

Advanced Troubleshooting Guide

for

EasyStart™ Soft-Starters



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EasyStart Advanced Troubleshooting Guide



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WARNING



Some of the testing in this document involves being near or interfacing with live AC utility power. This power can cause serious or fatal injury if mis-handled. The recommendations contained herein should only be performed by qualified and trained service persons. Please contact Micro-Air for more assistance using our *Micro-Air Contact Us Page*.

Introduction

EasyStart soft-starters are designed for excellent reliability and durability. Every EasyStart we produce is tested many times throughout the build process, and finally on a live compressor before it leaves Micro-Air to ensure it will work in the field. This document is provided for in-depth technical investigation to resolve installation and operational issues and to help determine if EasyStart is the cause of the problem.

Getting Started – How to Use This Document

There are a few steps that create a workflow for the successful installation and operation of EasyStart. The most effective troubleshooting steps can be taken when we first characterize the problem and determine what specifically is working and what is not. This means we must determine where you are in the workflow.

1. Use the chart in the *Problem Characterization* section to know where you are in the workflow
2. Proceed to the troubleshooting section pointed to by the *Problem Characterization* section
3. Follow the recommendations in the troubleshooting section
 - a. Determine it is the right section for you by answering the initial questions
 - b. Ensure you understand normal operation using the relevant appendix information
 - c. Perform the recommendations to determine the cause and resolution
4. Use the *Micro-Air Contact Us Page* if you have further trouble. Include detailed information:
 - a. The problem you are experiencing
 - b. How you have used this document
 - c. The steps you have taken to find a resolution

Problem Characterization

Use this section to determine where you are in a typical workflow and characterize what is not working. Navigate *Figure 1* to determine where you are in this workflow. Start at the top and work your way down. Each level points to a relevant troubleshooting section to go to next. Move down along the green arrows if the section is not for you, or out along the red arrow if your problem matches the description and proceed to the indicated troubleshooting section.

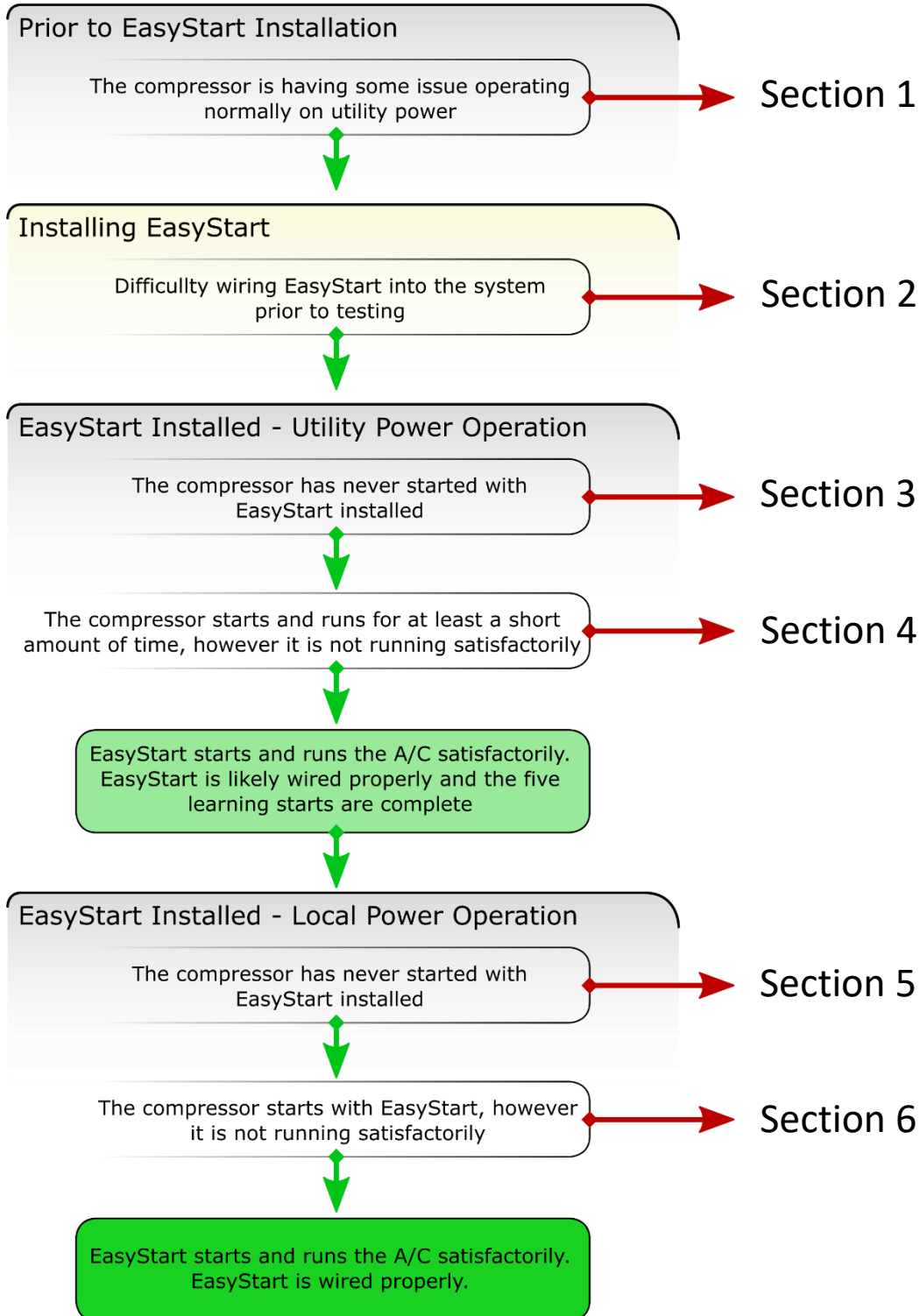
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EasyStart Workflow *Figure 1*



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Section 1 – Compressor Problems Without EasyStart

EasyStart is meant to be added into systems that are otherwise functioning normally. EasyStart can be added into these systems and could help in ways beyond its primary design, however it cannot be expected to resolve issues it was not designed to resolve.

For example, a compressor will shake on start-up as the motor quickly comes up to speed. EasyStart slows this process down, potentially reducing the initial vibration and so less mechanical stress may be as a result.

Keep and finish? Delete? 2DO

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Section 2 – Wiring Installation Resources

All EasyStart installations are electrically identical, regardless of what A/C make, model, manufacturer, or application you have. This section will take a comprehensive look at each EasyStart connection to help find what may be missed during installation. Please take the time to consider a fresh look at what you have already checked.

Application Specific Resources

Our *EasyStart Knowledge Bank* is where we have all of our EasyStart resources. Navigate to the installation section of the knowledge bank and check for a specific installation guide or schematic for your system.

Generic Wiring and Procedure

As previously stated, all installations are electrically identical. However, how and where these connections are made will vary across applications. *Figure 2* shows a typical compressor schematic without EasyStart.

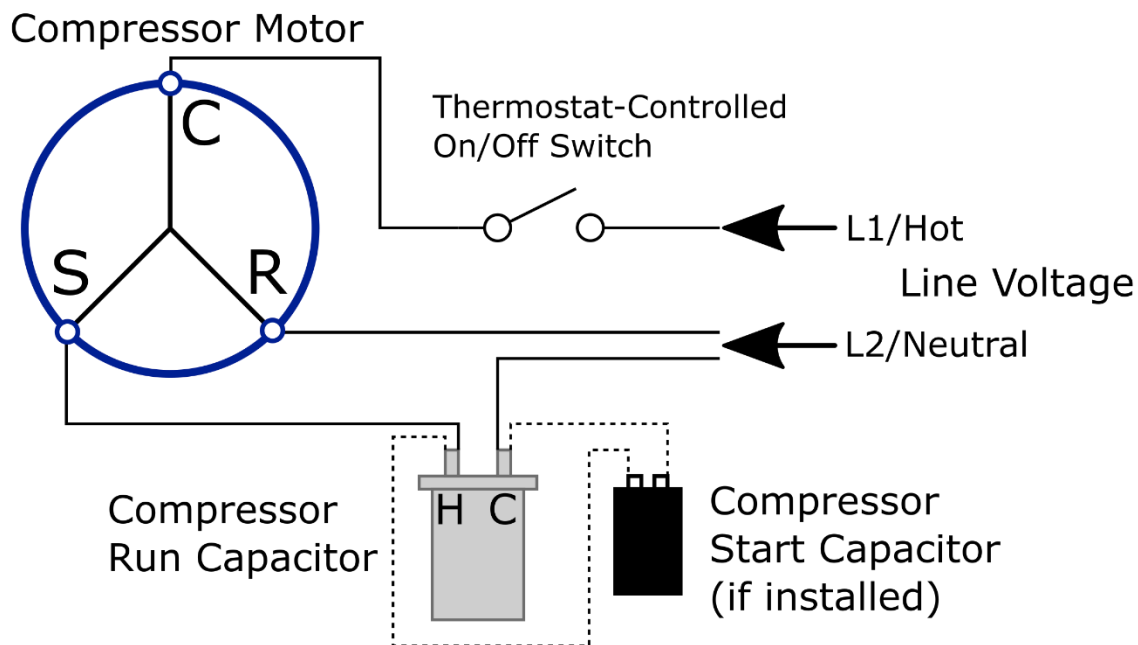


Figure 2 - Generic Factory Compressor Wiring

Note: *Figure 2* is an electrical schematic representation. Your system will be electrically identical but this is not a wiring diagram. How connections are exactly wired is application specific.

Note: L1 and L2 may be reversed in your application and is not important for EasyStart.

The first thing to do is identify the three compressor wires “C”, “S”, and “R”, and the compressor run capacitor in your application. These two components will be in every application. EasyStart can be installed in any system when these components are identified. *Figure 3* shows a typical compressor schematic that has EasyStart installed, overlaid over *Figure 2*.

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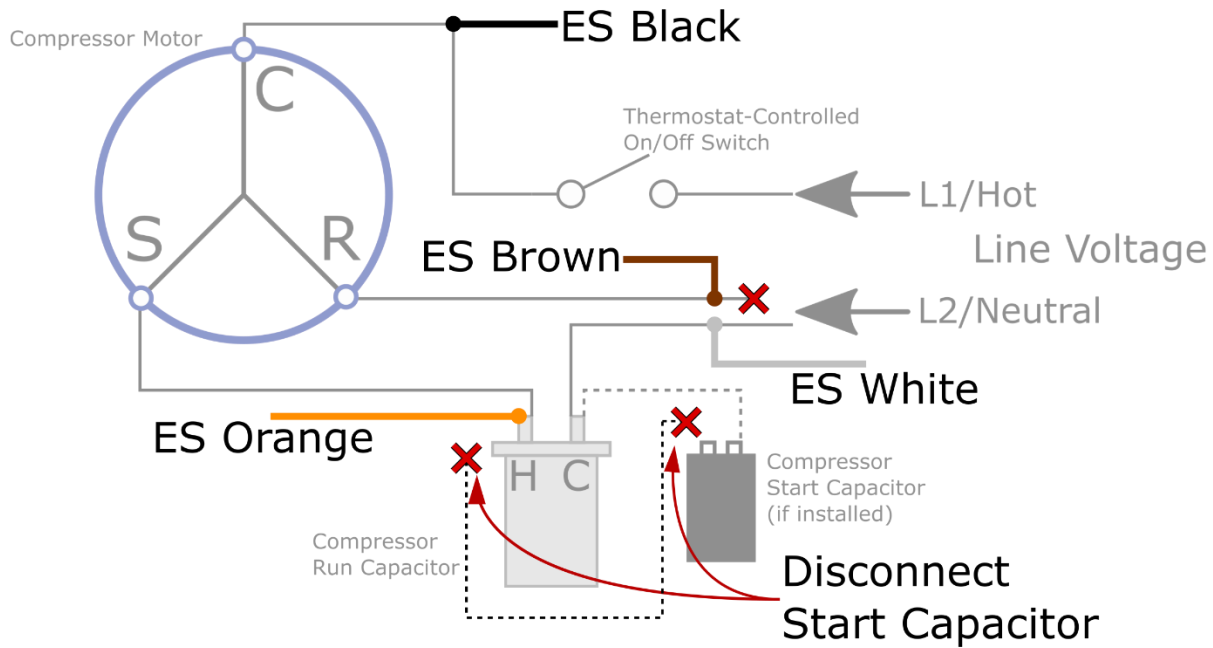


Figure 3 - Generic Compressor Wiring with EasyStart Installed

Note: Figure 3 is an electrical schematic representation. Your system will be electrically identical but this is not a wiring diagram. How connections are exactly wired is application specific.

Every installation is electrically correct when installed as shown in *Figure 3*. We will reference L1 and L2 as depicted, however they may be reversed in your application and is fine. Making your connections in reference to the identified compressor motor wires and run capacitor wires will ensure proper installation.

Wiring Criteria

The 5 criteria below ensure that EasyStart is wired correctly in any system, shown graphically by *Figure 3*.

- EasyStart Orange is connected to the Compressor “S” wire
- EasyStart Black is connected to the Compressor “C” wire with no hardware in-between
- The Compressor “R” wire is disconnected from L2 and connected exclusively with EasyStart Brown
- EasyStart White is connected to L2/Neutral, where the Compressor “R” wire used to land
- Any start devices are defeated by removing the wire between it and the “H” run capacitor terminal

Table 1 in section *Wiring Criteria Checklist* is a checklist to ensure that the above wiring criteria is met. Use it and the accompanied descriptions to ensure EasyStart is wired correctly in your application.

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Wiring Criteria Checklist

This section provides a step-by-step procedure to verify the wiring of EasyStart as outlined in the *Wiring Criteria* section. Use the *Table 1* checklist and its detailed descriptions to verify the wiring criteria is met. This section does not consider EasyStart mounting or routing its wires where needed.

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Table 1 - EasyStart Wiring Checklist

Order	Verification Step			✓
1.	Remove and disconnect all AC power from the system			
2.	Locate the A/C unit and gain access to the enclosure			
3.	Identify the compressor motor			
4.	Locate the wire cover on this motor where the C, S, and R wires exit. Look for identifying markings of these wires near, on, or under this cover on the motor exterior.	'C' color	'S' Color	
5.	Trace each of the three compressor wires out and inspect where they land			
6.	The compressor "S" wire will land on a terminal connected to the "H" or "HERM" connection of the run capacitor. Land EasyStart orange alongside or spliced into compressor "S".			
7.	Follow the compressor "S" circuit to the end, which will be on the compressor run capacitor "H" or "HERM" terminal, if it is not already. Inspect the HERM terminal for other wires other than EasyStart. Trace any of those wires to their end. If any land on a black start capacitor, start relay, or PTCR, then remove this wire at both ends to disconnect the start components.			
8.	The compressor "R" wire will connect to a power leg (typically L2/neutral) or possibly the output of a switch with this power leg as an input. Disconnect or cut the compressor "R" wire from wherever it lands. Connect this newly disconnected "R" end exclusively with EasyStart brown.			
9.	The EasyStart white wire should be landed wherever the compressor "R" wire was pulled from.			
10.	The compressor "C" wire will connect to a switch output (circuit board, relay, contactor, etc.) that has a power leg input (typically L1/hot), or to the power leg directly. Land EasyStart black alongside or spliced into compressor "C" so that there is no electrical hardware in-between.			
11.	Restore AC power and see that the compressor runs			

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1. Remove AC Power

All AC power sources should be disconnected from the A/C unit before opening it up. This is done by unplugging an RV from the pedestal, opening the main breaker and/or the A/C unit breaker, and turning off any inverters or generators. Use hand tools to verify the incoming power to the A/C unit is off.

WARNING: Interfacing with live AC utility power can cause serious or fatal injury if mis-handled. The recommendations contained herein should only be performed by qualified and trained service persons. Please contact Micro-Air for more assistance using our *Micro-Air Contact Us Page*.

2. Locate the A/C Unit Enclosure

RVs typically have rooftop units with a large shroud that is screwed in over the enclosure. Removing this typically gives access to the compressor motor and electric box panel. Sometimes they are underneath the RV and accessed by opening a side panel. Some units further are “window” or “cabinet” units that are built into the carpentry of the space that should have some removable paneling for service.

Home or marine units are typically sheet metal enclosures with a service panel and screws.

2DO

3. Identify the Compressor Motor

Somewhere in the A/C unit enclosure is the compressor motor itself. It is an oval or pill shaped metal housing, usually black and 12” or more long. It will have copper tubing entering and exiting the housing, as well as some wires for electrical connection. A typical compressor is shown in *Figure 4*.



Figure 4 - Compressor Motor

4. Identify the Three Compressor Wires (C, S, and R)

The windings of the compressor motor are accessible by three wires that exit the motor housing. These three wires are called “C”, “S”, and “R”, and we want to identify them. There is usually a cover on the motor housing that protects where the wires exit the housing. A typical wire cover is shown in *Figure 5*.

Some wire covers have the windings labeled on top of it. Others may have the label stamped on the compressor housing exterior near the cover. You may have to remove the cover to identify each wire’s appropriate name. Match the three wires with their associated electrical representation of “C”, “S”, and “R”. When we know this, we can generically install EasyStart in any system. A compressor with the wire cover removed is shown in *Figure 6*. The compressor “C” wire may rout through an overload switch (OL), also shown in *Figure 6*. The OL must be undisturbed and can be considered a continuation of the “C” wire for installation.

5. Trace Out the Three Compressor Wires (C, S, and R)

Typically, the three compressor wires when traced out will land in an electric box in the A/C unit enclosure. Use the following sections to make specific checks when tracing out the wires.

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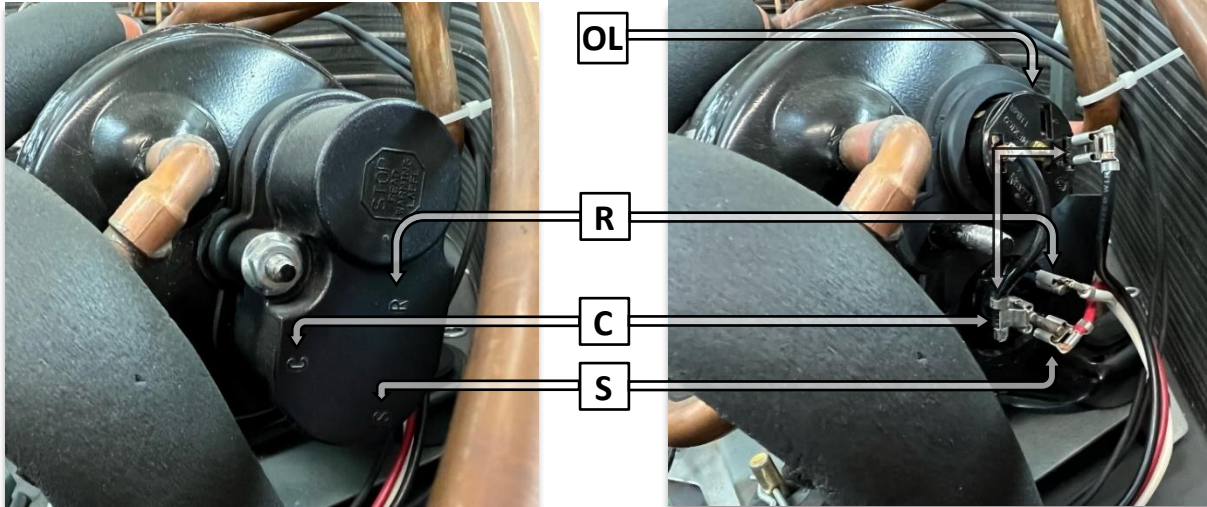


Figure 5 - Compressor Wire Cover

Figure 6 - Compressor Wire Cover Removed

6. Trace Out the Compressor “S” Wire and Splice in EasyStart Orange

Follow the compressor “S” wire to where it lands. This is typically in the A/C enclosure’s electric box. It will always be eventually or directly connected to the “H” or “HERM” terminal of the run capacitor. EasyStart orange must be spliced somewhere into this compressor “S” circuit. EasyStart orange can be slid onto the “HERM” terminal group in installations where this is accessible. Ensure that terminals are mated properly, slid into their metal housings and not pinched between the plastic housing.

See section *Identifying the Run Capacitor Connections and Terminals* for more details if needed.

7. Inspect the Run Capacitor for Factory Start Components and Disconnect Them if Found

Follow the compressor “S” wire to where it lands. Inspect this junction for any other connections to any other components. This junction may be the run capacitor “H” terminal itself, or a terminal block that eventually connects to the “H” terminal. Trace any other wires you find at this junction to their end. If you find they go to start components (start relay, start capacitor, or PTCR) then this wire must be removed by disconnecting this connection at both ends. This wire will exist if you have start components. If and only if you cannot remove this wire from both ends then remove the component entirely. *Figure 7* shows examples of start components you may find that must be disconnected as described. See section *Identifying the Run Capacitor Connections and Terminals* for more details if needed.



Figure 7 - Example of (from left) PTCR, Start Relay, Start Capacitor

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8. Trace Out the Compressor “R” Wire and Connect it Directly with EasyStart Brown

Follow the compressor “R” wire to where it lands. This is typically in the A/C enclosure’s electric box. The compressor “R” wire should be disconnected or (if no other option) cut from any factory electrical connection and connected exclusively with EasyStart brown.

Pay close attention to the compressor “R” wire to ensure you have it traced out properly. Often, the compressor “R” wire is the same color and thickness as several other wires in the electric box and so is easy to mis-identify. Smaller sized A/C units usually have compressor “R” wire landed on the top of the run capacitor “C” terminal, which is a power leg terminal. Larger units will have it connected to the power leg directly, or through a relay or contactor.

9. EasyStart White is Landed Where Compressor “R” was Pulled From

EasyStart white must be connected to the power leg (we will call it “L2”, as per *Figure 3*) that compressor “R” was connected to. You can land EasyStart white wherever you pulled the compressor “R” wire from.

Consult the factory schematic if you are not sure where compressor “R” was previously landed.

In any application, the compressor “R” wire from the factory is connected to “L2” directly, or through a switch. EasyStart white must be connected to the same power leg in an appropriate fashion.

WARNING: Compressor “R”, and now EasyStart white, carry the majority of compressor current. This connection point where EasyStart white is landed must be rated for compressor currents. In smaller systems that use our EasyStart 364, this can be the run capacitor “C” terminal. In larger systems that use our EasyStart 368, it must be on the main power contactor or relay terminal, separate from run capacitor “L2”. Run capacitor terminals are not rated for compressor currents of larger systems.

10. Trace Out the Compressor “C” Wire and Splice in EasyStart Black

Follow the compressor “C” wire to where it lands. This may be inside the A/C enclosure’s electric box. Some systems have the wire landed down in the plenum at the control box. These systems may route the wire through the A/C enclosure’s electric box, or straight down to the plenum from the compressor. EasyStart black must be spliced into this compressor “C” wire wherever most convenient. This is typically in the A/C electric box but almost always at least in the A/C enclosure.

The compressor “C” wire may rout through an overload switch mounted in the compressor housing, as shown in *Figure 6*. EasyStart black must be spliced into compressor “C” from outside of the wire cover. That is, the short wire shown should be preserved and the splice made somewhere away from the cover.

In systems where you cannot simply land EasyStart black alongside compressor “C”, a common approach is to create a three-wire pigtail on the end of the EasyStart black wire. You can then pull the compressor “C” wire, land one of the pigtail wires where you pulled compressor “C”, and connect compressor “C” into the pigtail. In systems where you cannot access the landing, you can cut the compressor “C” wire at a convenient location and create a three-way crimp. You may need to extend the length of the EasyStart black wire with similar 14 AWG copper wire to reach where you can make the connection.

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Identifying the Run Capacitor Connections and Terminals

Run capacitors can be in two styles as shown in *Figure 8*, where there are two terminal groups (left) or three terminal groups (right). Three terminal group capacitors should have their terminals labelled as “F” or “FAN”, “H” or “HERM” and “C”. Two terminal group run capacitors are always “H” and “C”, though unmarked. *Figure 9* shows the profile view of a typical run capacitor.



Figure 8 - Run Capacitor Tops



Figure 9 - Run Capacitor Profile

The “F” terminal of three-terminal run capacitors will always have the appropriate fan connection to it only. This is undisturbed by an EasyStart installation.

The “H” terminal will always have the compressor “S” wire attached to it, either directly or through a connecting wire. You can use this to identify a two-terminal group run capacitor terminal name. The “C” terminal is for a power leg connection to the run capacitor. It should always have this power leg connection. It may have other “C” terminal connections for other components (reversing valves, pumps, compressor “R”, etc.), depending on your application.

A two-terminal run capacitor is a bi-directional device. The terminals are unmarked because you can use either group as “H” or “C”. If you are unsure how a two-terminal capacitor is being used or labeled and has become mis-wired, you can pull everything off and reconnect it using either terminal as needed.

Figure 10 shows a typical drawing of a run capacitor as described above. The solid elements must be present in any application. The translucent elements may or may not be in your application. The wire colors shown are common for their purpose but may be different colors in your application. Note the terminal markings and “FAN” terminal itself are also optional.

Figure 11 shows a typical EasyStart installation overlaid a typical factory installation. Note that if the translucent components are not in your system then it may not be relevant to your EasyStart installation as shown. If you do have them then it should be handled as shown, and described in the relevant *Table 1 - EasyStart Wiring Checklist* step. **Note: *Figure 11* shows EasyStart white connected to the “C” terminal of the run capacitor. This should only be done for systems with EasyStart 364 models. EasyStart 368 models should have its white wire connected directly to L2 through the main A/C unit contactor or relay terminal. See the appropriate *Table 1 - EasyStart Wiring Checklist* step and description for more details.**

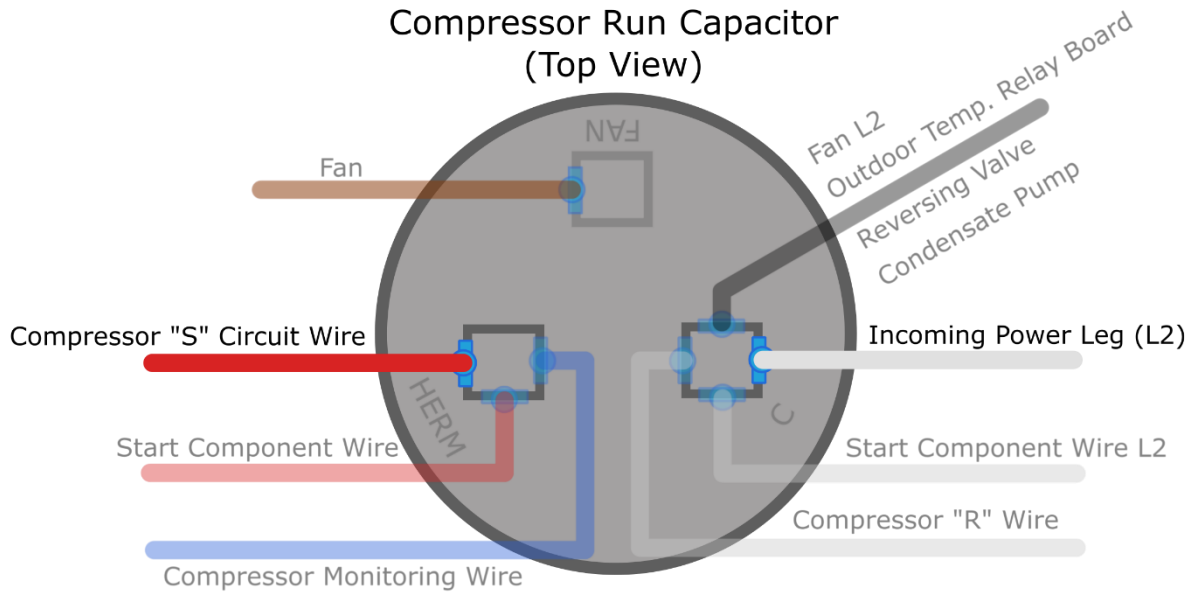


Figure 10 - Factory Run Capacitor Connections

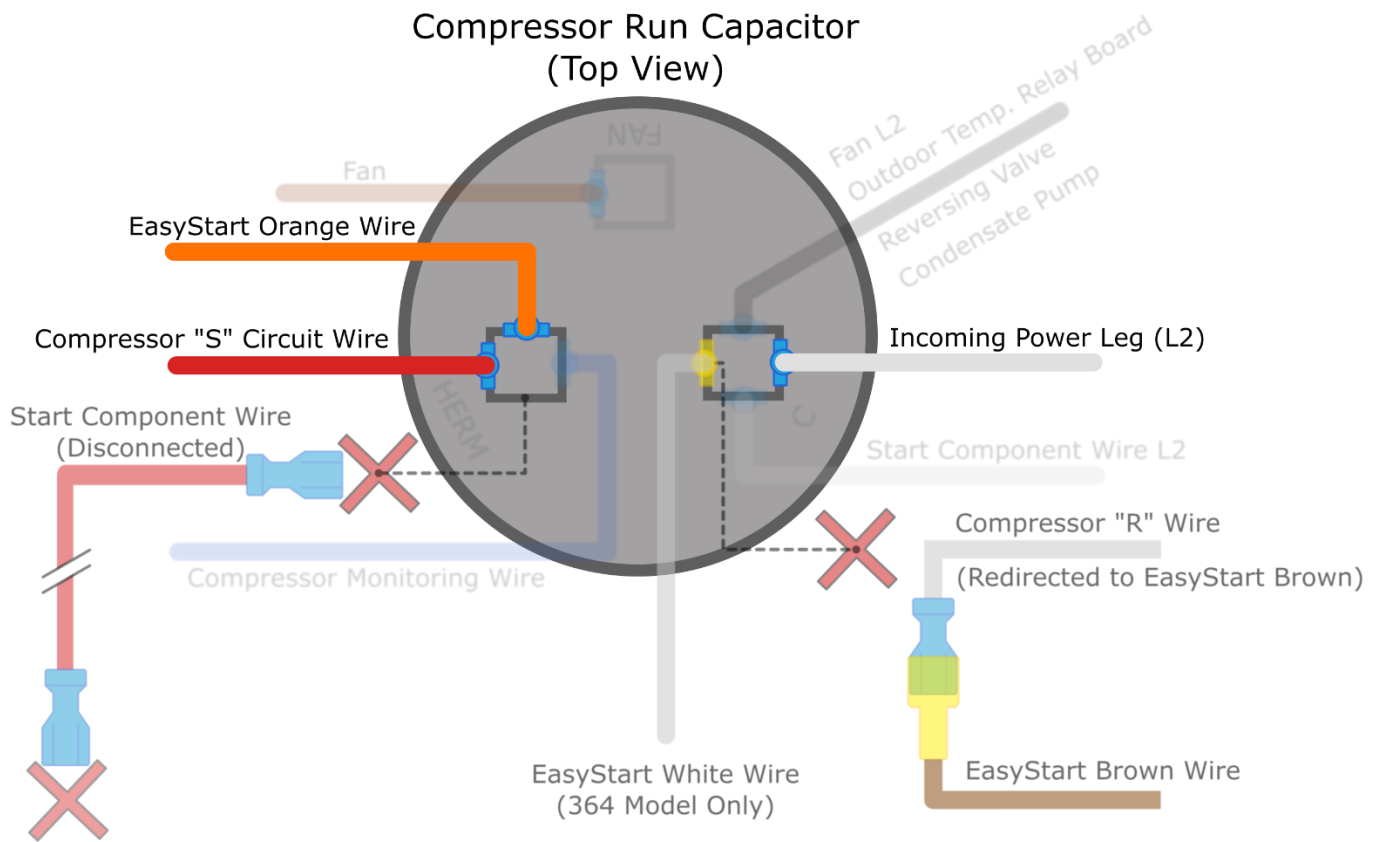


Figure 11 - Run Capacitor with EasyStart Connections

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Section 3 – The Compressor Has Never Started on Utility Power

Proceed into this section when the answer is YES to ALL of these questions:

- Before EasyStart first installed:
 - The compressor runs normally on utility power?
 - With EasyStart first installed:
 - The compressor does not and has never started on the same utility power?
-

Pre-Checklist

- Set the thermostat to off
- Wait at least 6 minutes from the last attempt to call for the compressor
- Connect your system to utility power or a large (running) generator
- Close all breakers between the power source and the A/C unit
- Set the thermostat to call for a compressor cycle
- Monitor compressor operation for the next 3 minutes

My RV Thermostat Now Has an Error Code or No Power

My RV Thermostat No Longer Has Certain Modes

A proper EasyStart installation does not affect the thermostat operation or its error checking. Some A/C control boards are configured using DIP switches on the board itself. These or the thermostat wiring may have been accidentally disturbed during EasyStart's installation. Use the thermostat owner's manual or service manual to verify the thermostat wires are still connected and any switches are set appropriately.

- If you are missing a mode (ex. Furnace mode), ensure the (ex. Furnace) mode switch is set
- If you are missing a zone, ensure the zone selection switches are correct and the communication wires are connected
- If you have no thermostat power, ensure the power wires are still connected

Use the thermostat owner's manual to identify and troubleshoot other error codes. No other errors should be as a result of EasyStart, however you can use the *Micro-Air Contact Us Page* for more assistance.

My Home Thermostat or Home A/C Control Board is Throwing a Fault

Some home units do not expect the EasyStart hardware and throw a fault when it detects EasyStart. By default, EasyStart has the compressor run winding disconnected for a few seconds to allow a fan motor to stabilize. This delay must be turned off in these systems that check for it. The faults are usually called "Open Run Winding" or "No Compressor Operation" or similar.

Please use the relevant section in our *EasyStart Generic Home Installation Guide* for how to configure EasyStart for these systems.

Use the A/C owner's manual or fault sheet to troubleshoot other kinds of faults. No other faults should be as a result of EasyStart, however you can use the *Micro-Air Contact Us Page* for further assistance.

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My Compressor Does Not Try to Start

Once the thermostat determines a cycle is needed, it should start the compressor within 3 minutes if the

Pre-Checklist is followed. No compressor operation suggests that EasyStart is not powered, has a wiring issue, or a problem with this particular EasyStart.

- **Ensure that all steps in the**
- **Pre-Checklist section are completed**
- **Remove AC Line Voltage**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior:
 - EasyStart orange is not connected to the run capacitor “HERM” terminal circuit
 - The compressor “S” wire was removed from the run capacitor “HERM” terminal
 - The run capacitor “C” terminal does not have its power leg connection
 - Any prior start components were not removed from the “HERM” terminal 2DO
 - EasyStart black is not spliced into or alongside the compressor “C” wire
 - The compressor “C” wire is not still (electrically) connected where it used to be
- **Verify the compressor is truly not attempting to start**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for a cycle using the**
 - Pre-Checklist
 - RV units or smaller unit’s compressors can sometimes be hard to hear over the fan. Have an assistant use the
 - Pre-Checklist section directions while you place your hand on the compressor motor. Feel for vibration to know its behavior:
 - Before the fan motor starts: no vibration
 - The fan motor starts and runs: some residual vibration on the compressor from the fan
 - During the 3 minutes after the fan: Compressor shakes on startup and its running vibration. The vibration felt from the fan will not change if the compressor is not starting
 - Home units or larger unit’s compressors typically have a much more distinct sound over the fan to determine if it is attempting to start
 - Use a clamp-on ammeter around the EasyStart white wire and look for any change in reading
 - If the compressor is actually starting then go to the appropriate section
 - *The A/C System Fans Do Not Spin or Not at the Same Speed as Before*

A proper EasyStart installation **cannot** affect the fan operation in any way. Any fans should turn on the same as they always have. This suggests a wiring issue or a power delivery issue outside of EasyStart itself. If the compressor also does not start then use section *My Compressor Does Not Try to Start* first.

Note: EasyStart introduces a 5-10 second delay between the fan and compressor starting to allow the fan motor to spin up at a different time than the compressor. This is normal operation.

- **Ensure that all steps in the**

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- Pre-Checklist section are completed
- **Remove AC Line Voltage**
- **Verify that the fan can spin freely without restriction from debris or routed wires**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Ensure that you have EasyStart interfaced properly with the Run Capacitor. Make sure incoming power (typically L2/Neutral) is connected to the run capacitor “C” terminal. If you have a three terminal group run capacitor, the “FAN” terminal is for the appropriate fan wire.
 - If there is no operation at all from the compressor or fan, there is likely a wiring issue that has disconnected power from the entire A/C unit.
 - Ensure the (if used) separate fan capacitor is undisturbed and connected per factory. These typically have oval tops instead of run capacitor circular tops.
- **Verify that the fan motor is wired properly.** There are usually 3 groups of wires for the fan motor:
 - **Speed:** One, two, or three wires select speed and have one power leg (typically L1/Hot) connect to it one at a time, through the A/C control board.
 - **Power:** One wire is always connected to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
 - **Capacitor:** One wire is always connected to a fan capacitor on one side. This could be the “FAN” terminal of the run capacitor. The other fan capacitor side or the run capacitor “C” terminal must connect to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
- **Verify line voltage is across the motor wires with an AC voltmeter**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for the fan to spin**
 - **STAY CLEAR of the fan spin path should it begin rotating at any time**
 - Set the meter to read AC line voltage. Place one probe on the appropriate speed wire and one on the power wire at an available contact point in the A/C enclosure.
 - No voltage suggests something earlier in this section is not verified correctly or a problem with the fan controller.
 - Full line voltage suggests where you probed is correct, but there may be a wiring problem “closer” to the motor in the circuit. Full line voltage at the fan motor terminals suggests a fan capacitor or fan motor problem.
 - Low voltage suggests a fan capacitor, fan motor, or wire joint issue causing an abnormal voltage drop.

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- Section 4 – The Compressor Starts on Utility Power but Not Satisfactorily
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Faults meaning the compressor attempts to start; navigate to *The A/C System Fans Do Not Spin or Not at the Same Speed as Before*

A proper EasyStart installation **cannot** affect the fan operation in any way. Any fans should turn on the same as they always have. This suggests a wiring issue or a power delivery issue outside of EasyStart itself. If the compressor also does not start then use section *My Compressor Does Not Try to Start* first.

Note: EasyStart introduces a 5-10 second delay between the fan and compressor starting to allow the fan motor to spin up at a different time than the compressor. This is normal operation.

- **Ensure that all steps in the**
- **Pre-Checklist section are completed**
- **Remove AC Line Voltage**
- **Verify that the fan can spin freely without restriction from debris or routed wires**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Ensure that you have EasyStart interfaced properly with the Run Capacitor. Make sure incoming power (typically L2/Neutral) is connected to the run capacitor “C” terminal. If you have a three terminal group run capacitor, the “FAN” terminal is for the appropriate fan wire.
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- **Verify line voltage is across the motor wires with an AC voltmeter**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for the fan to spin**
 - **STAY CLEAR of the fan spin path should it begin rotating at any time**
 - Set the meter to read AC line voltage. Place one probe on the appropriate speed wire and one on the power wire at an available contact point in the A/C enclosure.
 - No voltage suggests something earlier in this section is not verified correctly or a problem with the fan controller.

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- Full line voltage suggests where you probed is correct, but there may be a wiring problem “closer” to the motor in the circuit. Full line voltage at the fan motor terminals suggests a fan capacitor or fan motor problem.
- Low voltage suggests a fan capacitor, fan motor, or wire joint issue causing an abnormal voltage drop.

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- Section 4 – The Compressor Starts on Utility Power but Not Satisfactorily
 - Power Interruption, Stall, Overcurrent, Overload Open, Unexpected Current
- Mis-wiring, wiring section 2DO
- No LEDs, verify power see section 2DO

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The A/C System Fans Do Not Spin or Not at the Same Speed as Before

A proper EasyStart installation **cannot** affect the fan operation in any way. Any fans should turn on the same as they always have. This suggests a wiring issue or a power delivery issue outside of EasyStart itself. If the compressor also does not start then use section *My Compressor Does Not Try to Start* first.

Note: EasyStart introduces a 5-10 second delay between the fan and compressor starting to allow the fan motor to spin up at a different time than the compressor. This is normal operation.

- **Ensure that all steps in the**
- **Pre-Checklist section are completed**
- **Remove AC Line Voltage**
- **Verify that the fan can spin freely without restriction from debris or routed wires**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Ensure that you have EasyStart interfaced properly with the Run Capacitor. Make sure incoming power (typically L2/Neutral) is connected to the run capacitor “C” terminal. If you have a three terminal group run capacitor, the “FAN” terminal is for the appropriate fan wire.
 - If there is no operation at all from the compressor or fan, there is likely a wiring issue that has disconnected power from the entire A/C unit.
 - Ensure the (if used) separate fan capacitor is undisturbed and connected per factory. These typically have oval tops instead of run capacitor circular tops.
- **Verify that the fan motor is wired properly.** There are usually 3 groups of wires for the fan motor:
 - **Speed:** One, two, or three wires select speed and have one power leg (typically L1/Hot) connect to it one at a time, through the A/C control board.
 - **Power:** One wire is always connected to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
 - **Capacitor:** One wire is always connected to a fan capacitor on one side. This could be the “FAN” terminal of the run capacitor. The other fan capacitor side or the run capacitor “C” terminal must connect to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
- **Verify line voltage is across the motor wires with an AC voltmeter**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for the fan to spin**
 - **STAY CLEAR of the fan spin path should it begin rotating at any time**
 - Set the meter to read AC line voltage. Place one probe on the appropriate speed wire and one on the power wire at an available contact point in the A/C enclosure.
 - No voltage suggests something earlier in this section is not verified correctly or a problem with the fan controller.
 - Full line voltage suggests where you probed is correct, but there may be a wiring problem “closer” to the motor in the circuit. Full line voltage at the fan motor terminals suggests a fan capacitor or fan motor problem.
 - Low voltage suggests a fan capacitor, fan motor, or wire joint issue causing an abnormal voltage drop.

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Section 4 – The Compressor Starts on Utility Power but Not Satisfactorily

Proceed into this section when the answer is YES to ALL of these questions:

- Before EasyStart first installed:
 - The compressor runs normally on utility power?
 - With EasyStart first installed:
 - The compressor starts, but shuts down prematurely or is not the right air temperature?
-

Pre-Checklist

- Set the thermostat to off
- Wait at least 6 minutes from the last attempt to call for the compressor
- Connect your system to utility power or a large (running) generator
- Close all breakers between the power source and the A/C unit
- Set the thermostat to call for a compressor cycle
- Monitor compressor operation for the next 3 minutes

Once the thermostat determines a cycle is needed, it should start the compressor within 3 minutes if the Pre-Checklist is followed. This section is when you can see, feel, or hear the compressor attempt a start (not just the fan!), but there is some problem with its operation thereafter. The ability to cool should be exactly the same as it could prior to EasyStart installation in normal operation.

I Fixed a Wiring Issue but Now the Compressor is/still is Shutting Down Prematurely

During installation, you may have applied power to the system while a wiring error existed. Most wiring errors will be caught by EasyStart, however if invalid data was saved, EasyStart may need to have its memory cleared. Bad saved data may be erroneously tripping faults after a wiring error is resolved.

Ensure that all steps in the Pre-Checklist

- **Pre-Checklist section are completed**
- **Remove AC Line Voltage**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - You may have resolved one wiring issue but more may exist
 - Common wiring issues that may call for a Re-learn (Factory Reset) once resolved
 - Wired EasyStart into the fan motor rather than the compressor motor
 - Compressor “R” wire was connected to both EasyStart brown and power leg “L2”
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - If you have the Wiring Error Fault, there is still a wiring issue that must be addressed
 - Perform a Re-learn (Factory Reset) on EasyStart when appropriate 2DO

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The A/C System Fans Do Not Spin or Not at the Same Speed as Before

A proper EasyStart installation **cannot** affect the fan operation in any way. Any fans should turn on the same as they always have. This suggests a fan wiring issue outside of EasyStart itself. If the compressor is not starting then use *Section 3 – The Compressor Has Never Started on Utility Power* first.

Note: EasyStart introduces a 5-10 second delay between the fan and compressor starting to allow the fan motor to spin up at a different time than the compressor. This is normal operation.

- **Ensure that all steps in the *Pre-Checklist* section are completed**
- **Remove AC Line Voltage**
- **Verify that the fan can spin freely without restriction from debris or routed wires**
- **Verify that EasyStart is wired properly using *Section 2 – Wiring Installation Resources***
 - Common wiring issues for this behavior
 - Wired EasyStart into the fan motor rather than the compressor motor
- **Verify that the fan motor is wired properly.** There are usually 3 groups of wires for the fan motor:
 - **Speed:** One, two, or three wires select speed and have one power leg (typically L1/Hot) connect to it one at a time, through the A/C control board.
 - **Power:** One wire is always connected to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
 - **Capacitor:** One wire is always connected to a fan capacitor on one side. This could be the “FAN” terminal of the run capacitor. The other fan capacitor side or the run capacitor “C” terminal must connect to the other power leg (typically L2/Neutral) that is opposite the speed wire power leg.
- **Verify line voltage is across the motor wires with an AC voltmeter**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for the fan to spin**
 - **STAY CLEAR of the fan spin path should it begin rotating at any time**
 - Set the meter to read AC line voltage. Place one probe on the appropriate speed wire and one on the power wire at an available contact point in the A/C enclosure.
 - No voltage suggests something earlier in this section is not verified correctly or a problem with the fan controller.
 - Full line voltage suggests where you probed is correct, but there may be a wiring problem “closer” to the motor in the circuit. Full line voltage at the fan motor terminals suggests something earlier in this section is not verified correctly, or a fan capacitor or fan motor problem.
 - Low voltage suggests a fan capacitor, fan motor, or wire crimp/splice joint issue causing an abnormal voltage drop.

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My Compressor Tries to Start but Fails, Runs Only for a Couple Seconds at Most

EasyStart performs a multi-step ramping process to gently bring the motor up to speed. EasyStart checks a few parameters to control this process and ensure it is operating normally. We need to determine why the compressor is shutting down, which could be an EasyStart fault or something outside the EasyStart System.

Ensure that all steps in the Pre-Checklist

- Pre-Checklist **section are completed**
- **Remove AC Line Voltage**
 - It is important that a power source that could start the A/C without EasyStart is used
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior
 - EasyStart black is not spliced into or alongside the compressor “C” wire
 - Compressor “R” wire is connected to both EasyStart brown and power leg “L2”
 - Bad crimps/splice joints causing a voltage drop
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Stall see section 2DO
 - Overcurrent see section 2DO
 - No LEDs, verify power see section 2DO

My Compressor Starts and Runs for at least 10 Seconds, but Eventually Shuts Down Prematurely

EasyStart performs most of its function on motor startup and is about a 10 second process. After that, EasyStart is a closed switch, running the compressor motor as it always did. EasyStart is then only monitoring for faults. If a fault is detected, it will disconnect the compressor to shut it down. We need to determine why the compressor is shutting down, which could be that EasyStart detected a fault or something outside the EasyStart system.

Ensure that all steps in the Pre-Checklist

- Pre-Checklist **section are completed**
- **Remove AC Line Voltage**
 - It is important that a power source that could start the A/C without EasyStart is used
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior
 - EasyStart black is not spliced into or alongside the compressor “C” wire
 - Compressor “R” wire is connected to both EasyStart brown and power leg “L2”
 - Bad crimps/splice joints causing a voltage drop
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Stall see section 2DO
 - Overcurrent see section 2DO
 - No LEDs, verify power see section 2DO

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My Compressor Runs, However it Cools in Heat Pump Mode or Heats in Cool Mode

You may find that your compressor is making noise, vibrating, and/or running appropriately, however the air being produced is tempered the wrong way based on what mode the thermostat is in. This is almost always a wiring issue developed during EasyStart installation, where the reversing valve has become disconnected from its control. It is meant to open or close to create heat or cool and miswiring has disturbed this operation.

This is *not* the same as no cooling or heat with a running compressor. See section 2DO for help in this scenario.

- **Remove AC Line Voltage**
- **Verify that the reversing valve is wired properly**
 - The reversing valve will have two wires that have line voltage connected to it to turn it on and off. One wire will go to a control board or wire to connect a power leg (typically “L1”) that is switched. The other wire will go to the opposite power leg “L2” wire or control board terminal.
 - Look over your schematic for a reversing valve and note how it is wired
 - *Figure 4* shows a reversing valve. It is the yellow tube with two black wires
 - Ensure the two reversing valve wires are landed appropriately
 - Some manufactures will land the “L2” reversing valve connection on the compressor motor start capacitor. If you completely disconnected the start capacitor while installing EasyStart then you may have defeated the reversing valve circuit. Land the reversing valve “L2” wire on the run capacitor “C” terminal to restore the circuit in these systems.

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Section 5 – The A/C Has Problems Running on Limited Power

Proceed into this section when the answer is YES to ALL of these questions:

- Before EasyStart first installed:
 - The compressor runs normally on utility power?
 - With EasyStart first installed:
 - The compressor starts and runs satisfactorily on the same utility power?
 - The A/C unit does not start or run satisfactorily on limited power (genset, inverter, etc.)?
-

Pre-Checklist

- Set the thermostat to off
- Wait at least 6 minutes from the last attempt to call for the compressor
- Connect your system to your limited power source (small generator, inverter, etc.)
- Close all breakers between the power source and the A/C unit
- Set the thermostat to call for a compressor cycle
- Monitor compressor operation for the next 3 minutes

The A/C System Fans Do Not Spin When Called For

A proper EasyStart installation **cannot** affect the fan operation in any way. Any fans should turn on the same as they always have. First, verify that everything operates normally on utility power by reassessing where you are in the *Problem Characterization Figure 1* chart. Return if everything works on utility power.

- **Ensure there is no issue operating the unit on utility power**

Ensure that all steps in the Pre-Checklist

- **Pre-Checklist section are completed**
- **Ensure any inverter systems are not throwing any faults, preventing output of power**
- **Verify line voltage can reach the A/C unit**
 - Go to the inverter output and follow it to the breaker or bus it is connected to. Also, work back from the A/C unit to the A/C breaker. The inverter is likely not wired into the A/C breaker.
 - Limited power systems are sometimes not connected to main power buses or A/C power busses, as those limited power systems cannot handle the load without EasyStart. As such, many RV builders will not connect their inverter system to the main power bus. This means you must install an interlock switch between utility and inverter power so you can switch the inverter into the main power bus. Some inverters allow being on the main bus directly without an interlock switch. Above all, some type of rewiring is required in these systems. Micro-Air cannot assist with this type of work.
 - Typically, generators are already wired into the line directly or through an interlock switch.

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My Compressor Does Not Try to Start

Once the thermostat determines a cycle is needed, it should start the compressor within 3 minutes if the *Pre-Checklist* is followed. No compressor operation suggests that EasyStart is not powered or has a wiring issue.

Ensure that all steps in the Pre-Checklist

- Pre-Checklist **section are completed**
- **Remove AC Line Voltage**
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior:
 - Wiring has become loose
 - Factory Start components are still in circuit
 - Compressor “R” wire is connected to both EasyStart brown and power leg “L2”
 - EasyStart black is not spliced into or alongside the compressor “C” wire
- **Verify the compressor is truly not attempting to start**
 - **Restore AC Line Voltage (SEE SECTION WARNING) and call for a cycle using the Pre-Checklist**
 - RV units or smaller unit’s compressors can sometimes be hard to hear over the fan. Have an assistant use the *Pre-Checklist* section directions while you place your hand on the compressor motor. Feel for vibration to know its behavior:
 - Before the fan motor starts: no vibration
 - The fan motor starts and runs: some residual vibration on the compressor from the fan
 - During the 3 minutes after the fan: Compressor shakes on startup and its running vibration. The vibration felt from the fan will not change if the compressor is not starting
 - Home units or larger unit’s compressors typically have a much more distinct sound over the fan to determine if it is attempting to start
 - Use a clamp-on ammeter around the EasyStart white wire and look for any change in reading
 - If the compressor is actually starting then go to the appropriate section
 - *My Compressor Does Not Try to Start*
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Faults meaning the compressor attempts to start; go to *My Compressor Does Not Try to Start*
 - Power Interruption, Stall, Overcurrent, Overload Open, Unexpected Current
 - Mis-wiring, wiring section 2DO
 - No LEDs, verify power see section 2DO

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My Compressor Tries to Start and Fails, Runs Only For a Few Seconds at Most

EasyStart performs a multi-step ramping process to gently bring the motor up to speed. EasyStart checks a few parameters to control this process and ensure it is operating normally. We need to determine why the compressor is shutting down, which could be an EasyStart fault or something outside the EasyStart System.

Ensure that all steps in the Pre-Checklist

- Pre-Checklist **section are completed**
- **Remove AC Line Voltage**
 - It is important that a power source that could start the A/C without EasyStart is used
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior
 - Factory Start components are still in circuit
 - EasyStart black is not spliced into or alongside the compressor “C” wire
 - Compressor “R” wire is connected to both EasyStart brown and power leg “L2”
 - Bad crimps/splice joints causing a voltage drop
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Stall see section 2DO
 - Overcurrent see section 2DO
 - No LEDs, verify power see section 2DO

My Compressor Starts and Runs for at least 10 Seconds, but Eventually Shuts Down Prematurely

EasyStart performs most of its function on motor startup and is about a 10 second process. After that, EasyStart is a closed switch, running the compressor motor as it always did. EasyStart is then only monitoring for faults. If a fault is detected, it will disconnect the compressor to shut it down. We need to determine why the compressor is shutting down, which could be that EasyStart detected a fault or something outside the EasyStart system.

Ensure that all steps in the Pre-Checklist

- Pre-Checklist **section are completed**
- **Remove AC Line Voltage**
 - It is important that a power source that could start the A/C without EasyStart is used
- **Verify that EasyStart is wired properly using Section 2 – Wiring Installation Resources**
 - Common wiring issues for this behavior
 - EasyStart black is not spliced into or alongside the compressor “C” wire
 - Compressor “R” wire is connected to both EasyStart brown and power leg “L2”
 - Bad crimps/splice joints causing a voltage drop
- **Inspect the EasyStart Indicator Lights using SECTION 2DO**
 - Stall see section 2DO
 - Overcurrent see section 2DO
 - No LEDs, verify power see section 2DO

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Section 6 – A/C Worked For Some Time But No Longer On Utility Power

Section 7 – A/C Worked For Some Time But No Longer On Limited Power

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Appendix A – LED Indicator Lights and Troubleshooting Procedures

EasyStart is always checking to make sure the system is functioning normally. This is to prevent damage and ensure low current starts. The state of these checks and what EasyStart is doing is shown by its indicator lights on the EasyStart circuit board. Using these can greatly aid the troubleshooting process.

EasyStart and LED Indicator Light Relationship

EasyStart executes a series of steps to start and monitor the compressor motor. Understanding how it should operate will aid in characterizing if a problem is occurring and how to interpret the LEDs.

EasyStart should be wired so that it receives power only when the compressor is powered. That means it is off when the thermostat is not calling for cooling and so no LEDs will be lit. Then:

- Power is applied to the compressor and EasyStart when the thermostat calls for cooling
- Immediately, the LEDs will show either the “Normal” or “SCPT” indications.
 - “Normal” means the compressor will attempt to start in up to 10 seconds
 - “SCPT” will switch to “Normal” after the SCPT expires, *see Table 3*
- EasyStart activates its fault monitoring system
- EasyStart performs its compressor motor startup and runtime procedures
 - “Normal” is shown with a visibly/audibly/measured running compressor when successful
- Power is cut to EasyStart and the compressor shuts down
 - No LEDs at shutdown is cut power - which is normal when the thermostat ends a cycle
 - LEDs may light briefly then extinguish as EasyStart experiences the power loss
- **At any point, EasyStart may detect a fault**
 - LEDs show the fault EasyStart is stopped on and halt the compressor if it was operating
 - EasyStart locks out or restarts after (typically) 3 minutes, depending on the fault
 - A restart will switch back to “Normal” LEDs and repeat from the top of this list
 - Power must be removed to restart if stopped on a “lockout” fault
 - The LEDs are shown the entire duration of lockout or pending restart

EasyStart LED Indicator Light Appearance

EasyStart indicator lights can be a **solid**, always-lit type, or a **flashing**, on-off sequence, depending on the model. They are always on the EasyStart circuit board. Opaque lids will need to be removed to inspect the lights and are always the solid type. Transparent lids allow viewing the LEDs and may be solid or flashing. Solid LEDs are labelled D21, D22, and D23 for identification. **Error! Reference source not found.** shows an example of the solid LED locations. For flashing types, flash sequences occur in ½ second on/off intervals, with 1 second of off between repeating sequences. A single flash every second indicates a sequence of 1.

Bluetooth models will have flashing type LEDs. They can also be monitored through the app by connecting and looking at the system state. It is sometimes best to inspect the Bluetooth model’s LEDs directly for real-time troubleshooting. Detailed information on Bluetooth model identification and use is described in the *EasyStart Bluetooth Manual*.

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Figure 12 - Solid Version LED Indicator Lights Location

Procedure for Monitoring the LED Indicator Lights

EasyStart LED operation occurs as described in the *EasyStart and LED Indicator Light Relationship* section. The following is a procedure to best ensure you view the LEDs appropriately.

- **Set the thermostat to off**
- **Remove A/C line voltage from the system**
- **Locate where EasyStart is mounted and its LEDs.** An opaque lid must be removed by its 4 or 6 screws to view the LEDs. Transparent lids can view the LEDs directly.
- **Wait at least 5 minutes from when you removed line voltage to allow any delays to expire**
- **Restore AC Line Voltage (SEE SECTION WARNING) and set the thermostat to call for a cycle**
- **Return to the EasyStart and monitor the LEDs and compressor operation.** Wait at least 3 minutes for LEDs to light or for the compressor to start. Place your hand on the compressor to feel if it kicks in. Larger compressors can typically be heard over the fan. You can also use a clamp-on ammeter around the compressor “R” or “C” wire and see the current rise.
 - **No compressor, No LEDs means no power 2DO**
 - **LEDs found can reference Table 2**
- **Continue if the compressor starts and runs for at least 15 seconds**
 - **Note:** Some A/C units have a shroud that allows proper airflow in the system that must be removed to view the EasyStart LEDs. This means, now that we know the unit starts, we have to put the cover back on so the system has proper airflow. RV rooftop units are common examples for these types of systems. Do the following for these systems:
 - Set the thermostat to off
 - Leave the EasyStart LEDs exposed and restore the shroud with the screws out
 - Wait at least 5 minutes and call for another cycle
- **Let the A/C run until it shuts down.** Look at the LEDs at that time and remove the shroud if needed
 - **No LEDs or LEDs light briefly then extinguish, power was removed outside of EasyStart**
 - **LEDs found can reference Table 2**

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Table 2 – Indicator Lights Translation Chart

Indication	Solid			Flashes	Resetting
	D21	D22	D23		
Not Active	All off			none	
Normal	All off			solid green	
Unexpected Current			ON	1 Red	No
Over-Current		ON		2 Red	Yes
Short-Cycle Prevention Timer is active ¹		ON	ON	3 Red or Green ²	Yes
Power Interruption ¹		ON	ON	3 Red	Yes
Open Overload	ON			4 Red	Yes
Stall	ON		ON	5 Red	Yes
Wrong Line Voltage	ON	ON		6 Red	No
Mis-Wiring / Start Winding Not Detected	ON	ON	ON	7 Red	No

(1) These faults potentially have the same indication. If found, the LEDs will extinguish soon and another cycle will be attempted. If the same pattern returns then it is Power Interruption. SCPT is normal EasyStart operation. See note (2) for flashing models.

(2) EasyStart firmware FRM B26 and earlier will flash red for SCPT and FRM B27 and later will flash green.

EasyStart LED Indicator Light Description and Troubleshooting Procedures

This section provides detailed description of the faults listed by Table 2. Use the troubleshooting procedures to attempt to diagnose and resolve what EasyStart is seeing. Specific procedures may have been indicated by the *Problem Characterization* sections. It is OK to start here in this section, however some LED indications may have more context by using the *Problem Characterization* section first.

Normal

This state indicates normal operation of EasyStart. Solid LED models with no lit LEDs but a running compressor is normal operation. No LEDs and no compressor should see the *Not Active* section. Flashing LED models will have a solid green power LED, and a solid green status LED.

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Not Active

This state indicates that EasyStart is not active. Solid LED models with no lit LEDs and no compressor operation indicate that EasyStart is not active. No LEDs with a running compressor is normal operation for these models. Flashing type models have a dedicated power LED that is solid green when active, separate from the flashing status LEDs. “Normal” or stopped on a fault should always be indicated when line voltage is across the EasyStart white and black wires.

- **Set the thermostat to off**
- **Remove A/C line voltage from the system**
- **Inspect the EasyStart white and black wires.** Black should be connected to compressor “C” for one power leg (typically “L1”) and white connected to wherever compressor “R” was connected to from the factory (typically “L2”).
 - Use *Section 2 – Wiring Installation Resources* for a detailed description
- **Wait at least 5 minutes from when you removed line voltage to allow any delays to expire**
- **Restore AC Line Voltage (SEE SECTION WARNING) and set the thermostat to call for a cycle**
- **Wait an additional 3 minutes to let any thermostat delays expire.**
- **Use a voltmeter and probe where EasyStart black and white land.** You should find full line voltage when the thermostat is calling for a cycle. No line voltage indicates a wiring or thermostat issue. You want to measure as close to EasyStart as possible in the circuit to avoid false positives. Use the *Micro-Air Contact Us Page* if you have line voltage to EasyStart and no operation.

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Indication	Description
Not Powered	This indicates that EasyStart is not receiving line voltage across its white and black wires. For solid LED models, no LEDs and no compressor operation suggests EasyStart is not powered.
Normal	EasyStart is operating without fault. Solid LED models will have no LEDs when it is operating normally, so you should have a running compressor motor.
Unexpected Current	EasyStart sees a large current at the beginning of the start process.
Over-Current	The current measured by EasyStart has exceeded the maximum allowed.
SCPT	The Short-Cycle Prevention Timer is active and is normal operation. If the A/C shuts down and wants to start again in under (typically) 3 minutes, then EasyStart will prevent starting for the full 3 minutes. This ensures pressure has equalized in the system and a low current start can occur.
Power Interruption	Power was lost for several AC line voltage cycles and EasyStart shut down to prevent an overload. It may be normal for this to occur with natural power disruptions.
Open Overload	EasyStart has detected the compressor overload switch has opened during operation. This is when continuity is lost between orange and black when the compressor was running.
Stall	EasyStart is not seeing the condition where it can declare that the compressor motor is running at the correct speed. This means that the start failed, or the motor speed was reduced enough to stop the motor after it was running.
Wrong Line Voltage	120VAC only models. EasyStart (-X20 or -T36) has detected the line voltage exceeds ~150 volts and will not operate.
Mis-Wiring	EasyStart does not have continuity between orange and black

Table 3 - Indicator Lights Description

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Appendix B – Troubleshooting Procedures

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Appendix C: Additional Resources

This document references various other Micro-Air resources and are listed here.

EasyStart Knowledge Bank

Where all EasyStart resources are saved, including FAQs, articles, procedures, and troubleshooting guides.

http://www.micro-air.com/kb_easystart.cfm

EasyStart Bluetooth Manual

A manual that describes how to use the EasyStart Bluetooth interface.

http://www.micro-air.com/support-documents/installation_resources/EasyStart_Bluetooth_Manual.pdf

EasyStart Generic Home Installation Guide

A guide for installing in any home system with notes on adapting to a compressor monitoring system.

http://www.micro-air.com/kb-easystart/articles_installation/easystart_Home_AC_Wiring_Guide.cfm

Micro-Air Contact Us Page

Use this page for sending specific inquiries about any of our products

https://www.micro-air.com/contact_microair.cfm

Micro-Air Main Website

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