

**AIRSYS**

M A N U A L

# TELECOOL DC Series

**Cabinet Air Conditioner-Free Cooling**

**Installation, Maintenance and Operation Manual**

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# Safety Instruction

## Important

All installation and service work must be done by qualified professional technicians. Always wear protective gear and comply with all general and local safety standards and codes. Adhere to all warnings and safety instructions on the units and in this manual. AIRSYS shall not be held liable for any damage to persons or property due to improper operation or servicing of this equipment.

## Warning

Risk of electric shock. Switch off all electric breakers before servicing the units. Failure to comply can cause serious injury or death.

## Warning

Risk of contact with high speed rotating fan blades. Turn off the unit and verify that the fan blades have stopped rotating before working around the fans. Failure to comply can cause serious injury or death.

## Caution

The surfaces of compressors, motors, and discharge lines may become extremely hot during operation. Allow enough time for the components to cool before working on these components. Wear protective gear and exercise caution when working near hot surfaces. Failure to comply can cause injury.

## Caution

Risk of contact with sharp edges. Always wear protective gloves when handling panels and other components. Failure to comply can cause injury.

# 1. Introduction

The AIRSYS line of DC Telecool Cabinet Air Conditioner is an all DC powered system that incorporates variable speed air conditioning (mechanical cooling) which is able to continuously modulate cooling capacity to meet cooling demand. Depending on system configuration, the system may also include electrical heater to meet heating requirements.

When the operating conditions for mechanical cooling are met, a variable frequency drive changes to compressor speed to adjust compressor throughput and in turn, cooling capacity to match heat load. By precisely matching the headload at all times, the variable speed units minimize the times of turning on/off as well as sudden loading and unloading of the compressor, vastly extending the life time and reliability of the entire cooling system.

## 1.1 Model Identification

1	2	3	4	5	6	7	
A	C	A	040	E	D1	.	XXX

1	A	AIRSYS
2	C	Cabinet Size Code
3	A	A: Air Conditioner. A-FC: Air Conditioner with Free Cooling
4	040	Cooling Capacity (x100W)
5	E	E=Embedded; S=Side Mount
6	D1	Power Supply. D1=48VDC
7	.	Separator Character “.”
8	XXX	Product Code for Customized Product

Tab 1 - Model Identification

## 2. Installation

### 2.1 Installation Preparation

#### 2.1.1 Delivery

When your units are delivered, be sure to inspect them to verify that they have not been damaged during transportation. Also verify that all requested accessories listed on the purchase order have been included.







**Important.** If packages show any sign of shipping damage or potential shipping damage, it is very important to annotate *shipping damage* on the Bill of Lading prior to signing for the freight. In order to claim for any damage, please take detailed pictures of all packaging before the packaging is removed. Once detailed pictures of the packaging has been taken, then the external packaging may be removed, so the unit can be inspected further. Please document any damage to the unit with pictures which relates directly to the damage observed on the external packaging.

Without the detailed photos, it will be very difficult to claim unit loss.

#### 2.1.2 Unpacking

Unpack the unit carefully. Several parts are packed loosely and will be free moving as the packaging is opened. Before discarding the box, check the packaging carefully for any parts or documents inside.

List of symbols and their meaning that may appear on the external packaging are tabulated below

Symbol	Description	Symbol	Description
	THIS SIDE UP Shows the orientation of the unit.		NO HOOKS Do not use hooks to lift the packed unit.
	FRAGILE Handle with care.		KEEP AWAY FROM HEAT The unit must be kept away from heat sources.
	PROTECT AGAINST RAIN: The packaged unit must be stored in a dry place.		DO NOT STACK

Tab 2 - Packaging Symbols

#### 2.1.3 Moving the Unit

Forklifts are recommended for moving, loading, unloading, and positioning the unit for installation. If bands or ropes are used to create a sling, make sure that excessive force is not applied to the upper edges of the machines or the package to avoid cosmetic or material damage. When using spacing bars, protective materials are required around the units to prevent damage.

To avoid damage to the units, ensure the units always remain in the upright position.

#### 2.1.4 Verify Power Source

Verify the DC Power Supply meets the minimum requirements: 42VDC~57VDC.

## 2.2 AIRSYS Supplied Material

### 2.2.1 Air Conditioner

No.	Item	Qty	Comments
1	Shipping List	1	
2	Air Conditioner	1	Refer to 1.1 Model Identification
3	Drainpipe	1	6ft
4	Drain Connection Tube	1	
5	Pipe Clamp	1	
6	M3x8 Screw	3	For securing drain connection
7	Manual	1	This document
8	F7 Grade Filter	1	

Tab 3 - Material included with Air Conditioner



## 2.3 Installer Supplied Material

Note: This material list can be customized based on project. Subject to change without notice.

No.	Item	Qty	Comments
1	M6×16 Screw	20	Suggested mounting material
2	Φ6 Flat Washer	20	Suggested mounting material
3	Φ6 Spring Washer	20	Suggested mounting material
4	M6 Hex Nuts	20	Suggested mounting material
5	Sealant	As Needed	
6	DC Breaker	1	See nameplate for current rating.
7	DC Power Supply Cable, AC	1	1 conductor cable from power source to unit or door splice. See nameplate for current rating.
8	RS-485 Communication Cable	1	1 conductor shielded cable from unit to customer remote monitoring device or door splice.
9	Ground Cable	1	
10	Alarm Cable	1	

Tab 4 - Installer Supplied Material

## 2.4 Physical Installation

### 2.4.1 Clearance

There should be a minimum of 300mm (12") in front of supply and return vent as well as 500mm (20") on the outside to allow proper airflow

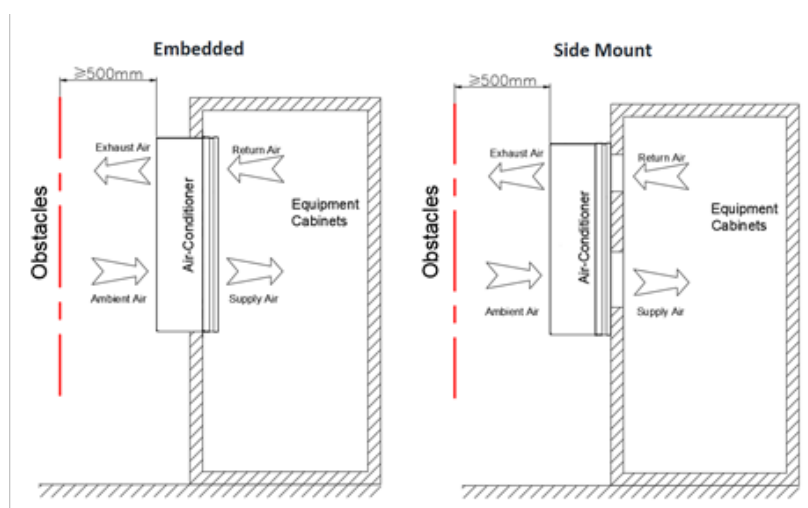


Fig 1 - Clearances

## 2.4.2 Dimensions

Refer to physical drawing for specific model. 3D drawing file also available upon request to facilitate cabinet integration.

## 2.4.3 Positioning the Unit

**Note:** The unit must be installed in a level position. (+/- 1 degree level)

- Lift the unit from below with lifting equipment or tools, and then move the unit to the intended location.
- **For embedded mounting:** Position the unit next to the interior using a forklift or leveling system. Push the unit through the cabinet door and secure unit with mounting screws and bolts.
- **For exterior (side) mounting:** Position the unit next to the exterior using a forklift or leveling system. Line the unit with cabinet door mounting holes and secure unit with mounting screws and bolts.

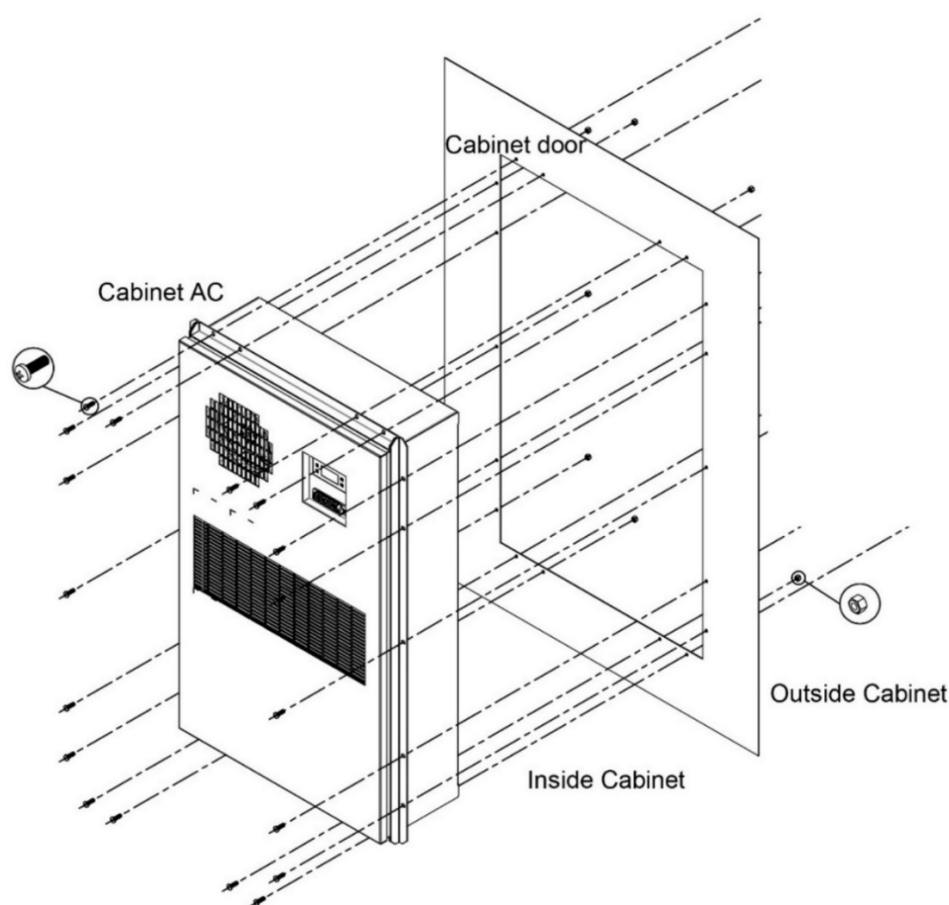


Fig 2 - Embedded Mounting

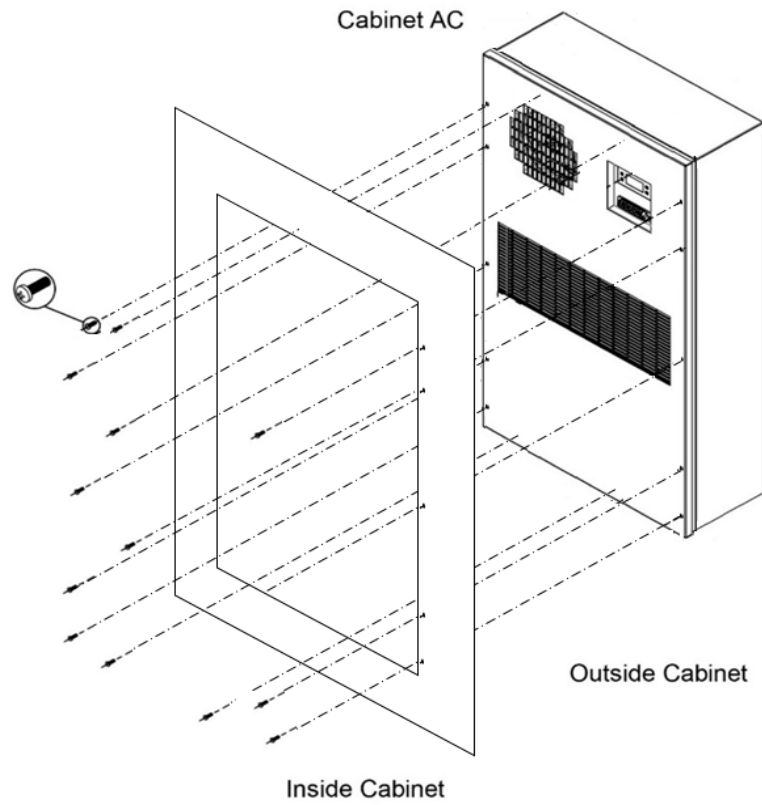


Fig 3 - Side (Exterior Mounting)

## 2.4.4 Install drainpipe

Install drainpipe according to diagram below:

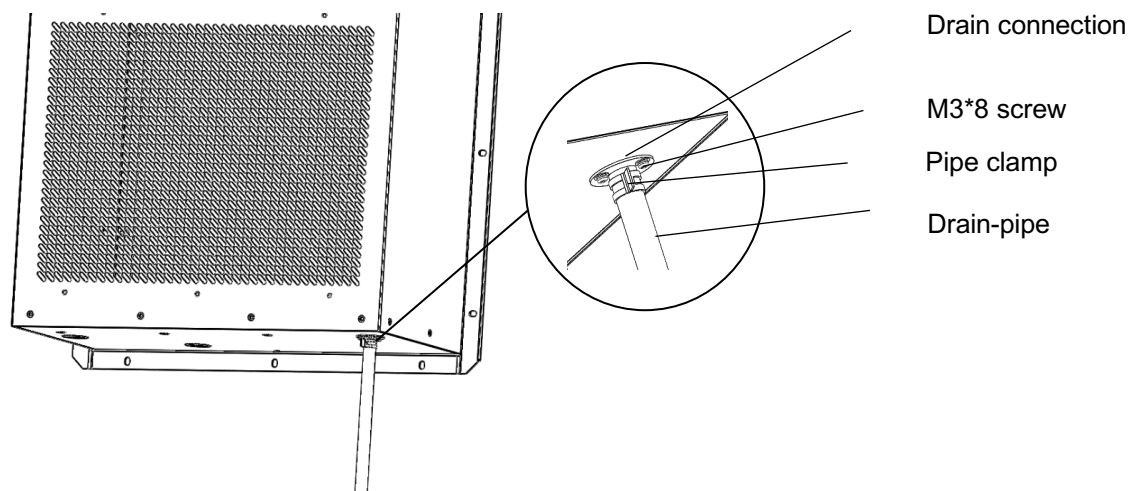


Fig 4 - Drain Installation

## 2.5 Electrical Installation

### 2.5.1 List of Electrical Connection

#	Connection	Description
1	48 VDC	Supplies operating power to the unit. Minimum 10AWG
2	Ground Connection	Grounding must meet local regulations
3	Alarm Connection	(Optional) Output Signal → Indicates unit has a fault (NC)
4	Modbus Connection	RS485 connection for remote remoting and control

Tab 5 - List of Electrical Connection



## Warning

Risk of electric shock. Switch off electric power source before electrical installation. Failure to comply can cause serious injury or death.

### 2.5.2 DC Power Connections

Connect RTN, -48V on each AC unit to the power source. Each unit shall have its own separate breaker position on the power source.

Connect grounding cable to PE (protective earth) terminal on each AC unit. See nameplate for model/configuration specific electrical rating.

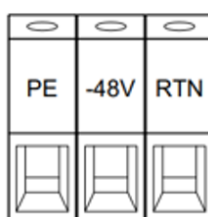


Fig 5 - Power Connection for AC unit

## 2.6 Installation Checklist

You should now have completed all of the physical and electrical installation steps. Before starting the system, ensure that no steps have been omitted by completing this installation and wiring checklist.

**Note:** Remote monitoring is not included in the physical and electrical checklist. See Remote Monitoring chapter on setting up remote monitoring.

**Date:** \_\_\_\_\_ **Unit Serial Number(S):** \_\_\_\_\_ (refer to name plate)

### PHYSICAL

✓ or X

Unit is securely mounted to the door

Sealant has been applied to seal ALL sides with NO gaps

Drainpipe installed

### ELECTRICAL

RS485 line 22AW G/2C is connected

Ground is connected

Power lines is connected to AC unit. Ensure positive is connected to RTN and negative is connected to -48V.

Tab 6 - Installation Checklist

## 2.7 System Commissioning

System commissioning is vital to ensure all components are operating correctly after the installation.

**Important:** The installation checklist must be completed prior to commissioning system.

### 2.7.1 Turn on Primary Power

**Important:** If any point the system is not upright during the installation, the unit must stay in upright position for a minimum of 30 minutes before power is applied to it.

## 2.7.2 Automatic Self-Test

Once power is applied to the AC unit, it will automatically perform a series of self-test. If a failure is detected, it will automatically enter alarm with alarm code displaying on screen. If no failure is detected, the system will enter normal operation.

Step	Duration	Description	Failure Condition	Failure Action	Alarm Recovery Condition
0	5s	Standby	N/A	N/A	N/A
1	10s	Verify DC Voltage	<42V or >59V	Exit self-test and display alarm	44V - 57V for 10s
		Verify Return, Supply and Condenser Sensor Reading	<-40°C or >140°C which indicate to short or open sensor	Continue test. Display alarm after test ends.	-40 ° c --+140 ° c for 10s
2	30s	Verify Internal Fan	Difference between speed signal and feedback >30% or no feedback within 30s	After the testing the external fan, end test and display alarm	Difference between speed signal and feedback <25% for 3 minutes
3	30s	Verify External Fan	Difference between speed signal and feedback >30% or no feedback within 30s	Exit self-test and display alarm	Difference between speed signal and feedback <25% for 3 minutes
4	35s	Verify Heater	Difference between return air temperature and supply air temperature <2°C	Continue test. Display alarm after test ends	Supply air temp is 2°C higher than return air temp
5	70s	Compressor Standby	N/A	N/A	N/A
6	3-6min	Verify Compressor (Compressor must start within 3min and have minimum 3 min run time. Skipped if outdoor temp is less than -20°C)	Compressor unable to start within 3 minutes	Exit self-test and display alarm	Compressor start when called

Tab 7 - Self-Test Detail

If any alarm is displayed during or after self-test, refer to System Alarms section in the Operations Chapter. All alarms must be cleared before the system is considered to be fully operational.

Once the installation checklist is complete and no alarm has occurred during automatic self-test, the system is considered to be commissioned and operational.

# 3. Operation

## 3.1 User Interface

The local user interface is composed of a display panel and 4 buttons (**Up**, **Down**, **Menu**, and **Set**). The display panel shows supply temperature by default. If there is an alarm, the display will alternate between alarm code and supply temperature. If the supply temperature sensor itself is in alarm, it will display 4 dashes (----



Fig 6 - Display Panel

### 3.1.1 Display LED Icons

Tab 8 - List of Display Icons

LED	Description
	Flashes when in Self Diagnose mode or in Parameter Menu
	On when cooling
	On when heating
	Dehumidification. (Not applicable)
	On when exterior fan is running
	On if an alarm is present

## 3.2 Information Display

From the default supply temperature display, some system information can be quickly accessed:

Information	To Access Information	To Return to Supply Temp
System Voltage	Press <b>Set</b>	Press <b>Menu</b>
Condensing Temperature	Press <b>Up</b>	Press <b>Menu</b>
Return Air Temperature	Press <b>Down</b>	Press <b>Menu</b>
Ambient Temperature	Press <b>Menu</b>	Press <b>Menu</b>
Compressor Speed	Press <b>Up</b> and <b>Down</b> Simultaneously	Press <b>Menu</b>
External Fan Speed	Press <b>Down</b> and <b>Set</b> Simultaneously	Press <b>Menu</b>
Internal Fan Speed	Press <b>Up</b> and <b>Set</b> Simultaneously	Press <b>Menu</b>
Compulsory Self-Test	Long Press <b>Down</b> and <b>Set</b> Simultaneously	Press <b>Menu</b>

Tab 9 - Display Information Access

## 3.3 Parameter Menu

Hold **Menu** key for 5 seconds to enter Parameter Menu. The first parameter (F01) will be displayed. Use the **Up** or **Down** button to scroll through the menu.

### 3.3.1 Reading A Parameter

When a parameter is displayed on screen, press **Set** to view the current value. Press **Menu** to return to the menu.

### 3.3.2 Writing Over A Parameter

**Important:** To ensure proper operation of the lead/lag setup, any setpoint, hysteresis, and rotation schedule change must be applied to both lead and lag units.

When a parameter is displayed on screen, press **Set** to view the current value. Use the **Up** or **Down** key to change the value. Then press **Set** and you will be prompted to enter the passcode. Quickly enter the passcode and press **Set**. If the Password is correct, "End" will be displayed, and the value will be changed. You may press **Menu** at any time to return to the menu.



### 3.3.3 List of Parameters

**Note:** Default setting provided for reference only. Default settings can be changed or locked depending on project requirements

Parameter	Description	Range	Default	Unit
F01	Indoor fan Step Speed	0~500	0	RPM
F02	Indoor Fan Max Speed	F03+200~2700 (3kW) F03+200~1600 (4kW)	2700 (3kW) 1600 (4kW)	RPM
F03	Indoor Fan Min Speed	540~F02-200 (3kW) 320~F02-200 (4kW)	800 (3kW) 600 (4kW)	RPM
F04	Damper 100% Open Hysteresis (Supply)	2~50	5	°C
F05	Damper 100% Open Temperature	F06+5~80	33	°C
F06	Damper Open Temperature (Indoor)	-20~F05-5	28	°C
F07	Damper Close Temperature (Supply)		50	°C
F08	Damper Open Min Temperature Difference	2~10	3	°C
F09	Indoor Fan Pulse Feedback Qty per Rotation	1~5	3	/
F10	Indoor Fan 1 Enable	0/1	1	/
F11	Indoor Fan 2 Enable	0/1	0	/
F12	Outdoor Fan Step Speed	0~500	0	RPM
F13	Outdoor Fan Max Speed	F14+200~2700 (3kW) F14+200~1600 (4kW)	2700 (3kW) 1600 (4kW)	RPM
F14	Outdoor Fan Min Speed	540~F13-200 (3kW) 320~F13-200 (4kW)	800 (3kW) 600 (4kW)	RPM
F15	Outdoor Fan Step Speed Temperature	0~20	0	°C
F16	Outdoor Fan Max Speed Temperature	F17+5~80	45	°C
F17	Outdoor Fan Min Speed Temperature	F18+F19~F16-5	30	°C
F18	Outdoor Fan Stop Temperature	-45~F17-F19	-42	°C
F19	Outdoor Fan Start Hysteresis	2~F17-F18	5	°C
F20	Outdoor Fan Pulse Feedback Qty per Rotation	1~5	3	/
F21	Outdoor Fan 1 Enable	0/1	1	/
F22	Outdoor Fan 2 Enable	0/1	0	/
F23	Heater Start Temperature	-45~15	8	°C
F24	Heater Operation Hysteresis	5~20	5	°C
F25	Heater High Current Alarm Setpoint	1.5~30	25	A
F26	Heater Low Current Alarm Setpoint	0.5~29	0.5	A
F27	Heater Enable	0/1	1	/
F28	System Address	0~255	1	/

Parameter	Description	Range	Default	Unit
F29	High Temp Alarm Setpoint	30~100	50	°C
F30	Low Temp Alarm Setpoint	-42~20	0	°C
F31	Reserved			
F32	Reserved			
F33	Reserved		0	°C
F34	Indoor Temp Sensor Calibration	-10~10	0	°C
F35	Outdoor Temp Sensor Calibration	-10~10	0	°C
F36	Heater Current Calibration	-2~2	0	A
F37	DC voltage Calibration	-10~10	0	V
F38	External Input Enable	0/1	1	/
F39	External Input Option	0/1	1	/
F40	High Voltage Alarm Setpoint	50~70	60	V
F41	Low Voltage Alarm Setpoint	24~47	42	V
F42	Indoor Temperature Setpoint	18~50	32.5	°C
F43	Compressor On/Off Hysteresis	1~8	2.5	°C
F44	Compressor Max Running Speed	1800~8000	2400 (3kW) 3200 (4kW)	RPM
F45	Password Setting	0000~9999	1111	/
F50	Damper Close Max Humidity Setpoint	50~100	80	%
F53	Free Cooling Close Humidity Hysteresis	2~20	5	%
F54	Free Cooling Open Temperature Hysteresis (Indoor)	1~10	2	°C
F62	Humidity Control Start point	0~80	60	%
F63	Coastal Mode Enable	0/1	0	/
F64	Emergency Ventilation Humidity Control	0/1	0	/
F65	Low Pressure Switch Option	0/1/2	1	/
F66	Humidity Calibration	-10 ~ 10	0	%
F67	Ambient Temperature Calibration	-10 ~ 10	0	°C
F68	Supply Temperature Calibration	-10 ~ 10	0	°C
F69	Forced Free Cooling Temperature Difference	3~20	10	°C
F70	Dust Sensor Alarm Damper Min Close Time	0~120	30	Min

Tab 10 - List of Parameters

## 3.4 Sequence of Operation

**Important:** To ensure proper operation of the lead/lag setup, any setpoint, hysteresis, and rotation schedule change must be applied to both lead and lag units.

### 3.4.1 Self-Test Mode

At power up, if ambient temperature  $\leq -20^{\circ}\text{C}$ , the unit will run through operating all main components of the system including fans, heater as well as verify that the sensors are reading correctly. Compressor will be involved after 30 mins.

If ambient temperature  $> -20^{\circ}\text{C}$ , the unit will run through all main component of the system including fans, heater, compressors, as well as verify that the sensors are reading correctly. At power up, the unit will enter self-test mode after 5s.

An alarm will be generated if any fault is detected. For more details, please see 2.7.2 Automatic.

### 3.4.2 Crankcase Heater Operation

If ambient temperature  $\leq -20^{\circ}\text{C}$ , the crankcase heater will start to operate. If ambient temperature  $\geq -15^{\circ}\text{C}$ , the crankcase heater will stop operate.

### 3.4.3 Standby Mode

If the system is not already running and the supply air temperature is below compressor starting temperature (F42) and above heater starting temperature (F23), the system will standby with internal fan running at low speed.

If the system is heating it will continue to heat until the supply temperature reaches above heater starting temperature + hysteresis (F23+F24) before engaging standby.

If the system is cooling it will continue to cool until the supply temperature reaches below compressor starting temperature – hysteresis (F42-F43) before engaging standby.

### 3.4.4 Compressor Operation

The compressor turns on at when indoor temperature  $\geq \text{F42} + \text{F43}$ . Once compressor turns on, it will follow PID adjustment according to indoor temperature. (Compressor min operation time is 3 mins)

The compressor turns off when indoor temperature  $\geq \text{F42} - \text{F43}$  and lasts for 2 mins.

Note: At power up, the compressor will start after 3 mins delay.

### 3.4.5 Heater Operation

When the indoor temperature drops to heater starting temperature (F23), the heater will turn on. When the indoor temperature rises to heater stop temperature (F23+F24), the heater will turn off.

### 3.4.6 Free Cooling Operation

#### 3.4.6.1 Free Cooling Start Logic

The unit will start free cooling mode if either of the below two situations is met.

- A. Unit has alarm in refrigeration system (system high/low pressure alarm, compressor fault alarm, external fan alarm)
  - $\text{F06} \leq \text{indoor temperature}$
  - $\text{Indoor temperature} - \text{Ambient temperature} \geq \text{F08}$
  - $\text{Ambient humidity} \leq \text{F50}$

- 30 mins since last filter alarm
  - Seaside mode is disable
- B. Unit has no alarm in refrigeration system
- $F06 \leq \text{indoor temperature} \leq F42 + F43$
  - Supply air temperature  $\geq F07 + F04$
  - Ambient humidity  $\leq F50$
  - 30 mins since last filter alarm
  - Seaside mode is disable
  - Compressor is not operating, or compressor is operating and there is no damper alarm in the past 24 hours. Indoor temperature-ambient temperature  $\geq F08$

#### 3.4.6.2 Free Cooling Damper Operation Logic

##### Supply air temperature control

When supply air temperature  $> F07 + F04$ , the openness of damper is 100%. When  $F07 \leq \text{supply air temperature} \leq F07 + F04$ , the openness of damper follows linear control. When supply air temperature  $< F07$ , damper will close.

##### Ambient Humidity Control

When ambient humidity  $< F62$ , the openness of the damper is 100%. When  $F62 \leq \text{ambient humidity} < F50$ , the openness of damper follows linear control.

Note:

The openness of the damper is the minimum value between supply air temperature control and supply air humidity control.

The openness of the damper will not be affected by the internal fan alarm and external fan alarm.

The control of the damper follows 0-10V analog value control.

#### 3.4.6.3 Free Cooling Stop Logic

The unit will stop free cooling mode if either condition in the following two situations is met.

- A. Unit has alarm in refrigeration system (system high/low pressure alarm, compressor fault alarm or external fan alarm)
- Indoor temperature  $\leq F06 - F54$
  - Ambient humidity  $\geq F50 + F53$
  - Indoor temperature - ambient temperature  $\leq F08 - F54$
  - Unit has dust sensor alarm, damper actuator alarm, return temperature sensor alarm, ambient temperature sensor alarm, air filter alarm or humidity sensor alarm.
- B. Unit has no alarm in refrigeration system
- Indoor temperature  $\leq F06 - F54$
  - Indoor temperature  $\geq F42 + F43$
  - Supply air temperature  $\leq F07$
  - Ambient humidity  $\geq F50 + F53$
  - Indoor temperature - ambient temperature  $\leq F08 - F54$
  - Unit has dust sensor alarm, damper actuator alarm, return temperature sensor alarm, ambient temperature sensor alarm, air filter alarm or humidity sensor alarm.

## 3.5 System Alarms

If there is an alarm detected, the display panel will alternate between the supply temperature and the alarm code. If the supply temperature itself is in alarm, it will display 4 dashes (----)

Note: Some alarm may not be available depending on unit configuration

### 3.5.1 Alarm Codes

Code	Description	Response	Possible Cause	Component to Check	Recommended Action
E01	Internal fan alarm	Heating and cooling disabled. Auto-reset	1. Controller board damaged	Check if there is a signal output of internal fan at controller port (0-10VDC)	Replace the controller board
			2. Cable connection is loose	Check if cables are connected properly	Connect cables properly
			3. Internal fan has failed	If internal fan does not run with power and speed signal with no physical obstruction, the fan has failed	Replace with a new fan
			4. Software settings	Check the parameter setting or refresh software	Reset to factory default or update software
E02	Ambient temperature sensor alarm	Auto-reset	1. Temperature sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable.
			2. Temperature sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E03	External fan alarm	Cooling disabled. Auto-reset	1. Controller board damaged	Check if there is signal of external output at controller port (0-10VDC)	Replace the controller board
			2. Cable connection is loose	Check if cables are connected properly	Connect cables properly
			3. External fan has failed	If external fan does not run with power and speed signal with no physical obstruction, the fan has failed	Replace with a new fan
			4. Software settings	Check the parameter setting or refresh software	Reset to factory default or update software
E05	Compressor fault alarm	Cooling disabled. Auto-reset	1. Compressor overheat protection	Check if overheat protection is engaged (engages at 115C, disengage at 80C)	Wait until compressor cools down or replace with a overheat protection
			2. Controller board failure	Check if there is a signal output of compressor at controller port	Replace the controller board

Code	Description	Response	Possible Cause	Component to Check	Recommended Action
			3. Compressor contactor has failed	Check if compressor contactor has coil voltage and if it is closed.	If contactor is not closed with coil voltage, replace contactor
			4. Cable connection is loose	Check if cables are connected properly	Connect cables properly
			5. Software settings	Check the parameter setting or refresh software	Reset to factory default or update software
			6. Compressor has failed	Check all above components if compressor still doesn't work or the compressor is obviously damaged	Replace the unit
E07	Dust sensor alarm	Free cooling disable	1. Dust sensor fails	Dust sensor	Replace the sensor or reconnect the cable.
E11	Return temperature sensor alarm	Heating disabled. Auto-reset	1. Temperature sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable.
			2. Temperature sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E12	Condenser temperature sensor alarm	Cooling disabled. Auto-reset	1. Temperature sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable.
			2. Temperature sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E13	DC Power over voltage alarm	Heating and cooling disabled. Auto-reset	1. Power failure at site	Check the power supply voltage	Change power supply or adjust input power voltage
			2. Controller board damaged	Check if the DC voltage reading on board matches with actual DC voltage	If significant deviation exists with no calibration, replace controller board
			3. Overvoltage limit setting is too low	Check if the limit setting point (F40) is reasonable (default 60v)	Reset voltage limit setting
E14	DC Power under voltage alarm	Heating and cooling disabled. Auto-reset	1. Power Failure at site	Check the power supply voltage	Change power supply or adjust input power voltage
			2. Controller board damaged	Check if the DC voltage reading on board matches with actual DC voltage	If significant deviation exists with no calibration, replace controller board

Code	Description	Response	Possible Cause	Component to Check	Recommended Action
			3. Undervoltage limit setting is too high	Check if the low limit setting point (F41) is reasonable (default 42v)	Reset undervolt limit setting
E15	High temperature alarm	Auto-reset	1. Supply air temperature sensor is not at a proper position	Check if the temperature sensor is loose or positioned properly	Re-locate the supply air temperature sensor
			2. A/C unit is not cooling properly	Check if A/C unit works in cooling mode and cooling performance	Replace with a new A/C unit
			3. Heat load is too high, or A/C unit is not large enough	Check if the headload in the cabinet is abnormal	If not, replace with a larger A/C unit
			4. High temperature alarm setting point is low	Check if the high temperature alarm setting point is too low (default 55 °c)	Reset the high temperature alarm setting point
E16	Low Temperature Alarm	Auto-reset	1. Heater not operating	Heater contactor, heater switch, thermal fuse	Replace component
			2. Low temperature alarm set point is high	Check if the low temperature alarm setting point is too high for environment insulation	Adjust low temperature alarm setting point
			3. Heater too small for environment and/or insulation	Outdoor temperature, insulation, and heater wattage	Change heater size, add additional supplemental heaters, improve insulation
			4. Supply air temperature sensor is not at a proper position	Check if the temperature sensor is loose or positioned properly	Re-locate the supply air temperature sensor
E17	System high pressure alarm	Cooling disabled. Auto-reset	1. Blockage at condenser side affecting heat exchange	Check for any blockage at condenser side	Clean the condenser
			2. Indoor or outdoor temperature is too high.	Check if the indoor or outdoor temperature is too high	Check again when the outdoor/ambient temperature goes down.
			3. A/C unit failure	Check if A/C system has failed	Replace with a new A/C unit
E18	System low pressure alarm	Cooling disabled. Auto-reset	1. Airflow blockage <sup>3</sup>	Check internal fan for airflow	See E01
			2. Low refrigerant	Check for low pressure and leak	Repair leak and recharge refrigerant

Code	Description	Response	Possible Cause	Component to Check	Recommended Action
			3. Bad low pressure switch	Check if low pressure switch is engaged when actual pressure is normal	Replace the switch
			4. Loose low pressure switch connection	Check for low pressure switch connection	Reconnect the cable
E22	Supply temperature sensor alarm	Cooling disabled. Auto-reset	1. Temperature sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable.
			2. Temperature sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E23	Supply temperature sensor alarm	Cooling disabled. Auto-reset	1. Temperature sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable.
			2. Temperature sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E24	Humidity sensor alarm	Auto-reset	1. Humidity sensor cable is damaged	Check if the sensor cable is damaged	Replace the sensor or reconnect the cable
			2. Humidity sensor cable connection is loose	Check if connection between sensor and AC unit is loose	Connect cables properly
E25	Damper actuator alarm	Auto-reset	1. Cable connection is loose	Check if cables are connected properly	Connect cables properly
			2. Software settings	Check the parameter setting or refresh software	Reset to factory default or update software
E26	Air Filter alarm	Auto-reset	1. Cable connection is loose	Check if cables are connected properly	Connect cables properly
			2. Dirty filter	Check if the filter is dirty	Clean the filter or change the filter

Tab 11 - System Alarms and Resolution



## 4. Remote Monitoring

The air conditioner configured for Modbus communication protocol, please refer to <http://www.modbus.org> for further detail about the protocol.

The AC unit transmits data through RS485, the transmitting mode is: RTU mode, 8 bit data, no parity, CRC check, and 9600 baud rate. Timeout: 50ms.

### 4.1 MODBUS Function Code

The controller supports the following function code

Function Code	Description	Definition
01 (0x01)	Read Coils	This function code reads status from 1 to 2000 contiguous coils in a remote device.
02 (0x02)	Read Discrete Inputs	This function code reads status from 1 to 2000 contiguous discrete inputs in a remote device.
03 (0x03)	Read Holding Registers	This function code reads the contents of a contiguous block of holding registers in a remote device.
04 (0x04)	Read Input Registers	This function code reads from 1 to approx. 125 contiguous input registers in a remote device.
05 (0x05)	Write Single Coil	This function code writes a single output to either ON or OFF in a remote device.
06 (0x06)	Write Single Register	This function code writes a single holding register in a remote device.
16 (0x10)	Write Multiple Register	This function code writes a block of contiguous registers (1 to approx. 120 registers) in a remote device.

Tab 12 - Modbus Function Codes

### 4.2 Exception Code

The controller supports the following exception code

Error Code	Description	Definition
01 (0x01)	Illegal Function	The function code received in the query is not an allowable action for the controller
02 (0x02)	Illegal Data Address	The data address received in the query is not an allowable address for the controller
03 (0x03)	Illegal Data Value	A value contained in the query data field is not an allowable value for the controller
04 (0x04)	Slave Device Failure	Fail to read or write the register
05 (0x05)	Controller Busy	The master should retransmit the data later when the controller is free
06 (0x06)	Too Much Data	The received data is more than 255 bytes
12 (0x0c)	CRC Check Error	CRC Check Error

Tab 13 - Modbus Exception Codes

## 4.3 Data Type

The data has two types: bit data and word data. The bit data include discrete input data that is read-only and Coil data that is readable and writable. The word data include input register that is read-only and holding register that is readable and writable.

## 4.4 Data List

Data address of the controller register follows Modbus communication protocol, which start from 0 and the maximum address is 65535. If the master request data from an undefined address, the controller will return error. The defined data points are as follows:

### 4.4.1 MODBUS Coil Data Points List

Tab 14 - Modbus Coil Data Points

Network Control Property	Read Or Write	Data Type	Id	Description
Internal Fan Status	R	Coil	00	1=Run, 0=Stop
Damper Statues	R	Coil	01	1=Open, 0=Close
External Fan Status	R	Coil	02	1=Run, 0=Stop
Compressor Status	R	Coil	04	1=Run, 0=Stop
Heater Status	R	Coil	05	1=Run, 0=Stop
Self-Test Status	R	Coil	11	1=Run, 0=Stop
System Status	R/W	Coil	12	1=Run, 0=Stop
Emergency Fan Status (Optional)	R	Coil	13	1=Run, 0=Stop

### 4.4.2 MODBUS Discrete Input Data Points List

Network Control Property	R/W	Data Type	Id	Description	Alarm Code
Internal Fan Alarm	R	Discrete Input	00	1=Alarm ,0=No Alarm	E01
Damper Alarm	R	Discrete Input	01	1=Alarm ,0=No Alarm	E25
External Fan Alarm	R	Discrete Input	02	1=Alarm ,0=No Alarm	E03
Compressor Alarm	R	Discrete Input	04	1=Alarm ,0=No Alarm	E05
Communication Drive Alarm	R	Discrete Input	05	1=Alarm ,0=No Alarm	/
Heater Alarm	R	Discrete Input	07	1=Alarm ,0=No Alarm	/
Heater Over-Current Alarm	R	Discrete Input	08	1=Alarm ,0=No Alarm	/
Heater Non-Current Alarm	R	Discrete Input	09	1=Alarm ,0=No Alarm	/
Return Temp Sensor Alarm	R	Discrete Input	10	1=Alarm ,0=No Alarm	E11
Cond. Temp Sensor Alarm	R	Discrete Input	11	1=Alarm ,0=No Alarm	E12
High Dc Voltage Alarm	R	Discrete Input	12	1=Alarm ,0=No Alarm	E13
Low Dc Voltage Alarm	R	Discrete Input	13	1=Alarm ,0=No Alarm	E14
High Temp Alarm	R	Discrete Input	14	1=Alarm ,0=No Alarm	E15

Network Control Property	R/W	Data Type	Id	Description	Alarm Code
Low Temp Alarm	R	Discrete Input	15	1=Alarm ,0=No Alarm	E16
High Pressure Alarm	R	Discrete Input	16	1=Alarm ,0=No Alarm	E17
Ambient Temp Sensor Alarm	R	Discrete Input	21	1=Alarm ,0=No Alarm	E02
High Humidity Alarm	R	Discrete Input	24	1=Alarm ,0=No Alarm	/
Humidity Sensor Alarm	R	Discrete Input	26	1=Alarm ,0=No Alarm	E24
Low Pressure Alarm	R	Discrete Input	27	1=Alarm ,0=No Alarm	E18
Dust Sensor Alarm	R	Discrete Input	30	1=Alarm ,0=No Alarm	E07
Supply Sensor Alarm	R	Discrete Input	32	1=Alarm ,0=No Alarm	E23
The Filter Alarm	R	Discrete Input	33	1=Alarm ,0=No Alarm	E26

Tab 15 - Modbus Discrete Input Data Points

#### 4.4.3 MODBUS Input Register Data Points List

Network Control Property	R/W	Data Type	ID	Unit
Internal Fan RPM	R	Input Register	0	RPM
Damper Position	R	Input Register	1	
External Fan RPM	R	Input Register	2	RPM
Reserved	R	Input Register	3	
Indoor Temperature	R	Input Register	4	0.1C
Outdoor Temperature	R	Input Register	5	0.1C
DC Voltage	R	Input Register	6	0.1V
Compressor RPM	R	Input Register	7	RPM
Reserved	R	Input Register	12	
Condenser Temperature	R	Input Register	13	0.1C
Ambient Humidity	R	Input Register	14	%
Supply Temperature	R	Input Register	30	0.1C
System Run Time (high bits)	R	Input Register	40	Hour
System Run Time (low bits)	R	Input Register	41	Hour
Compressor Run Time (high bits)	R	Input Register	46	Hour
Compressor Run Time (low bits)	R	Input Register	47	Hour
Compressor Starts (high bits)	R	Input Register	48	Hour
Compressor Starts (low bits)	R	Input Register	49	Hour

Tab 16 - Modbus Input Register Data Points

#### 4.4.4 MODBUS Holding Register Data Points List

**Note:** Default setting provided for reference only. Default settings can be changed or locked depending on project requirements

Network Control Property	R/W	Data Type	Id	Range	Default	Unit
Internal Fan Max Speed	R/W	Holding Register	1	1200 ~ 2700 (3kw) 800 ~ 1600 (4kw)	2700 (3kw) 1600 (4kw)	RPM
Internal Fan Min Speed	R/W	Holding Register	2	540 ~ 2500 (3kw) 320 ~ 1400 (4kw)	800(3kw) 600 (4kw)	RPM
Damper 100% Open Hysteresis (Supply)	R/W	Holding Register	3	2 ~ 50	5.0	°C
Damper 100% Open Temperature	R/W	Holding Register	4	33 ~ 80	33.0	°C
Damper Open Temperature (Indoor)	R/W	Holding Register	5	-20 ~ 28	28.0	°C
Damper Close Temperature (Supply)	R/W	Holding Register	6	-45 ~ 50	10.0	°C
Damper Open Min Temperature Difference	R/W	Holding Register	7	2 ~ 10	3.0	°C
External Fan Max Speed	R/W	Holding Register	12	1200 ~ 2700 (3kw) 800 ~ 1600 (4kw)	2700 (3kw) 1600 (4kw)	RPM
External Fan Min Speed	R/W	Holding Register	13	540 ~ 2500 (3kw) 320 ~ 1400 (4kw)	800(3kw) 600 (4kw)	RPM
External Fan Max Speed Temperature	R/W	Holding Register	15	35 ~ 80	45.0	°C
External Fan Min Speed Temperature	R/W	Holding Register	16	-30 ~ 40	30.0	°C
Outdoor Fan Stop Temperature	R/W	Holding Register	17	-42 ~ 25	-42	°C
Outdoor Fan Start Temperature Difference Hysteresis	R/W	Holding Register	18	2 ~ 30	5.0	°C
Heater Start Temperature	R/W	Holding Register	22	-45~15	8.0	°C
Heater Operation Hysteresis	R/W	Holding Register	23	5~20	5.0	°C
Heater Enable	R/W	Holding Register	26	0: Disable 1: Enable	1	/
System Address	R/W	Holding Register	27	1~255	1	/
High Temp Alarm Setpoint	R/W	Holding Register	28	30~100	50	°C
Low Temp Alarm Setpoint	R/W	Holding Register	29	-42~20	0.0	°C

Network Control Property	R/W	Data Type	Id	Range	Default	Unit
Indoor Temp Sensor Calibration	R/W	Holding Register	33	-10 ~ 10	0.0	°C
Outdoor Temp Sensor Calibration	R/W	Holding Register	34	-10 ~ 10	0.0	°C
DC Voltage Calibration	R/W	Holding Register	36	-10 ~ 10	0.0	V
Filter Alarm Enable	R/W	Holding Register	37	0: Disable 1: Enable	1	/
Filter Alarm Option	R/W	Holding Register	38	0: No 1: Nc	1	/
High Voltage Alarm Value	R/W	Holding Register	39	50~70	60	V
Low Voltage Alarm Value	R/W	Holding Register	40	24~47	42	V
Temperature Setpoint	R/W	Holding Register	41	18~50	32.5	°C
Compressor On/Off Differential	R/W	Holding Register	42	2~20	2.5	°C
Damper Close Max Humidity Setpoint	R/W	Holding Register	49	50~100	80	%
Free Cooling Close Humidity Hysteresis	R/W	Holding Register	52	2~20	5	%
Free Cooling Open Temperature Hysteresis (Indoor)	R/W	Holding Register	53	1~10	2	°C
Humidity Control Start Point	R/W	Holding Register	61	0~80	60	%
Coastal Mode	R/W	Holding Register	62	0: Disable 1: Enable	0	/
Emergency Ventilation Humidity Control	R/W	Holding Register	63	0: Disable 1: Enable	0	/
Low Pressure Switch Option	R/W	Holding Register	64	0: Disable 1: No 2: Nc	2	/
Humidity Calibration	R/W	Holding Register	65	-10 ~ 10	0	%
Ambient Temperature Calibration	R/W	Holding Register	66	-10 ~ 10	0	°C
Supply Temperature Calibration	R/W	Holding Register	67	-10 ~ 10	0	°C
Forced Free Cooling Temperature Difference	R/W	Holding Register	68	3~20	10	°C

Tab 17 - Modbus Holding Register Data Points

# 5. Maintenance

## 5.1 Preventive Maintenance Schedule

This section provides guidelines for the owner of an AIRSYS unit to ensure that the unit perform well continuously. Following these guidelines for a regular maintenance will help to avoid serious damage on components and expensive repairs by service technician.

Task	Recommended Frequency	Comments
Condenser Cleaning	Based on Local Conditions	Generally, at least every 12 months. Harsh environment may require more frequent cleaning, especially if condenser screen is not installed
Condenser Screen Cleaning (If installed)	Based on Local Conditions	Generally, at least every 12 months. Harsh environment may require more frequent cleaning.
Indoor Filter Cleaning	Based on Local Conditions	Generally, at least every 6 months. Harsh environment may require more frequent cleaning.
Verify System Operation	12 Months	Re-powering the unit will engage system self-test. Ensure no alarm is reported, otherwise resolve alarm. See section 3.5 for more details on alarms.
Inspect Wiring and Connection for Signs of Wear	12 Months	May require more frequency in areas with active rodent or insect populations
F7 Filter Cleaning	Based on Local Conditions	Generally, at least every 6 months. Harsh environment may require more frequent cleaning.

Tab 18 - Preventive Maintenance Schedule

It is generally recommended to compare the operation parameter of the equipment with the results of the previous inspection. Any differences in operating characteristics can then be easily identified.

Closely following the recommend maintenance schedule will ensure the system always operates without impairment and ensure long term reliability of the system.

## 5.2 Wiring and Connections

For wiring and connections

- Check that the system has been installed correctly and all wiring are still snug
- Check that the wiring cable sections meet current capacity.
- Check that the grounding cables have been installed

## 5.3 Condenser Screen Cleaning

Your unit may come with condenser screen that helps blocking larger particle and debris from entering the condenser. If condenser screen is installed, follow these steps to clean the condenser screen.

- Remove condenser screen cover

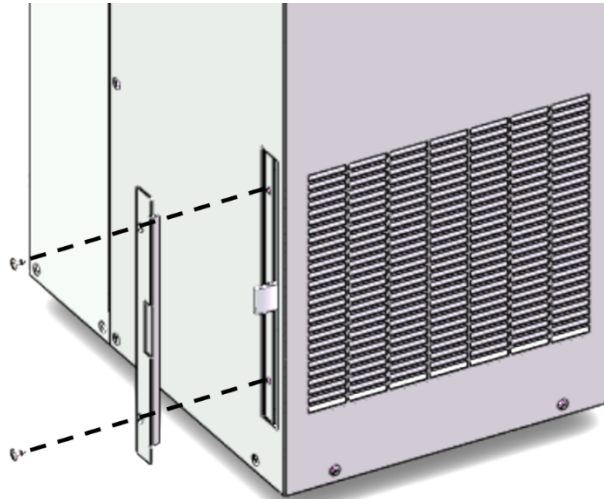


Fig 7 - Condenser Screen Cover

- Pull out condenser screen

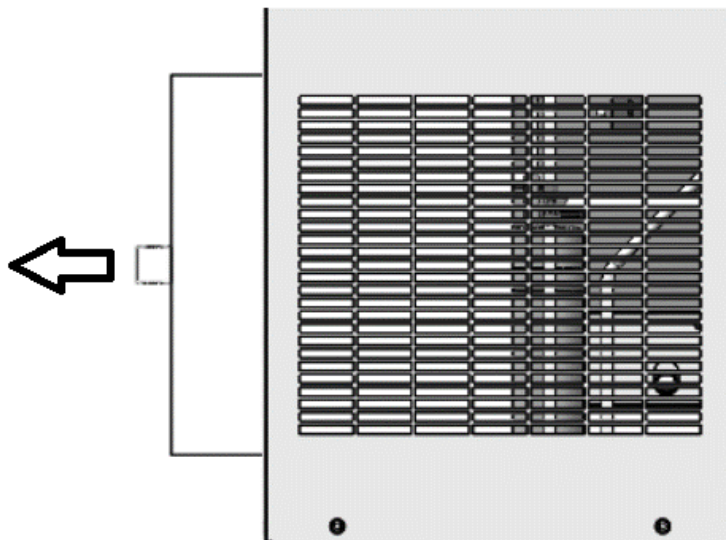


Fig 8 - Condenser Screen Removal

- Brush off larger loose particles and debris
- If screen is not clean after brushing, it can be wiped using paper towel with water

## 5.4 Air Filter Maintenance

- Remove air filter protect panel

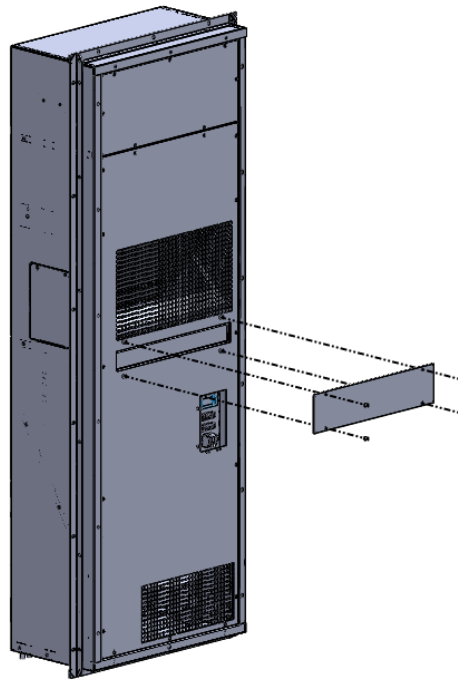


Fig 9 - Air Filter Protect Panel

- Pull out air filter
- Brush off larger loose particles and debris
- If the air filter wears out, replace it with a new one.

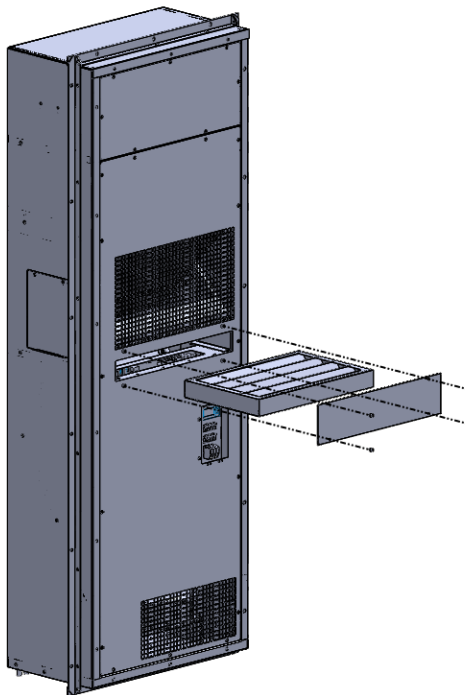


Fig 10 - Air Filter Removal





## 6. Warranty

Unless separate extended warranty agreement is signed, the warranty duration is 12 months from the date of installation. AIRSYS warrants that its products will be free from defects in materials and workmanship for a period of 12 months after installation.

Warranty must be registered at [airsysnorthamerica.com](https://airsysnorthamerica.com). If no warranty is registered, warranty period starts at date of shipment.

# 7. Appendix

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## 7.2 Appendix 2-Specification Sheet

### 48VDC FC Series Cabinet Air Conditioner (Embedded)

Unit Model		ACA-FC030ED1	ACA-FC040ED1
Input Voltage		48VDC	
Cooling Capacity L35/L35	W	3000	4000
Power Consumption L35/L35	W	860	1150
Airflow	m <sup>3</sup> /h	800	1050
Application Temperature	°C	-40°C~+70°C	
Working Temperature	°C	-20°C~+55°C	
Mounting Method		Embedded	
IP Grade		IP55*	
Electrical Heater*	W	/	
Refrigerant		R134a	
Noise	dB (A)	65	65
Surface Treatment		Outdoor type powder coating RAL7035	
Dimensions* (Include Flange)	mm	1650*600*350	1800*650*350
Dimensions (Without Flange)	mm	1600*550*300	1750*600*300
Weight	kg	80	110

Note:

1. Unit qualifying GR487 and IP65 is available upon request.
2. Flexible capacity of electrical heater integration based on the requirements of applications.
3. Customized dimension design available upon request.



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