

## INTRODUCTION:

NuStart is the premier solution to start and protect scroll compressors in the HVAC/R market. The OEM approved technology is the most trusted in the HVAC/R market – with years of global installations. NuStart is the most compact device available allowing for the easiest installation inside the condensing unit.

NuStart uses current-based motor control to optimize start-up of the scroll compressor. In doing so, significant reductions inrush current and starting motor torque result. End-user benefits include: reduction in start-up noise and vibration, eliminates light flicker and nuisance circuit breaker trips at start-up, reduction in contactor arcing, and less mechanical stress of the compressor and connected refrigerant piping during start-up. Lowering the inrush current of the compressor allows for more efficient start-up with off-grid solutions such as solar/battery systems or other back-up power sources – allows the use of a smaller generator.

In addition, NuStart provides unique advantages that many competing products don't offer including: reverse scroll protection technology, hard start time out feature, and best market line-up with single and three phase options for residential and commercial systems.

## GENERAL QUESTIONS:

### 1. What is NuStart?

NuStart is an innovative soft starting device used to control the acceleration of an electric motor. It is designed to reduce the sudden high start-up current that occurs when a motor starts up. Instead of abruptly turning the motor on at full power, a soft starter gradually increases the motor's speed, reducing stress on a generator or battery inverter, helping prevent sudden power surges. Soft starters are essential to modern HVAC systems, serving as a bridge between the power supply and the motor, ensuring a more controlled and reduced start-up current, light flickering, start-up noises, as well as giving compressor protection.

### 2. How does NuStart work?

The primary function of NuStart is to ensure that compressor motors start optimally every time, achieve balance between delivering neither too much nor too little torque. NuStart helps optimize the startup time based on factors like compressor size, power supply, and loading. This approach promotes enhanced reliability during each startup.

### 3. Does NuStart save energy?

Yes. NuStart is an innovative device that reduces start-up current, providing a smoother and more controlled startup without stalling. NuStart reduces the start-up current in HVAC systems by up to 70%, making it easy to operate for smaller generators and solar or battery inverters. This saves homeowners the significant cost of an oversized generator or prevents the stalling of a smaller one; not to mention they can still provide a full startup torque.

### 4. Is NuStart bad for a compressor motor?

NuStart is intended for residential and commercial applications to optimize the starting of large scroll compressors up to 15 horsepower.

## Specialty Products

### NuStart™ Compressor Soft Starter



### 5. Can I use on NuStart on marine (house boats) and RV applications?

**Marine:** Yes. Most 115 volt marine air conditioning applications use rotary compressors. However, these systems always start with equalized system pressure since these air conditioning units need to run on generator power on the boat or limited shore power. NuStart (model 5010-10) must be installed inside a waterproof electrical cabinet.

**RVs:** There are soft starters on the market specifically designed for the specific requirements of RVs for the most versatility in the field. Nu-Calgon's NuStart model 5010-10 could be used in an RV application provided if used with 3kW generator or larger so NuStart works effectively. Also, NuStart model 5010-10 must be carefully installed in a location away from water or dust ingress. For additional application guidance in this market, contact Nu-Calgon.

### 6. Are all three phase motors compatible with NuStart?

NuStart types for commercial applications are specifically engineered to optimize the starting of three phase scroll compressors up to 15 horsepower with RLA limit up 28 amps (230VAC) or 27 amps (460 VAC).

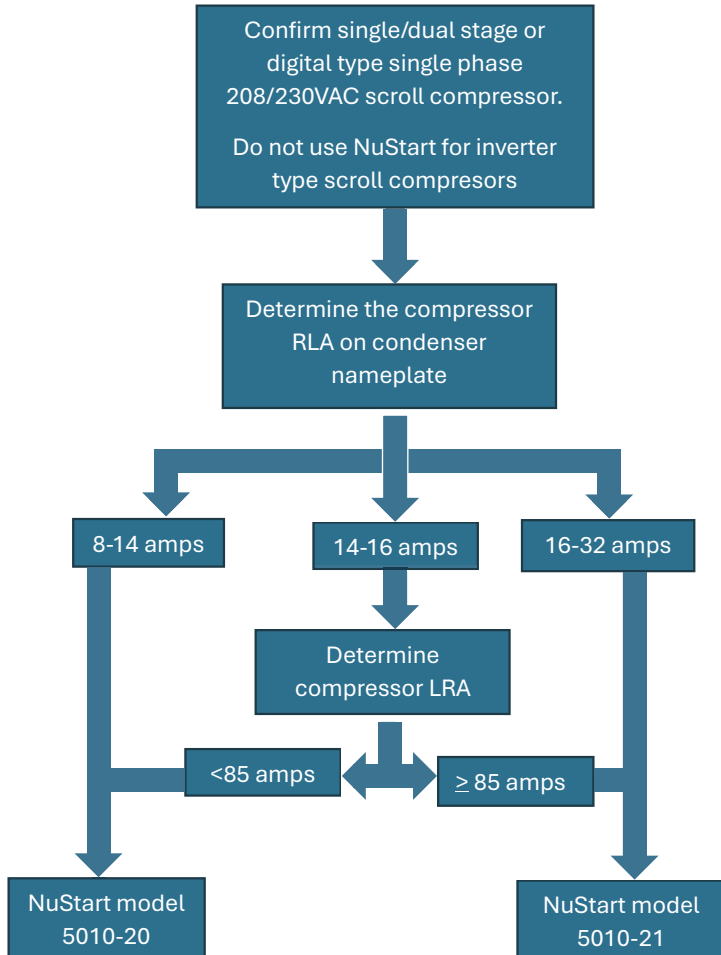
### 7. Can NuStart be used with generator load management or controller devices?

Yes. NuStart aids with load sharing managed by the controller since it will help to reduce inrush current of the air conditioning or heat pump system so more devices could be potentially running at the same time.

## BEFORE INSTALLATION:

### 8. How is the correct NuStart chosen?

NuStart is for scroll equipped air conditioning, heat pump or refrigeration system. NuStart is chosen based on the RLA, LRA and phase type (single or three phase) of the compressor stated on the compressor/equipment nameplate. For residential a/c systems that operate on 208/230 VAC with a RLA between 14-16 amps with an LRA over 85 amps, select Nu-Calgon model 5010-21. If the LRA is below 85 amps, select Nu-Calgon model 5010-20. See flow chart below. For additional questions please contact Nu-Calgon.



### 9. I have a limited single phase generator/inverter capacity: how do I calculate if fitting a single phase NuStart would be enough to make it work with my generator?

From the nameplate data of the single phase ac unit, identify the nominal supply voltage and LRA value of the compressor. As a thumb rule, the inrush demand requirement for each model can then be estimated as:

$$\text{Surge kW needed} = (\text{Nominal Supply Voltage} \times \text{Compressor LRA}) \div 3125$$

### 10. I am concerned that my battery system will not be able to supply enough single phase current. How do I calculate if fitting a single phase NuStart would be enough to make it work on my battery?

From the nameplate data of the ac unit, identify the nominal LRA value of the single phase compressor. The inrush current demand requirement can then be calculated as:

$$\text{Minimum battery RMS current capacity needed} = 0.4 \times \text{Compressor LRA}$$

### 11. Can a NuStart model 5010-21 be used for scroll compressors with an RLA less than 16A?

Using the larger model on a unit with less than 16A RLA will not achieve the same inrush current reduction as NuStart model 5010-20. The larger model will over-drive the compressor's start winding and cause the compressor to fail prematurely.

### 12. Can a compressor with an RLA less than 8A be run using NuStart model 5010-20?

NuStart model 5010-20 can be used for scroll compressors with an RLA no lower than 5A. When the running current is below 8A, the expected current reduction is up to 10% less than a correctly sized compressor.

### 13. What is the difference between NuStart and a hard-start kit?

For permanent split capacitor motors, the torque is dictated by:

1. The current magnitude (more current means more torque) and:
2. The phase difference between the run and start winding currents. Both hard-start kits and NuStart manipulate the phase and current to change the start-up torque.

Hard-start kits change the current by temporarily adding a start capacitor in parallel with the run capacitor. This extra capacitance increases the current and phase angle on the start winding. The net result is a larger torque, but due to its simplicity, it does not regulate nor limit the current drawn by the motor. This results in a larger start-up current.

NuStart uses a start capacitor to increase the phase difference but also regulates and limits the current flowing through the run winding. To accommodate for the torque lost due the smaller current, the soft-starter extends the starting-time (and increases starting energy) of the motor.

### 14. Does NuStart work with two-wire motors?

No. NuStart requires three wires (run, start and common) to be accessible for installation.

### 15. Is it possible to install NuStart on a motor outside of an a/c or heat pump application?

There may be a possible solution for the application so please contact Nu-Calgon at [info@nucalgon](mailto:info@nucalgon) with the following information:

- Description of the motor application.
- Brand and model of the motor. A picture of the nameplate would be helpful.
- Picture of the manufacturer's wiring diagram.

### 16. How does NuStart compare to other brands in the market?

The product's reliability has been well established and trusted by a number of globally reputable HVAC companies for over 20 years. It has been in the market longer than other brands and is the most compact solution available plus the broadest compressor protection features available.

### 17. Can NuStart be installed on HVAC systems that use reciprocating or rotary compressors?

NuStart is intended for HVAC/R systems where internal pressures equalize within 3 minutes of system shut down. NuStart is positioned for scroll compressor applications because its design allows for quick system equalization.

**18. Can NuStart be installed on HVAC systems with variable speed or “inverter-driven” compressors?**

No. Inverter-driven technology already provides lower LRA benefits at start-up.

**19. Does NuStart void warranty on the A/C unit?**

HVAC manufacturers can be skeptical of installing third party devices, it is quite commonplace to install start assist devices in HVAC units. Other typical examples would be drives and hard-start kits.

In recent years, it has become an accepted industry standard to install soft-starters in air conditioning and heat pump systems to overcome the limitations of residential solar/battery backup.

The technology used in NuStart has been successfully used globally for over 20 years and the product is aimed to enhance the life of the compressor. A case where the manufacturer has voided warranty with the use of NuStart's technology has not been encountered.

**20. Does the three phase models of NuStart provide phase imbalance and single phasing protection?**

No. NuStart offers partial phase monitoring with low voltage, high voltage, and phase sequence monitoring. A complete three phase monitor also includes phase imbalance protection and single phasing protection (three phase motor losing complete power only or any one phase). Phase imbalance and single phasing is out of scope with features provided by NuStart. Some applications do necessitate comprehensive protection. For example, chillers for the medical industry or other critical usages that may require all the above features.

**DURING INSTALLATION:**

**21. Is NuStart easy to install?**

Yes. NuStart should take approximately 15 minutes to properly mount and connect inside the HVAC system control/electrical service compartment. The wiring leads necessary for a normal system installation and unit mounting bracket are included. Installation Instructions are included with NuStart models and all steps should be followed for proper installation and operation.

**22. I am having trouble wiring NuStart into the a/c or heat pump, how can I get help?**

A sample wiring diagram can be found in the installation instructions. If the wiring is substantially different from the diagram, please send a picture of the manufacturer's wiring schematic to Nu-Calgon at [info@nucalgon.com](mailto:info@nucalgon.com) so we can advise further.

**23. The unit has a separate capacitor for the compressor and the fan. Will NuStart still work with this application?**

Yes, NuStart works with both dual and single capacitors. In both cases the NuStart's START WINDING lead is connected to the same **HERM** terminal on the capacitor as the compressor's start winding.

**24. In my installation only one side of the power input is switched by the contactor. Will NuStart still work?**

Yes, NuStart will still work in this case. Only one side of the contactor needs to be switched to ensure that NuStart will work.

**25. How is NuStart installed on HVAC units which power the compressor through a control board rather than a contactor?**

Please send a picture of the manufacturer's wiring diagram to [info@nucalgon.com](mailto:info@nucalgon.com) so an installation diagram can be created for the HVAC unit.

**26. Does the wiring change if there is an Emerson SureSwitch™ present in the system?**

The wiring and performance of NuStart does not change with use in conjunction with an Emerson Sureswitch™, as it simply acts as a series contactor. Please note that there is one second delay at start up to avoid any conflict.

**27. Can NuStart be installed in tandem with the Emerson CoreSense™?**

NuStart is compatible and should be wired as indicated in the installation diagram. Please ensure that the three compressor wires are fed through the correct holes of the CoreSense™. Failure to loop the necessary cabling through can lead to spurious fault codes to be flagged by the AC control board.

**28. What happens when the hard-start kit is left connected when NuStart is installed?**

Installation with hard start kits can cause NuStart and hard start kit to fail prematurely. These devices usually fail before affecting the compressor.

**AFTER INSTALLATION:**

**29. Why is the motor not running after power has been turned on?**

Many issues can be a result of incorrect wiring. Please contact Nu-Calgon, having a picture of the manufacturer's wiring schematic so we can verify its proper wiring. Should the problem persist after the connections have been checked to be correct and securely fastened, then review the LED flash code on NuStart – this is a useful tool for determining a fault.

**30. NuStart's LED light is flashing. What does it mean?**

The flash code will vary according to the fault. Please review the Nu-Calgon's installation or product bulletins on NuStart for specifics. Contact Nu-Calgon with further questions.

**31. I have wired up the NuStart into my AC or heat Pump unit. The compressor runs fine, but why does the fan not turn on?**

There is an error in wiring during installation. Send Nu-Calgon a picture of the manufacturer's wiring schematic and we can make a mark-up of the installation wiring for you to verify. **Please be advised the compressor is at risk of overheating if it runs for more than 30 seconds without the condensing fan operating.**

**32. Is there a problem when the NuStart's LED is not flashing but the compressor is operating correctly?**

The LED only turns on to indicate that a fault has occurred. Unless the compressor has not turned on, then NuStart should be operating correctly

**33. Why after the installation of NuStart is the meter reading too low/high of a current?**

NuStart takes less than a third of a second to complete compressor start-up. Conventional ammeters/multimeters do not have adequate time resolution to capture this. Meters equipped with inrush current measurement are needed for accurate results. An example of an inrush current meter is the FLUKE® 375 Clamp Meter.

**34. The motor is running correctly but why don't I see a measured reduction inrush current?**

The inrush current cannot be measured by a typical current meter. To verify LRA reduction in a field installation, technicians will require a device that can capture inrush current and display this LRA value in a digital readout. FLUKE® 375 Clamp Meter is one such tool that is available for field use. **Please allow 6-8 compressor cycles for NuStart to optimize start-up of the compressor for optimum LRA reduction improvement.**

Should the current be correctly measured and there is no improvement in inrush current, please check the connections are correct and secure and note if there are any visible flash codes on the LED light. Please contact Nu-Calgon with the findings.

**35. My single phase NuStart is showing the over current flash code (1 LED flash every three seconds) when attempting the start-up. Is there something wrong with the NuStart device?**

First diagnose if the compressor is drawing excess current. If the compressor is cold and/or having difficulty starting with this flash code, this can be a result of loose or failing terminations upstream from the compressor. Please check that the connections to the contactor or to the compressor's common terminal are not loose. Should the problem persist after the connections are found to be secure, then this problem may be a result of a failing circuit breaker or wiring upstream of the contactor. Since this can be cause for electrical fire, this needs to be checked out immediately.

**36. I have tried everything, but the unit is still not working. What can I do?**

NuStart has a QR code on the label that will send you to Nu-Calgon's website on NuStart. Many resources will be available with ongoing updates – specifically the latest wiring guidelines applicable equipment. If added help is needed, please contact/provide Nu-Calgon with the following information:

- NuStart model number installed
- The brand and model number of the HVAC unit. A picture of the nameplate data would be helpful.
- A picture of the HVAC unit's manufacturer wiring diagram. From it a markup of the installation wiring can be created and used to verify the installation
- If there is a flash code visible on the NuStart's LED light.

**37. Is NuStart similar to many low cost hard start kits where it could cause compressor damage by continually trying to start the compressor with an open run capacitor?**

For an open run capacitor, NuStart will not attempt a compressor start. If the run capacitor fails while the compressor is running, NuStart will immediately stop power to the compressor. An open run capacitor leads to overheating of the run winding by drawing 20-30% excess current draw. Hence, it is imperative to quickly shut down power to the compressor.

Note: NuStart includes a mechanism to detect a functional or open run capacitor in the circuit; however, it cannot assess its exact state if there is some degradation or partially failed capacitor.