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RLC Basic Service & Troubleshooting

Due to Samsung's policy of ongoing product development, specifications are subject to change without prior notice. Every effort has been made to insure that the information included in this presentation is as accurate as possible at the time of it's publication.

This presentation is provided as a guide to help HVAC field technicians understand the most common service and diagnostic procedures for the Samsung RLC systems. This training module is not intended to replace Samsung service manuals, technical data books, installation/operation manuals or other factory documents.

Only properly trained, HVAC professionals should attempt to install and start up any Samsung heating and air-conditioning system.

High Voltage Caution:
Extra care must be taken when working on or around RLC equipment due to numerous high voltage components. Whether installing or servicing RLC systems in the field or while attending Samsung HVAC training classes which include powered simulators and equipment, be aware of the potential dangers of high voltage – use caution

This presentation may only be used with authorization by Samsung HVAC. Unauthorized use, duplication or alteration of this presentation is prohibited.

For technical support issues, always contact your Samsung equipment provider.

www.samsunghvac.com www.dvmdownload.com

Slide 2

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RLC Basic Service & Troubleshooting

Contents

- RLC Product Line
- Basic Component Acronyms
- Basic System Components
- Wireless Remote Controller Basic Features
- Basic System Operation Logic & Control
- Basic System Troubleshooting
- Troubleshooting Error Codes

3

Samsung Business Academy

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Samsung Business Academy (SBA)

SBA Account Sign Up Required:

- Register for future training classes/courses.
- Receive credit for this training class.
- Access completion certificates.
- Complete surveys/submit feedback.

List of Courses | Training Courses Catalog | Visitor's Guide | Samsung Business Academy Login | Samsung Business Academy Registration

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Samsung Business Academy (SBA)

1. **Sign up for a SBA Account**
   - Contractor
   - Distributor
2. **View/print completion certificates**
3. **Register for future training**
   - Instructor-Led Courses
   - Online Demand

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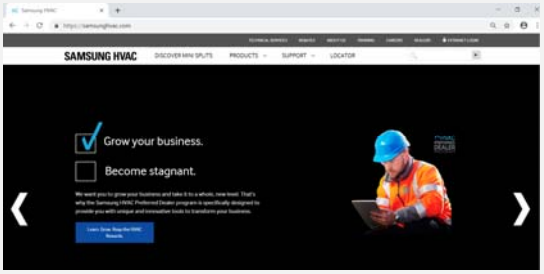
Go to Samsung HVAC Training

Go to:
www.samsunghvac.com*

*Disable popup blocker.



Click TRAINING

Hover over:

SBA

Samsung Business Academy Registration

Choose either:

HVAC Distributor
HVAC Contractor

Please bookmark this page, open computer or phone and sign up for SBA account in class.

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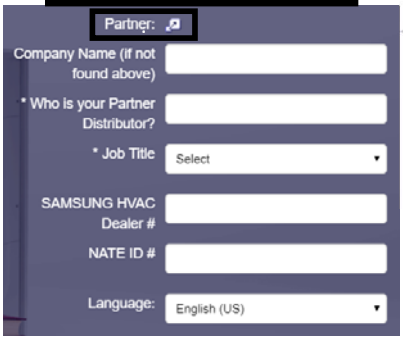
1. Sign Up for a SBA Account

HVAC Contractor

Complete all required fields designated by an asterisk (*).

Click Partner: to add Distributor information.

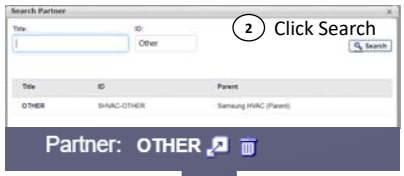


1 Type Distributor Name

2 Click Search

3 Click your Distributors name to add to form.

If your Distributor is not in the list,
1 Type **Other** in the **ID**: field.



3 Click OTHER to add to form.

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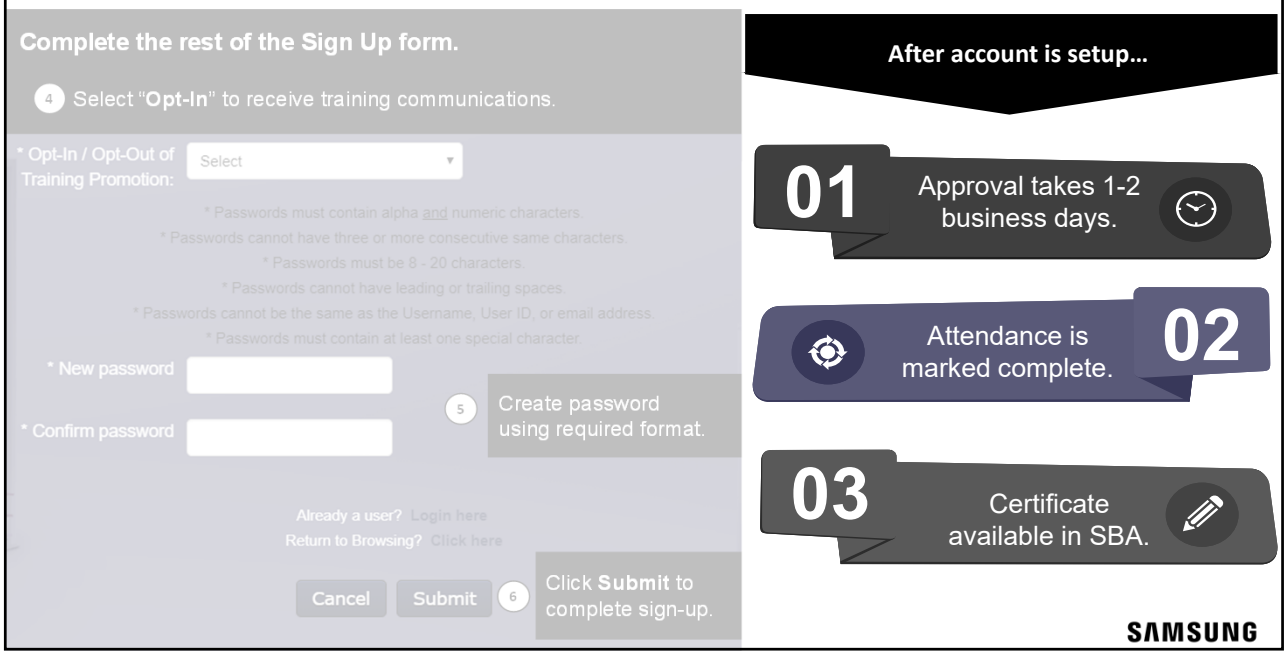
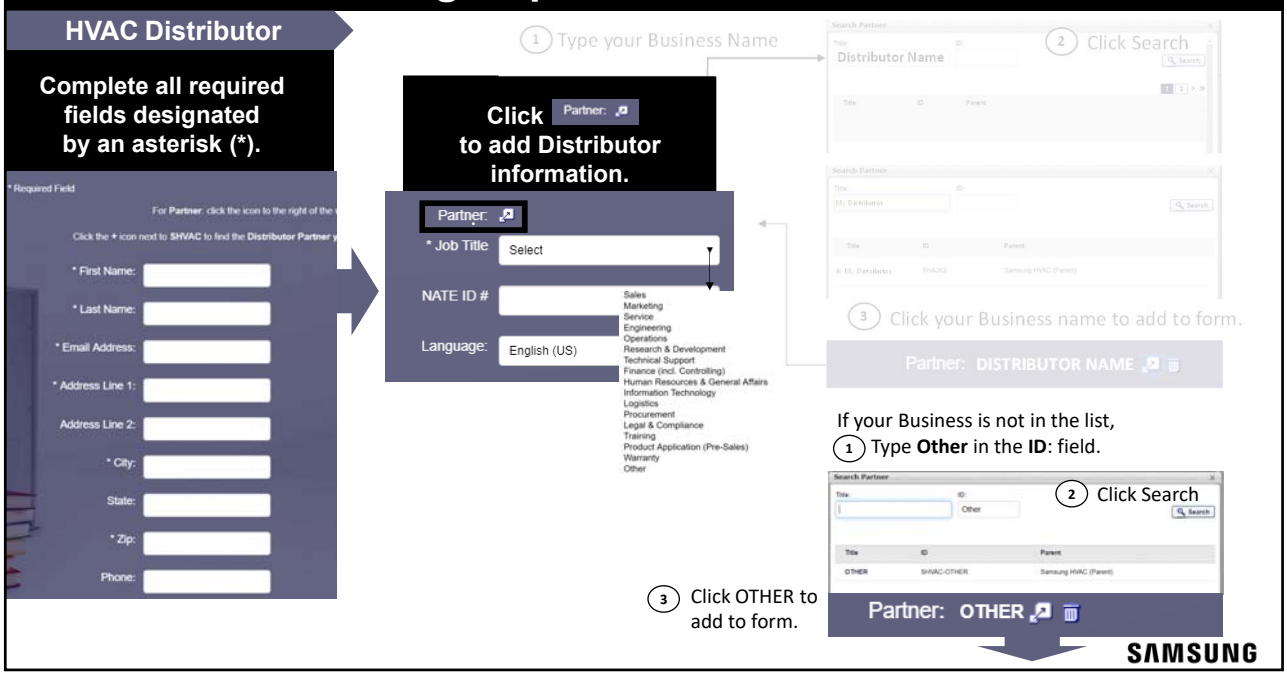
1. Sign Up for a SBA Account



9

1. Sign Up for a SBA Account



10

1. Sign Up for a SBA Account

Complete the rest of the Sign Up form.

4 Select "**Opt-In**" to receive training communications.

* Opt-In / Opt-Out of Training Promotion: Select

* Passwords must contain alpha and numeric characters.
* Passwords cannot have three or more consecutive same characters.
* Passwords must be 8 - 20 characters.
* Passwords cannot have leading or trailing spaces.
* Passwords cannot be the same as the Username, User ID, or email address.
* Passwords must contain at least one special character.

* New password

* Confirm password

5 Create password using required format.

Already a user? Login here
Return to Browsing? Click here

Cancel Submit 6 Click **Submit** to complete sign-up.

After account is setup…

01 Approval takes 1-2 business days.

Attendance is marked complete. **02**

03 Certificate available in SBA.

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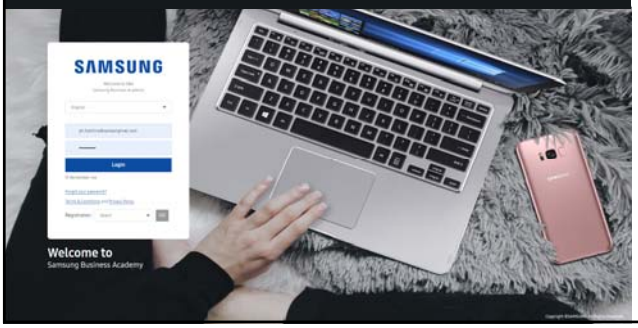
2. View/Print Completion Certificates

1 Go to www. https://samsunghvac.com/our_training.php

Click:

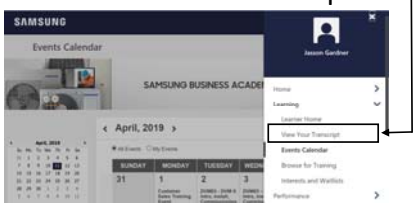
2 SBA Samsung Business Academy Login

Login with Samsung Business Academy (SBA) username/password.



3 Open Menu. ( )

4 Click "View Your Transcript".



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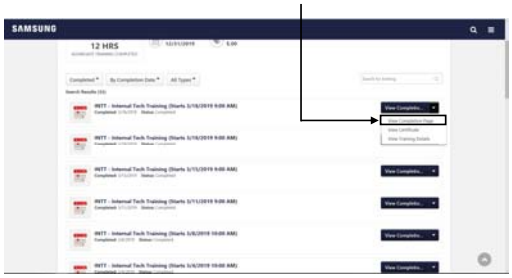
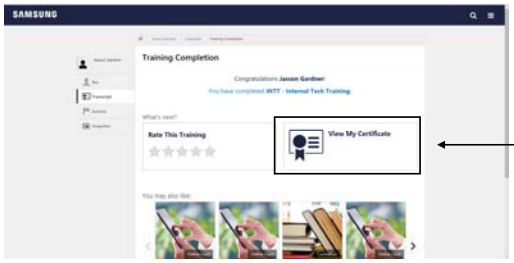
2. View/Print Completion Certificates

⑤ Click “View Completion Page”.



⑥ Click “View My Certificate”.



⑦ Select “Print” or “Save” option(s).

Note: Confirmation email will be sent with link to down-load certificate.

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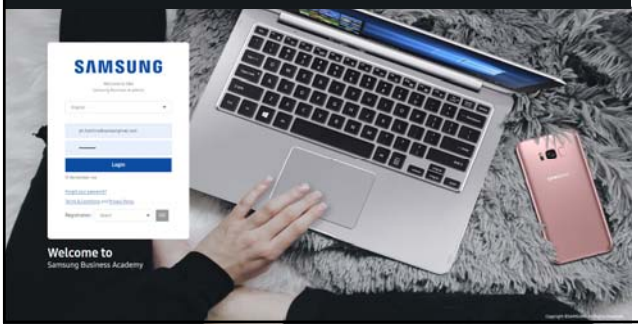
3. Register for Future Training

① Go to www. https://samsunghvac.com/our_training.php

Click:

② SBA Samsung Business Academy Login

Login with Samsung Business Academy (SBA) username/password.



③ Samsung Business Academy (SBA) displays.

- **Hover** - on class name to view class information.
- **Click** - on class name to open the class registration form.

Instructor - Led Training

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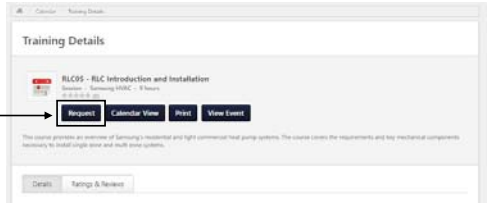
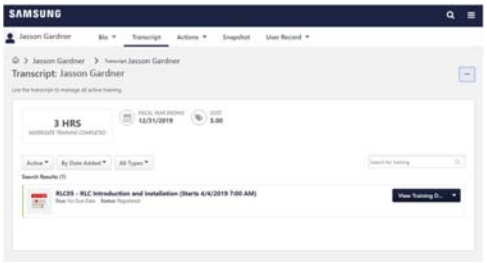
3. Register for Future Training

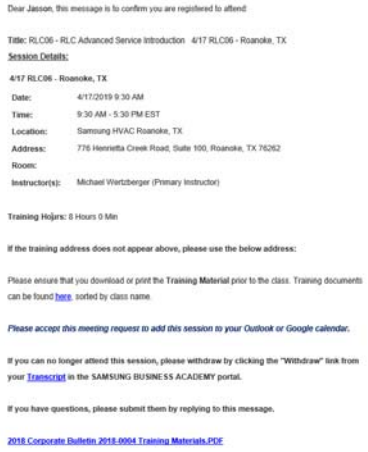
④ Click “Request”.



Registration status screen displays.



⑤ Confirmation email will be sent.



Dear Jasson, this message is to confirm you are registered to attend:

Title: RLC06 - RLC Advanced Service Introduction 4/17 RLC06 - Roanoke, TX

Session Details:

4/17 RLC06 - Roanoke, TX

Date: 4/17/2019 9:30 AM
Time: 9:30 AM - 5:30 PM EST
Location: Samsung HVAC Roanoke, TX
Address: 776 Henrietta Creek Road, Suite 100, Roanoke, TX 76262
Room:
Instructor(s): Michael Wertzberger (Primary Instructor)

Training Hours: 8 Hours 0 Min

If the training address does not appear above, please use the below address:

Please ensure that you download or print the Training Material prior to the class. Training documents can be found here, sorted by class name.

Please accept this meeting request to add this session to your Outlook or Google calendar.

If you can no longer attend this session, please withdraw by clicking the "Withdraw" link from your Transcript in the SAMSUNG BUSINESS ACADEMY portal.

If you have questions, please submit them by replying to this message.

2018 Corporate Bulletin 2018-0004 Training Materials.PDF

Note: If you do not receive with email within 15 minutes, check your Junk/Spam folder.
Add *@samsunghvac.com to trusted sites.

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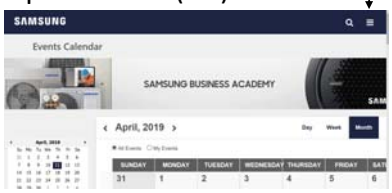
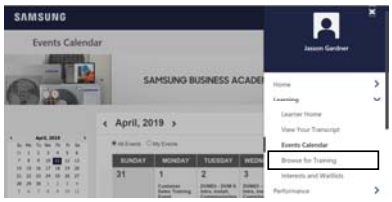
3. Register for Future Training

On - Demand Training

① Open Menu. (☰)

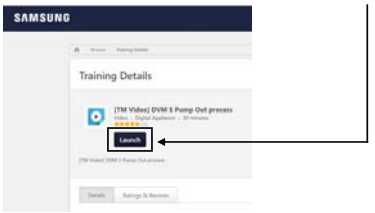


② Click “Browse for Training”.



③ Click “Browse All”.

⑤ Select course and click “Launch”.



④ Click “Type”*.

*Online, Video and Materials.

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RLC Product Line

Single Zone RAC Systems

- ***Pearl, Whisper & Wind Free***
  Smart Pearl: **9,000 & 12,000 Btu/h models**
  - **SEER: up to 28**
  - **WiFi control standard**

  Smart Whisper – MAX Heat**: 9,000 to 24,000 Btu/h models**
  - **SEER: up to 23**
  - **WiFi control standard**

  Wind Free: 9,000 & 12,000 Btu/h Models
  - **SEER: up to 21**
  - **WiFi control standard**
- **Quantum**
  - **9,000 Btu to 24,000 Btu models**
  - **SEER: 17**
  - **Not WiFi compatible**
- **MAX**
  - **36,000 Btu/h model**
  - **SEER: 18**
  - **Not WiFi compatible**

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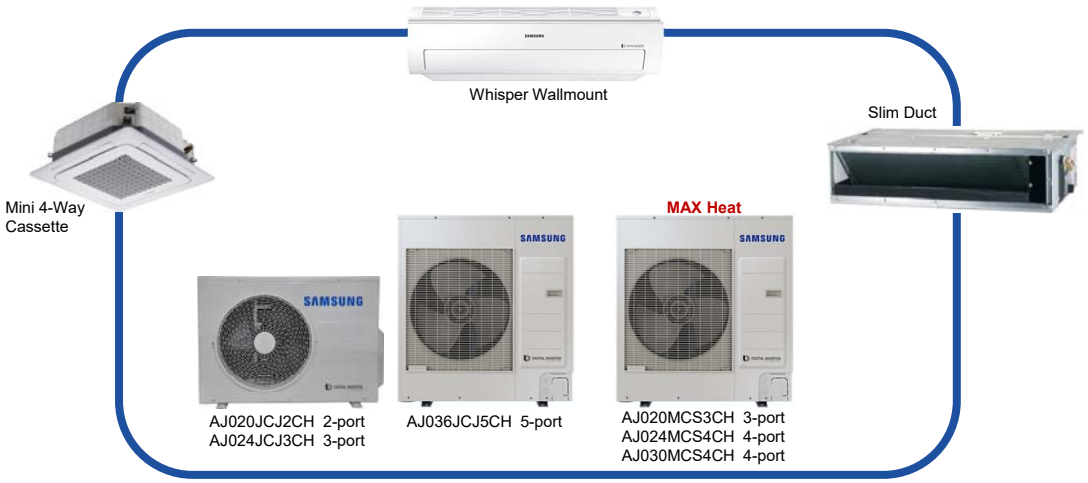
RLC Product Line

Multi-zone Zone FJM Systems



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RLC Basic Service & Troubleshooting

Samsung Mini-split Technology

Basic Component Acronyms

- **BLDC** – Brushless Digitally Commutated, referring to the Samsung inverter rotary compressor and fan motors
- **EEPROM** – Electrically Erasable Programmable Read-only non-volatile Memory device used to store data information to control another device. Data can be erased and reflashed (programmed) with new control data
- **EEV** – Electronic Expansion Valve is a digitally pulsed, motor (coil) driven expansion valve regulating the flow of refrigerant through a heat exchanger coil
- **EMI** – Line voltage filter
- **IDU** – Indoor Unit
- **IGBT** – Insulated-gate Bipolar Transistor (Inverter component)
- **INV** – Refers to prefix for Inverter PCB or inverter compressor (inverter driven compressor)
- **IPM** – Intelligent Power Module
- **MCA** – Minimum Circuit Amps
- **MFA** – Maximum Fuse Amps (breaker)
- **ODU** – Outdoor Unit
- **OLP** – Overload Prevention
- **PCB** – Printed circuit board (also PBA)
- **PFC** – Power Factor Correction (Refers to a capacitor)
- **SMPS** – Switched Mode Power Supply (IDU & ODU) – Rectifier: converts ac voltage to dc voltage

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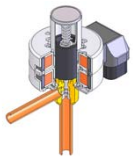
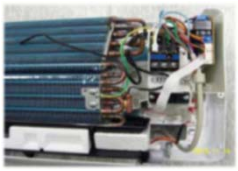
RLC Basic Service & Troubleshooting



Basic System Components



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RLC Basic System Components

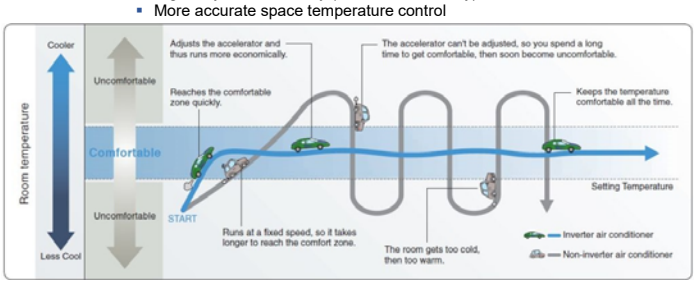
Basic Inverter Technology

The Inverter Is:

- A variable frequency drive (VFD) that changes the electrical frequency (hertz) applied to an electric motor to control the motor speed (RPM) up and down
- The inverter technology is used to vary the HVAC system's operating capacity to match the heating and cooling load as it changes
  - The inverter controls the compressor speed like an automobile's throttle controls engine speed
  - The inverter varies the applied frequency to the compressor based on a number of system temperature sensors (thermistors) and the room setpoint temperature selected on the remote controller

The advantages of inverter control as compared to standard on/off

- Higher system efficiency (Part-load efficiency)
- More accurate space temperature control



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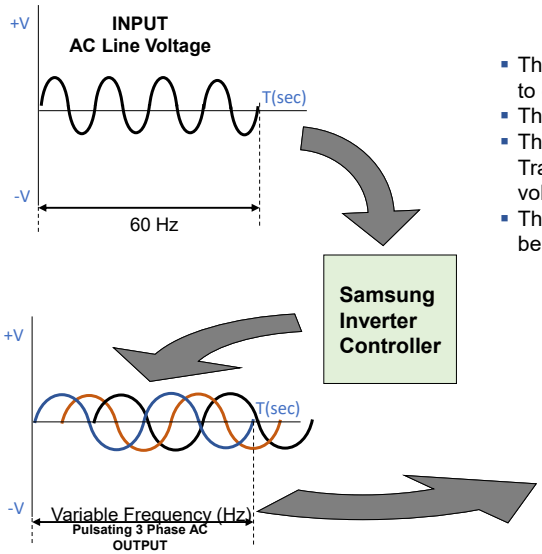
RLC Basic System Components

Basic Inverter Technology



- The Samsung inverter controller converts the incoming ac line voltage to dc voltage (rectifier)
- This dc voltage is then fed to the Intelligent Power Module (IPM)
- The dc voltage is then run through a set of Insulated Gate Bipolar Transistors (IGBT) which are electronic switches that allow the dc voltage output to simulate 3-phase ac voltage
- The resulting variable pulsating "ac" voltage and frequency (Hertz) can be controlled by the rate at which the IGBT's switch

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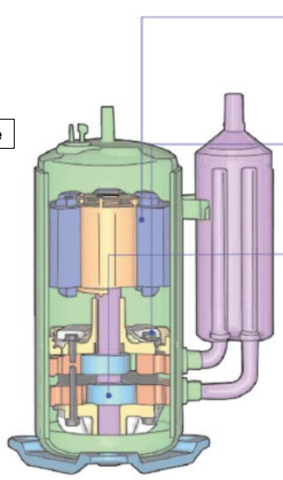
RLC Basic System Components

Samsung BLDC Twin Rotary Compressor

- **Higher Reliability & Durability**
- **Higher Efficiency**
- **Small physical size for Btu/h capacity**
- **Reserve Capacity**
- **Neodymium Permanent Magnets**

Twin rotary example



High Efficiency BLDC Motor
- Creative motor design
- High density neodymium magnet
- Concentrated type stator

Extremely Low Vibration
- Twin eccentric cams
- 2 balance weights

Very Stable Moving Parts
- Optimal material matching rollers and vanes
- Highly robust bearings
- Coated vane
- Coated shaft

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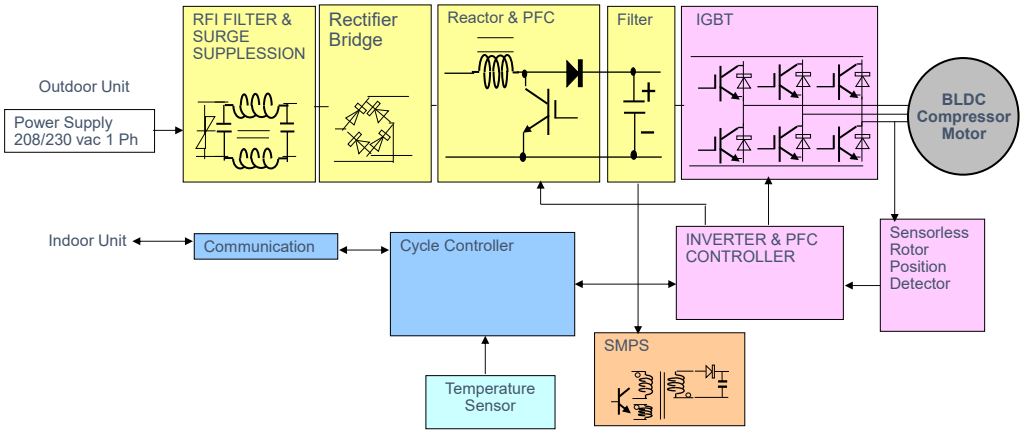
RLC Basic System Components

Samsung Inverter Technology



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RLC Basic System Components

Samsung Anti Corrosion Fin Coating

- The indoor and outdoor unit heat exchanger's aluminum fins are coated with a hydrophilic protective coating
  - Reduced coil corrosion
  - Promotes water shedding for better condensate flow, easier coil cleaning and faster defrost cycles

Samsung's Anti Corrosion fin

conventional

Samsung's Coated Indoor Coil

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RLC Basic System Components

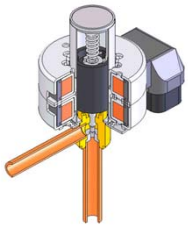
RLC Electronic Expansion Valve Control

Electronic Expansion Valve (EEV)

- **Components:** Stepper motor – Valve body – Control algorithm
  - The "stepper motor" is an electro-magnetic coil assembly that can divide a full rotation into a large number of steps (0 – 480 steps), designated as "pulses"
    - Primary characteristics is its ability to rotate a prescribed angle (steps) in response to each control pulse applied to the coil in each direction
  - The electronic expansion valve is the component that controls the rate at which liquid refrigerant can flow into the evaporator coil (superheat)
    - RLC systems incorporate the indoor coil EEV in the outdoor unit
  - Control algorithm is continuously providing signals to the EEV to open or close by small amounts (pulses) to vary the amount of refrigerant being delivered to the evaporator coil to meet the target superheat

Algorithm Defined:

- Algorithm - In mathematics and computer science, an ***algorithm*** is a self-contained step-by-step set of operations to be performed. ***Algorithms*** exist that perform calculation, data processing, and automated reasoning.



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RLC Basic System Components

Thermistor Sensors

- Samsung systems use thermistor sensors to control EEV steps, Compressor frequency, ODU Defrost operation, IDU & ODU Fan speed, and on-off control (wired remote controller).
- 200KΩ thermistor: Discharge and OLP (Over Load Protector)
- 10KΩ thermistor: Indoor sensors, outdoor ambient and coil

Thermistors Defined:
- Thermistor sensor is a thermally sensitive resistor
- The sensor resistance value changes in direct relation to the sensing temperature
- **NTC** (Negative Temperature Coefficient): Sensor resistance value decreases with temperature increase
- **PTC** (Positive Temperature Coefficient): Sensor resistance value increases with temperature increase
- Thermistor resistance calibration @ 77°F

200KΩ

TEMP. (°F)	MAX (kΩ)	CENTER (kΩ)
32	563.1	553.5
41	476.1	446.2
50	385.1	362.4
59	312.6	295.4
68	256.6	242.5
77	210	200
86	174.6	165.7
95	145.8	137.8
104	122.5	115.4
113	103.3	96.95
122	87.87	81.92
131	74.47	69.44
140	63.65	59.16
149	54.55	50.54
158	46.96	43.37
167	40.55	37.34

10KΩ

TEMP. (°F)	MAX (kΩ)	CENTER (kΩ)	Min (kΩ)
-58.0	351.4	329.5	308.8
-49.0	263.4	247.7	232.6
-40.0	199.9	188.5	177.5
-31.0	152.4	144.1	136.0
-22.0	117.5	111.3	105.4
-13.0	86.5	86.4	82.0
-4.0	71.2	67.8	64.5
5.0	55.9	53.4	50.9
14.0	44.4	42.5	40.8
23.0	35.3	33.9	32.5
32.0	28.4	27.3	26.2
41.0	22.9	22.1	21.2
50.0	18.6	18.0	17.3
59.0	15.2	14.7	14.2
68.0	12.5	12.1	11.7
77.0	10.3	10.0	9.7
86.0	8.6	8.3	8.0
95.0	7.2	6.9	6.7

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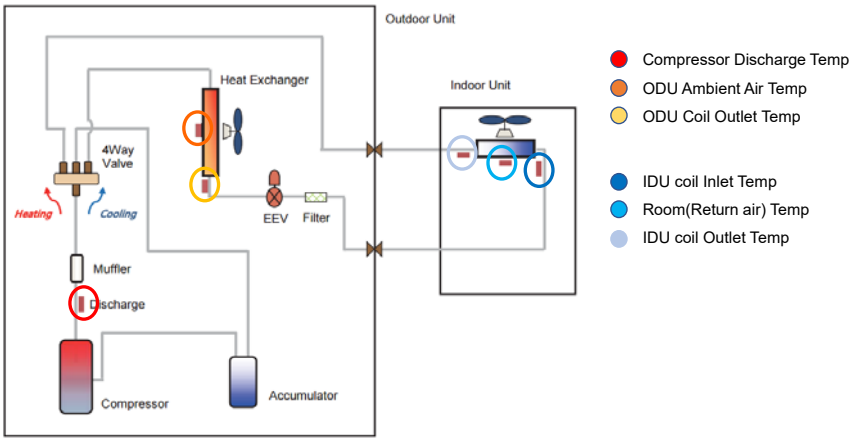
RLC Basic System Components

Basic Thermistor Sensor Function

Example only



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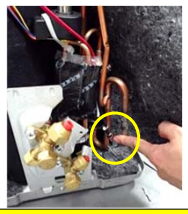
RLC Basic System Components

Thermistor Sensor Locations

ODU Sensors

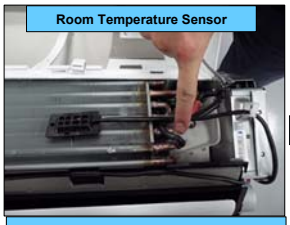
Outdoor Ambient Temp Sensor



Condenser Temperature Sensor

Compressor Discharge Temperature Sensor

Room Temperature Sensor



Indoor MID Coil Sensor

IDU Sensors

Indoor Coil Inlet Pipe Sensor

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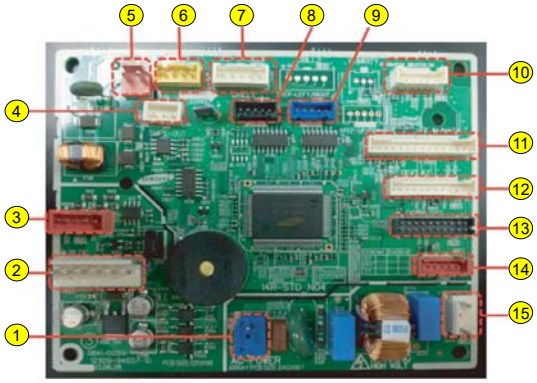
RLC Basic System Components

Indoor Unit Main PCB – Wallmount: Whisper/Pearl/Wind Free/FJM



1	Main Power (208/230VAC)	9	Blade Motor left/right (Pearl only)
2	BLDC Fan motor	10	Sensor (Room, Evap in, Evap out)
3	SMPS DC Out (19V)	11	Option (for NASA Product)
4	SMPS DC Out (12V)	12	Display
5	F1, F2 communications	13	Download (for Gman)
6	SPI(Virus doctor) **NA**	14	Wifi (for RAC)
7	Blade Motor for Grill	15	SMPS In
8	Louver Motor Up/Down		

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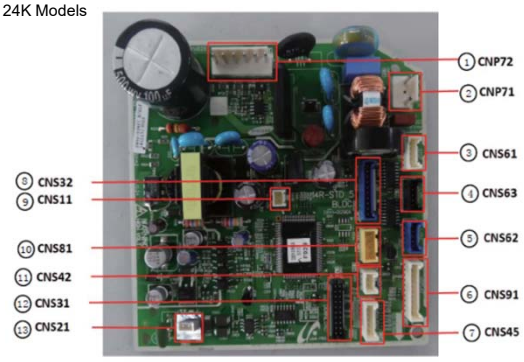
RLC Basic System Components

Indoor Unit Main PCB – Wallmount: Quantum

Quantum 18K & 24K Models



1	Fan Motor	8	FJM NASA
2	Power N/Out fan relay/4-Way Valve	9	12vdc
3	Step Motor	10	SPI
4	Step Motor	11	Hum Sensor
5	Step Motor	12	Download
6	Display	13	Communication
7	Sensors		

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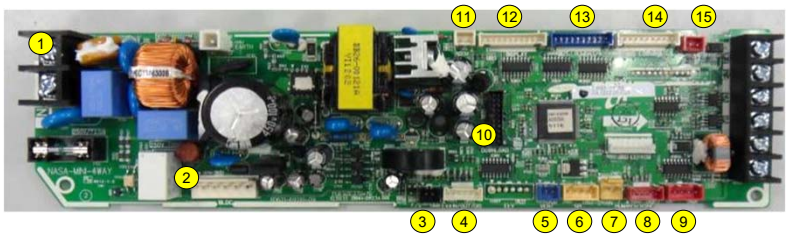
RLC Basic System Components

Indoor Unit Main PCB - Mini 4-Way Cassette: FJM



1	Main Power (208/230VAC)	9	External Out (for MIM-B14)
2	FAN	10	Download (for Gman)
3	Float switch	11	Room Sensor
4	EVA In/Out Sensor	12	Display
5	Vent NA	13	Louver 3/4
6	SPI	14	Louver 1/2
7	Condensate pump	15	External contact input (for MIM-B14)
8	Human sensor	16	EEPROM

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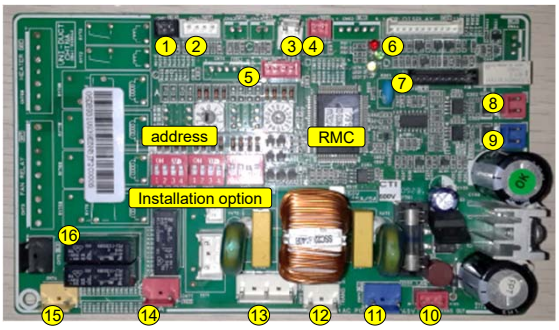
RLC Basic System Components

Indoor Unit Main PCB – Slim Duct: FJM



1	Floating SW	9	F3, F4
2	EVA, Room Sensor	10	Trans out
3	Wired remote controller	11	Power
4	External contact input (for MIM-B14)	12	Trans in
5	External Out (for MIM-B14)	13	Fan
6	Display	14	Hot coil
7	Download (for Gman)	15	Condensate pump
8	F1, F2	16	Ventilation

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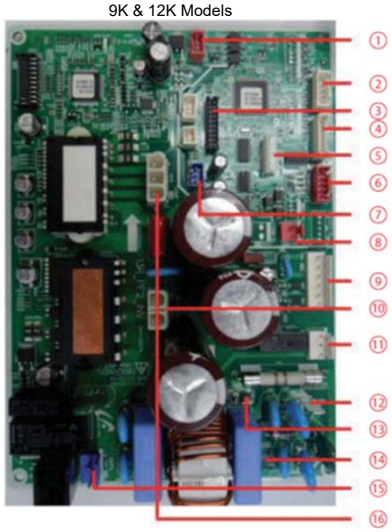
RLC Basic System Components

Outdoor Unit Main PCB – Whisper/Pearl/Wind Free/Quantum

9K & 12K Models



1	SMPS Inverter	9	Fan Motor
2	DRED	10	Reactor
3	Download Main	11	4-Way Valve
4	Sensor	12	Power N
5	EEPROM	13	Power L
6	EEV A	14	Earth Ground
7	SMPS Main	15	SMPS AC
8	F1 F2 Communication	16	Compressor

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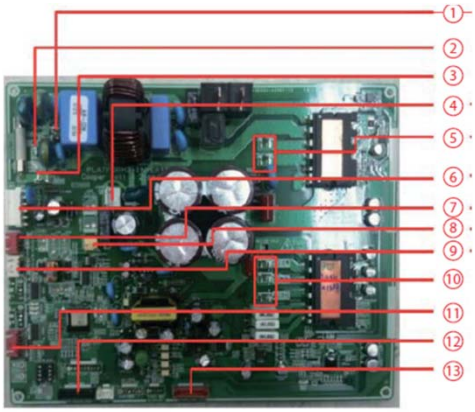
RLC Basic System Components

Outdoor Unit Main PCB – Whisper/Quantum

Whisper 18K Model Quantum 24K Model



1	Earth Ground	8	F1 F2 Communications
2	Power N	9	Cond Sensor
3	Power L	10	Compressor
4	4-Way Valve	11	EEV
5	Reactor	12	Download Main
6	Fan Motor	13	Download Inverter
7	Out/Dis Sensor		

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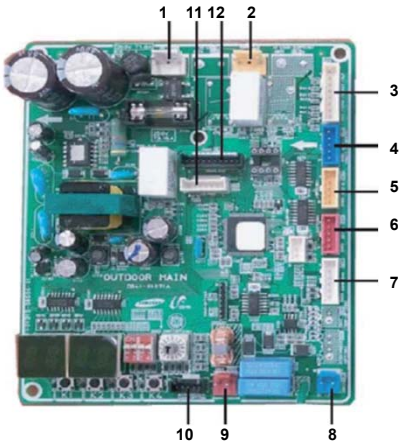
RLC Basic System Components

Outdoor Unit Main PCB – Whisper

Whisper 24 K Model



1	Line Voltage	**7**	Inv Comm
2	4-Way Valve	**8**	12vdc
3	Sensors	**9**	Communication
4	EEV C	**10**	Sub Comm
5	EEV B	**11**	MICOM Download
6	EEV A	**12**	Download

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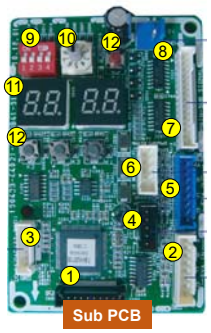
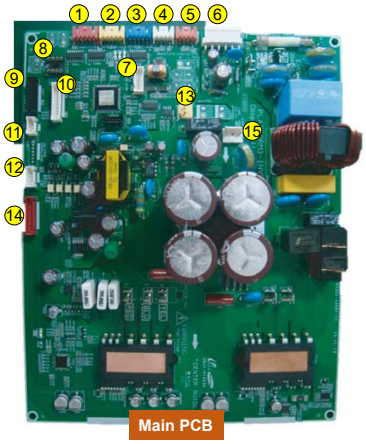
RLC Basic System Components

Outdoor Unit PCBs – FJM AJ020 & AJ024



1	EEV A	9	Download(Main)
2	EEV B	10	Main-Sub Comm.(Display)
3	EEV C	11	S-net
4	Sensor(OLP/Cond)	12	Main-Sub Comm.(Display)
5	Sensor(Outdoor/dis)	13	F1,F2
6	Fan	14	Download(Inverter)
7	Main-Sub Comm.	15	4Way valve
8	EEPROM		



1	MICOM Download	7	Main-Sub Comm. (Display)
2	Pipe IN Sensor	8	DC 12V Out (for IM)
3	Download(for AS-Pro)	9	Dip Switch
4	EEV D	10	Rotary Switch
5	Pipe OUT Sensor	11	Display
6	Main-Sub Comm.	12	Tact Switch

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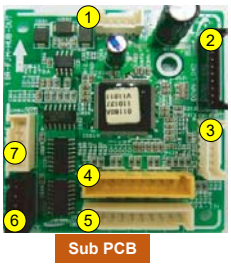
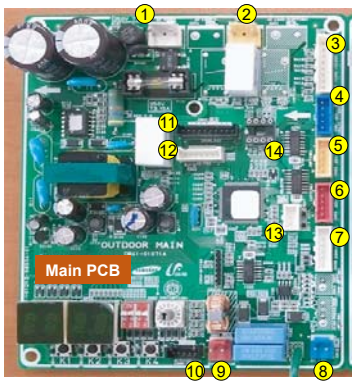
RLC Basic System Components

Outdoor Unit PCBs – FJM AJ036/MAX AQX36



1	Main-Sub communication
2	Download
3	Download
4	Pipe IN Sensor
5	Pipe OUT Sensor
6	EEV D
7	EEV E



1	AC Power	8	DC 12V
2	4Way V/V	9	Communication (F1F2)
3	Sensor	10	Main-Sub communication
4	EEV C	11	Download
5	EEV B	12	Download
6	EEV A	13	Mode selector connector
7	Main-INV communication	14	EEPROM

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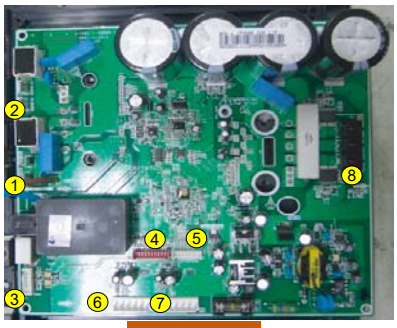
RLC Basic System Components

Outdoor Unit PCBs – FJM AJ036/MAX AQX36 – cont.



Inverter PCB

1	Reactor	5	Encoder
2	Reactor	6	FAN 2
3	Communication with Main PCB	7	FAN 1
4	Downloader	8	Compressor

EMI PCB

(Line voltage filter)

1	AC Power L
2	AC Power N
3	AC Power

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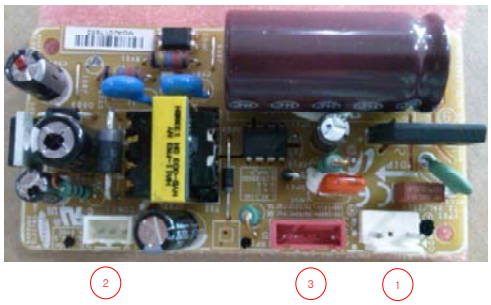
RLC Basic System Components

Indoor Unit SMPS (Switched Mode Power Supply)



Layout is an example only.
PCB Layout may vary depending on specific model

① CON01	② CON02	③ CON03
#1: L #2: N	#1: 12V #2: GND #3: 5V	#1: DC_LINK #2: NC #3: NC #4: 17V ~ 27V #5: GND_P

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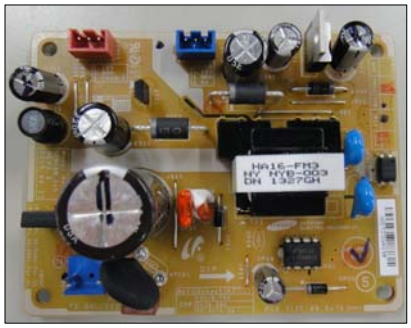
RLC Basic System Components

Outdoor Unit SMPS (Switched Mode Power Supply)



① CON01	② CON02	③ CON03
#1: N #2: L	#1: 12V #2: GND #3: 5V	#1: 15V #2: CGND #3: ENABLE

Layout is an example only.
PCB Layout may vary
depending on specific model

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RLC Basic Service & Troubleshooting

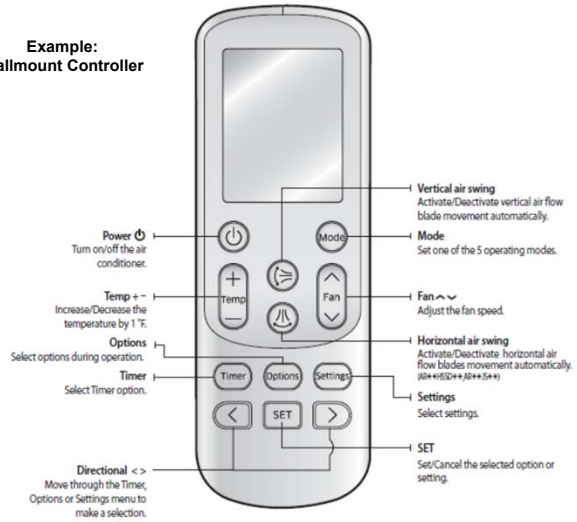
Wireless Remote Controller Basic Features

Features vary depending on system model

Remote Controller Features

Standard IR Wireless Controller

Example:
Wallmount Controller



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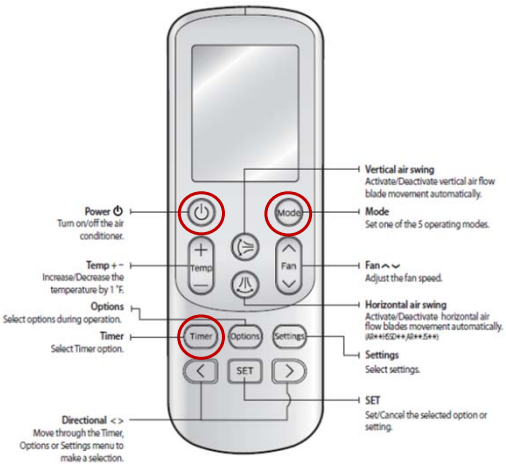
Remote Controller Features

Standard IR Wireless Controller

- **Power** – Turning system On/Off
  - Louvers open when On - close when Off
- **Mode** - Basic system operations
  - **Auto** – The system will automatically set the temperature & fan speed depending on the room temperature (61°F - 86°F)
  - **Cool** – Users electable set point temperature and fan speed (61°F - 86°F)
  - **Dry** – Operates in cool mode only, user adjusts set point temperature below room temperature (65°F - 86°F) slows fan speed
  - **Fan** – Fan only operation – User selectable fan speed or Auto (speed changes with load)
  - **Heat** – User selectable set point temperature and fan speed - Indoor coil will preheat for 3 to 5 minutes before fan starts (61°F - 86°F)
- **Timer** – System turn On and Turn Off can be set in 30 min. increments from 3 to 24 hrs.
- **Vertical/Horizontal air swing** – user set blade angle
  - Powered vertical vanes – Pearl only
- **Temp** – User selected Heat or Cool setpoint



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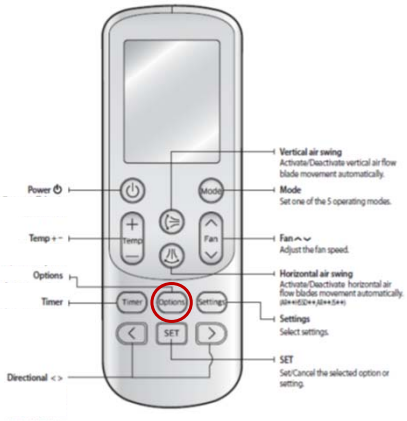
Remote Controller Features

Standard IR Wireless Controller

Option – Special operating features unique to each model family (Whisper/Pearl example)

- **2-Step cooling** – Automatically sets cooling operation to high capacity when the room temp is above setpoint. When setpoint temp is reached, system automatically changes to DRY mode
- **Fast (Cool or Heat)** – Automatically sets fan speed to High and cool setpoint to 37° or heat setpoint to 99° for 30 mins. Fan speed and setpoint are locked. After 30 mins. the system reverts to normal operation
- **Single User** – When selected, Inverter limits compressor operation to lower energy usage Longer run cycle to reach setpoint.
- **Quiet mode** – Sets fan speed to "Auto"
- **Smart Install** – When selected checks system operation status (7 to 13 mins.)
- **Good'sleep** – Sets overnight system temperature control to operate in 3 stages: Fall asleep – Sound sleep – Wake up
  - Fall asleep: Drops to low temperature
  - Sound asleep: Raises temperature slightly
  - Wake up: Intermittent air

Example:
Wallmount Controller



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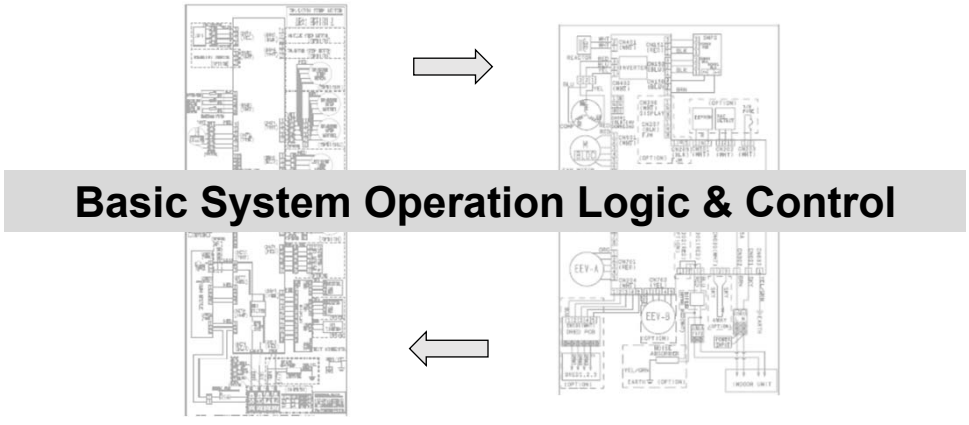
RLC Basic Service & Troubleshooting



Basic System Operation Logic & Control

SAMSUNG HVAC

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System Operation Logic & Control

Basic Control Logic

Control Loop Components

- **Measurement**
  - Thermistor sensor connected to the refrigerant circuit or controlled space
  - Local Remote Controller- Temp Setpoint – On/Off – Mode – Fan, etc.
- **Decision**
  - Made in advanced processor controller
  - Algorithm
- **Action**
  - Taken through an output device (actuator) such as the EEV stepper motor or variable speed inverter compressor

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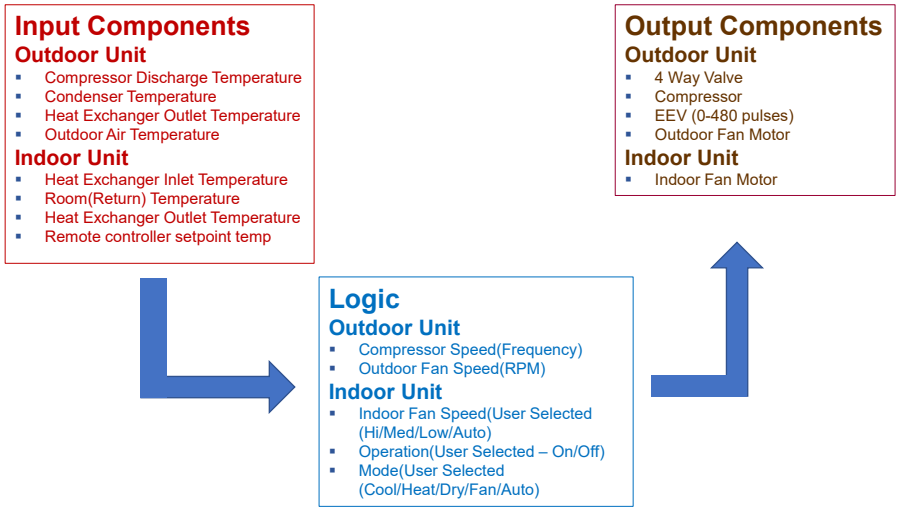
System Operation Logic & Control

Basic System Operation Logic



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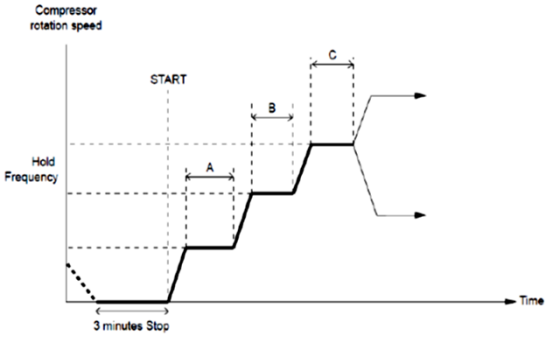
System Operation Logic & Control

Operation Logic

Compressor Start Sequence

- Compressor starts with a thermo-On condition but will be suspended in the following cases
  - 3 minutes from Power On reset
  - 3 minutes from last compressor stop
- After compressor start, the rotational speed rises to the hold frequency and remains for compressor lubrication
- The compressor speed varies according to the room temperature and other conditions



OUTDOOR UNIT	COMPRESSOR HOLD REGION	HOLD FREQUENCY	HOLDING TIME
9 & 12MBtu	A	26 Hz	30 sec
	B	52 Hz	60 sec
	C	88 Hz	60 sec
18, 20 & 24MBtu	A	26 Hz	0 sec
	B	49 Hz	60 sec
	C	88 Hz	0 sec
30, 36 & 48MBtu	A	30 Hz	30 sec
	B	52 Hz	60 sec
	C	63 Hz	60 sec

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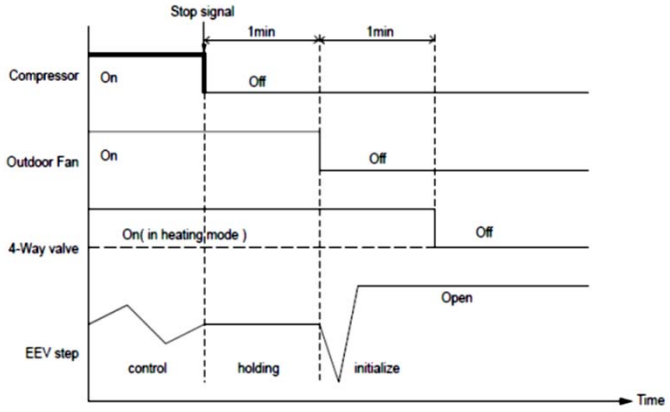
System Operation Logic & Control

Operation Logic

Compressor Stop Sequence

- When the compressor stops, the Outdoor Fan, EEV, and 4-way valve operations revert to the following status:



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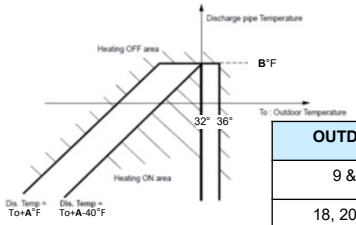
System Operation Logic & Control

Operation Logic

Compressor Crankcase Heater

- In low ambient temperatures with the compressor in stop mode (standby) the compressor is heated by passing current through the compressor motor windings – external crankcase heater element not required
  - This heating function prevents liquid refrigerant from migrating into the compressor crankcase which can cause “liquid slugging” and crankshaft bearing failure on compressor start up
  - On–Off compressor heat function is controlled according to the conditions indicated in the chart
  - The compressor heat on function is delayed for 10 minutes after compressor stop
  - Compressor heat on function is delayed 1 hour after 3 hours of continuous heating operation for controller protection



OUTDOOR UNIT	A	B
9 & 12MBtu	60°F	50°F
18, 20 & 24 MBtu	50°F	40°F
30, 36 & 48 MBtu	60°F	50°F

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System Operation Logic & Control

Freeze Protection Control (Cool mode)

Freeze Protection

- Anti-freezing control prevents frost on the indoor unit evaporator coil. If frost is allowed to accumulate on the indoor coil, air flow through the coil can be restricted.
- Cool or Dry mode: when the indoor coil sensor detects temperature below 39°F, the compressor frequency is reduced to 15Hz – 35Hz (depending on unit model)
- After the compressor speed has been reduced, the anti-freezing control will be de-activated when the indoor coil temperature rises to 45°F - 50°F

- Example System – 9MBtu/h
  - Indoor coil temperature is detected below 39°F – Compressor speed reduced to 33Hz for 9 mins.
  - Indoor coil temperature is detected below 36°F - Compressor stops
  - Indoor coil temperature is detected to increase to 48°F – Compressor restarts

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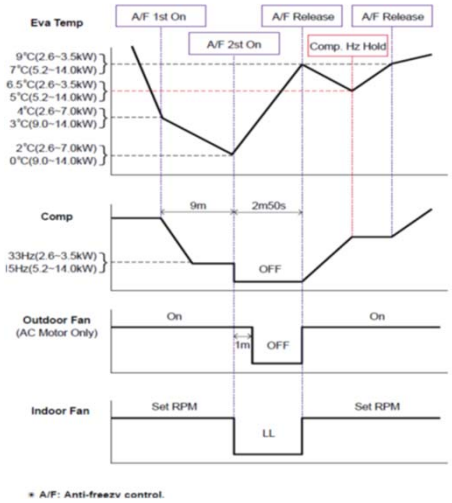
System Operation Logic & Control

Freeze Protection Control (Cool mode)



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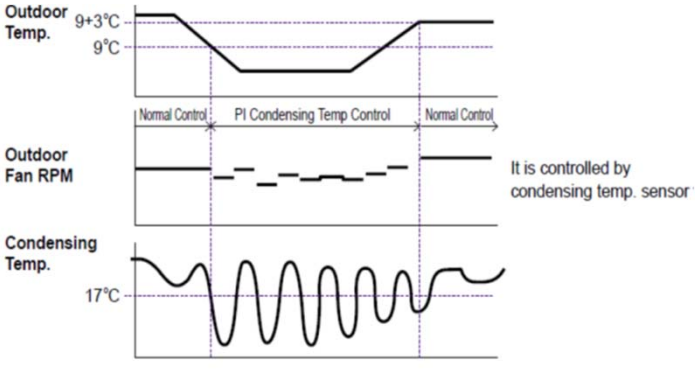
System Operation Logic & Control

Low Ambient Control (Cool mode)

- Condensing temperature control (outdoor fan motor)
  - Cool operation condensing temperature control is activated based on outdoor ambient temperature
  - Low ambient control prevents the indoor coil from freezing in cool operation
  - Low ambient control activates when the outdoor temperature drops below 48°F (depending on unit model)



[9 degC = 48 degF / 17 degC = 62 degF]

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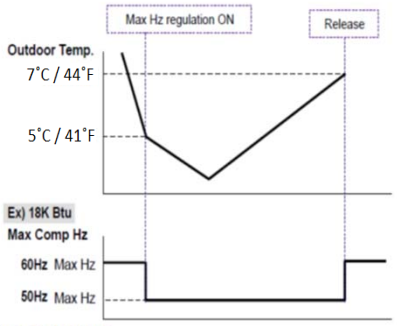
System Operation Logic & Control

Low Ambient Control cont.

Max Comp. frequency regulation (At the low ambient temperature in cooling mode)

◆ Depending on the outdoor temperature,each model has its own maximum allowable frequency.



◆ For example of 18K Btu/h.

When the ambient temperature is below 41°F, the maximum frequency is limited to 50 Hz

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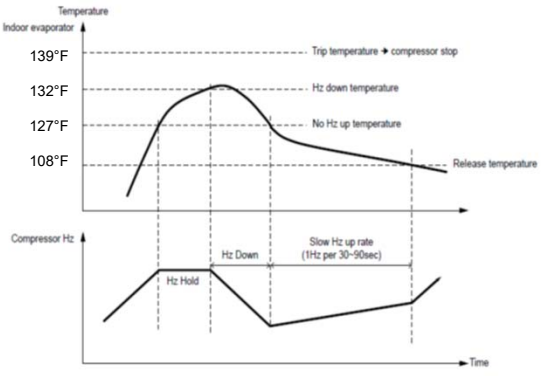
System Operation Logic & Control

Overload Prevention Control

◆ This control is to protect system from overload operation in heating mode.



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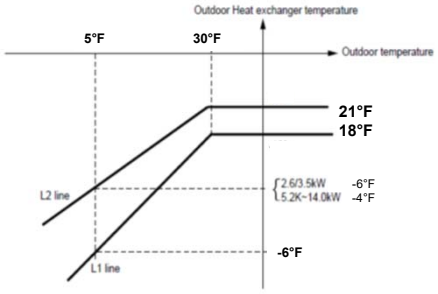
System Operation Logic & Control

Defrost Control (Heat Mode)

Defrost Control – Heat operation

- Detects frost on the outdoor heat exchanger and removes it
- System changes over to the cool mode when defrost is initiated

- Defrost start
  - Compressor running and outdoor heat exchanger temperature < L2 line for continuous 120 minutes
  - Compressor continuous running for 35 minutes and outdoor heat exchanger temperature < L1 line for continuous 3 minutes



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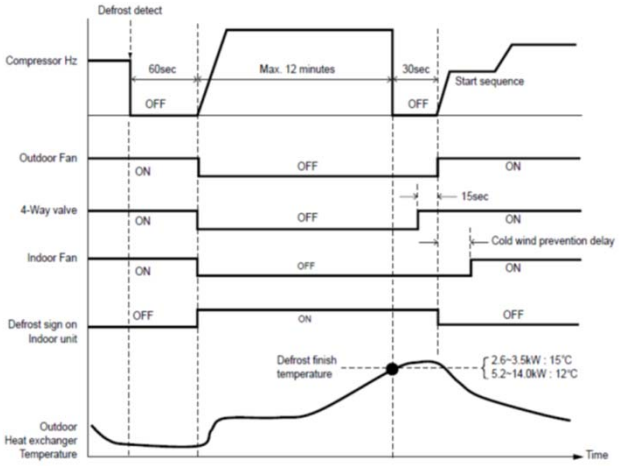
System Operation Logic & Control

Defrost Control

Defrost sequence



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RLC Basic Service & Troubleshooting

Basic System Troubleshooting

Basic System Troubleshooting

Smart Install Mode

To initiate **Smart Install** operation press and hold: Power – Mode – SET buttons simultaneously for 4 secs.

88 Display: Progress will be indicated from 0-99

LED Display: Indicator on the indoor unit display will blink in sequence and then all indicator lights will blink.

If a malfunction is detected, the operation will end and the error code displayed on the indoor unit.

TYPE	88 Display	LED Display
Indoor unit indicator	88	LED 1 LED 2 LED 3

* Display may be different depending on the model.

Error indicator: 88 Display	LED 1	LED 2	LED 3	Error	Measures to take by an installer
E 101	○	◑	◑	Communication Error between Indoor and outdoor unit	1. Check the connection wire between indoor and outdoor unit. (whether the power cable and communication cable is crossed or not)
E 121	○	◑	○	Error on Indoor temperature sensor	1. Check the connection of the sensor
E 122, E 123	◑	◑	○	Error on Indoor heat exchanger	1. Check the connection of the sensor
E 154	○	○	◑	Error on Indoor fan motor	1. Check the connection of the connector 2. Remove foreign substance (Check to see if fan spins.)
88 display and all LED blinks / E 162, E 163	◑	◑	◑	EEPROM/Option error	1. Option code
E422	●	○	◑	Refrigerant flow blocking Error	1. Check if the service valve is completely open. 2. Check if there's any blockage in the refrigerant pipe which connects Indoor and outdoor unit. 3. Check for refrigerant leak.
E554	◑	○	◑	Lack of Refrigerant (For Inverter model only)	1. Check if sufficient amount of additional refrigerant was charged for the pipe length that exceeds 7.5m. 2. Check for refrigerant leak between valve and pipe connection.

* Above LED pattern is displayed when there's error is occurred on outdoor unit. Check the LED display on outdoor unit for the details.

Example: Wallmount Controller

Basic System Troubleshooting

Sequence Of Items To Check

- **Input Voltage**
  - Rated Voltage: 208/230vac
  - Voltage range: ± 10% only
  - System may not operate correctly if input voltage is outside of specification
- **Power Line & Communication Line**
  - Outdoor unit
    - Caution: line voltage power must not be connected to the digital communication terminals (F1 F2)
    - AC voltage applied to terminals “F1 F2” will damage the PCB
  - Indoor unit line voltage
    - Line voltage power must be connected in proper polarity from the ODU to the IDU
    - If line voltage power is connected to the “F1 F2” terminals, an error “E101” is created
      - Reconnect the line voltage power to the correct terminals on the IDU
  - Indoor unit digital communication line (AWG 16/2 with shield)
    - The communication wire must be connected in proper polarity from the ODU to the IDU
      - “F1” to “F1” and “F2” to “F2”

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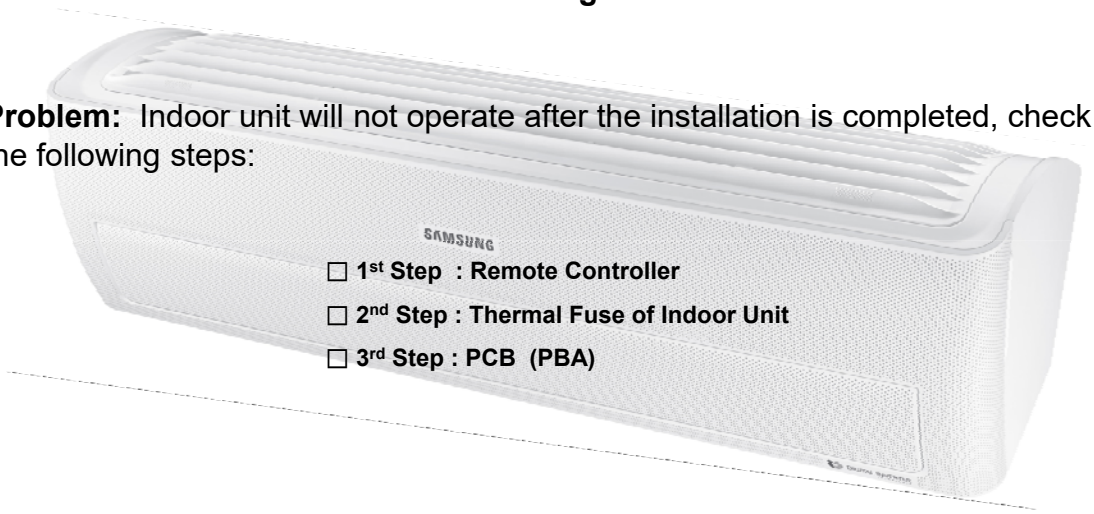
Basic System Troubleshooting

Troubleshooting Procedures

Problem: Indoor unit will not operate after the installation is completed, check the following steps:



- ☐ **1st Step : Remote Controller**
- ☐ **2nd Step : Thermal Fuse of Indoor Unit**
- ☐ **3rd Step : PCB (PBA)**

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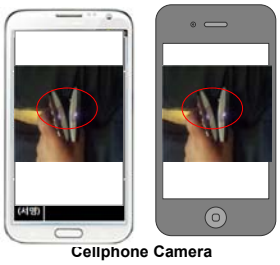
Basic System Troubleshooting

1st Step – Wireless Remote Controller

Problem: Wireless remote controller not working
- Check the battery voltage
- No display or ⌀ on the controller LCD, replace batteries

- LCD is displayed but IDU is not receiving any signal from the wireless remote controller
  - Verify wireless remote controller is emitting a signal properly
    - Verify emitter with a digital camera or cell phone camera – NOTE: iPhone forward facing camera models only
    - Switch remote controller ON and press any button while facing the controller emitter toward the camera lens
    - Looking at the camera LCD should see a purple or white light from the controller emitter when any controller button is pressed – normal operation

Digital Camera



Cellphone Camera

Normal Signal

No Signal

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Basic System Troubleshooting

Wireless Remote Controller Transmit Test

❑ Verify indoor unit operation by pressing the "Forced Operation" button
- If indoor unit has line voltage and it does not operate after pressing the button the indoor unit has a failure

❑ Check the indoor unit remote controller receiver module (Vcc)
- Check Vcc for 5vdc measured between Vcc and GND
- If no 5vdc, main PCB and Panel PCB are defective

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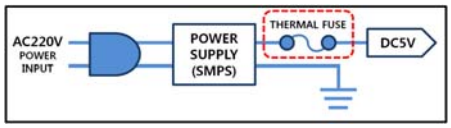
Basic System Troubleshooting

2nd Step – IDU Thermal Fuse

- **Thermal fuse**
  - The thermal fuse is located below the terminal block of the indoor unit
  - Thermal fuse is a protection device to eliminate the potential of overheating which could cause a fire
    - Loose wire connection on a terminal block can create a voltage drop and over heating
    - When the thermal fuse activates (open) power is terminated to the unit

- **Thermal fuse diagnosis**
  - ❑ Check continuity through the fuse – open/close
  - ❑ Thermal fuse open – no 12vdc to PCB – Replace terminal block
  - ❑ Check thermal fuse for secure connection to PCB




Fail


Defective

Check both sides of wire on the connector after disassembling

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Basic System Troubleshooting

3rd Step – PCB

Step	Procedure	The things to be checked	Cause
1	-First, plug out the power plug - Pull the PCB out of control box	-Check If the both fuses on PCB are open	-Over Current -Indoor fan motor short -PCB pattern short
2	-If the operating lamp is twinkling, supply power and then check right sides	-Input voltage of BD71 · Normal : 200 ~ 240Vac	-Fuse open, Wrong power cable connection, AC part is out of order
		-The voltage of between both terminal of C111(+) and (-) · Normal : 12Vdc	- Switching Trans of Power Circuit is out of order
		- The voltage of between both terminal of C118(+) and (-) · Normal : 5Vdc	-Power Circuit is out of order -Load short
3	-Turn on the unit with fan RPM high & minimum setting temperature and check right sides	-The voltage between terminal #1 ~ #3 of fan motor connector(CN72) · Normal : More than DC 270V	-Fan motor is out of order
		-The fan motor is not running	-Fan motor connector(CN72) is out of order or -Wire of fan motor is disconnected
		-If the voltage between terminal #1 ~ #3 of fan motor connector(CN72) is zero volts	-PCB is out of order

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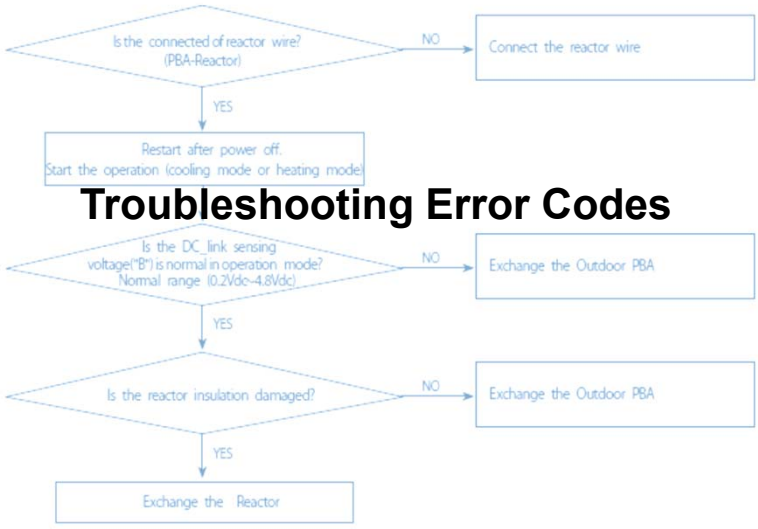
RLC Basic Service & Troubleshooting



Troubleshooting Error Codes

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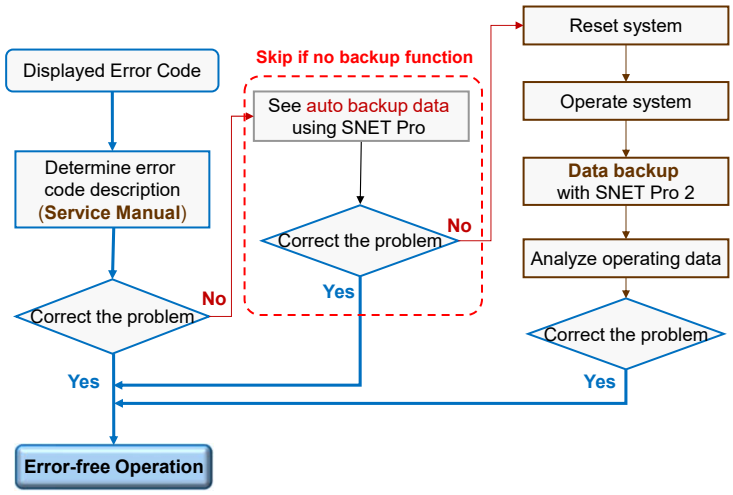
Troubleshooting Error Codes

Basic Error Code Troubleshooting Process



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Troubleshooting Error Codes

RLC Error Code List

Error	Description	No. of Error to stop	ODU	Error IDU	Other IDUs
121	Room temperature sensor is short/open	0	Normal	Stop	Normal
122	Evaporator In temperature sensor is open/short	0	Normal	Stop	Normal
123	Evaporator out temperature sensor is open/short	0	Normal	Stop	Normal
128	Evaporator in temperature sensor is detached	1	Stop(R)	Stop	Stop
129	Evaporator out temperature sensor is detached	1	Stop(R)	Stop	Stop
153	Float switch error - second detection	1	Normal	Stop	Normal
154	Indoor unit fan motor error	0	Normal	Stop	Normal
161	Mixed mode operation error (simultaneous cooing & heating)	1	Normal	Stop	Normal
162	Error in outdoor unit's EEPROM	0	Normal	Stop	Normal
163	Indoor unit option code is incorrect or missing Outdoor unit EEPROM data error	0	Normal	Stop	Normal
171	Evaporator mid sensor is detached	1	Stop(R)	Stop	Stop
172	Pipe in sensor is detached	1	Stop(R)	Stop	Stop
173	Pipe out sensor is detached	1	Stop(R)	Stop	Stop
186	SPI (Virus doctor) feedback error	1	Normal	Normal	Normal
190	Pipe check failure	1	Stop	Stop	Stop
199	Pipe check not initiated	1	Stop	Stop	Stop

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Troubleshooting Error Codes

RLC Error Code List

Error	Description	No. of Error to stop	ODU	Error IDU	Other IDUs
201	Indoor unit quantity error - FJM	1	Stop	Stop	Stop
202	Communication error between outdoor unit and indoor units - FJM (while normal operating)	1	Stop	Stop	Stop
203	Communication error between ODU MAIN PCB and INVERTER PCB	1	Stop	Stop	Stop
206	Communication error between ODU MAIN PCB and HUB PCB	1	Stop	Stop	Stop
221	Ambient temperature sensor in the outdoor unit is open/short. ERROR LEVEL: over 4.9V (-50°C, -58°F), under 0.4V (93°C, 199.4 °F)	1	Stop	Stop	Stop
237	Condenser out sensor is OPEN/SHORT ERROR LEVEL: over 4.9V (-50°C, -58°F), under 0.4V (93°C, 199.4°F)	1	Stop	Stop	Stop
246	Condenser out sensor is detached	1	Stop(R)	Stop	Stop
251	Comp1 Discharge sensor OPEN/SHORT ERROR LEVEL: over 4.9V (-30°C, -22°F), under 0.4V (151°C, 308°F) & ambient temperature > -10°C (14°F).	1	Stop	Stop	Stop
261	Compressor discharge sensor is detached	1	Stop(R)	Stop	Stop

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Troubleshooting Error Codes

RLC Error Code List

Error	Description	No. of Error to stop	ODU	Error IDU	Other IDUs
320	OLP sensor is open/short ERROR LEVEL: over 4.95V (-30°C), under 0.5V (151°C)	1	Stop	Stop	Stop
330	Hub in 1 sensor is open/short	1	Stop	Stop	Stop
331	Hub in 2 sensor is open/short	1	Stop	Stop	Stop
332	Hub in 3 sensor is open/short	1	Stop	Stop	Stop
333	Hub in 4 sensor is open/short	1	Stop	Stop	Stop
334	Hub in 5 sensor is open/short	1	Stop	Stop	Stop
335	Hub out 1 sensor is open/short	1	Stop	Stop	Stop
336	Hub out 2 sensor is open/short	1	Stop	Stop	Stop
337	Hub out 3 sensor is open/short	1	Stop	Stop	Stop
338	Hub out 4 sensor is open/short	1	Stop	Stop	Stop
339	Hub out 5 sensor is open/short	1	Stop	Stop	Stop
401	Compressor trip by freezing protection	0	Stop	Normal	Normal
404	Compressor trip by overload protection	3	Stop	Normal	Normal
416	Compressor trip by discharge temperature protection	3	Stop	Normal	Normal
419	Outdoor unit's EEV opening failure error (EEV is blocked)	1	Stop(R)	Stop	Stop
422	Outdoor unit's EEV closing failure error (EEV is leaking)	1	Stop(R)	Stop	Stop
440	Heating start restriction due to high ambient temperature over 86°F	0	Stop	Normal	Normal
441	Cooling start restriction due to low ambient temperature under 14°F	0	Stop	Normal	Normal
458	Outdoor fan motor error	1	Stop	Stop	Stop

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Troubleshooting Error Codes

RLC Error Code List

Error	Description	No. of Error to stop	ODU	Error IDU	Other IDUs
461	Compressor starting failure (5 times)	5	Stop	Normal	Normal
462	Compressor trip by current protection control	3	Stop	Normal	Normal
463	Compressor trip by OLP temperature protection	3	Stop	Normal	Normal
464	IPM over-current	9	Stop	Normal	Normal
465	Over current error in Inverter compressor(Over 30A)	9	Stop	Normal	Normal
466	Voltage in DC Link is below 150V or over 410V in inverter PBA	0	Stop	Normal	Normal
467	Abnormal RPM or wire is disconnected in inverter compressor	3	Stop	Normal	Normal
468	Current sensor error (Open / Short)	1	Stop	Stop	Stop
469	DC voltage sensor error (Open / Short)	1	Stop	Stop	Stop
470	Outdoor unit EEPROM Error	1	Stop(R)	Stop	Stop
472	Inverter micom zero-crossing error	1	Stop	Stop	Stop
473	Inverter compressor lock error	3	Stop	Normal	Normal
474	Inverter IPM heat sink sensor error (Open / Short)	1	Stop	Stop	Stop
475	Inverter fan 2 error	1	Stop	Stop	Stop
483	Error due to over current	1	Stop	Stop	Stop
484	PFC overload(over current) error	0	Stop	Normal	Normal
485	Inverter 1 input current sensor error (Open / Short)	1	Stop	Stop	Stop
486	Error due to over voltage/low voltage of fan motor	3	Stop	Normal	Normal
500	Inverter 1 IPM overheat error	9	Stop	Normal	Normal
554	Refrigerant leak error	1	Stop(R)	Stop	Stop
660	Inverter boot code error	1	Stop	Stop	Stop

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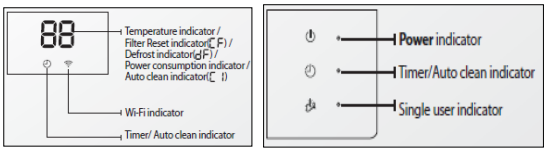
Troubleshooting Error Codes

RLC Error Code Display - Whisper/Pearl/Wind Free/Quantum

IDU error code status is displayed at the LED display in the lower right hand corner behind the powered louver
(Quantum LED display on lower right hand unit cover)

Error indicator				Error
88 Display	LED Display			
	LED 1	LED 2	LED 3	
	⏻	◷	✱ / Wi-Fi / ⚙	
E 101	○	◑	◑	Commnuication Error between Indoor and outdoor unit
E 121	○	◑	○	Error on indoor temperature sensor
E 122,E 123	◑	◑	○	Error on indoor heat exchanger

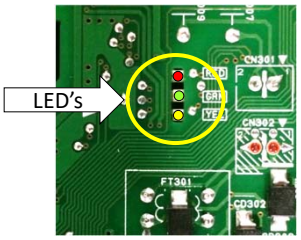
✱ ○: Off / ◑: Blinking / ●: On Example list



ODU errors displayed with the Red, Green & Yellow LEDs on the main PCB

	LED PATTERN			DESCRIPTION
	YEL	GRN	RED	
	○	○	○	Power off/VDD NG
E464	○	○	⊙	IPM OVER CURRENT (O.C)
E202	○	○	●	ABNORMAL SERIAL COMMUNICATION (DISPLAY BOARD : INDOOR ↔ OUTDOOR)
	○	●	●	
	○	⊙	●	NORMAL OPERATION
E461	○	⊙	○	COMP STARTING ERROR

● LED ON, ○ LED OFF, ⊙ LED BLINKING Example list



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Troubleshooting Error Codes

RLC Error Code Display – MAX AQ*036

IDU error code status is displayed with LEDs located on the lower right hand unit cover

Error indicator			Error
LED Display			
LED 1	LED 2	LED 3	
⏻	◷	✱ / Wi-Fi / ⚙	
○	◑	◑	Commnuication Error between Indoor and outdoor unit
○	◑	○	Error on indoor temperature sensor
◑	◑	○	Error on indoor heat exchanger

✱ ○: Off / ◑: Blinking / ●: On Example list

ODU error code status displayed on the 7-segment display on the main PCB
All error codes begin with "E" followed by 3 numbers

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Troubleshooting Error Codes

Most Common RLC Error Codes

E101 – Indoor unit communication error. Indoor unit cannot receive any data from outdoor unit.
E121 – Room TH sensor error
E153 – Indoor float switch error.
E154 – Indoor unit fan motor error.
E190 – Pipe check failure
E199 – Pipe check not initiated. (usually happens on new installs when unit is first powered on.)
E201 – Indoor unit quantity error. Settings on outdoor PCB wrong or duplicate address.
E203 – Communication error of ODU main & inverter PCB's
E320 – OLP (Over Load Protector) open or short
E416 – Compressor stop due to high discharge pressure
E458 – Outdoor fan motor error
E461 – Compressor failure to start
E464 – IPM over current
E467 – Compressor rotation error. Abnormal compressor operation
E470 – ODU PCB EEPROM error

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Troubleshooting Error Codes

E101 – IDU communication error

- ❑ Check the incoming ac voltage : 208/230vac ± 10%
  - Step down transformer is recommended If supply voltage is above 245vac
- ❑ Make sure communication control wire is 16/2 AWG stranded with shield
  - Solid core thermostat wire is not to be used for communications
- ❑ Verify the control wire shield is grounded at the outdoor unit only
- ❑ Make sure the unit is wired in proper polarity (F1 to F1, F2 to F2, etc.)
- ❑ The control wire must not be run in the same conduit as ac voltage wiring
  - Control wire must be run with at least a 2" air gap from conduit with ac voltage wiring
- ❑ Control wire must be run with no splices or junction boxes
  - Must be a continuous run from indoor to outdoor unit
- ❑ Are there any condensate pumps on system that are tied into F1 and F2?
  - The F1 F2 communication circuit cannot be broken (switched) or spliced
- ❑ Are there any breaks in the control wires? (Connect ends and Ohm out)
- ❑ Try option coding the indoor unit

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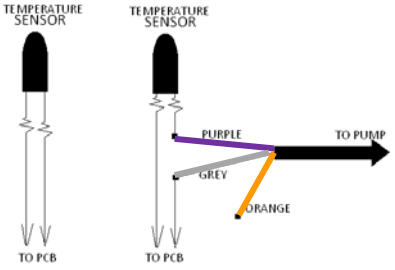
Troubleshooting Error Codes

E121 – Room TH sensor error

Check:

- ❑ Is the indoor unit room temperature sensor wire harness properly connected to the PCB
- ❑ Is the sensor placed correctly on the return air side of the coil
- ❑ Check the resistance value in relation to the ambient temperature
- ❑ Is there a separate field installed condensate pump in this unit with the float switch wired into the unit room sensor leads
  - Check the condensate water level and the pump float switch status (open/close)
  - If open, is there a blockage in the condensate removal circuit or pump failure



TEMP. (°F)	MAX (kΩ)	CENTER (kΩ)	Min (kΩ)
-58.0	351.4	329.5	308.8
-49.0	263.4	247.7	232.6
-40.0	199.9	188.5	177.5
-31.0	152.4	144.1	136.0
-22.0	117.5	111.3	105.4
-13.0	86.5	86.4	82.0
-4.0	71.2	67.8	64.5
5.0	55.9	53.4	50.9
14.0	44.4	42.5	40.8
23.0	35.3	33.9	32.5
32.0	28.4	27.3	26.2
41.0	22.9	22.1	21.2
50.0	18.6	18.0	17.3
59.0	15.2	14.7	14.2
68.0	12.5	12.1	11.7
77.0	10.3	10.0	9.7
86.0	8.6	8.3	8.0
95.0	7.2	6.9	6.7

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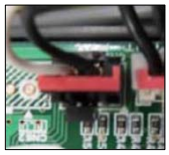
Troubleshooting Error Codes

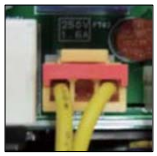
E153 – IDU float switch error (cassette & ducted units)

- This error code will only show up on ducted or cassette units that are equipped with a condensate pump
- If a factory condensate pump is installed in a unit that doesn't normally have one, and the function is initialized with the install option codes, this error can occur as well.

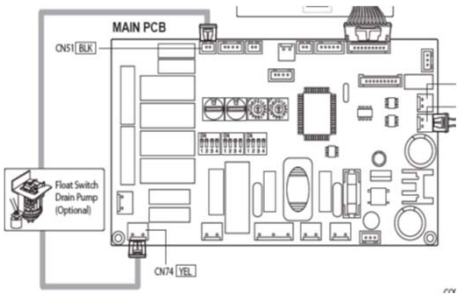
- ❑ Test the float switch plug on PCB to make sure the contacts are closed. This is a normally closed switch
- ❑ If it is open, check to see if the drain pan is full of water
- ❑ If drain pan has no water, the float switch could be stuck or defective
- ❑ If full of water check to make sure there is voltage to the drain pump
- ❑ Make sure the drain hose is not clogged or pinched shut
- ❑ If voltage is present replace pump
- ❑ No voltage replace indoor PCB



Float Switch Plug



Drain pump power Plug



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Troubleshooting Error Codes

E154 – IDU fan motor error

- ❑ Is your incoming voltage correct?
- ❑ What mode are you in? In heating mode fan will not run until indoor coil reaches 93°F
- ❑ Does the fan spin freely?
- ❑ Are the filters and evaporator coil clean?
- ❑ Is the fan plugged into PCB properly?
- ❑ Cycle power does the fan run at all?
- ❑ Try option coding the indoor unit.
- ❑ Check the voltage of DC Link between #1 & #3 in cooling mode
  - Normal range: 270V – 320 V
- ❑ Check the DC voltage between #3 & #5 or #3 & #6 in cooling mode
  - Normal range: 5vdc – 10vdc
- ❑ If voltage is ok, replace the indoor fan motor.
- ❑ If voltage is not correct replace indoor PCB

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Troubleshooting Error Codes

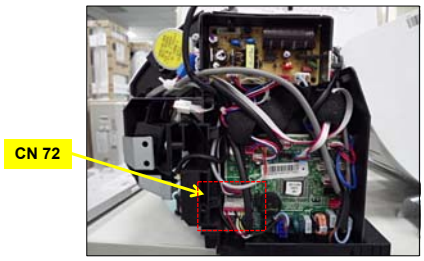
E154 – IDU fan motor error cont.

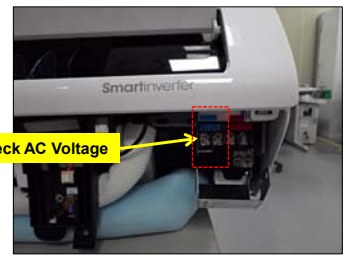
Indoor display

3-LED DISPLAY			7-SEG DISPLAY	DESCRIPTION
LED1	LED2	LED3	E154	Indoor fan error
○	○	◎		

● LED ON ◎ LED BLINKING ○ LED OFF

1. Checklist :
   1) Is the indoor units fan motor properly connected with the connector(CN72)?
   2) Is the AC voltage correct?





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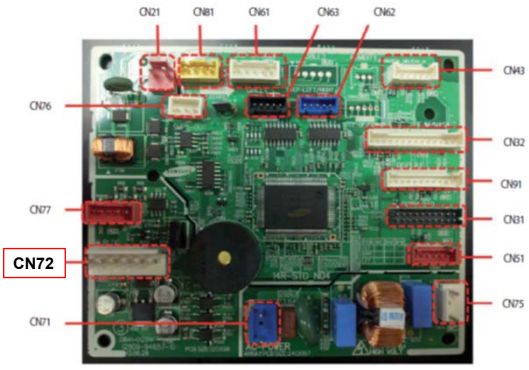
Troubleshooting Error Codes

E154 – Indoor fan motor error cont.

Determine which components have malfunctioned: Motor, Wire harness connection or PCB

- ❑ Verify the fan motor wire harness connector is securely connected to the PCB
- ❑ Switch power off to the outdoor unit and after 15 minutes disconnect the fan motor harness from CN72 on the PCB
- ❑ Check continuity between each pin: #1~#6
  - Replace fan motor if short is detected
  - If no shorts – reconnect fan motor harness to PCB (CN72)
- ❑ Restore power to the outdoor unit
- ❑ Check the voltage of DC Link CN72 (between #1& #3) in cooling mode
  - Normal range : 270V~340V (≈1.41 X AC Voltage Input)
- ❑ Check the DC voltage between #3 & #5 or between #3 and #6 in cooling mode
  - Normal range: 5vdc~10vdc (when fan is running)
- ❑ With fan motor off, verify voltage fluctuation of 0vdc to 15vdc when fan is manually turned
- ❑ If the voltage value is within the normal range: replace the fan motor



Example Indoor Unit Main PCB

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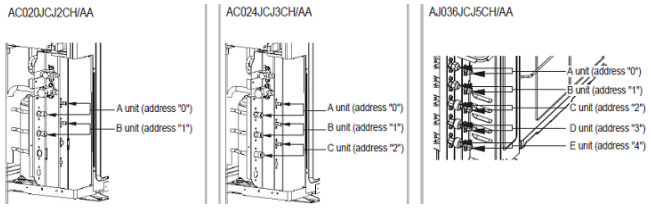
Troubleshooting Error Codes

E190 – Pipe check failure FJM series

There are only a few causes of this problem

- Refrigerant piping crossed. Small or large line from one unit swapped on the ports of another unit.
- ❑ Verify all refrigerant piping connections to the outdoor unit.
- Indoor coil thermistor sensor reading out of range or separated from indoor coil.
  - ❑ Test the indoor coil sensor (refer to10KΩ sensor chart)
  - ❑ Verify thermistor sensor is attached properly to the coil.



TEMP. (°F)	MAX (kΩ)	CENTER (kΩ)	Min (kΩ)
-58.0	351.4	329.5	308.8
-49.0	263.4	247.7	232.6
-40.0	199.9	188.5	177.5
-31.0	152.4	144.1	136.0
-22.0	117.5	111.3	105.4
-13.0	86.5	86.4	82.0
-4.0	71.2	67.8	64.5
5.0	55.9	53.4	50.9
14.0	44.4	42.5	40.8
23.0	35.3	33.9	32.5
32.0	28.4	27.3	26.2
41.0	22.9	22.1	21.2
50.0	18.6	18.0	17.3
59.0	15.2	14.7	14.2
68.0	12.5	12.1	11.7
77.0	10.3	10.0	9.7
86.0	8.6	8.3	8.0
95.0	7.2	6.9	6.7

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Troubleshooting Error Codes

E199 – Pipe Check Not Initiated - FJM

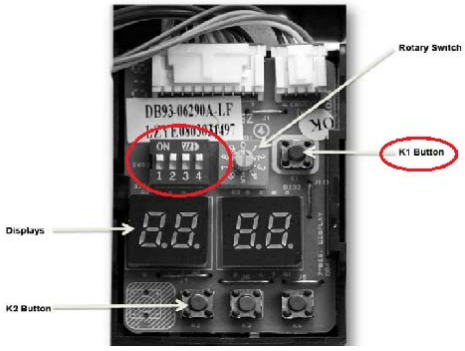
This error code is most typical on initial power up. You should only see this code on the **FJM** series. If none of the dip switches on the outdoor unit are changed from factory. You should see this code on the outdoor unit once power is applied. Set the rotary dial to the number of indoor units you have and then press the **K1** button one time to initiate the pipe check operation on the system. You will see what looks like a sideways "T" and a five on the left hand screen. This is showing you the system is going through its pipe check. If it fails you will get an error code. This process can last up to an hour depending on the amount of units connected to the system. Once tracking is complete it will flash through the addresses on the left hand screen.

■ Settings of PCB Display of the Outdoor unit

◆ Key Options of PCB Display

- K1 : pipe checking operation button
- K2 : Function button
- K3 : Reset button
- K4 : View mode change button

Push \ Key	K1	K2	K3	K4
1	Pipe Checking Operation (Display: H5)	Heat Mode Try run (Display: H1)	Reset	View mode change
2	-	Refrigerant Charging (Display: H2)		
3	-	Cool Mode Try run (Display: H3)		
4	-	Pump down (Display: H4)		



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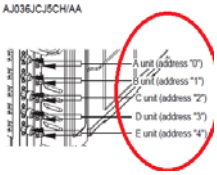
Troubleshooting Error Codes

E201 – IDU quantity error – FJM

This is a communication error. This error will be displayed when the outdoor unit cannot communicate with the number of indoor units you have set on the outdoor unit PCB rotary dial.
For example, you have it set for 4 but the unit can only find 3. You will also get this error if you have duplicate indoor addresses, 2 indoor units with the same address.

Check the following on all the indoor units:

- ❑ Check the incoming ac voltage: 208/230vac
  - If above 245V use step-down transformer.
- ❑ Make sure communication control wire is 16/2 AWG with shield
- ❑ Verify the control wire shield is grounded at the outdoor unit only
- ❑ Make sure the unit is wired in proper polarity (F1 to F1, F2 to F2, etc.)
- ❑ The control wire must not be run in the same conduit as ac voltage wiring.
  - Control wire must be run with at least a 2" air gap from conduit with ac voltage wiring
- ❑ Control wire must be run with no splices or junction boxes
  - Must be a continuous run from indoor to outdoor unit
- ❑ Are there any condensate pumps on system that are tied into F1 and F2?
  - Cannot break communication circuit
- ❑ Are there any breaks in the control wires? (Connect ends and Ohm out)
- ❑ Verify addresses are correct per Installation Manual (manual addressing only)
- ❑ If all this checks out. Try to narrow it down to which unit it cannot find.
- ❑ Power system off and remove all but one set of F1 and F2 wires. Set rotary dial to one and power system back on. See if it finds that one unit.
- ❑ If so continue on until you locate the unit it wont find. Problem is usually in the wire.
- ❑ If not replace indoor PCB.



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Troubleshooting Error Codes

E203 – Communication Error ODU Main & Inverter PCB's

This is strictly an outdoor PCB communication error. This happens when the main and inverter PCB's cannot communicate.
** Sometimes these error codes can be caused by a spike in voltage and just cycling power to the system will correct the issue

- Check supply voltage: 185vac – 245vac – If above 245vac install step-down transformer
- Inspect reactor wire – burned or melted
- Unplug outdoor fan motor(s). Motors are dc powered and if there is an internal short in the motor, it can cause a problem with the dc communications
  - If the error code goes away after the motor is unplugged, replace the fan motor
  - If the unit has 2 fan motors (MAX - AQX36), pinpoint which motor is causing the issue and replace
  - If the error still does not go away, replace the outdoor control assembly


Example unit has 2 DC fan motors

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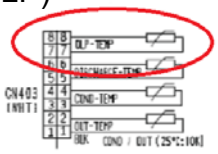
Troubleshooting Error Codes

E320 – Over Load Protector Open/Short (OLP)

This error pertains to the outdoor unit OLP (Over Load Protector) sensor.



- Does the system run or does the error code appear right away?
- If it appears right away, locate the sensor plug designation and ohm the sensor at 77°F This is a 200KΩ sensor – refer to chart
- If sensor is out of range replace.
- If sensor is within range reseat connection and test. If error occurs again replace outdoor PCB
- If system runs before error, check running pressure.
  - Over or under charge could cause this error.
- Make sure outdoor fan motor is running.
- Make sure coil is clean.
- If in heat mode make sure indoor fan is coming on and air filter is clean.
  - If not refer to E154 troubleshooting
- Make sure there is no obstructions in front of indoor or outdoor units.
- Check the discharge sensor

TEMP. (°F)	MAX (kΩ)	CENTER (kΩ)	Min (kΩ)
32	563.1	553.50	515.2
41	476.1	446.20	417.1
50	385.1	362.40	340.2
59	312.6	295.40	278.5
68	256.6	242.50	229.5
77	210	200.00	190.0
86	174.6	165.70	156.8
95	145.8	137.80	130.0
104	122.5	115.40	108.4
113	103.3	96.95	90.8
122	87.87	81.92	76.5
131	74.47	69.44	64.6
140	63.65	59.16	54.9
149	54.55	50.54	46.7

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Troubleshooting Error Codes

E416 – Compressor stop – high discharge temperature

This error is protection for the compressor when discharge temperature is too high.
Does the system run before getting this error?

TEMP.(°F)	MAX (kΩ)	CENTER (kΩ)	MIN (kΩ)
32	563.1	553.5	515.2
41	476.1	446.2	417.1
50	385.1	362.4	340.2
59	312.6	295.4	278.5
68	256.6	242.5	229.5
77	210.0	200.0	190.0
86	174.6	165.7	156.8
95	145.8	137.8	130.0
104	122.5	115.4	108.4
113	103.3	96.95	90.78
122	87.87	81.92	76.45
131	74.47	69.44	64.59
140	63.65	59.16	54.85
149	54.55	50.54	46.71

If error appears right away

- Locate the sensor plug designation and ohm sensor. This is a 200KΩ sensor at 77°F. (Use chart)
  - If sensor is out of range replace.
  - If sensor is within range reseat connection and test. If error occurs again replace outdoor PCB

If system runs before error

- Check running pressure. Over or under charge could cause this.
- Verify outdoor fan motor is running.
- Make sure coil is clean.
  - If in heat mode make sure indoor fan is coming on and filter is clean. (If not refer to E154 troubleshooting)
- Make sure there is no obstructions in front of indoor or outdoor units.

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Troubleshooting Error Codes

E458 – ODU BLDC fan error

Indoor display

3-LED DISPLAY			7-SEG DISPLAY	DESCRIPTION
LED1	LED2	LED3	E458	Outdoor fan error
◎	○	◎		

Outdoor display

●	○	○	Outdoor fan error

● LED ON ◎ LED BLINKING ○ LED OFF

Check for obstacles or locked fan

Check Connector

PF2(Platform2)
Model: 9k,12k,18k Btu/h

PF3(Platform3)
Model : 24k Btu/h

Check Connector

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Troubleshooting Error Codes

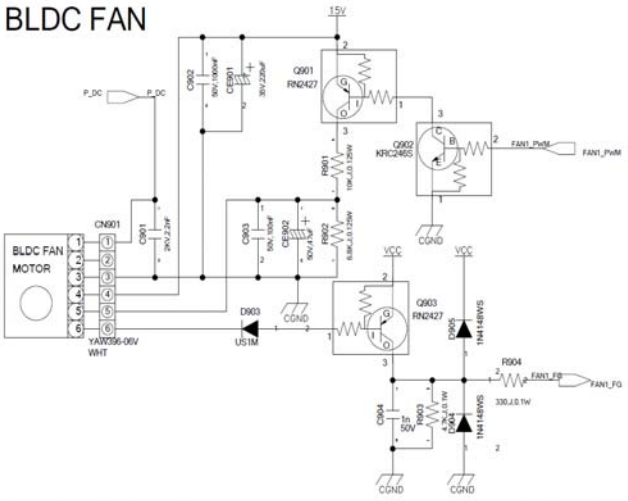
E458 – ODU BLDC fan error cont.

To determine which parts are out or order, follow the procedure below

CAUTION: Never unplug a BLDC motor while the unit is powered up. Power must be switched off for at least 15 minutes before removing the plug from the PCB.

- Check the FAN connector is tightly connected to PBA
  - If fan connector is tightly connected
- Check if DC_ link voltage in DC Capacitor (PF2:CE101, PF3:CE054) in cooling mode
  - Normal range : 279V ~ 342V (at AC 220 V input)
- Check if DC voltage between #3 and #5 or between #3 and #6 is changing(up and down)
  - If so, it is normal

If checked value is within normal range, Fan motor is defective



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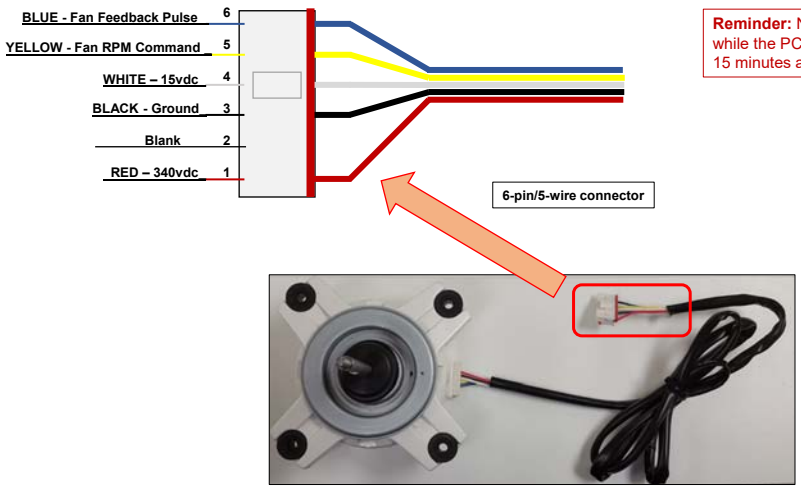
Troubleshooting Error Codes

BLDC Fan Motor



Reminder: Never unplug a BLDC motor while the PCB is still powered up; wait 15 minutes after power is switched off

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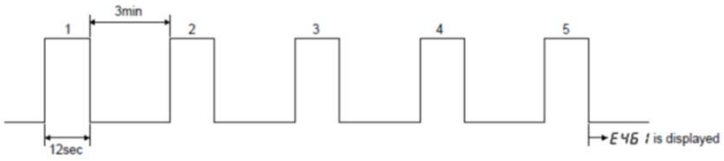
Troubleshooting Error Codes

E461 – Compressor failure to start

Compressor starting error detection (E46 1)

(1) Control
E46 1 is displayed when compresson fails to start after starting failure of 5 times is detected.



(2) Cause
Compressor wire trouble(disconnect etc.),
Compressor trouble(locking, motor wire trouble etc.),
PCB trouble(Power Driver open mode etc.)

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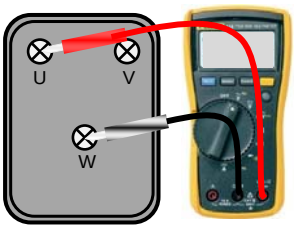
Troubleshooting Error Codes

E461 – Compressor failure to start

Check compressor malfunction with VOM tester or a Megohmmeter

- Switch the power off to the ODU and wait at least 15 minutes
- Remove compressor wires from terminal block
  - Use the VOM to check compressor winding resistance on all three phases
    - Fail: 0Ω or over 2Ω
  - Use a Megohmmeter to measure the winding insulation resistance
    - Fail: Less than 1MΩ from wire terminal U – V – W to chassis

Resistance test	Normal range
Resistance value of (**U↔V**,**V↔W**,**W↔U**) on compressor	less than 2Ω
Compressor winding insulation test	>1MΩ



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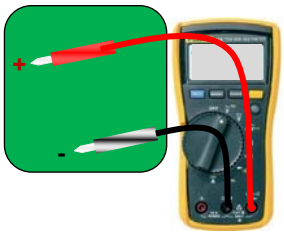
Troubleshooting Error Codes

E461 – Compressor failure to start

Check the Inverter using the VOM

- Measure the diode voltage values (preferred) or the diode resistance values



Action	Measuring point		Normal range	Remark
	+	-		
Measure the diode voltage values	U	P	0.3~0.7V	 
	V	P		
	W	P		
	N	U		
	N	V		
	N	W		
Measure the resistance values	U	P	More than 500kΩ	NOTE: When performing the diode resistance test on the inverter, power to the ODU must be switched off for at least 15 minutes.
	V	P		
	W	P		
	N	U		
	N	V		
	N	W		

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Troubleshooting Error Codes

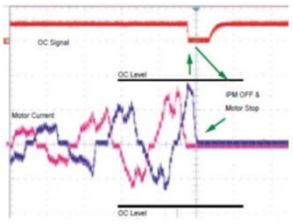
E464 – IPM overcurrent

IPM Over current protection/OC error/DC peak error (E464)

(1) Control
When peak current of compressor exceeds designed current, compressor stops operating immediately.

(2) Protection purpose
Compressor rotor magnet demagnetizing
IPM(power semiconductor) breakdown

(3) Cause
There are many reasons.
Indoor air flow blocked in heating mode by blade closing, covering air inlet with curtain, etc.
Compressor motor or wiring short circuit, Off the compressor wire connector during rotation, Compressor lock, Compressor magnet demagnetizing, Compressor rotation error, High compressor load in low speed rotation, PCB short circuit, IPM breakdown, etc.



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Troubleshooting Error Codes

E464 – IPM overcurrent cont.

- Verify that the service valves are open !!!!
- Verify supply voltage 208/230vac
- Check outdoor display lights are matching the main PCB
- Inspect the main PCB for burn marks or melted components
- Check wire harness connector between PCB and compressor
  - Corrosion – loose connections – wire polarity
- Check compressor terminal connections
  - Tight connections – corrosion – burnt wires or terminals
- With compressor unplugged power system back up. Do you get the E464 error immediately?
  - If so replace outdoor control assembly.
- If you get compressor start error(E461 or E467) the problem is in the compressor, replace compressor.
- Ohm compressor windings. This is a 3 phase DC compressor so all windings should be equal and a fairly low ohm value. Usually below 2Ω's
  - Check with multi meter to bare shell of compressor. Should have nothing to ground on any leg.
  - If compressor insulation test fails, replace compressor

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Troubleshooting Error Codes

E461- E467 Troubleshooting Procedures

- Check your incoming voltage. Make sure it is within range 185V-253V.
- Pull disconnect and locate the compressor plug.
- Ohm compressor windings.
  - This is a 3 phase compressor so all windings should be equal and a fairly low ohm value. Usually below 2Ω's
- Check with multi meter to bare shell of compressor. Should have nothing to ground on any leg.
- If compressor tests ok, use inverter checker to test inverter board. Use plug going down to the compressor.
  - If bad replace outdoor control assembly.
- IF ALL TESTS ON COMPRESSOR AND PCB's TEST OK SAMSUNG RECOMMENDS STARTING WITH CONTROL ASSEMBLY. THIS DOES NOT MEAN COMPRESSOR CAN NOT BE MECHANICALLY LOCKED. IF CONTROL PCB's FAIL TO FIX. REPLACE COMPRESSOR.

ERROR CODE	E461	E467
Describe the error	Compressor Starting Error Detection	Compressor Rotation Error
Logic of a detection	- 3 min later : restart (5 combination signal) - 5 times repeat - Set off - Error display : Indoor	- 3min later : restart - 3 times repeat - Set off - Error display : Indoor
Check point of a prediction	- Comp defect - INVERTER PBA defect (IPM/ I-SENSOR, IGAT) - CYCLE(overload)	- Comp defect - Contract Faulty of COMP connected terminal - Comp wire defect

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Troubleshooting Error Codes

E467 – Compressor Rotation Error

Compressor rotation error (E467)

(1) Control
E467 is displayed when targeted rpm is different from actual rpm after mismatched rpm of 3 times is detected.

(2) Protection purpose
Overcurrent trouble, Abnormal compressor vibration.

(3) Cause
Power line voltage changes quickly.
Cycle load changed quickly.
Compressor liquid back. Compressor trouble.
PCB trouble(noise etc).
Compressor motor magnet demagnetizing

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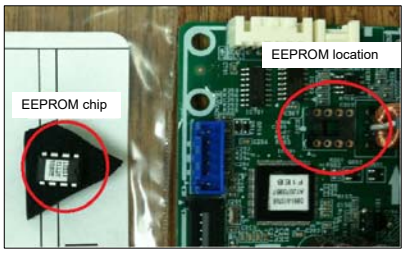
Troubleshooting Error Codes

E470 – ODU PCB EEPROM error

- **Did you just replace your outdoor main PCB?**
  - Yes- Did you install the EEPROM chip that came with the control assembly?
  - If not cycle power off and install.
  - Chip must be positioned with the “half circle” notch aligned with the white dot on the PCB.
  - Power on the unit. The red LED will light up and should stay on for 5-10 seconds. The LED sequence should then change to normal operation. Solid red and flashing green.
- **If main PCB was not replaced.**
  - Do you have any power issues?(spikes, brown outs)
  - Were there any storms in the area?
- **Replace outdoor PCB and install EEPROM chip.**



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RLC Advance Training

Thank You !

Samsung System Air Conditioner

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SAMSUNG HVAC Exclusive Dealer Features

Easy System Error Code Diagnostics & New System Registration

SAMSUNG HVAC Dealer Mobile App

Dealer support at your fingertips
Android or IOS devices

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Error Code Diagnostics

All Samsung Residential/Light Commercial and Commercial systems implement processor based self-diagnostics which generate error codes to identify specific operational and component issues

System error code lists are included in the Installation and Service Manuals & DVMS Error Code Booklet

There is an easy way to access the error code lists with descriptions by simply using the

SAMSUNG HVAC Dealer Mobile app on your Android or IOS devices

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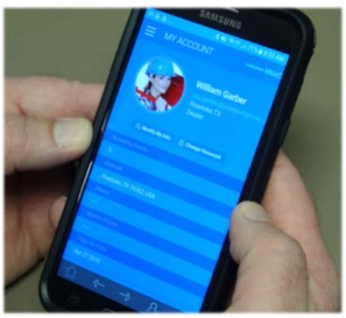
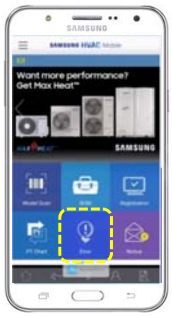
Error Code Diagnostics

The error code listing with descriptions for the complete Samsung product line is easily accessed through the Dealer Mobile App.



Launch the app and sign in



Select "Error" tab from Menu

Enter the error code or enter the type of error i.e. "Communication"

You can select the video description of the error code

Error codes greatly enhance the diagnostic procedures required to quickly and accurately analyze and resolve system component and operation issues

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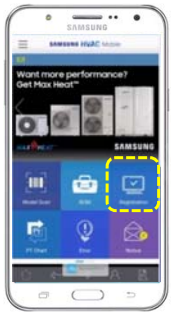
Samsung System Registration

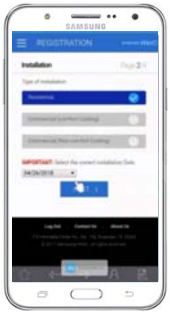
New Samsung systems can be conveniently registered through the SAMSUNG HVAC Dealer Mobile App

Launch the app and sign in



Select the "Registration" tab from Menu

Enter the installation information including the end-user email address



Select the installation type:
Residential
Commercial (comfort cooling)
Commercial (non-comfort cooling)
Select installation date

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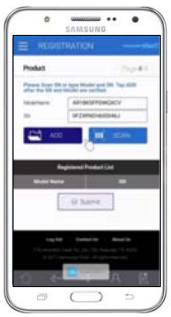
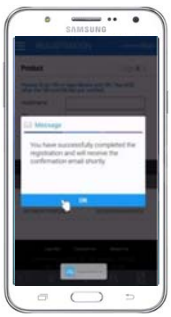
Samsung System Registration

System unit model and serial numbers can be typed in, however with the Dealer Mobile App, each unit's model and serial number can be easily scanned in – Multiple units can be scanned for each system



The product model & serial # will appear, then Select "ADD" to enter an additional unit
Select "Submit" when all units have been added for the system

Enter the confirming E-mail address
Select:
Installer/Servicer or Customer (end-user)
Add any comments



When properly submitted, the registration is complete and confirming email will be sent

NOTE: Every new Samsung air conditioning system must be properly registered within 60 days of installation to activate the enhanced warranty on eligible products

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