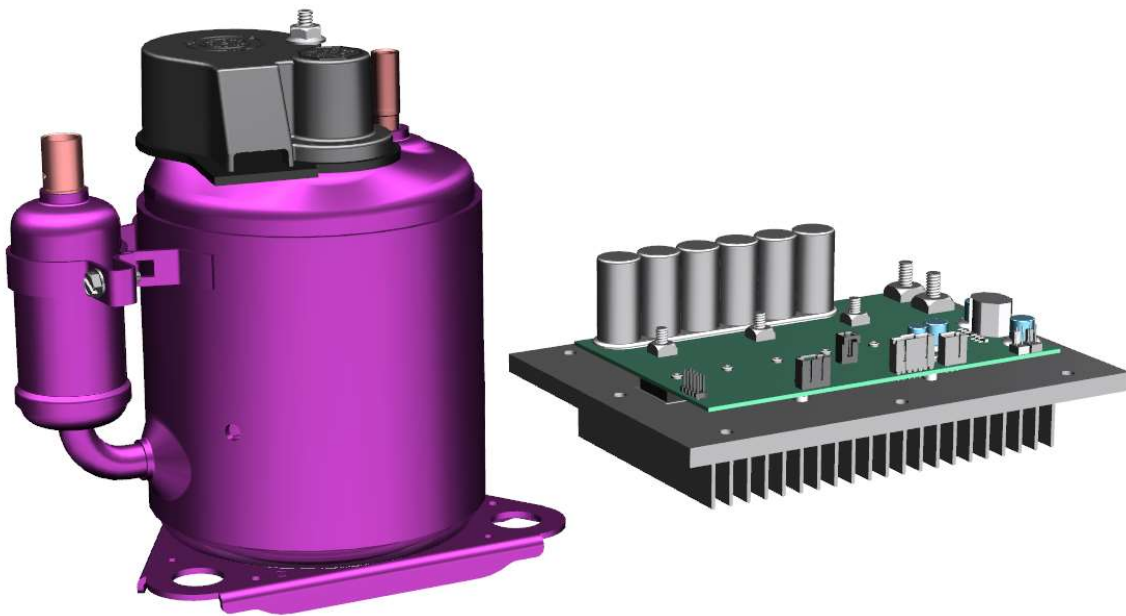


## **Assembly Instructions for 12/24V SIERRA Compressors and Controllers**



**Original Instructions**

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## Purpose

The purpose of this document is to communicate to OEM's how to apply, use and maintain the 12/24V SIERRA compressor and controller in a safe and efficient manner. This guide is also intended to convey any residual risks that need to be addressed by the OEM in respect to EHSR when being applied to the Machinery Directive 2006/42/EC.

## Safety Guidelines

- Only qualified HVAC or refrigeration personnel are permitted to install, operate, and service this equipment.
- Electrical connections must be made by qualified electrical personnel.
- Always use personal protective equipment when working on this equipment. Boots, gloves, protective clothing, safety goggles, and a hard hat must be worn when necessary.
- These products must only be used for their intended purpose.
- Failure to follow these guidelines can result in injury to a person, fire, burn, frostbite, shock, or damage to equipment.
- Read, understand and follow these Safety and Application guidelines before operating this equipment.
- Must comply with local and national safety requirements.

## Safety Icon Explanation

|                                                                                     |                                                                                           |                                                                                     |                                                                                  |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
|    | <b>WARNING</b><br>This Icon indicates a potential for personal injury or property damage. |    | <b>ELECTRICAL SHOCK</b><br>This Icon indicates a potential for electrical shock. |
|   | <b>BURN OR FROSTBITE</b><br>This Icon indicates a potential for Burn or Frostbite         |   | <b>FLAMMABLE WARNING</b><br>This Icon indicates a potential for Fire             |
|  | <b>ESD WARNING</b><br>This Icon indicates a potential for ESD (Electrostatic Discharge).  |  | <b>EXPLOSION WARNING</b><br>This Icon indicates a potential for Explosion        |
|  | <b>HAZARDOUS MATERIAL</b><br>This icon indicates a potential for Hazardous materials      |                                                                                     |                                                                                  |

**Safety Warnings****WARNING**

Only approved refrigerants and refrigeration oils must be used. Remove refrigerant from both high- and low-pressure sides with a suitable recovery unit before removing compressor.

**ELECTRICAL SHOCK WARNING**

Disconnect and lockout power before performing maintenance. Allow capacitors to discharge before performing maintenance. The Compressor and controller must be properly connected to the ground. For correct wiring, refer to the wiring diagram for your compressor and controller, located on [www.masterflux.com](http://www.masterflux.com).

**BURN OR FROSTBITE WARNING**

The top of the compressor and discharge can become very hot, with temperatures capable of reaching 150°C (302°F) and potentially causing burns or fire. Make sure that wiring or other materials do not come in contact with the compressor as this may cause damage or fire. Proceed with caution when brazing system components. Frost or ice can form on the suction tube and accumulator and prolonged exposure can lead to frostbite. Let the compressor come to room temperature before working on it.

**PRESSURIZED SYSTEM WARNING**

The system and components contain oil and refrigerant under pressure. Only use approved refrigerants and oils. Before removing the compressor, remove refrigerant from the system on both the high and low sides with suitable recovery equipment. The combination of refrigerant, oil, high temperature, or spark can cause an explosion, which may cause personal injury.

**ESD WARNING**

The controller is sensitive to ESD (Electrostatic Discharge). Do not touch components on the printed circuit board. When handling the controller make sure that the proper precautions are taken, use anti-static mats and wrist straps, etc. Reference ESD Handling recommendations on [www.masterflux.com](http://www.masterflux.com)

**FLAMMABLE WARNING**

The top of the compressor can reach temperatures of 150°C (302°F) Use appropriate personal protective equipment.

**HAZARDOUS MATERIAL OR FUMES WARNING**

Hazardous material or fumes can be present in the event of leaks, tube/fittings breakage, pin venting, fire, melting of materials, or similar hazards. Use proper personal protective equipment and follow precautions to avoid personal injury from skin contact or inhalation.

## Product Description

The compressor employs a 3-phase brushless DC motor and a motor controller. The motor electronic controller provides control and monitoring (+) of the compressor to allow for a constant speed that is independent of motor voltage and load. The compressor motor is powered by a 3-phase output voltage received from the electronic controller. (Maximum voltage potential applied to the motor terminals is 24VDC. Electronic controller power supply is single phase DC). This is accomplished by the electronic controller sending high-frequency pulses to each of the motor windings. These pulses are generated by switching the DC sources w/FET transistors controlled through the microprocessor.

The Controller employs the use of a microprocessor for control of the motor resulting in improved control and performance. The Controller is designed to provide efficient control and monitoring of a DC-powered brushless hermetic compressor.

## Scope of Document

This document pertains only to the following Compressors and Controllers.

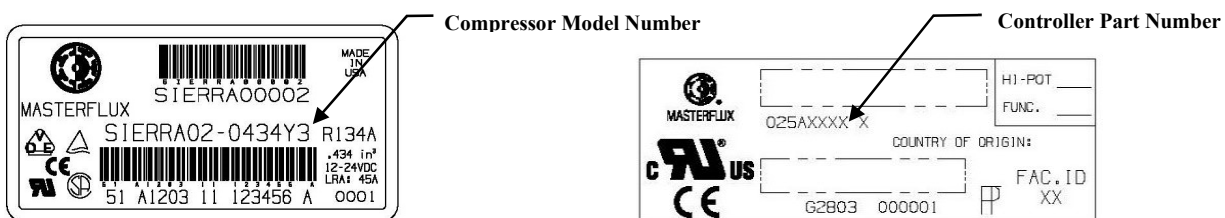
| Model Series | Voltage code (12-24V) | Displacement: in <sup>3</sup> /rev | Refrigerant Code | Application Code |
|--------------|-----------------------|------------------------------------|------------------|------------------|
| SIERRA       | 02                    | -0434                              | Y                | 1                |
| SIERRA       | 02                    | -0434                              | Y                | 3                |
| SIERRA       | 02                    | -0434                              | Z                | 1                |
| SIERRA       | 02                    | -0716                              | Y                | 3                |

**Table 1: Compressor Model Numbers**

| SIERRA Compressor | Masterflux Controller |
|-------------------|-----------------------|
| SIERRA02-0434Y1   | 025F0095<br>025F0219  |
| SIERRA02-0434Y3   |                       |
| SIERRA02-0434Z1   |                       |
| SIERRA02-0716Y3   | 025F0200              |
|                   | 025F0218              |
|                   | 025F0252              |
|                   | 025F0298              |
|                   | 025F0335              |
|                   | 025F0378              |

**Table 2: Use these compressors with the controllers shown here.**

The model numbers are located on the Compressor and Controller labels



## End Product Considerations

- **Compressor related**
  - Using the compressor and controller outside of the specified operating conditions can result in unreliable or unsafe performance and may cause damage to the compressor and controller or create other potential hazards.
  - The compressor and controller must be protected from adverse environmental conditions.
  - Corrosion protection provided on the electrical enclosure is suitable for outdoor use when used within a separate outer enclosure.
  - Mechanical protection of nonmetallic electrical enclosures shall be considered on the end-use application.
  - The compressor employs a fused glass-insulated terminal.
  - The compressor is a self-contained welded steel shell.
  - The refrigeration system must provide a pressure relief device to relieve excess pressures that may develop in event of a fire.
  - The terminal enclosure gasket, adhesive, and/or sealing compound has been evaluated for an 80°C temperature rise.
  - The nonmetallic terminal cover material is made of Noryl PX9406 or Lexan 503R and has a temperature rating of 105°C.
  - Temperatures and pressures shall not exceed allowable limits when the end-use product is tested per the applicable standards.
  - The compressor enclosure has been tested for 2400 PSIG Minimum and the accumulator has been tested for 1000 PSIG Minimum.
  - A mechanical overload protector maybe with the compressor, but it has not been evaluated as a safety device.
  - An overload protector operating under abnormal conditions such as multiple faults has not been tested and should be evaluated in the end product.
- **Controller related**
  - The controller shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application.
  - The terminals are not acceptable for field connections. The acceptability of connections to these terminals, including temperature and secureness, shall be determined in the ultimate application.
  - The device has been evaluated for suitability for required electrical spacings per UL 873, Standard for Temperature-Indicating and Regulating equipment.
  - RLA depends on the speed and function of the controller and must be determined in the end-use product.
  - The entire assembly is located in a single circuit below Class 2 voltage levels.
  - The controller is intended to be used in an application where the DC supply source is provided with overcurrent protection. Circuit over current protection is not included on the controller
  - The device has not been investigated as safety or limiting control. The controller should not be relied upon as such, during the end-product stalled rotor testing of the motor or compressor.
  - A Bonding terminal for the FET heat sink is not provided and the heat sink shall be mounted to a grounded metal surface.
  - The temperature of the FET heatsink is monitored with a temperature sensor and an electronic circuit. This circuitry has not been investigated for providing safety or limiting function and shall not be relied on for performance during the end-product testing.
  - The controller has not been investigated for interpreting or responding to the Compressor Shell Temperature switch. Therefore, this circuitry shall not be relied upon for performance during end-product testing.
  - The heat sink can reach 100°C (212°F) during operation and air movement across the heat sink is required for cooling. The temperature is dependent on ambient temperature conditions, airflow over the heat sink, and motor current, and must be considered in the end-use testing and approval.

## Certifications

- Compressor
  - Certifications
    - UL File SA707
    - UL File SA5575
    - ANSI/ UL 60335-1 4<sup>th</sup> Edition
    - UL 60335-2-34 4<sup>th</sup> Edition
    - CAN/CSA C22.2 No. 140.2 4<sup>th</sup> Edition
    - CE
      - Machinery Directive 2006/42/EC Ed. 2.2 – October 2109
      - RoHS & REACH Compliant
      - EU DOI – 600A1968
      - EU TCF – 600A1970
    - Not tested or certified to IEC 60335-2-34 and Annex AA
    - Not tested or certified to IEC 60079-15 Clause 22.4
- Controller
  - Certifications
    - UL File E197896
    - CSA C22.2 NO. 140.2-96, 4<sup>th</sup> Ed
    - CE
      - Machinery Directive 2006/42/EC Ed. 2.2 – October 2109
      - EMC Directive 2014/30/EU
        - CISPR 25, Limits and methods of measurement for the protection of on-board receivers
        - SAE J1113-2, EMC Measurement Procedures and Limits for Vehicle Components (Except Aircraft)-Conducted Immunity, 15 Hz to 250 kHz-All Leads.
        - SAE J1113-4, Immunity to Radiated Electromagnetic Fields-Bulk Current Injection (BCI) Method.
        - SAE J1113-11, Immunity to Conducted Transients on Power Leads.
        - SAE J1113-13, EMC Measurement Procedure for Vehicle Components - Part 13: Immunity to Electrostatic Discharge
        - SAE J1113-21, EMC Measurement Procedure for Vehicle Components - Part 21: Immunity to Electromagnetic Fields, 30 MHz to 18 GHz, Absorber-Lined Chamber.
      - EMC Directive E/ECE/324/Add.9/Rev.6–E/ECE/TRANS/505/Add.9/Rev.6, Addendum 9: UN Regulation No. 10 dated 20 November 2019
        - CISPR 25, Radiated Emissions, 30 MHz to 1.0 GHz, ALSE Method
        - ISO 11452-2, Immunity of ESA's to electromagnetic radiation – Radiated, 20 MHz to 2 GHz
        - ISO 11452-4, Immunity of ESA's to electromagnetic radiation – Conducted, 20 MHz to 200 MHz
        - ISO 7637-2, Immunity to and emission transients of ESA's
      - RoHS & REACH Compliant
      - EU DOI – 600A1968
      - EU TCF – 600A1969

## Intended Use

### Datasheets, Specifications, Drawing, and Application Notes

The intended use of the compressor and controller is defined in the Products Specifications, Datasheets, Electrical and Mechanical Drawings, Assembly Instructions, and Application Notes. These documents can be found at [www.masterflux.com](http://www.masterflux.com).

The documents found on the website are controlled and supersede any/all other documents, including any marketing or sales literature. The Declarations of Incorporation for the compressors and controllers are also available on the website. These documents must be read and understood and followed to ensure safe handling, operating, servicing, and use of the equipment in the end-use product. Furthermore, it is expected that the reader of this document must understand and follow these documents. If, after reading all the available documents, there are any questions or concerns, contact Masterflux Application Engineering.

## Transportation and Storage

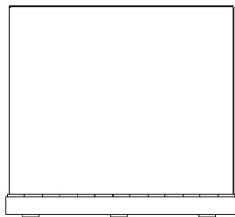


Always keep the compressor in an upright position. Always use proper personal protective equipment when handling manually. All compressors are shipped from the factory in bulk packs or single packs. Keep packaging dry at all times. Do not stack bulk packs.



ESD preventative measures must be taken when transporting and storing the Controllers – See the ESD Handling document on the Masterflux website.

All compressors and controllers are shipped from the factory in bulk pack or single pack.



### Compressor Bulk Pack

Up to 4 Layers of 25  
Compressors,

Dimensions 100 pcs:  
118cm x 113cm x 108cm  
(46.5"x40.5"x42.5")

Weight 100 pcs:  
726 kg (1600 lbs.)

Do Not Stack



### Compressor Single Pack

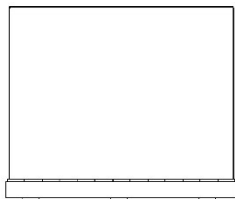
1 Compressor per pack

Dimensions:  
27cm x 27cm x 27cm  
(10.5"x10.5"x10.5")

Weight:  
7.5 kg (16.5 lbs.)

Do Not Stack more than 3 high

Do Not Stack



### Controller Bulk Pack

20 or 24 Controllers per  
box, 8 Boxes per pallet

Dimensions:  
110cm x 110cm x 110cm  
(43"x43"x43")

Weight: Approx.  
175 kg (386 lbs.)



### Controller Single Pack

1 Controller per pack

Dimensions:  
18cm x 25cm x 15cm  
(7"x10"x6")

Weight:  
1.2 kg (2.6 lbs.)

Do Not Stack more than 4 high

## Handling



Do not use the suction accumulator, or suction tube to lift or move the compressor. Some edges of the compressor may be sharp. Move compressors with proper mechanical or handling equipment. Do not handle or move the compressor by the suction accumulator or tubes.



ESD preventative measures must be taken when handling the Controllers – See the ESD Handling document on the Masterflux website – Separate section

## Additional Compressor Considerations

### Mounting

The SIERRA compressors are designed to be mounted on a solid level base. Mounting must be performed using vibration-dampening rubber grommets, steel sleeves to hold the grommet in place, and fasteners for mounting. Fasteners are not supplied by Masterflux. When designing the SIERRA compress into your application, make sure to leave space between the compressor and other components to allow for the compressor to move during start-up, operation, and shut down. To ensure proper oiling, the SIERRA compressor can be mounted up to 30° from vertical in the final application. SIERRA Tilt Requirements are available for reference at [www.masterflux.com](http://www.masterflux.com).

| Mounting Kit Part Number | Description                              | Grommet | Qty | Sleeve | Qty |
|--------------------------|------------------------------------------|---------|-----|--------|-----|
| LP96                     | 1" Tall Grommet with 1/4" Bolt Hole      | 70941   | 3   | 71000  | 3   |
| LP157                    | 1" Tall Grommet with 5/16" Bolt Hole     | 70941   | 3   | 70953  | 3   |
| LP158                    | 5/8" Tall Grommet with 5/16" Bolt Hole   | 70711   | 3   | 70459  | 3   |
| LP100                    | 13/16" Tall Grommet with 5/16" Bolt Hole | 70794   | 3   | 70970  | 3   |

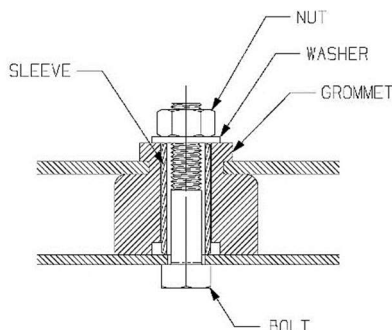


Figure 1 – Typical Assembly of Mounting Hardware

## Oil

SIERRA compressors are provided with an initial oil charge from the factory. See the datasheet for your compressor to determine the appropriate oil type and oil charge amount.

The oils used are very hygroscopic and exposure to the air can cause the oil to absorb moisture. Corrosion and copper plating can occur if the moisture level in the oil is too high. A properly sized filter/dryer must be installed in the system to minimize moisture.

Evacuate the system to a minimum of 200 microns, with a vacuum pulled from both the low and high-pressure sides of the system. Care must be taken to prevent moisture from entering the system components before assembly. Proper evacuation could take longer to reach acceptable limits of system moisture and non-condensable. Masterflux recommends a maximum of 2% non-condensable and 80 PPM moisture in the oil. The completed system should have a moisture level of 10 PPM or less after running, with an appropriate filter/drier installed. Masterflux does not recommend using oil additives and adding additives may result in malfunction or premature failure of the components in the system.

## Suction and Discharge Connections

The size and location of the discharge and suction connections are shown in DCMX drawings and datasheets of your specific compressor. The drawings and datasheets are available at [www.masterflux.com](http://www.masterflux.com)

## Vibration

Rotary compressors do not have internal mounting springs in contrast to reciprocating compressors. The internal design and external mounting are designed to reduce vibration. However, some vibration is transmitted to the suction and discharge tubing. Masterflux recommends designing the tubing to prevent vibration from being transmitted to the rest of the installation. Annealed copper tubing is recommended to be used rather than hard-drawn copper tubing. Flexible tubing or hoses can also be used. Figure 2 shows a potential design for tubing connections.

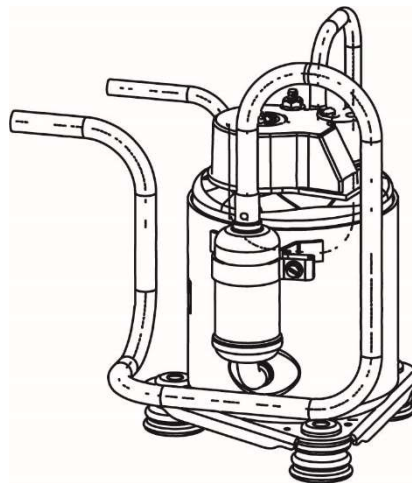


Figure 2

## Oil Return

Tubing must be properly sized and designed to not create oil traps in the system and allow the oil to properly return to the compressor. Insufficient oil in the compressor, can lead to premature bearing failure or seizing of the mechanism.

### Brazing



The suction and discharge tubes must be clean and free of burrs to ensure proper brazing. To minimize moisture entering the compressor, do not remove the tube plugs until the compressor is mounted in the system and ready for brazing. Use a 5/60 so similar brazing alloy with a high tensile strength. See Caution should be taken when brazing, as the high temperatures may cause damage to components or wiring. Complete any brazing before installation of the controller or wiring as damage could occur from the high temperatures

### Electrical Connections



Figure 3 shows an exploded view of the compressor electrical assembly. When assembling use the following, Torque the #10-32 Terminal screws to 12-18 in-lbs. If, Metric connectors are being used, Torque M5 Terminal screws to 1.5-2.2 N-m. Torque the Terminal cover nut to 15-20 in-lbs. Figure 4 shows assembling the cable harness to the terminals. Ensure all electrical connections are attached and secure. Terminal Cover must be installed for operations. Terminals and connectors are employed for factory wiring only. The acceptability of the connections shall be determined in the end-use application.

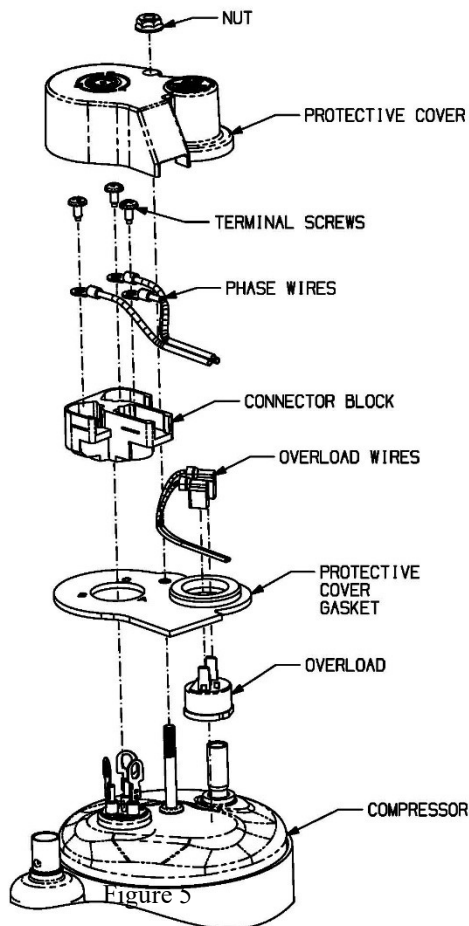


Figure 3



Set Connector block over the terminals.

Fold down each terminal so that they are flush with the screw hole

Place the Phase wire ring terminals on the folded over terminals

Fasten the ring terminals to the connector block. Use correct screw for terminal

Figure 4

## Wire / Cable Specifications

Cable harnesses are not supplied with the Compressor or controller. Compressor Cable harness drawings can be found on [www.masterflux.com](http://www.masterflux.com). These drawings are for reference only and can be used when designing a cable harness for your specific application. Wire gauge, insulation and terminals must be suitable for the application.

## Compressor Ground



The compressor must be connected to an earth ground before operating. The SIERRA compressor mounting plate incorporates through hole(s) for grounding. Figure 5 shows one of the Ground locations provided. A thread cutting screw and a ring terminal are recommended to secure the ground wire to the compressor. Wire gauge, insulation and terminals must be suitable for the application.

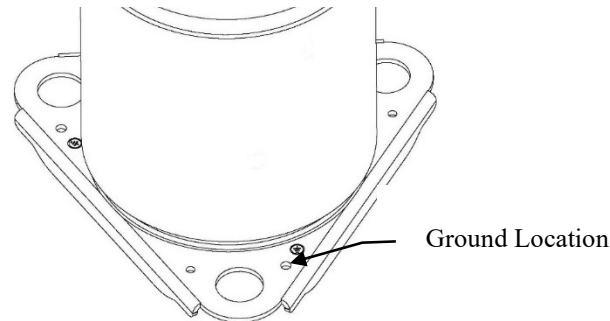


Figure 5

## Additional Controller Considerations

### Mounting



The controller can be mounted in any orientation using the mounting holes provided. The controller can be mounted using screws or bolts, depending on the end application. The fins of the heatsink must be mounted in line with airflow to properly provide cooling for the controller. A Bonding terminal for the FET heat sink is not provided and the heat sink shall be mounted to a grounded metal surface. Refer to the electrical diagram for proper wiring and connector details. The controller may have sharp edges and must be mounted to not cause injury to personnel.



**ESD Sensitive equipment!** – To protect against static electricity, use protective equipment when handling the controller - anti-static mats and wrist straps.



**Electrical Shock Hazard!** Always disconnect and lockout power before servicing. Refer to the electrical diagram for proper wiring and connector details. Electrical connections must be made by qualified electrical personnel.

## Wiring Diagram



Figure 6 shows a typical wiring diagram for a SIERRA compressor and controller. Masterflux suggests that an appropriately sized fuse is to be installed on the (+) power to the controller for electrical protection. Wiring and wiring methods shall comply with the requirements of the end-use product standards. Wire connecting means shall be such that the electrical spacings are not reduced below the acceptable minimums. Wiring shall be routed as to prevent damage to insulation and is supported in such a manner that it does not contact moving or vibrating parts or sharp edges. Wire gauge, insulation and terminals must be suitable for the application.

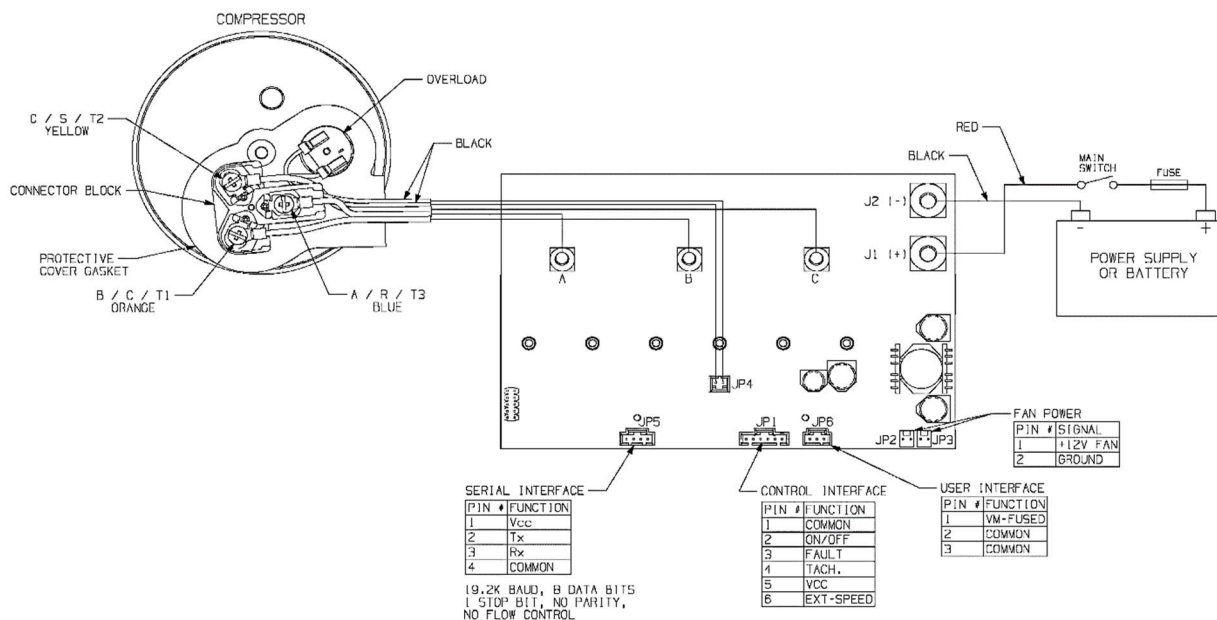


Figure 6

## Enclosure Requirements



The Controller is provided as an open controller board and the following items must be considered in the end product enclosure:

- Shock hazards may be present and must be considered in the installation of the controller in the end application.
- Protection from the environment must be incorporated in the end application.
- EMC considerations must be included in the end application.
- ESD protection considerations must be included in the end application.

## In-Rush Current



When the compressor starts, the controller will experience current In-Rush. This must be considered when selecting components and wiring for the end product – This is a safety issue and must be addressed by the OEM

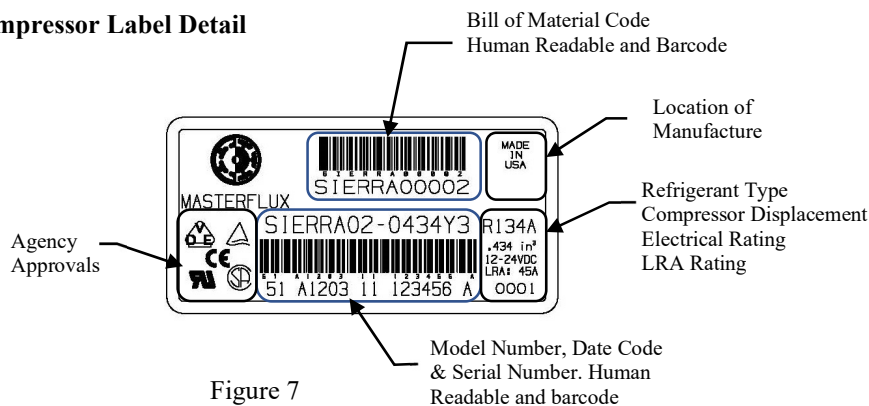
## Speed Limitation

The controller is designed to provide a constant speed for the compressor as commanded by the speed set-point independent of motor voltage and load. However, a reduction in speed of the compressor will occur if the average current that the motor requires to maintain the commanded speed, exceeds 55Amps. This speed reduction can also occur if the motor supply voltage is not high enough to reach the commanded speed. This is normal operation and is expected.

## Labels

The Compressor and Controller labels are applied at the factory and must not be removed or modified. The labels contain basic electrical information, or full electrical information and ratings for your specific model, you must refer to the Product Specifications and Datasheets located on [www.masterflux.com](http://www.masterflux.com). Figures 7, 8, and 9 show the labels and give a brief description of the information contained in them.

### Compressor Label Detail

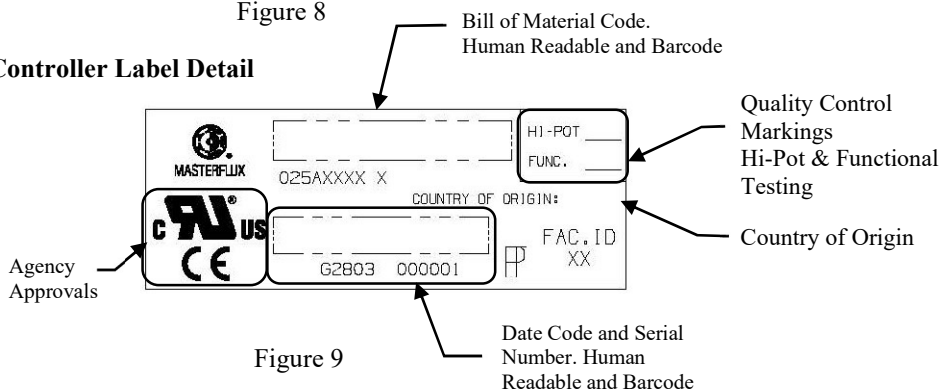


### Compressor

### Warning Label



### Controller Label Detail



## Initial Start-up



- Visually check that the wiring is correct, and the connectors are secure and properly connected and that the protective cover is properly attached.
- Verify the system is properly charged with refrigerant.
- Verify that the compressor and controller are properly grounded.
- Do not start the compressor with the system in a vacuum.
- Verify that all circuit protection components and safety controls are in place and functional.
- Verify that the incoming power source is correct.
- Verify that no one is in contact with the equipment and proper clearance of any flammable materials is maintained.
- Verify that all fans are properly installed and operational.

## Maintenance and Diagnostics

SIERRA compressors and controllers are not designed to be serviceable and must be replaced with direct replacement parts from Masterflux.

### Maintenance

It is expected that the OEM will develop, communicate, and ensure comprehensive and routine inspection and maintenance of the End product, including cleanliness of the coils and proper system charge. As it relates to the compressor and controller the following points should be considered:

- Periodic inspection should be performed to ensure that the equipment is operating correctly.
- This inspection must be performed when the electricity has been disconnected and locked out and the compressor has been allowed to cool and the controller has discharged and is safe to touch.
- Inspect electrical connections and tighten to the specified torque, if necessary.
- Inspect the wiring for signs of wear or abrasion.
- Following ESD precautions, Check the controller for a buildup of dust, dirt, or moisture. Clean Heatsink fins if needed.
- Check that the Protective cover is properly installed, and the nut is tightened to the specified torque.
- Inspect the tubing for signs of leakage or breakage.
- Inspect mounting hardware for signs of wear or loosening.
- Check that all circuit protection components and safety controls are in place and functional.
- Make sure all fans are operational.

### Replacing a compressor



Before removing a compressor from a system, the refrigerant charge must be recovered from both the high and low-side of the system using proper refrigerant recovery equipment and trained personnel.  
**Do Not vent refrigerant in the air.**

**Diagnostics**

The serial port connector on the controller is used for diagnostic purposes. Wiring and pinout can be found in the Electrical drawings and the Product Specifications found on the Masterflux website. A USB Diagnostic Tool (030F0135) is available from Masterflux and instructions for using can be found on the website. The diagnostic tool allows the controller to send status messages to a computer via a serial or USB connection. The output includes:

- Temperature of Heatsink in °C
- Voltage
- Current – Average current delivered to the motor
- Motor Speed in RPM
- Fault codes, if any.

The fault codes and descriptions can be found in the Product Specification, available on the Masterflux website.

**Once a fault is detected, the underlying cause for the fault must be corrected before continuing operation.**

**If there are any questions after reading these assembly instructions and all other related documents, please contact Masterflux Application Engineering**

## Important Product Notice

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