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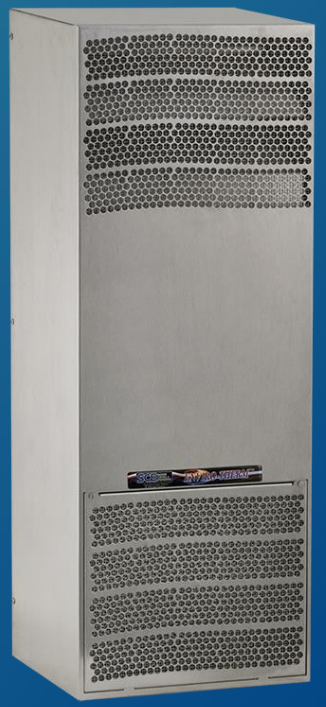
Cabinet Air Conditioner Training



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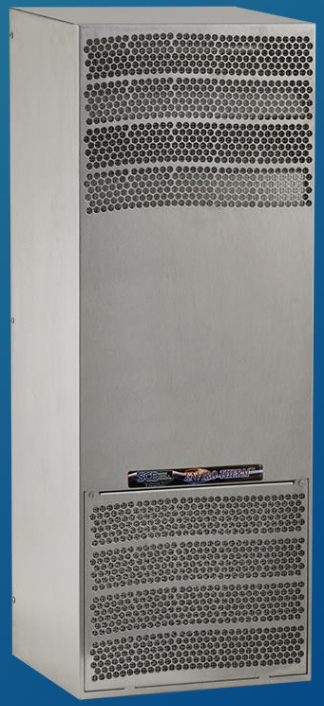
Topic Overview

1. Why we need cabinet air conditioning?
2. Air conditioner principles
3. Verifying that the selected air conditioner has the apropriate cooling performance
4. Controller funtions
5. Wiring and mounting units
6. Handling and storage information
7. Troubleshooting & Debugging



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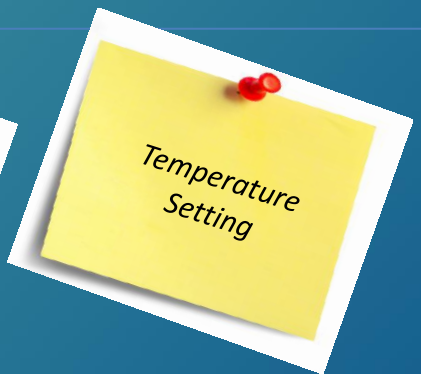
Why do we use cabinet close loop temperature control

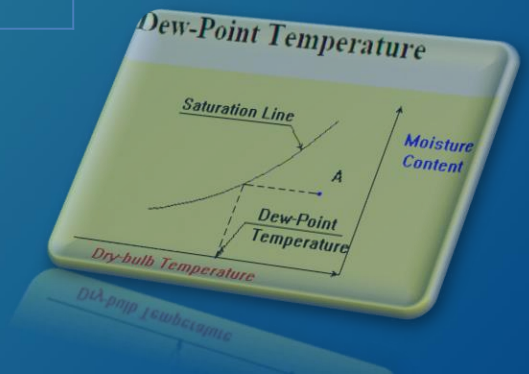
Protection from:

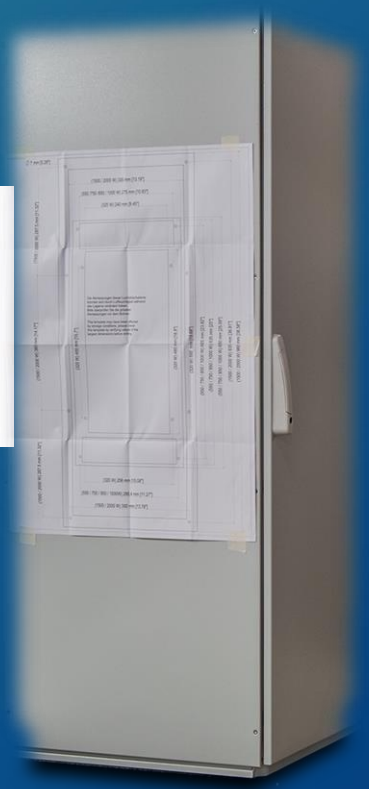
- Dust
- Humidity
- Heat
- Cold
- Water
- Wide temperature changes

Which effect an AC has inside the cabinet?

- Heat dissipation from components
- Temperature control
- Humidity control







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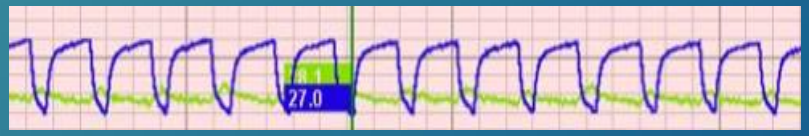
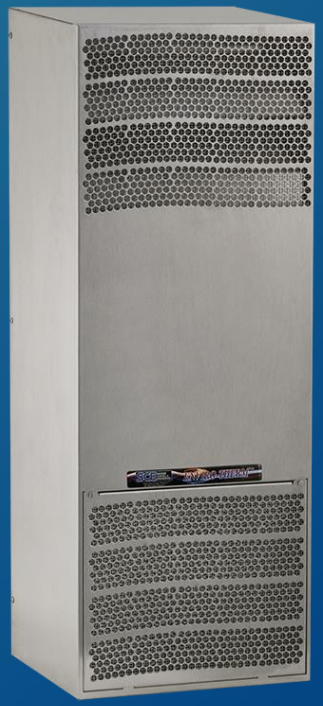
Duties of a cabinet air conditioner?



- Maintains Uniform air temperature within the enclosure
- Protects against dust, moisture and potential damage
- Protects against overheating thus extending the service life of electrical components
- An increase in 18°F will reduce the service of electrical components lifetime by half
- Cooling naturally stops when the cabinet door is opened in order to reduce condensation



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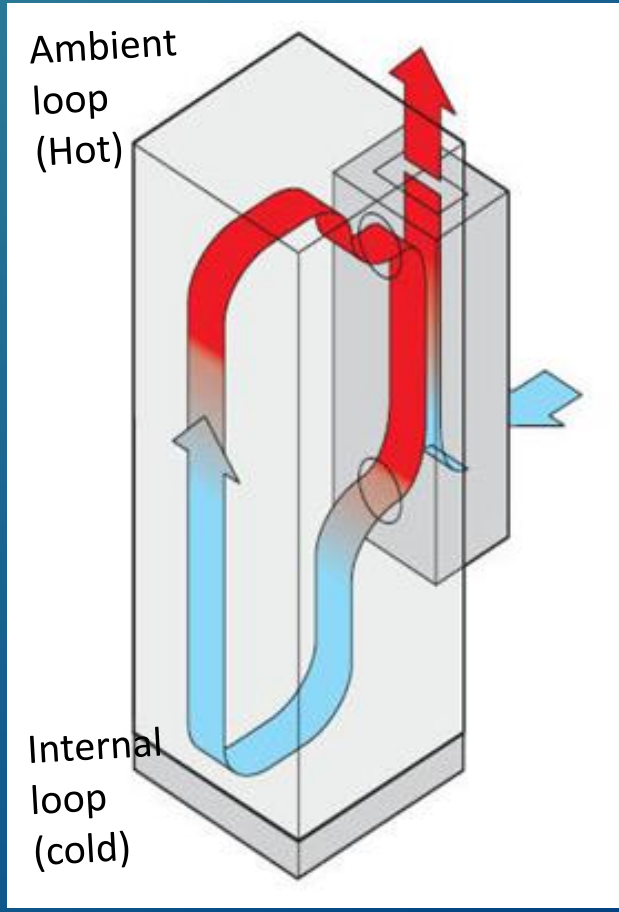
Close loop cooling

For a close loop air conditioner to function at full cooling capacity:

- Don’t obstruct internal & external Airflow
- Keep cabinet closed tight and free of air infiltration



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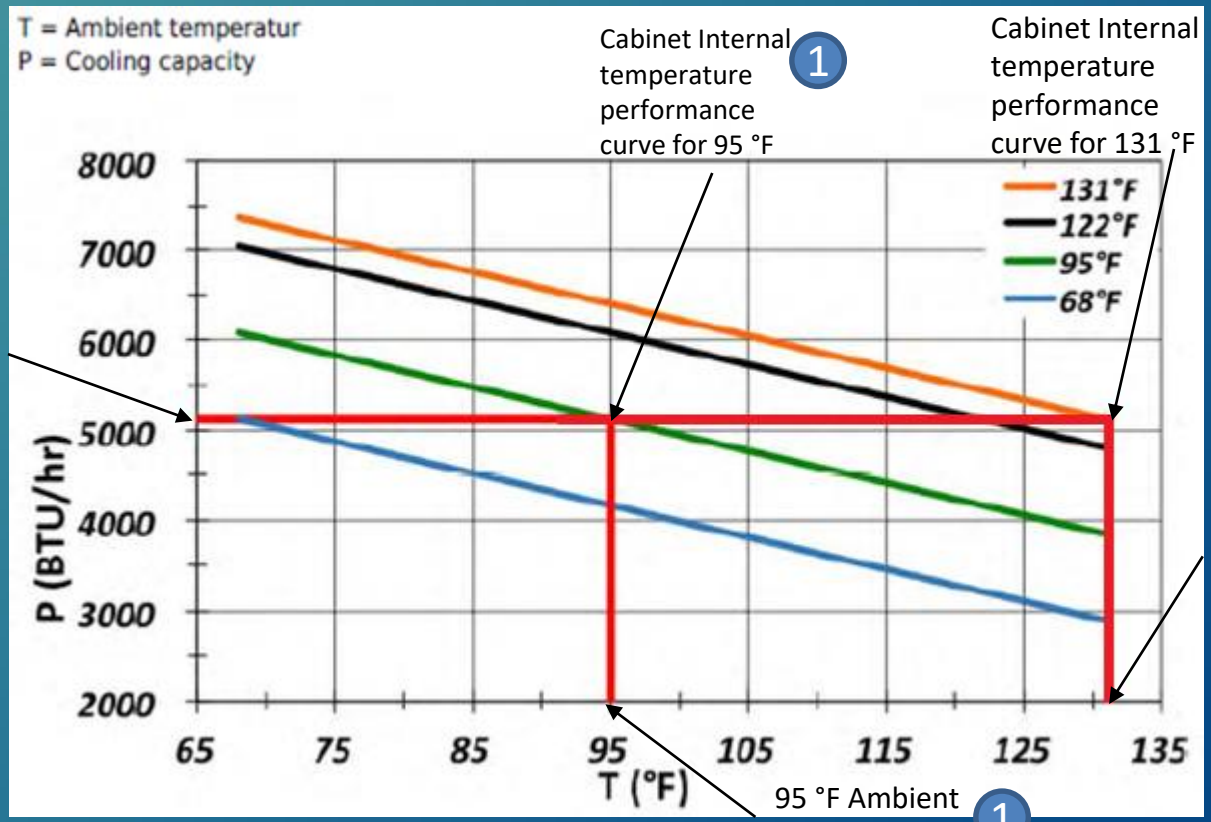
How to choose?

You can use performance curves on the air conditioners to determine if an air conditioner is sized appropriately. The chart below shows two examples: the unit selected cooling performance at 95 °F Internal and 95 °F ambient is 5100 BTU/hr and if you look at the same unit at 131 °F internal and 131 °F you observed that under such condition the performance was the same, 5100 BTU/hr, This is not always the case



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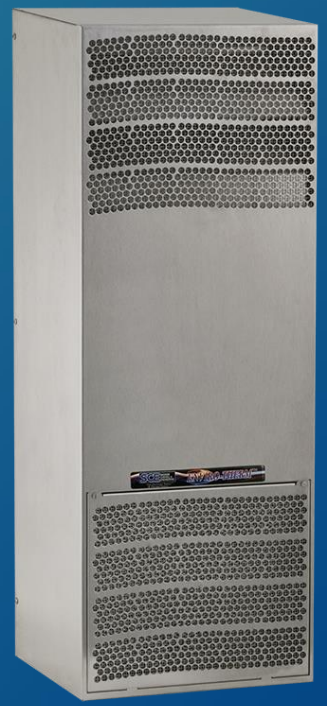
If you look at the data sheet of the unit selected you find the cooling capacity of the unit selected at 95°F / 95°F and at 131°F / 131°F

How to choose!

Technical data	
Part number	AC5100B120VSS
Order Number	57151182SG
Cooling capacity @ 95°F / 95°F	5100 BTU ← 1
Cooling Capacity @ 131°F / 131°F	5100 BTU ← 2
Heating capacity	1,000 W
Compressor	Reciprocating compressor
Refrigerant	R134a
Refrigerant charge	14 oz
Max. pressure	348 psig
Operating temperature range	-40°F - 131°F
Max. air volume flow	Ambient air circuit: 385 cfm Cabinet air circuit: 235 cfm
Mounting	External
Material housing	Stainless steel AISI 304 (1.4301)
Dimensions (H x W x D)	45.2 x 15.5 x 10.6 inch
Weight	113 lbs.
Rated operating voltage / frequency	120 V - 50/60 Hz
Rated current @ 95°F / 95°F	9.6 A
Starting current	32 A
Max. current	12.8 A
Power consumption @ 95°F / 95°F	880 W
Max. power consumption	1.29 kW
Fuse rating	16 A (T)
Connection	Connection terminal block
Protection class NEMA	NEMA 4X
Approvals	CE, cURus



Cabinet aircondition

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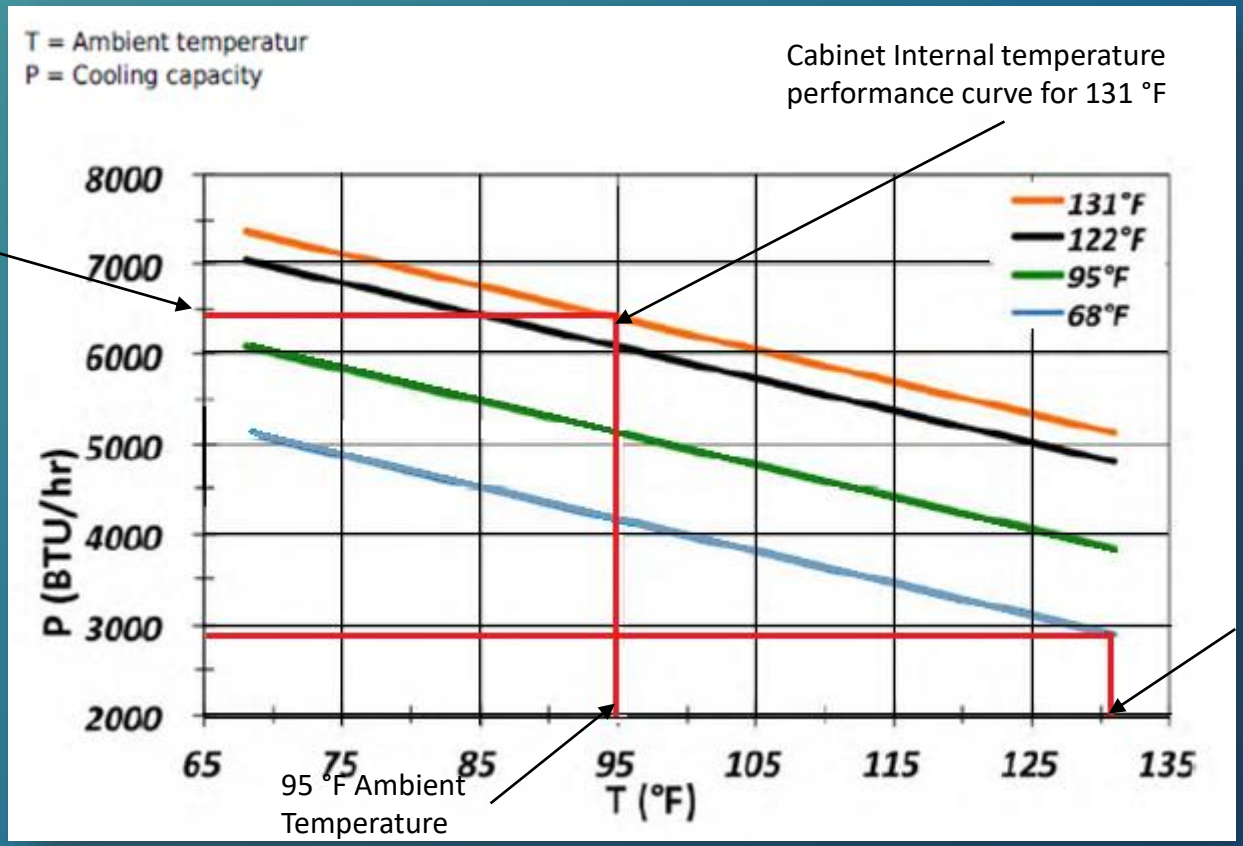
How to choose?

The chart below shows another two examples:

1. At 95 °F Internal air temperature and 122 °F ambient air temperature the cooling performance is lower at 4100 BTU/hr, note that with high ambient temperature the air conditioner cooling performance degrades.
2. At 131 °F Internal air temperature and 95 °F ambient air temperature the cooling performance is higher at 6500 BTU/hr,



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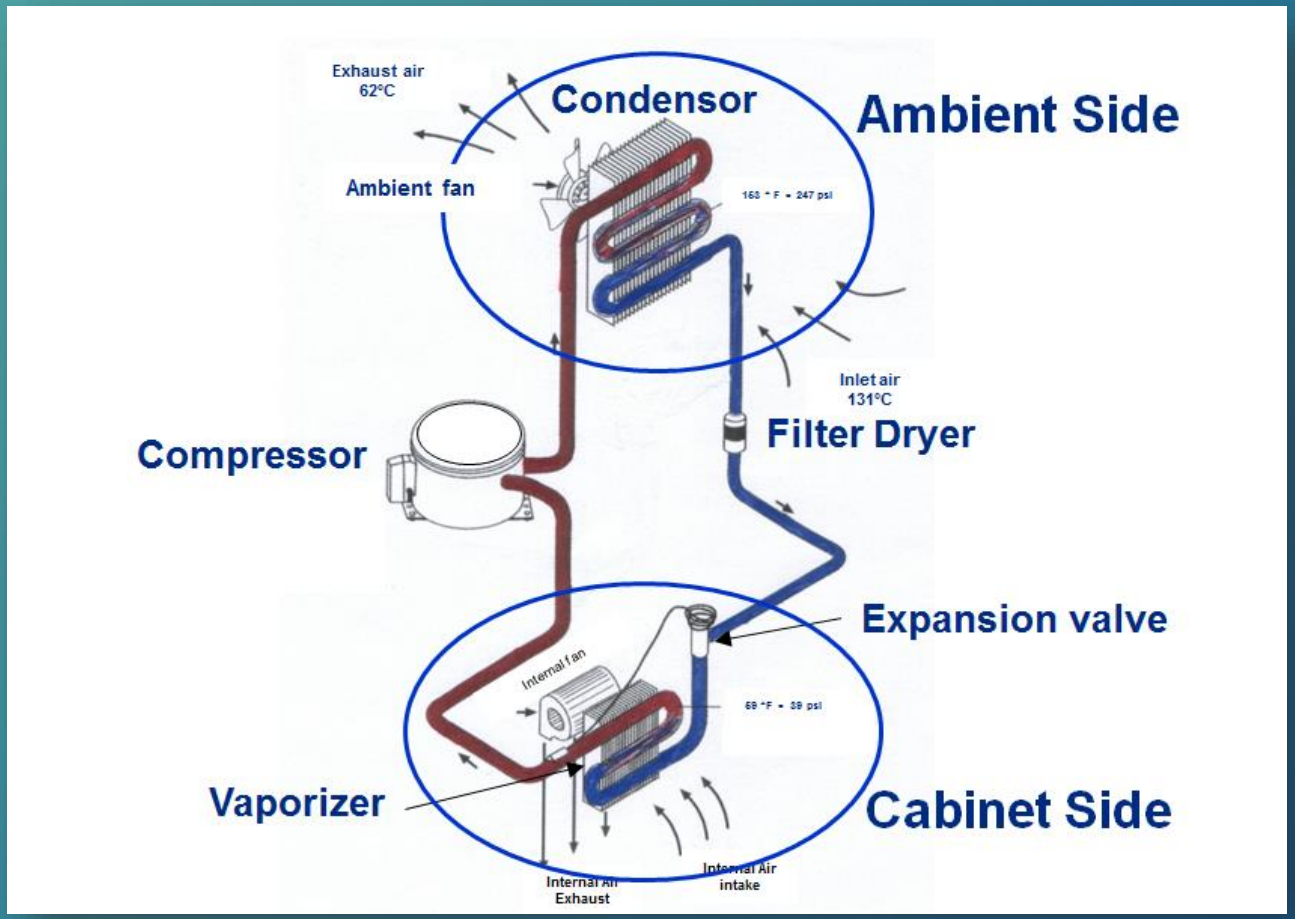
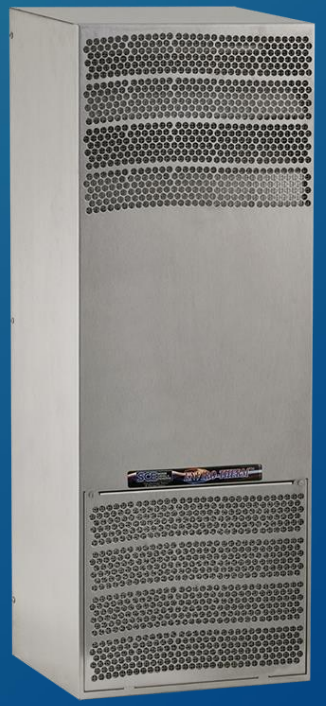
What mechanical components are inside an air conditioner?





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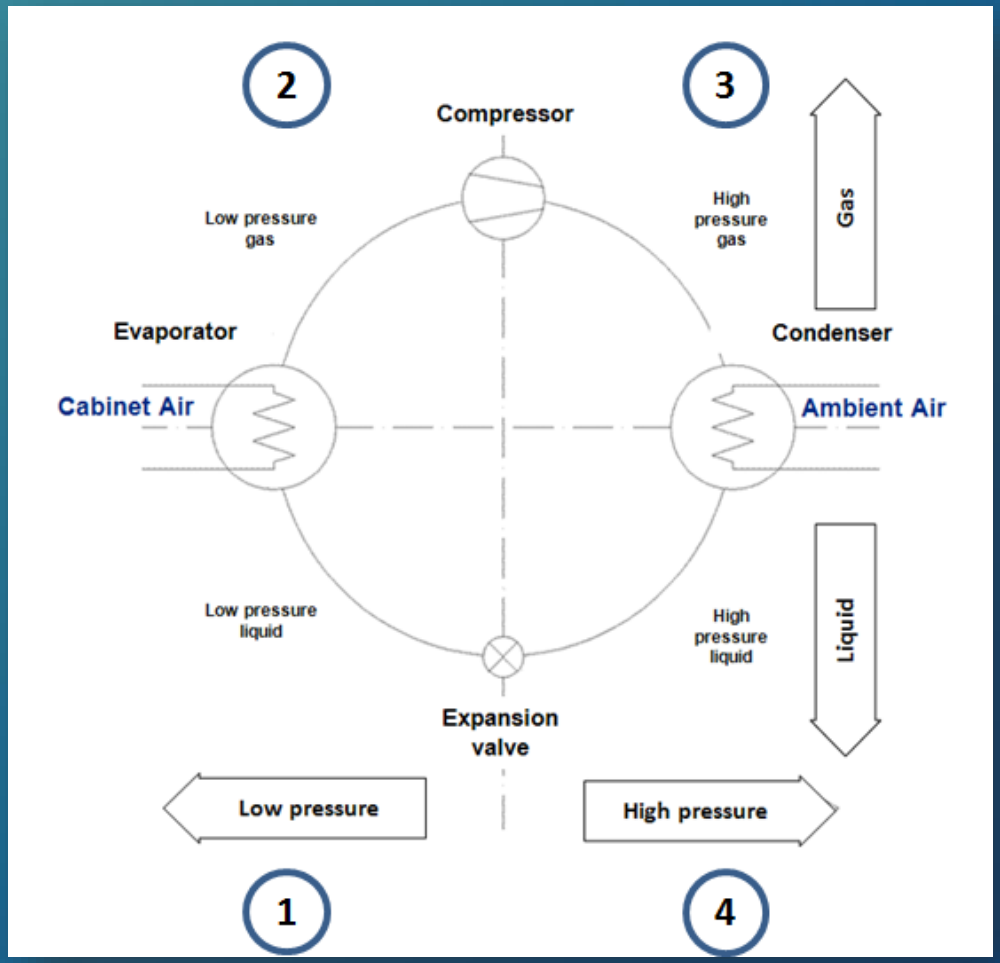
Air conditioner operation

How does it work?

1. The refrigerant (R134a) leaves the expansion valve or capillary tube to enter the evaporator in a low pressure liquid vapor state.
2. The refrigerant evaporates thoroughly in the evaporator removing the heat from the cabinet and enters the compressor as an low pressure gas.
3. The refrigerant gas is then compressed to a high pressure gaseous refrigerant before it enters the condenser.
4. The removal of the heat from the compressed gas through the condenser results into a high pressure liquid. The liquid is then forced through an expansion valve or capillary tube evaporating the refrigerant returning to step 1 and completing the cycle.



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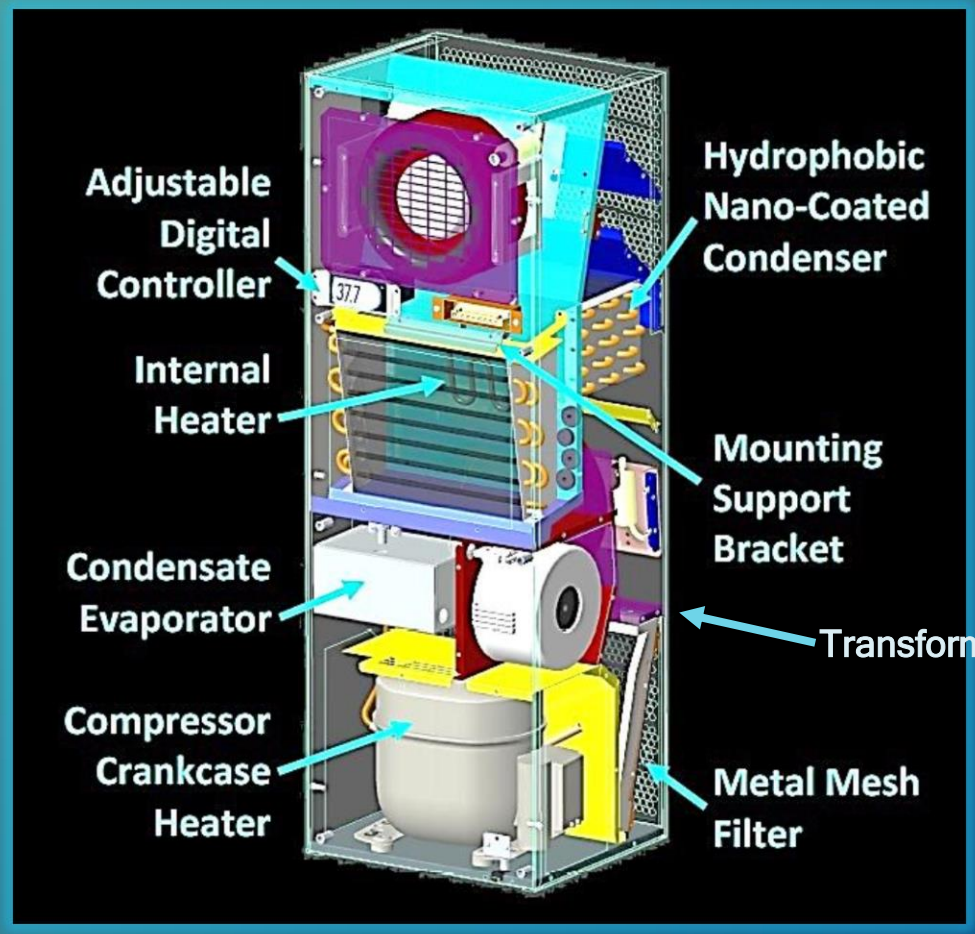
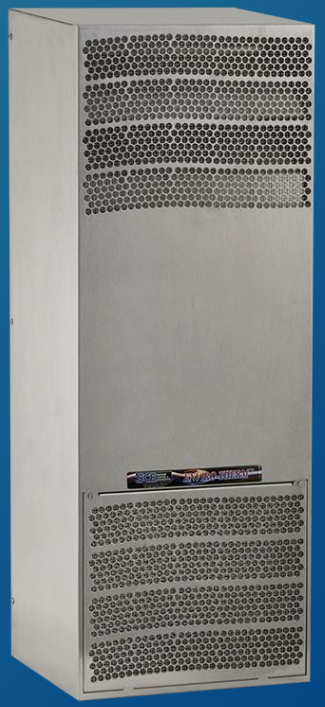
Where are the components in a Universal air conditioner





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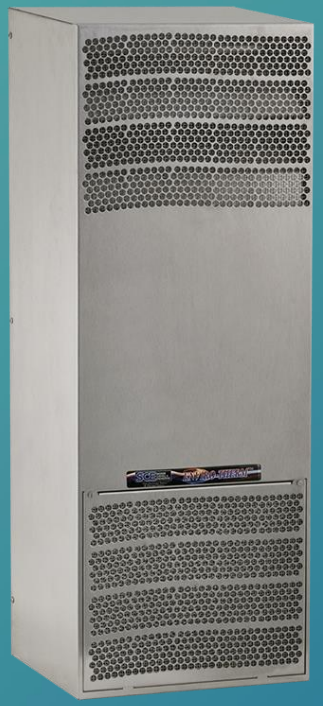
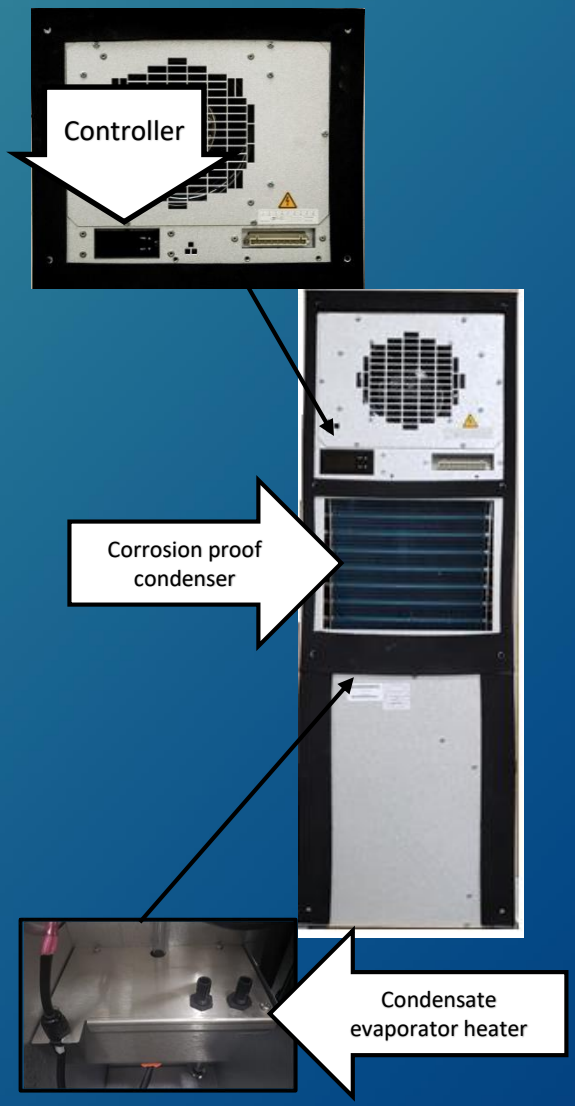
Universal units NEMA 12, 3R, 4 and 4X rating



- Universal units are all NEMA 4 rated and harden for the outdoor environment
- Internal sheet metal parts coated in Alu-zinc
- Corrosion proof coated condenser
- Controller (digital display) mounted internally to protect from elements
- Heater is standard in all Universal units
- Crank case heater standard in all Universal units
- Condensate evaporator heater standard in all Universal units
- Replaceable Aluminum mesh filter is standard on every unit

A NEMA 4X option is available for all single phase 110, 230, 400 and 460 V Universal units

- Built in a stainless AISI 304 steel housing for harsh environment, corrosion proof units with an AISI 316 steel covers are also available.



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Filter replacement on the Universal air conditioners

- All Universal Seifert air conditioners include an aluminum mesh filter
- The aluminum mesh filter is easily replaced or removed by removing the air inlet cover located on the front of the unit

Remove cover to replace filter

Filter slides off from top

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Controller Function

Functions of the Controller

Temperature Control

The electronic controller insures a stable operation of the cabinet air conditioner:

- Internal temperature of the enclosure
- Run time of the compressor
- Downtime of the compressor
- Hysteresis of temperature:
  - ✓ to control the accuracy of the temperature setting at a tolerance of 3°F

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Controller function on the Universal air conditioners

The temperature display shows the temperature in the range of -50°C to +150°C (-58°F to +302°F). The temperature is displayed with resolution of tenths between -19.9°C and +99.9°C (-3.8°F to +211.8°F). During programming, it shows the codes and values of the parameters. The display also shows icons according to occurring events.

Display icons

Icon	Function	Description
1	Compressor relay active	Flashes when activation is delayed or inhibited by protection times, external disabling or other procedures in progress
2	Alarm relay active	
3	Heater relay active	
4	Ambient blower relay active	
⚠	Alarm	Flashes when alarms are active
R	Heating mode	Signals operation of unit in heating mode
D	Cooling mode	Signals operation of unit in cooling mode
TEST	Text mode in progress	Activated only by manual procedure

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Controller function on the Universal air conditioners

Under normal working conditions the display shows the temperature inside the enclosure.
The controller “set point” for the interior of the enclosure is pre-set at 95°F and can be adjusted between 68°F and 122°F.
The controller heating “set point” for the heating of the enclosure is pre-set at 41°F and can be adjusted between -4°F and 68°F.

The High temperature alarm (parameter AH) is preset at 131°F. The High Temperature Alarm relay is delivered as “normally closed” (H1=1). If you need to change it to “normally open”, please modify value of parameter H1 (H1=2).

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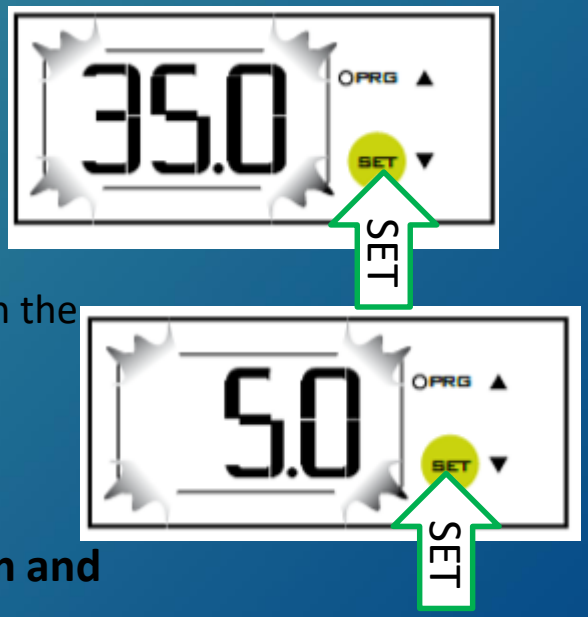
Controller function on the Universal air conditioners

Setting cooling set point, St1:

1. Press “SET” and display should show St1 and then the pre-set value of St1. (default: +35°C / +95°F)
2. Reach the desired value by using ▲ or ▼.
3. Press “SET” again to save the new value of St1.



Setting Heating set point, St2:

1. Press “SET” twice slowly and display should show St2 and then the pre-set value of St2. (default: +5°C / +41°F)
2. Reach the desired value by using ▲ or ▼.
3. Press “SET” again to save the new value of St2

Setting temperature units (°C / °F), low temperature alarm and high temperature alarm:

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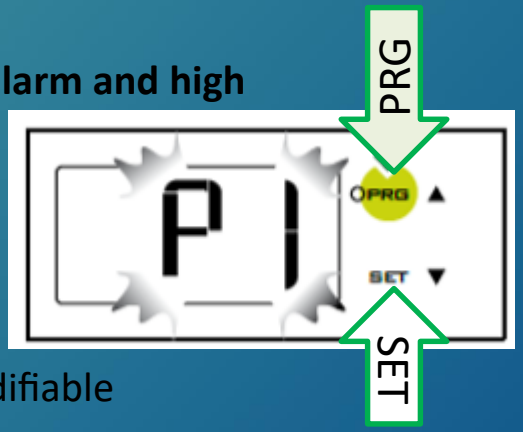
Controller function on the Universal air conditioners

Setting temperature units (°C / °F), low temperature alarm and high temperature alarm:



1. Press “PRG” button for 5 seconds to reach the modifiable parameter list.
2. Use ▲ or ▼ to reach the desired parameter: C18 for temperature unit of measure °C = 0 °F = 1 P25 for low temperature alarm threshold (default -10°C / +14°F) P26 for high temperature alarm threshold (default +55°C / +131°F)
3. Press “SET” on the desired parameter to display the current value.
4. Use ▲ or ▼ to reach the desired value.
5. Pressing “SET” temporarily saves the new value and returns to the parameters list.
6. Repeat steps 2-5 to set other parameters.
7. Press “PRG” for 5 seconds to permanently save the new values.

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Controller function on the Universal air conditioners

Test function

Different test functions can be used depending on the combination of keys pressed. Such tests run for the duration of 4 minutes.

- "SET+▲" tests Compressor and Ambient Blower relays.
- "SET+▼" tests Alarms and Heater relays

Alarm Relay Operation

Both normally closed (NC) and normally open (NO) alarm contacts are provided. Under normal conditions, the NC contact is closed and the NO contact is open. When an alarm condition is present, the NC contact will open and the NO contact will close.

1. System power OFF

2. System powered ON
   -NO ALARM
   -Door Contact Closed

3. System Powered ON

4. System powered ON
   -ALARM STATE

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Controller function on the Universal air conditioners

Notes:

State 2: Additional icons (1,3,4, Reverse, Direct, Test) depending on operation.

State 3: The display shows “OFF” alternating with the standard display.

State 4: The display shows “EXX” alternating with the standard display – at the same time, the alarm icon flashes.

Typical Alarm Codes:

Error Code	**Description**
E01	Probe B1 fault
E02	Probe B2 fault
E04	High temperature alarm
E05	Low temperature alarm

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Important Notes

- Whilst programming, if no button is pressed for 10 seconds, the display starts flashing, and after 1 minute returns to the main display without saving changes.
- To increase scrolling speed, press and hold the ▲ or ▼ button for at least 5 seconds.
- When pressing “PRG” for 3 seconds, the firmware revision code is displayed for 2 seconds.
- When cleaning the controller panel, do not use ethanol, hydrocarbons, ammonia or their by-products. Use neutral detergents and water.
- In order to protect the unit’s components, minimum relay output on (3 or 7 minutes) and off (4 minutes) times and minimum time (7 or 11 minutes) between activation of the same relay output are applied.
- In case of digital inputs not configured, probes not fitted or configured, or St2 not enabled on the controller the display shows ‘nO’

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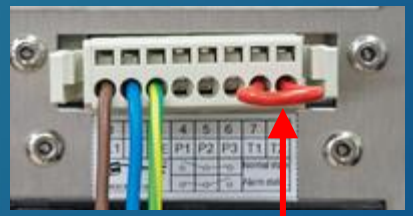
Controller function on the Universal air conditioners

Door Switch

The unit can be turned on and off via a door contact switch. When a new unit is delivered the door contact terminals are bridged on the female connector. In order to connect the door contact switch remove the bridge and connect the door contact switch. The contact must be closed when the cabinet door is closed.



Door contact bridge

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Controller single phase wiring on the Universal air conditioners

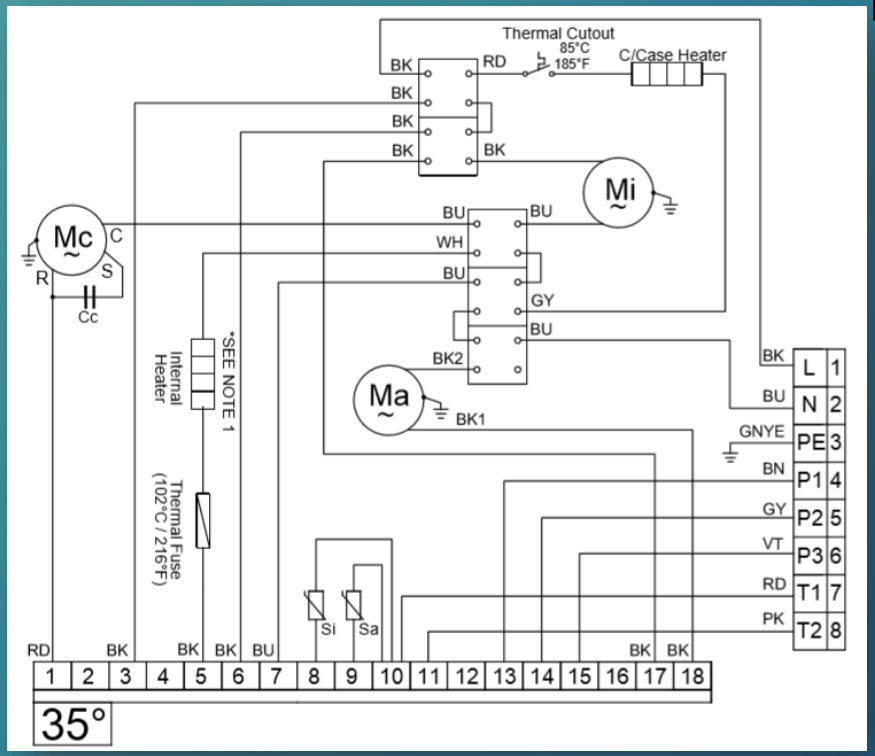
- 1000 BTU/hr Universal units are available in 120 V and 230 V

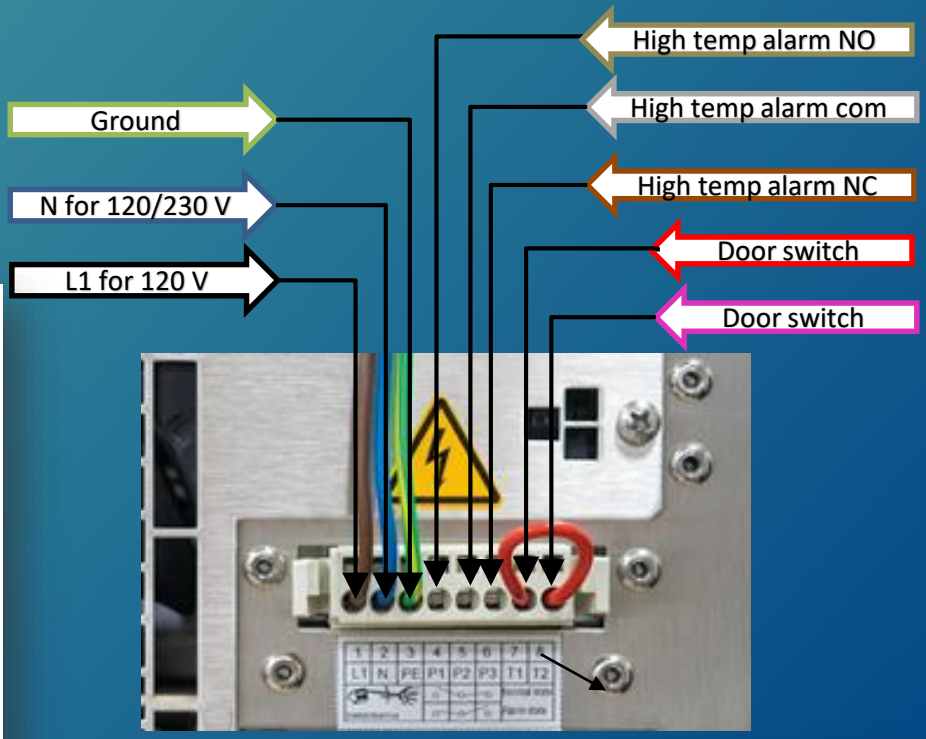
Parts List

Mc: Compressor
Ma: Ambient fan
Mi: Internal fan
Cc: Comp. capacitor
Ci: Int. fan capacitor
Sa: NTC sensor for ambient temperature

Notes

1. Connector for units with internal heater

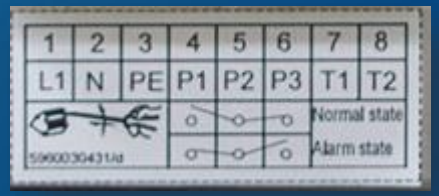




Notes

Hight temp alarm can be wired NC or NO

When wires:
P1 P2 – NO
When wires:
P2 P3 - NC



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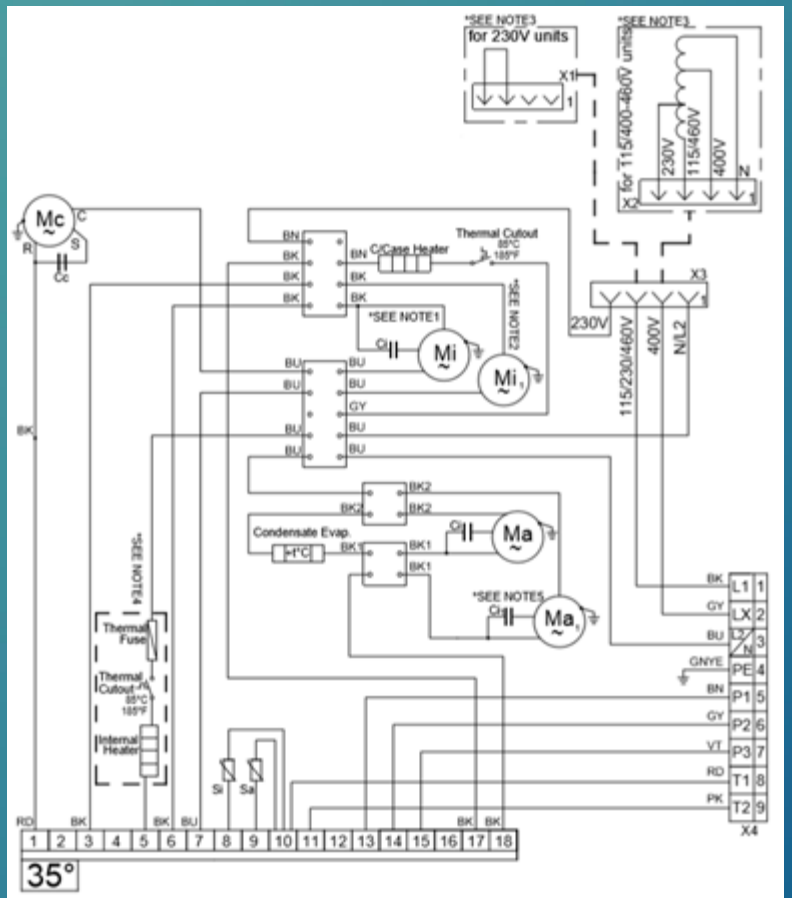
Controller single phase wiring on the Universal air conditioners

- All single phase Universal units use 230 V electrical components with exception of the 1000 BTU/hr unit.
- All single phase units are available in 110 V, 400 V and 460 V when equipped with the appropriate transformer with the following exceptions: 1000, 6800, 10200 and 13600 BTU/hr units

Single phase wire diagram



Parts List

Mc: Compressor
Ma: Ambient fan
Mi: Internal fan
Cc: Comp. capacitor
Ca: Amb. fan capacitor
Ci: Int. fan capacitor
Sa: NTC sensor for ambient temperature
Si: NTC sensor for internal temperature

X4 ELECTRICAL SUPPLY CONNECTION (see unit typeplate for unit voltage)
115/230V 1: L1(115/230V), 3:N 400V - 2:LX(400V), 3:L2(400V)
460V - 1:L1(460V), 3:L2(460V)

Notes:

1. Ci not used in 300-850W [1000-2890BTU].
2. Mi1 used only in 550-850W [1870-2890BTU]
3. X1 used for 230V units, X2 used for 115/400-460V units.
4. Connected for units with internal heater.
5. Ma1+Ca1 for 4kW [13650BTU] only.

Wiring of a single phase Universal air conditioners

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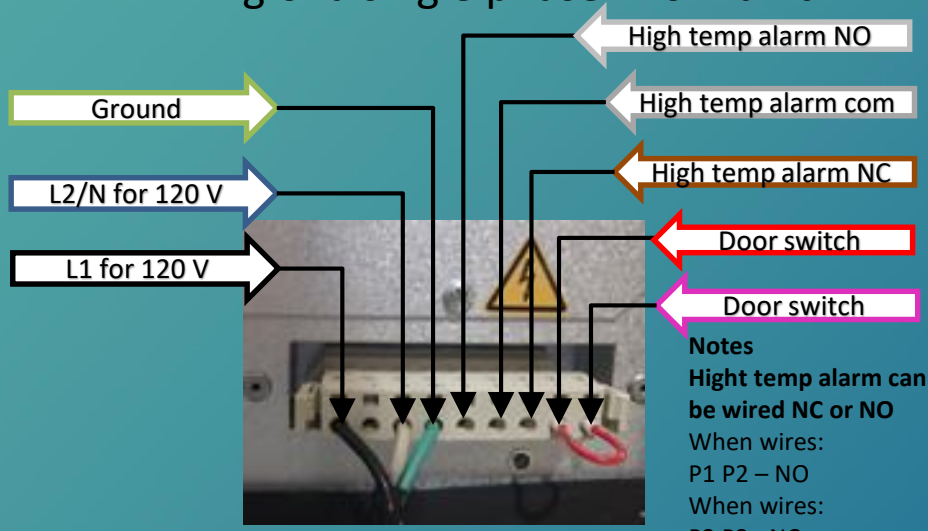
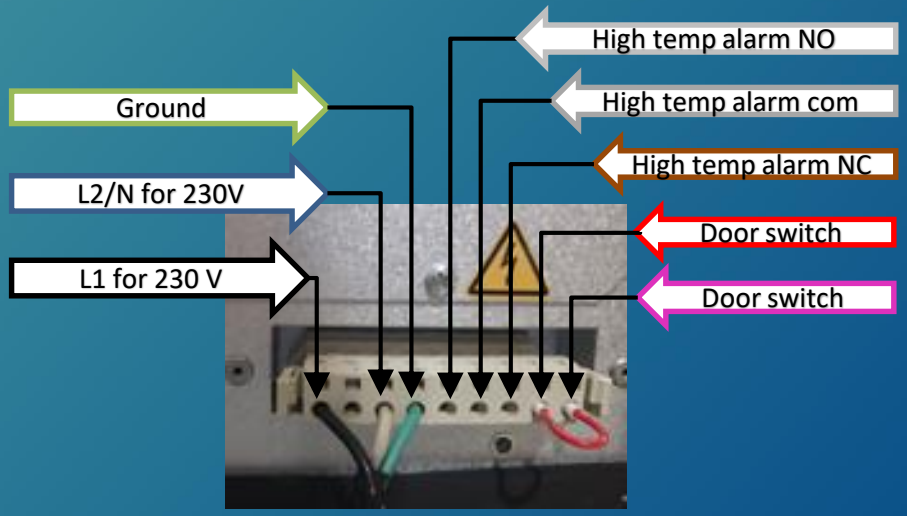
Wiring of a single phase 120 V unit

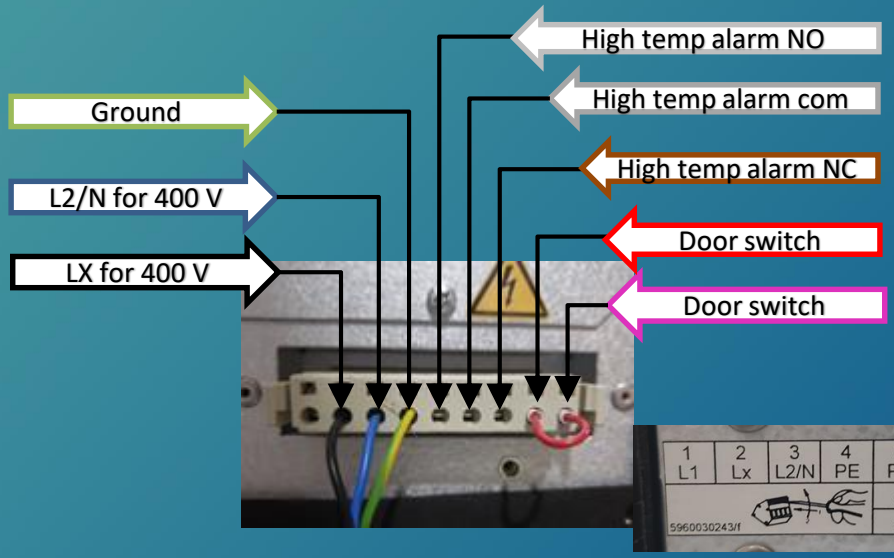


Notes
Hight temp alarm can be wired NC or NO
When wires:
P1 P2 – NO
When wires:
P2 P3 - NC

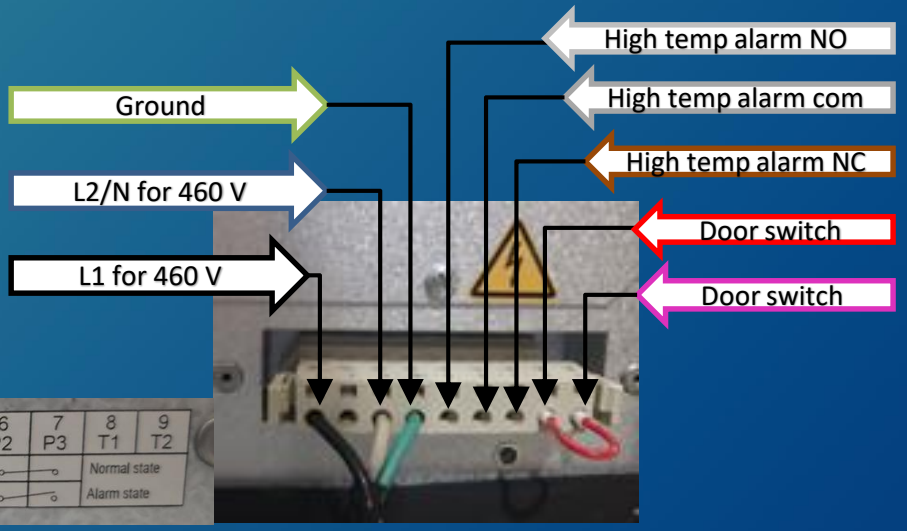
Wiring of a single phase 230 V unit



Wiring of a single phase 400 V unit



Wiring of a single phase 460 V unit



Controller single phase wiring on the Universal air conditioners

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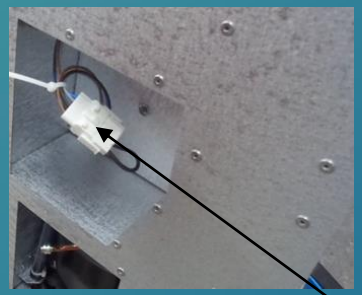
The transformer for the Universal units with voltages 110, 400 and 460 and capacities of 3400 BTU/hr and smaller are located on the on the opposite side of the controller. In order to access the transformer the outer cover has to be removed.

Units larger then 3400 BTU/hr and voltages of 110, 400 and 460 the transformer is located behind the internal blower, In order to access the transformer the blower and the outer cover have to be removed.

Controller

Transformer location



On the 230 V units a connector with a jumper is found were a transformer would be normally be located on the 110, 400 and 460 V units.

Controller three phase wiring on the Universal air conditioners

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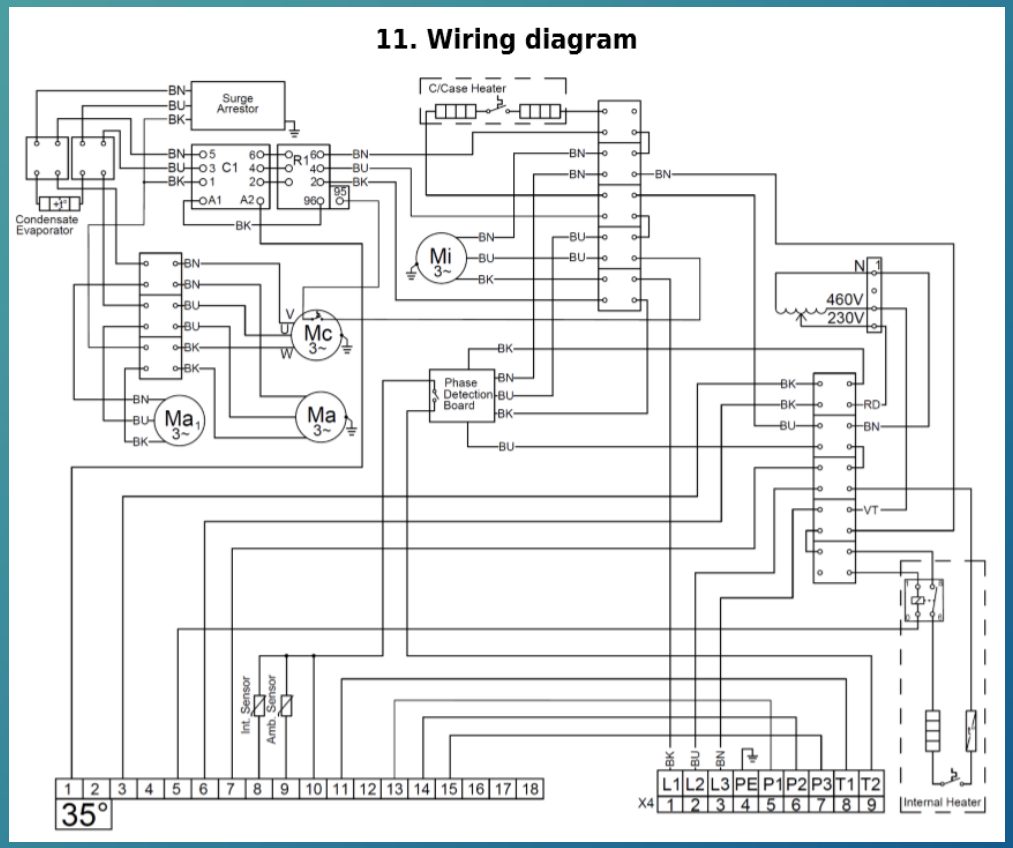
- All moving electrical components operate in three phase power
- The controller is single phase 230 V on all units (3 phase units have a transformer to convert 230 V)



Mc Compressor
Ma Ambient fan
Mi Internal fan
TS Temp. Sensor
PDB Phase Detection Board
CE Condensate Evaporator
CH C/Case heater
HR Heater relay
IH Internal heater

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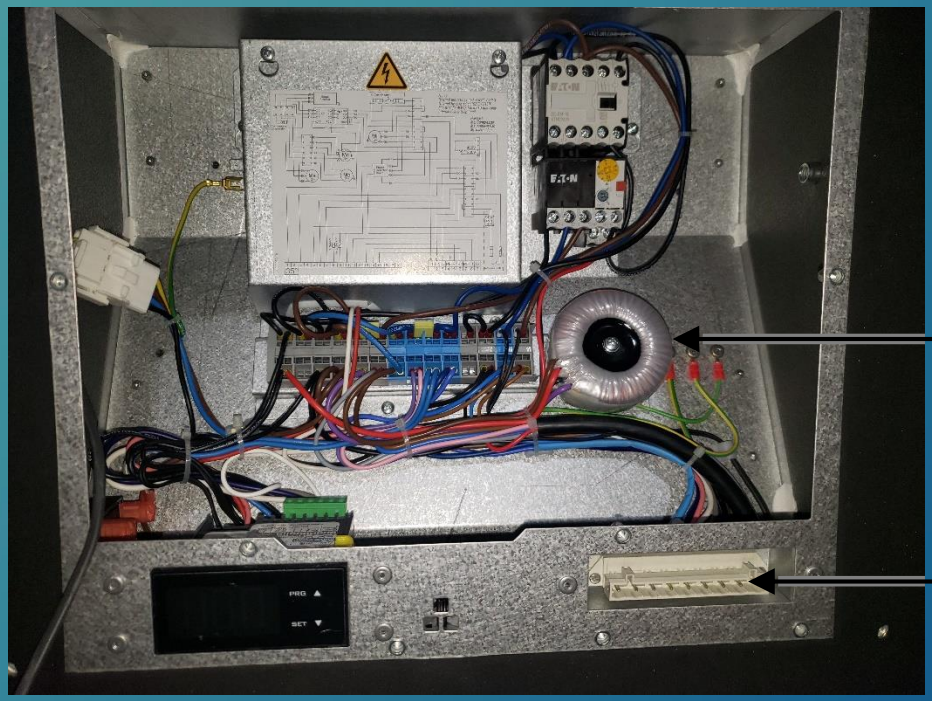
Controller three phase wiring on the Universal air conditioners

- The three phase universal units have a 9 pole power connector
- These units all have a 230 V single phase controller supported by a transformer



Controller transformer

9 pole power connector with alarm and door switch

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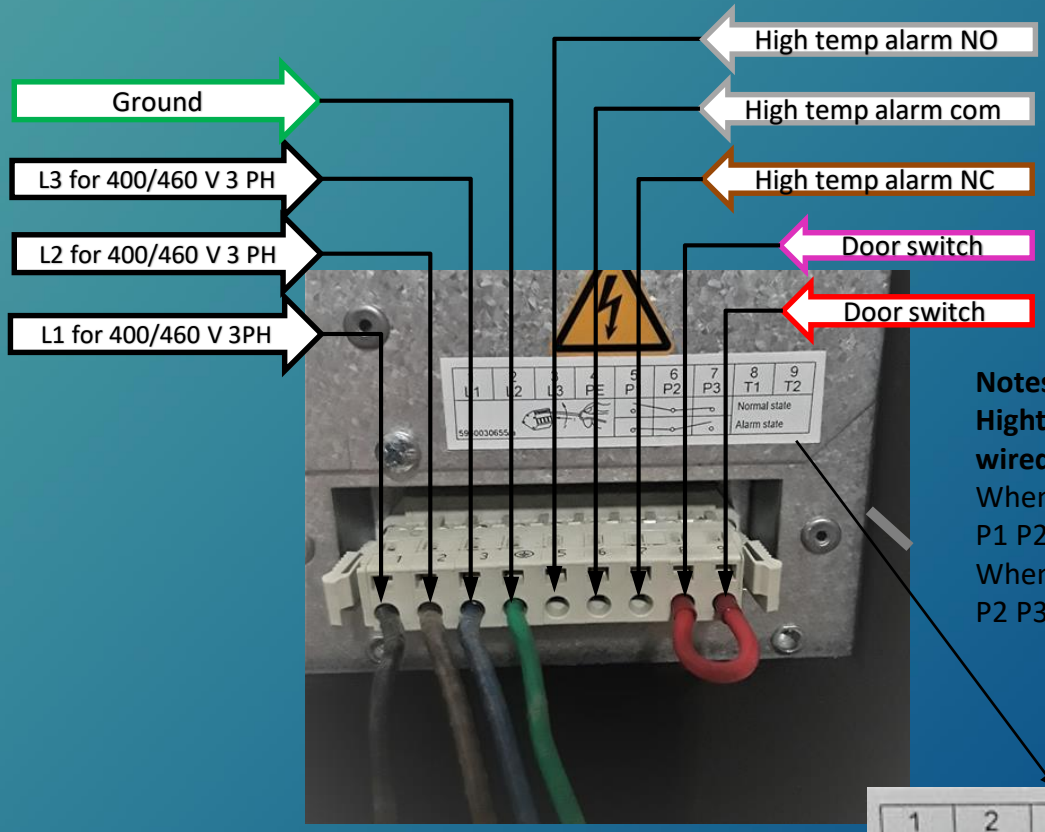
Controller three phase wiring on the Universal air conditioners

Wiring of three phase units to
400/460 V power



Notes
Hight temp alarm can be wired NC or NO
When wires:
P1 P2 – NO
When wires:
P2 P3 - NC

The Universal line has 3 Phase 400/460 V units available with cooling capacities of 6800, 10200 and 13600 btu/hr

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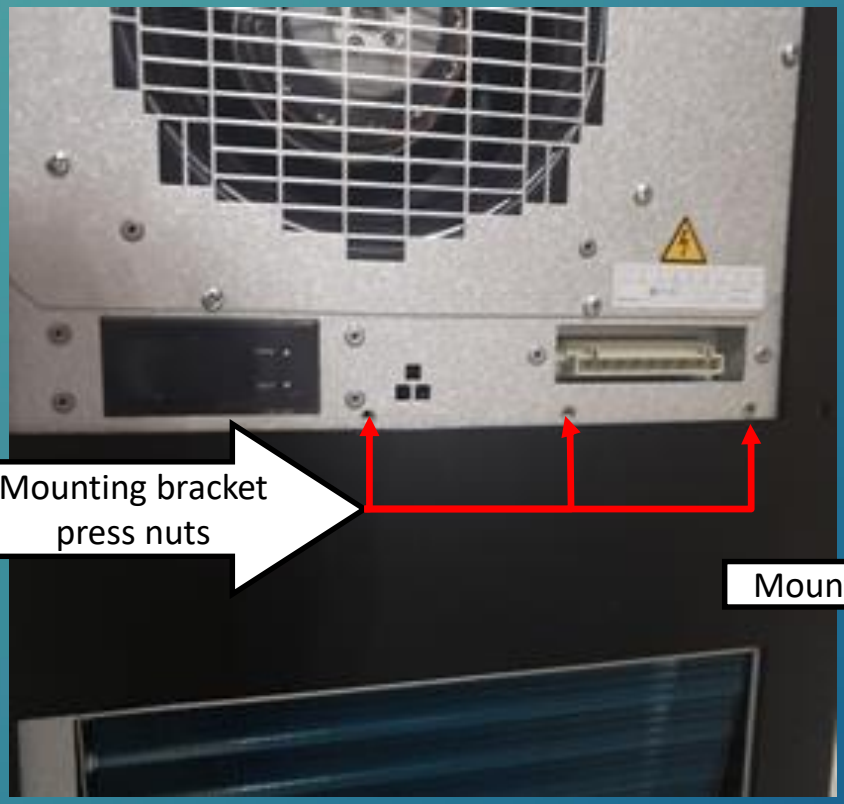
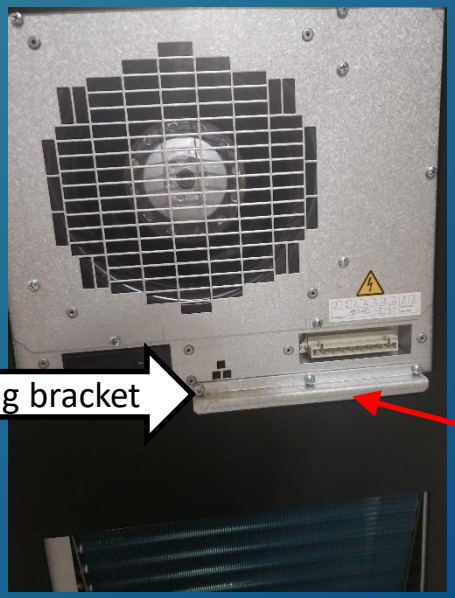
Mounting bracket on the Universal air conditioners

- All units include a mounting bracket for easy installation
- The mounting bracket is included in a bag with mounting screws and instructions manual





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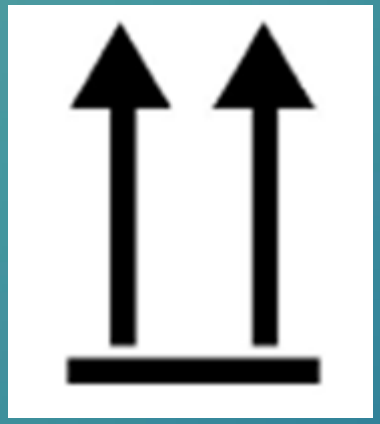
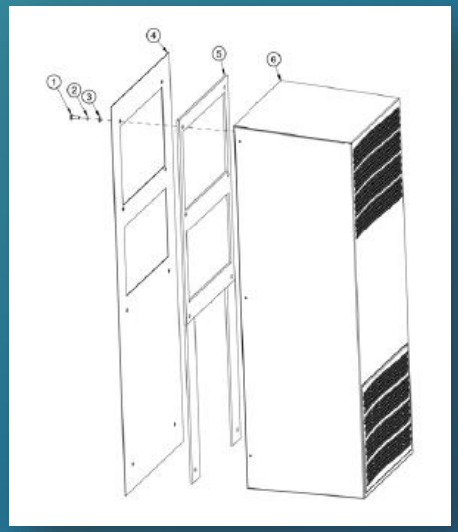
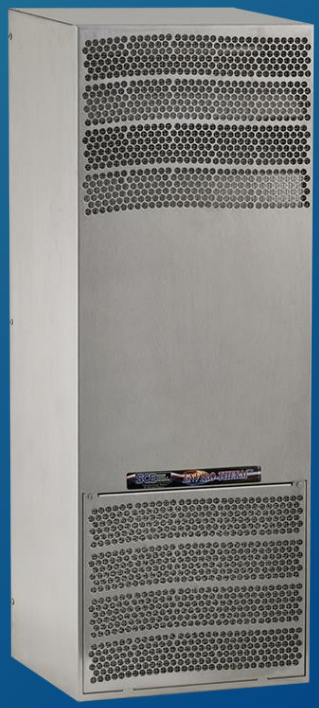
Installation and storage instructions

Attention!
The unit must be stood up for at least **30 min** prior to operation



Symbol for Transportation and Handling Position





During transport and storage the air conditioner unit must be kept in the position marked on the box and at a temperature between -40 °F and 158°F and a relative humidity of max. 95% (at 77 °F). Check the packaging has not been damaged during transport

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Safety

Take care!

General danger
Indicates compulsory safety regulations which are not covered by a specific pictogram such as one of the following.

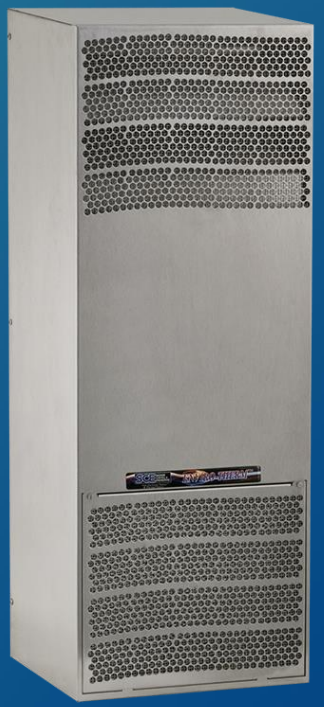
High electric voltage
Indicates electric shock danger.

Important safety instruction
Indicates instructions for safe maintenance and operation of the unit.

Attention
Indicates possible burns from hot components.

Attention
Indicates possible damage to the unit.

Instruction
Indicates possible danger to the environment.



Transportation & Installation

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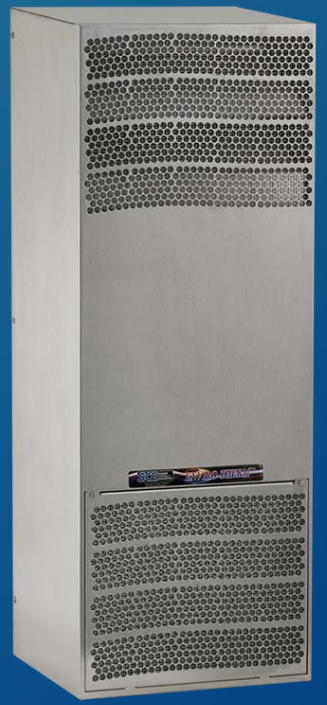
What to do

If air conditioner

Does not cool

Condition	Cause	Solution
Internal fan doesn't work	Power not connected.	Verify power supply
Internal fan works, external fan and compressor don't work	Enclosure temperature is below setting temperature (St)	Verify values of parameter "St"
	Door switch contact is open	Verify door switch
	Controller doesn't work	Verify door switch
Internal fan works, external fan and compressor don't work Display shows alternating "OFF" and temperature	The sequence of the phases inside the power supply connector is incorrect	Change phases inside power supply connector
External and internal fan work, compressor does not work	Compressor motor electrical failure	Verify external fan, verify ambient temperature, clean condenser
	Capacitor for compressor failed	Replace capacitor
Compressor works, external fan doesn't work	External fan needs to be replaced	Replace external fan



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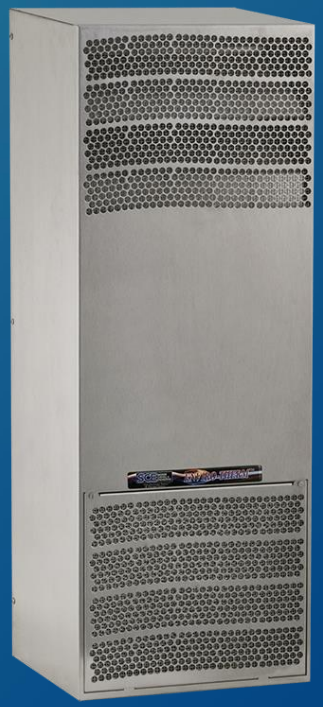
What to do
in case of
Overtemperature

Condition	Cause	Solution
Compressor and fans (external and internal) work all the time	Unit cooling undersized	Enclosure needs a bigger cooling unit
Enclosure needs a bigger cooling unit	Thermal compressor protector triggered	Verify ambient temperature, clean condenser
	Refrigerant leakage	Contact dealer/service center



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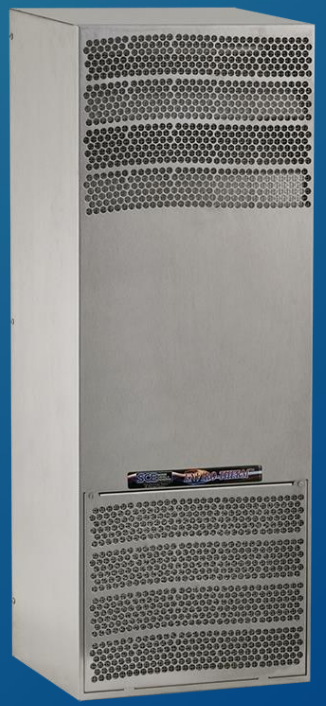
What to do
in case of
excessive condensate

Condition	Cause	Solution
Door enclosure open	Ambient air gets into the enclosure	Ensure door is closed, add a door switch and connect it to controller
Door enclosure closed	Enclosure protection rating minimum NEMA4	Seal openings on enclosure
	Damaged misplaced sealing strip	Repair strip accordingly



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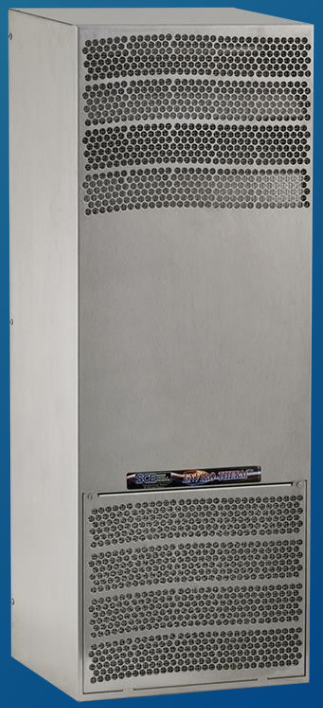

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Glossary

AIR CONDITIONERS: Heat removed from the enclosure is discharged by circulating the ambient air through the condenser coil and returning the heated air to the ambient.

AMBIENT The environment surrounding the product. The word Ambient is typically used to describe the temperature, humidity, air cleanliness or quality including dust and possibly any other harsh weather condition.

CAPILLARY A copper tube with a very small inside diameter. Its function in the refrigerant system is to separate the High Pressure (condenser) side from the Low Pressure (evaporator) side, by providing a calibrated restriction and a resulting pressure drop.

EXPANSION VALVE A refrigerant metering device that provides the same function as a capillary tube (See Capillary), but can provide a variable flow rate to match different load conditions.

BLOWER An air moving device typically used to move air against medium to high static pressure systems. Blowers are designed to operate against higher static pressures than fans.

BTU/H British Thermal Unit per Hour is a unit of measure for heat. Heat is also commonly measured in watts: (1 BTU/H = .29 watts)

CLOSED LOOP COOLING An industry term used to describe a cooling process that reconditions (reuses) the air inside a chamber. The purpose of this system is to prevent contamination from entering the chamber.

COMPRESSOR is the main component in a refrigerant system. Inside compressors there is a motor and a pump that circulates the refrigerant through the rest of the system.

CONDENSATION The process in nature that causes water (condensate) to be removed from the air, and form on a cold surface. This is commonly seen on the outside of a glass of ice water, or dew on grass in the morning.

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CONDENSER The hot section of the refrigerant system that removes the waste heat away from the refrigerant system. This is commonly accomplished with either air or water to carry away the heat. This component is called a condenser, because the refrigerant inside is changing state from a gas to a liquid (condensing).

CORROSIVE ATMOSPHERES Corrosive environments, such as those found in chemical plants and in industries where processes result in harsh chemical by-products, usually preclude the use of filtered ambient air for forced convection cooling.

DEW POINT The surface temperature at which condensate (water) will form as related to the air temperature and air humidity. (See Condensation)

HYSTERESIS A property of a system such that an output value is not a strict function of the corresponding input, but also incorporates some delay, or history dependence, and in particular when the response for a decrease in the input variable is different from the response for an increase. For example, a thermostat with a nominal setpoint of 95° F might switch the controlled cooling source on when the temperature rises above 99° F, and off when it drops below 92° F.

EVAPORATOR The section of a refrigerant system that operates colder than the ambient. This component is called an evaporator, because the refrigerant inside is changing state from a liquid to a gas (evaporating).

FILTERS Filters used with typical electronic equipment cooling devices are usually the viscous-impingement type. They utilize fibers that have been coated with a nondrying, tacky substance which traps particulates as air is drawn through. Usually constructed of aluminum foil, the filters can be cleaned, recoated and re-used indefinitely.

WATT A unit of measure for electrical power. Watts are also used to quantify the amount of heat in a system, because 1 watt will convert to 3.413 BTU’s.