COMPRESSOR SOFT STARTER - SINGLE PHASE SERIES

PREMIER BENEFITS:

- Most Compact Soft Starter in the Market
- Compatible with Modern Scroll Technologies
- Reduces In-Rush Current by 60-70%
- Lowers Start-Up Torque by 30-40%
- Reduces Compressor and Refrigerant Piping Stress
- Reduces Start-Up Noise and Vibration
- Eliminates Light Flicker at Start-Up
- Reverse Motor Protection
- Under Voltage and Overcurrent Protection
- Compatible with Major Utility Regulations
- Easy Retrofit

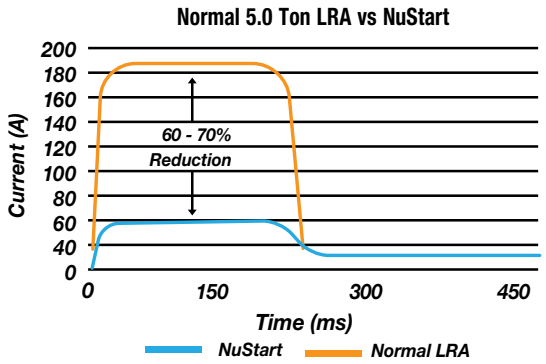
FURTHER ADVANTAGES:

- OEM Approved Technology – Time Proven
- Efficient Start-Up on Back-Up Power Sources
- Prevents Generator Stalls/Solar Inverter Shutdown
- Eliminates Motor Stalling During Brownouts
- Automatic Optimization of Motor Start-Up Current
- Protects Compressor from Rapid Cycling
- Reduces Contactor Arcing Damage
- Easy-To-Use LED Fault Diagnostics

Specialty Products

NuStart

Compressor Soft Starter



Description:

NuStart is a soft starter and protection device for scroll compressors in HVAC/R systems. NuStart uses current-based motor control to optimize start-up of the scroll compressor. In doing so, significant reductions inrush current and 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, compressor mounts, 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.

NuStart provides another level of protection for the scroll compressor in the HVAC/R system. NuStart offers reverse motor (scroll) protection, plus under voltage protection to prevent motor stalling at start-up or during operation in low voltage (brownout) events. The device also provides overcurrent protection to prevent the compressor from operating beyond a preset level. NuStart provides additional compressor protection – it is NOT a replacement for any primary circuit breaker or an overload protection device, nor is it a surge protector.

Application:

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. In addition, the device 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.

NuStart is designed for modern scroll compressor technologies in the HVAC/R market – single stage, dual stage, and digital type scroll compressor types. Do NOT use NuStart for inverter type scroll compressors. For other compressor types, contact Nu-Calgon.

NuStart must be selected on proper electrical phase, RLA, and LRA of the compressor stated on the nameplate of the condensing unit. Use NuStart for the following systems equipped with scroll compressors:

- Air Conditioning
- Heat Pumps
- Chillers
- Refrigeration

NuStart models 5010-20 and 5010-21 cover residential air conditioning and heat pump systems that operate on 208/230 VAC power. They are an excellent accessory to promote on a new HVAC install to provide efficient start-up and added compressor protection for the new homeowner investment, allows the homeowner smaller power back-up options to run the HVAC system or to simply reduce start-up noise and vibration. NuStart model 5010-10 requires 115VAC power input is intended for including marine or RV possibilities or outlier stationary HVAC system requiring this input.

Packaging:

NuStart, 115VAC Single Phase 12-20 RLA **5010-10**
NuStart, 230 VAC Single Phase 8-16 RLA **5010-20**
NuStart, 230 VAC Single Phase 16-32 RLA **5010-21**

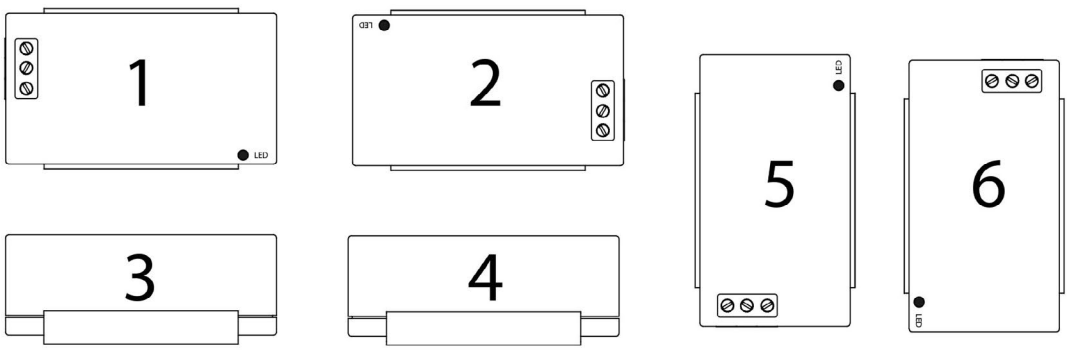
Specifications:

Attributes	Nu-Calgon Single Phase Models		
	5010-10	**5010-20**	**5010-21**
Nominal Voltage Rating	110-115 VAC	208-230 VAC	208-230 VAC
Rated Phase	Single	Single	Single
Rated Frequency, Hz	60	50/60	50/60
Motor Current, Max. RLA/FLA Range	12-20A	8-16A	16-32A
LRA, Max.	85A	85A	180A
Start Current Reduction	60-70% of LRA	60-70% of LRA	60-70% of LRA
Startup Torque Reduction	30-40%	30-40%	30-40%
Degree of Protection – Housing	IP20	IP20	IP20
Operating Temperature	-4° to 140°F	-4° to 140°F	-4° to 140°F
Storage Temperature	-40°F to 185°F	-40°F to 185°F	-40°F to 185°F
Maximum Number of Starts per Hour	15	15	15
Minimum Startup Voltage	103V	180V	180V
Maximum Permissible High Voltage	130V	253V	253V
Shutdown on Low Voltage	90V	175V	175V
Dimensions	5.30"x 1.96"x 2.94"	5.30"x 1.96"x 2.94"	5.30"x 1.96"x 2.94"
Weight	1.1 lb.	1.1 lb.	1.1 lb.
Life Expectancy	Minimum 100,000 Cycles	Minimum 100,000 Cycles	Minimum 100,000 Cycles
Limited Warranty	One Year from Install	One Year from Install	One Year from Install

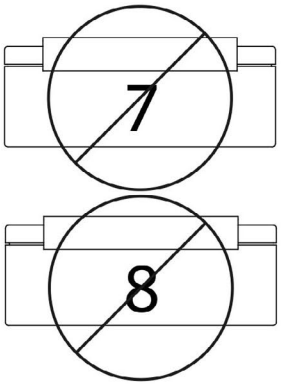
Cautions:

1. NuStart is designed for install in the electrical compartment of the condensing unit, confirm dry fit location before install. If NuStart must be installed outside the condensing unit, contact Nu-Calgon.
2. All voltage to equipment MUST be disconnected before removing any devices.
3. Allow two minutes to discharge the run capacitor before disconnecting.
4. Do not swap the Run & Start Windings.
5. Prior to installation, be sure all start capacitors & start relays, along with hard-starters and/or any other start-assist devices, are removed.
6. The start capacitor is built into the NuStart. For use with single/dual stage scroll compressors, plus digital type scroll compressors.
7. Not for use with inverter type compressors. For other compressor types, contact Nu-Calgon.
8. Do not mount NuStart upside down from mounting bracket.
9. Loose terminals can lead to heating & subsequent damage to the soft starter. As per UL508 standard, ensure proper tightening torque as per field wiring specifications.
10. Compatible to be used with Emerson Comfort Alert or CoreSense modules.
11. **Opening of the soft starter unit or atttempting to run the unit on motor loads beyond stated capacity will void warranty!**

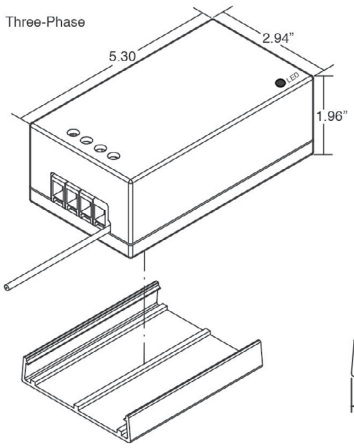
Approved Mounting:



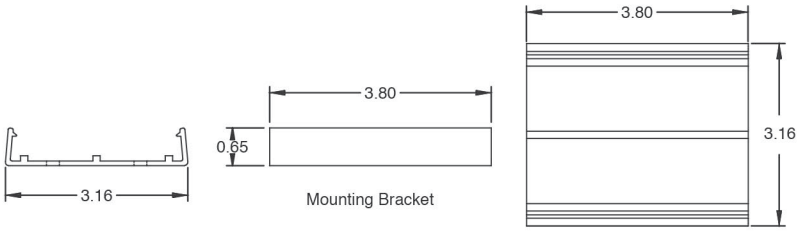
Not Approved



Dimensions:

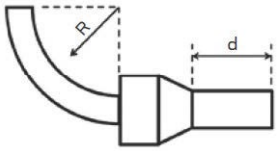


Note: Install mounting bracket to interior metal cabinet wall with two self-tapping screws (field supplied).



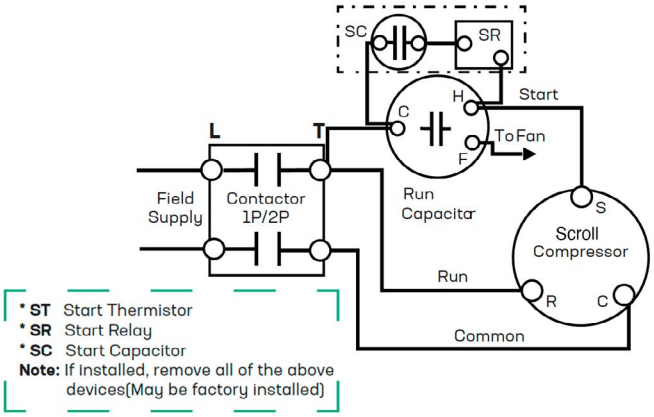
Field Wiring Specifications:

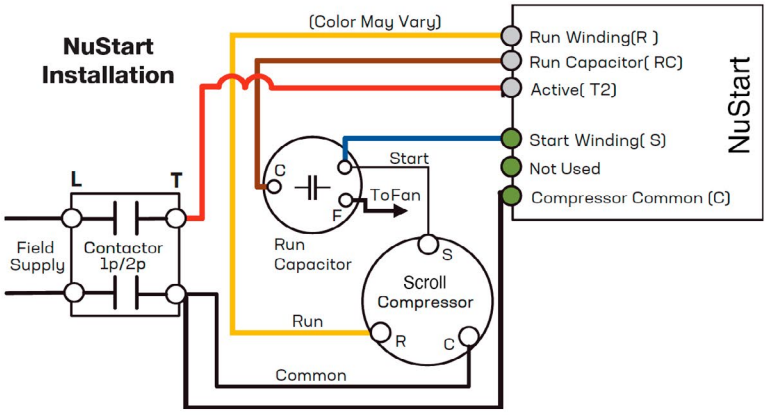
Wire Range:
8 to 12 AWG Cu, stranded, for terminals (Run Winding (R) and Active(T2))
12 to 16 AWG Cu, stranded, for terminals (Run Capacitor (RC), Start Winding (S), and Compressor/Motor Common (C), these are supplied)
Tightening Torque: 11.5 lbs - in LARGE TERMINALS, 4.5 lbs - in SMALL TERMINALS.
Field wiring conductors shall be rated 167°F [75°C]
Minimum end use enclosure size: 10″ x 8″ x 6″



- **CRIMP CORRECT SIZED FERRULES TO ENSURE PROPER TERMINATION**
- **INSERTION LENGTH OF FERRULE “D”: 11 ± 1 mm (0.43 ±0.04”)**
- **CABLE BEND RADIUS “R” > 38mm (1.5”) MINIMUM**

General Wiring Schematic:





Notes:
1. NuStart is compatible with systems that use Emerson Core Sense and Comfort Alert current sensing models.
2. Above is a general wiring guideline for installing NuStart, but system variances exist. For more information, see www.nucalgon.com/nustart for more information about particular systems.

Certifications:

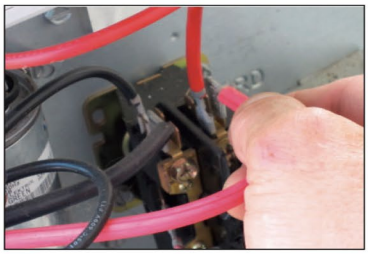
NuStart products are complaint to RoHS, REACH, 3TG and SCIP regulations. UL compliance as per UL IEC60947-4-2
Compliant under ETL file 5008 865
CE compliance as per IEC60947-4-2 and IEC61000 series EMI/EMC standards

Installation:

NuStart must be installed by qualified/licensed technician. Record date of installation on device.

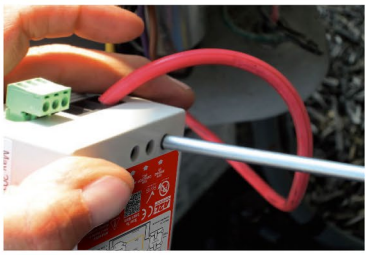
1. Turn off all power to the HVAC unit at the circuit breaker.

2. Secure the mounting bracket for the NuStart inside the control



3. Remove the compressor Run wire from the contactor or Run Capacitor terminal, as applicable.

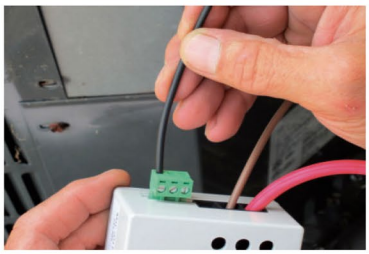
4. Strip the compressor Run wire at least 1/2 in* Crimp appropriate size Ferrule (supplied) onto it.



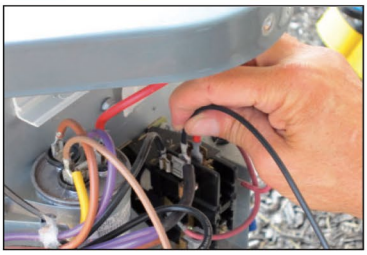
5. Attach the compressor Run wire to the NuStart Run Winding terminal.

6. Attach the brown wire supplied with the NuStart to the Run Capacitor terminal of NuStart.

7. Identify the cable connecting the contactor and the Run Cap. Remove this connection to the Run Cap Attach the flagged end of the brown wire to the same terminal of the Run Cap[#1].

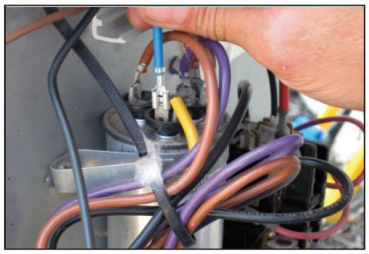


8. Attach the black wire (supplied) to Compressor Common on the NuStart green terminal connector.



9. Attach the flagged end of the black wire to the Compressor Common on the "T" side of the contactor.

10. Attach the blue wire (supplied) to the Start Winding on the NuStart green terminal connector.



11. Attach the flagged end of the blue wire to the other terminal[#2] of the Run Capacitor. Ensure that this terminal on the capacitor also joins to the Start Winding of the compressor.

12. Attach the red wire (supplied) to the Active Terminal on the NuStart.

13. Remove the loose wire (from Step 7) from the active input of the contactor and attach the stripped end of the Active wire in its place.

14. Apply power to the equipment and cycle[#3] to ensure proper operation.

⚠ Caution

NuStart must be installed in a location that ensures that the external heat from a hot gas line, compressor discharge piping, or similar heat source will not cause damage. Minimum 3˝ (76 mm) clearance is recommended.

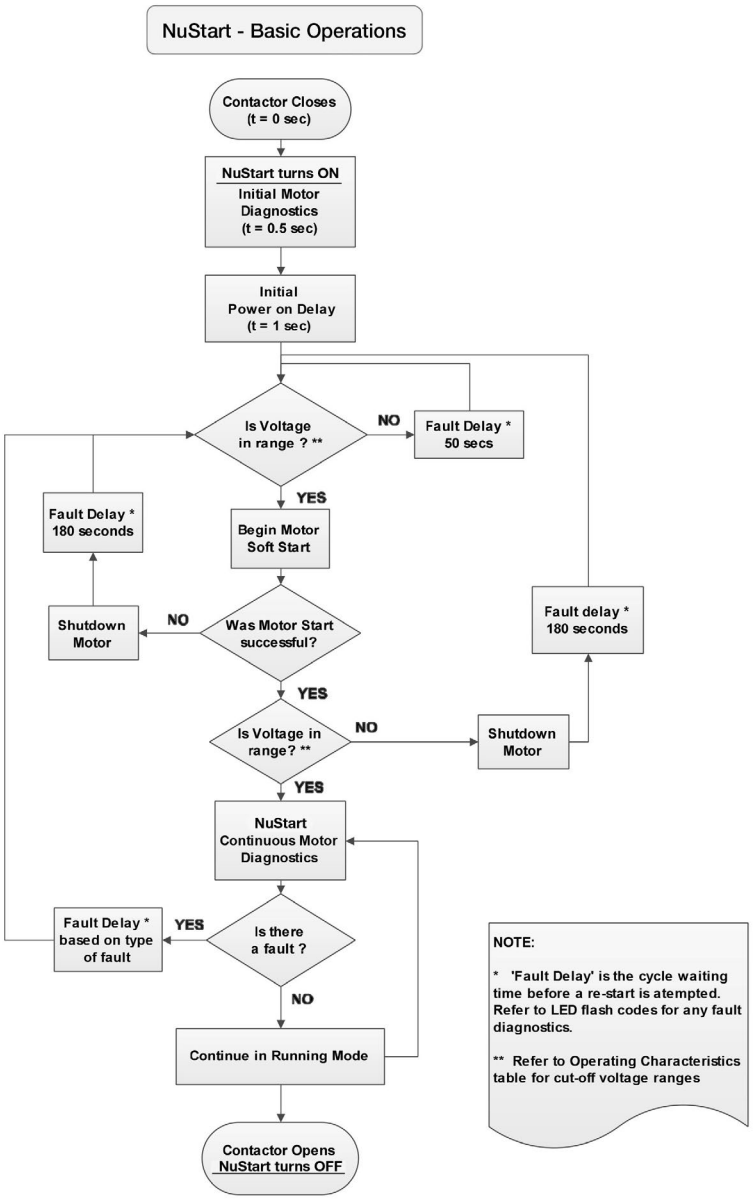
Sample schematic is not a reflection of all HVACR units in the field. If the wiring differs from the base schematic or if it needs to be wired through a control board, please contact us: info@nucalgon.com

Suitable for use on a circuit capable of delivering no more than 5000rms symmetrical amperes, 240 volts maximum, when protected by a non-time delay RK5 fuse or circuit breaker rated 80A, or a time delay fuse rated 70A. NuStart does not provide current limiting control or equivalent.

NuStart is NOT an overcurrent protection device and must NOT be used as a replacement for any primary circuit overcurrent protection. NuStart does not provide surge protection.

NOTES:
#1 This is the Common (C) terminal for Dual Compressor/Fan Capacitors.
#2 This is the Herm (H) terminal for Dual Compressor/Fan Capacitors.
#3 NuStart device could take up to six (6) starts to optimize.

Mode of Operation:



LED Flash Codes

Flash Code	Definition	Time to Re-start Attempt
Rapid Flash 10 LED Flashes per second	Low Voltage	3 min
Triple Flash 3 LED Flashes per every 3 seconds	Lockout on 3 Failed Starts	50 min
Slow Flash 1 LED Flash every 3 seconds	Lockout on Overcurrent	10 min
Steady Flash 1 LED Flash every second	Cycle Delay/Faults	3 min

NOTE: LED fault indicator remains off in normal running mode.

Flash Code - Rapid Flash (10 LED flashes every second): *Low Voltage*

- Displayed for “Low supply voltage” before or after a soft start.
- If low voltage is detected before a start, a re-start is attempted after 50 seconds.
- If low voltage is detected after a start, a re-start is attempted after 3 minutes.

Flash Code - Triple Flash (Triple LED flash every 3 seconds): *Lockout on Three Failed Starts*

- Displayed after failure to start on “three consecutive start attempts”.
- Re-start is attempted after 50 minutes.
- Standard lockout period is revised to 3 minutes after a successful start.

In circumstances where the compressor may have seized or is unable to startup due to failure of other components in the HVAC system, the software will check for three consecutive failed starts. On the third sequential failed start, the program goes into Lockout for 50 mins. On failing to get a good start even after 50 mins, it will re-attempt start again after duration of 50 mins. Once a good start is eventually achieved, it will reset the hard start counter and will require 3 failed starts again to force it back into Lockout mode. Lockout can be cleared anytime through a power reset of NuStart.

Flash Code - Slow Flash (One LED flash every 3 seconds): *Lockout on Over current*

- Displayed for “overcurrent” in running mode of the compressor motor.
- Overcurrent limit is “25A for 08-16A version” and “50A for 16-32A rated version”.
- Also displayed, if internal Klixon of the compressor trips out on overheat.
- Re-start is attempted after 10 minutes.

To limit the current in compressors from extending abnormally beyond its stated capacities, NuStart is also equipped with Overcurrent limit protection. For models rated from 16-32A, NuStart is designed to trip out in overload conditions exceeding 50A. In smaller models, it is designed to cutoff power to the compressor if the current drawn exceeds 25A. On overcurrent lockout, NuStart attempts a re-start automatically after 10 minutes. Both failed start lockout and overcurrent limit protection have been designed to prevent the compressor from drawing abnormal currents in conditions not feasible for the compressor operation.

Flash Code - Slow Steady Flash (One LED flash every second): *Cycle Delay / Fault Mode*

- Displayed for “cycle delay” between two consecutive soft starts or other faults mentioned below.
- Re-start is attempted after a default period of 3 minutes.
- Other possible reasons for this fault mode indicator can be due to:
  - Incorrect wiring during installation
  - Failed soft start attempt
  - Intermittent power loss (duration longer than 100ms)
  - Frequency out of range
  - Failed run capacitor

1. What is different between a hard start kit and NuStart?

Hard start kits are more preferred in applications where the system design requires high starting torque. In small sized applications reciprocating and rotary compressors that must start against a pressure head and may require a device to increase the starting torque. If the HVAC unit utilizes a scroll compressor, hard start kits are not normally required.

NuStart is a sophisticated and intelligent device designed to reduce the starting current of the compressor by actively controlling the current in both the run and start windings. They actively (phase control) limit the current through run winding while a balanced value of start capacitor is connected in situ to provide the optimal torque required to start a compressor at any operating voltage. Along with soft starting, electronic soft starters also provide a substantial number of built-in features to pre-emptively protect the compressor under abnormal circumstances.

2. How do I select a NuStart?

Determine voltage input, phase type (single or three), compressor RLA and LRA to make sure it falls between specified range of appliable NuStart model. For residential a/c systems if the RLA is between 14-16 amps but LRA over 85, go with model 5010-21. If LRA is under 85, go with model 5010-20.

3. What compressors is NuStart suitable for?

Single stage, dual stage, and digital scroll type compressors. Do not use NuStart on inverter type scroll compressors.

4. Why can't I use NuStart on a reciprocating compressor?

It is extremely important that NuStart starts a compressor when system pressures are equalized so not to shorten NuStart's service life. By design, scroll compressors equalize very quickly at shut-off. Reciprocating and other compressors don't necessarily equalize quickly at system shut-down and NuStart is not to be used with non-scroll compressor designs without some system design provision to allow quick pressure equalization at shut-down.

5. Can I use NuStart with Emerson CoreSense and Comfort Diagnostics?

Yes. NuStart is a current control based controller – its methodology and timing allows its compatibility the device sampling rate.

6. Do I need to do anything different with a condensing fan using a ECM motor?

No, NuStart is wired independently of the condensing fan motor.

7. What is unique with NuStart vs. other market options?

Most compact soft starter in the market for easiest installation inside the condensing unit. NuStart is available in single and three phase models and provides a suite of protection features for the scroll compressor: reverse scroll protection, low voltage, hard start lock-out feature, plus overcurrent protection (single phase types) and over voltage/integrated phase protection (three phase types).

8. What is reverse scroll protection?

If there is a brief interruption in power, it is possible for a scroll compressor to suddenly operate in reverse direction caused by pressure differential in the system – this is very detrimental to the compressor. NuStart will de-energize the compressor and restart the compressor after a few minutes.

9. What is low voltage protection?

During a low voltage (brownout) event, if the voltage is below the specified minimum voltage input during start-up or during running, NuStart will de-energize the compressor and try a restart three minutes later. Low voltage conditions can cause compressor stall resulting in LRA current draw which is damaging to the compressor after an extended period of time.

10. How does NuStart protect the compressor from rapid cycling damage?

After three failed attempts, the NuStart will go automatically into a 50 minute lockout before attempting another start. This prevents the compressor from overheating due to rapid cycling which leads to a bigger issue versus what is preventing the compressor from starting successfully.

11. Is NuStart transferable to another system?

Yes, as long as it is for another single, dual or digital scroll compressor system. Not to be to be used in an inverter type scroll compressor equipped system.

12. What is automatic optimization of motor start-up?

NuStart requires 6 to 8 starts to learn what is required to optimize the start-up of the compressor. NuStart continues to automatically optimize the compressor start-up during its service life.

13. Do I need a circuit breaker with installing NuStart?

Yes, a circuit breaker is electrical circuit protection is required with installation of NuStart.

14. Is NuStart a surge protection from electrical storms?

No. NuStart does not provide this level of protection to protect the refrigerant system. This requires a standalone protection device for the system or house.

15. Does the capacitor stay in the system with the installation of NuStart?

For a single phase scroll compressor systems equipped with a run capacitor, this device remains in the system with NuStart installation. If there is a hard start kit installed in a single phase system, this must be removed before installing NuStart. Start and run capacitors are not applicable with three phase NuStart installations.