unit/outdoor communication failure	F1	
3	Compressor drive failure, IPM failure, IPM module protection (overload), compressor drive protection	F4	
4	Current sensor, voltage sensor failure	F3	
5	EEPROM failure	F5	
6	Overload protection (indoor heat exchanger temperature too high in heating mode; outdoor coil temperature too high in cooling mode, over-current)	F6	
7	Too low or too high voltage	F7	
8	Pressure switch failure	F8	

9	Outdoor EEPROM failure	F9	
10	Outdoor temperature sensor failure	Fb	
11	System shut off on pressure switch failure	Fc	
12	System shut off on extreme ambient temperature	Fd	
13	Indoor coil anti-freezing protection	FE	
14	Flow switch failure	FF	

Error codes displayed in Indoor LED screen

Time of flickering	Protection/Failure	Time of flickering	Protection/Failure
1	Indoor water outlet temp. sensor failure	10	Outdoor coil temp. sensor failure
2	Indoor coil outlet temp. sensor failure	11	Compressor discharge temp. sensor failure
3	Indoor water inter temp. sensor failure	12	Voltage sensor failure
4	Indoor EEPROM failure	13	Current sensor failure
5	Improper communication between wired controller and indoor PCB bard	14	IPM failure
6	Pressure switch failure	15	Improper communication in outdoor unit
7	Improper communication between indoor and outdoor unit	16	Outdoor EEPROM failure
8	Compressor drive failure		
9	Outdoor room temp. sensor failure		

7.3 Display in outdoor unit

There is an indication light on outdoor PCB board or module board to show the system’ s operation. When compressor turns on, this light flickers in a frequency of “on for 1 second, and then off for 1 second”; when compressor is in normal operation, this light shines; when failure happens in outdoor unit, this light turns off for 2 seconds and then turns on for 3 seconds, and then flickers in a way of “on for 0.2 second, and then off for 0.2 second”. Different times of flickering indicate different kinds of failures, details as shown by below table.

Time of flickering	Failure	Time of flickering	Failure
1	IPM protection	10	Outdoor coil temperature sensor failure
2	Improper voltage	11	Compressor discharge temperature sensor failure

3	Over current	12	Voltage sensor failure
4	Compressor discharge temperature too high	13	Current sensor failure
5	Outdoor coil temperature too high	14	IPM failure
6	Compressor drive failure	15	Outdoor communication failure
7	Improper communication with indoor unit	16	High pressure protection
8	Compressor overheat protection	17	Defrosting
9	Ambient temperature sensor failure	18	Sunction Temp sensor failure
19	Outdoor EEPROM failure	20	Too low/high outdoor Temp
21	Indoor Flow switch failure	23	System failure
24	Preserve	25	Room Temp sensor failure
26	Indoor coil temp sensor failure	27	Indoor EEPROM failure
28	Indoor water outlet temperature sensor failure	29	Preserve
30	Outdoor controller drive failure	31	Too low/high outdoor Temp
32	Indoor anti-freezing protection	33	Indoor coil over-heat protection
34	Abnormal pressure	35	Pressure sensor failure