
Installation, Operation & Troubleshooting for Texas Instruments 41AA Motor Protection Modules

**SUBJECT: Installation Operation & Troubleshooting Texas Instruments (TI)
“KLIXON” 41AA Motor Winding Protectors**

**APPLICATION: 110mm & 127mm Medium Screw Compressors &
Big 4 Semi-Hermetic Compressors**

Hartford Compressors Inc. is presently supplying the TI module, model 41AA standard with all compressors. It is designed to protect the motor from excessive motor winding temperatures. The 41AA module has the capability to monitor motor-winding temperatures only. See service bulletin # SB22a for information on the TI model 2ACE module.

There is presently only one 41AA module being offered by HCI for use in our compressors. Do not attempt to install a substitute with a different TI model number!

HCI Part #	Texas Instrument Part #	Thermister Type
055970A1*	41AA1500E	PTC (TI)

*This part number is for a module only. This is the module that is supplied as standard with all new (OEM) compressors.

INSTALLATION

Many operating problems can be avoided if the module is properly installed. Here are some helpful hints on installing the module.

LOCATION

- Normally, this module is installed in the compressor terminal box. If installed in a remote control panel, the panel must be well ventilated.
- Maximum ambient temperature is 150°F

INSTALLING AND WIRING MODULE POWER

- Module input power to terminals **L1 & L2**
- Input voltage must be between 98 & 132 VAC (120 VAC service) or 196 to 265 VAC (240 VAC service)
- Do not ground wires
- To protect the module components, install a ½ amp quick-blow in-line fuse from the power supply

SENSOR WIRING

- Wire sensors to **C, S1, S2 & S3**
- The sensor wires must match the motor terminals and the module terminals
- If the module is mounted remote to the compressor, the sensor wires must run in a separate wire conduit from the power wires
- This wire conduit should be installed separately from the main power run

NOTE: "C" is **NOT** a common or ground. Do not connect this terminal to any type of ground.

MODULE RELAY

- Terminals **M1 & M2** tie in to a normal open (N/O) relay in the module.
- These terminals are to be wired to the compressor control circuit in such a way as to shut the compressor off if this relay opens. It is recommended that it break the circuit to the compressor contactor coil.

GENERAL

- Do not ground any wires.
- No jumpers are to be used.

OPERATION

- The 41AA module functions in conjunction with sensors that are imbedded in the motor windings
- The sensors are positive temperature coefficient (PTC) thermistors
- Three sensors are connected for normal operation and one is installed as a spare
- They are preset to trip at a predetermined temperature

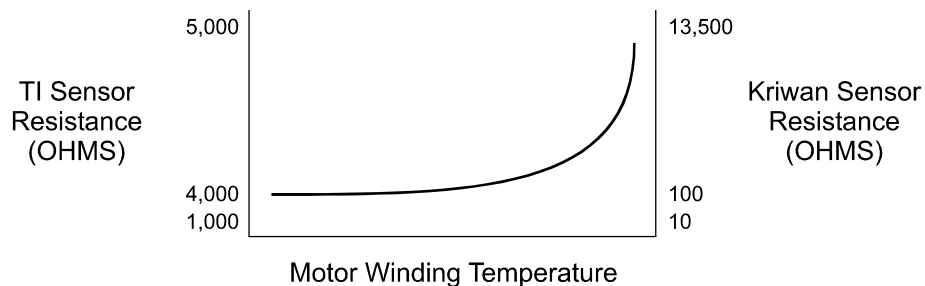
Compressor	Trip Point
Big 4 (Recip)	266°F (130°C)
MSC	302°F (150°C)

- The module senses the resistance of the sensors.
- When the motor winding temperature reaches the set point, the module opens a set of contacts between terminals M1 and M2. These are wired to the compressor's control circuit shutting down the compressor.
- In order to reset the module, the power to the module must be interrupted.
- This is normally accomplished with a normally closed (N/C) push button.

- Refer to the attached wiring diagram showing the recommended method of wiring the control.

When reading the sensor resistance, the sensor wires **MUST** be disconnected from the control module. Otherwise an erroneous reading will result.

- Refer to SB35 for resistance readings for TI & Kriwan sensors.



Note: When troubleshooting, it is important to realize that, once the compressor shuts down, the motor winding temperature will decrease rapidly and the resulting PTC resistance will also drop rapidly. For this reason, all resistance readings should be taken as soon as possible after the module trips.

TROUBLESHOOTING

- The 41AA module will reset automatically if supply power is lost and regained.
- For all other faults, the module will not reset automatically
- To reset the module, the power must be interrupted to the module.
- As mentioned earlier, this is normally accomplished with a normally closed (N/C) push button.
- Refer to the attached wiring diagram showing the recommended method of wiring the control.

NORMAL CAUSES OF HIGH MOTOR WINDING TEMPERATURES

- If the motor is overloaded, the amperage will increase resulting in a rise in motor winding temperature above the normal operating temperature.
- A large voltage imbalance will cause the amperage to rise abnormally resulting in an increase in the motor winding temperature. The phase to phase voltage imbalance should be limited to a maximum of 2%.
- On Big 4 compressors, high suction temperature can be a problem. If the suction temperature becomes extremely high, this will result in a high motor temperature because the motor is cooled by suction gas.
- For Medium Screw Compressors, applied to air-cooled installations, the motor is indirectly cooled using liquid injection. When the package goes into a “pumpdown” mode, the liquid injection shuts off. This may allow the motor windings to approach the trip point and trip the module even though the compressor has actually shut down. The solution is to install a separate liquid injection line with solenoid or limit the pumpdown time.

OTHER CAUSES OF MOTOR WINDING PROTECTOR MODULE TRIPS

It has been our experience that, being a solid state control, the module can be susceptible to nuisance trips. We have listed some other problems that may cause the module to trip.

- Loose wires. All wire connections must be tight. Check all connections, especially the thermistor wires.
- Check the module power supply. It must be within the parameters described above.
- Check control voltage quality. Sudden spikes in the supply power can cause the module to trip.
- Induced Voltages: If the module is installed in a remote control panel, the sensor wires must be run in a separate conduit from the main power wires. If run in the conduit with the main power wires, the voltage from the power can cause erratic readings of the sensors.
- Defective sensor. A defective sensor will be open, giving a resistance reading of infinity. In rare instances, the sensor may appear to be operating correctly but it will open shortly after the compressor runs. Follow the instructions for troubleshooting a sensor that opens sporadically. If one of the sensors is defective, it can give a "trip" signal to the module. If a sensor is determined to be defective there are two solutions to remedy the problem. See section on repairing a defective sensor.
- High Ambient temperatures. If the module is subjected to temperatures in excess of 150°F, it will trip.

LOCATING A SENSOR THAT OPENS SPORADICALLY

In rare cases, a sensor will only open when the compressor runs. It will close again when the compressor is shut down. Use the following instructions to find the defective sensor.

When running these tests; closely monitor temperatures and pressures to be sure that the compressor motor does not overheat. It is recommended that a thermometer be installed on the discharge line within 6" of the compressor. The discharge line temperature should not be allowed to go above 170°F.

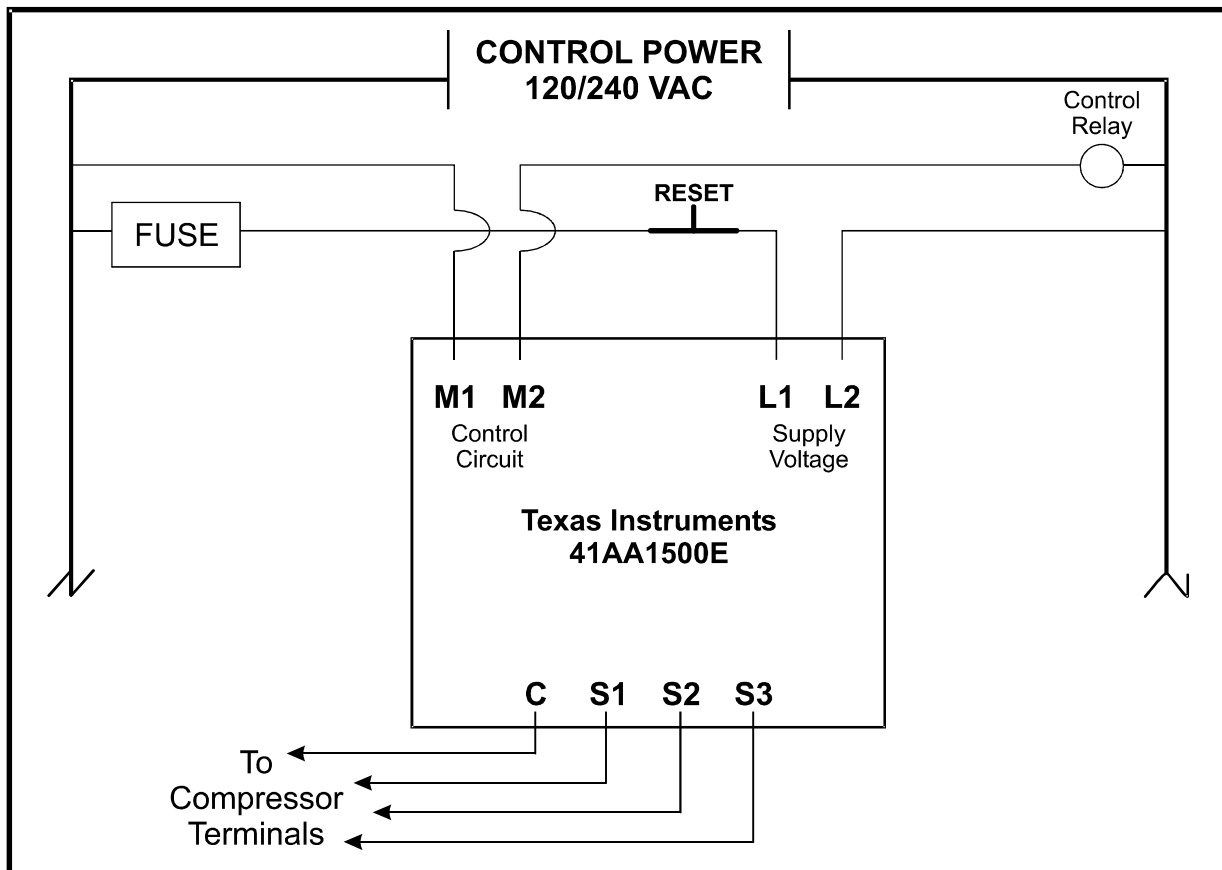
1. With the compressor shut down, disconnect the four sensor wires (C, S1, S2 & S3) from the module and install three, 1000 ohm resistors in the module between terminals C and S1, C and S2, C and S3.
2. Run the compressor normally for, between 30 and 60 minutes.
3. If the module trips, the module is bad.
4. If the module does not trip the compressor, remove the resistor between C and S1. Connect wires C and S1 between the compressor and the module
5. Run the compressor for another 30 to 60 minutes.
6. If the module trips, that sensor is bad. Replace the resistor.
7. Shut down the compressor and repeat steps 4, 5 & 6 with sensors S2 and S3.
8. Once you have determined which sensor(s) is bad, continue with the following repairs

REPAIRING DEFECTIVE SENSORS

If a temperature sensor is determined to be defective there are two accepted solutions to the problem. The first is to use the spare sensor. The second is to jump out the defective sensor and install a 1500 ohm resistor between the sensor and the module.

USING THE SPARE SENSOR

- Except on some early production compressors, there is a spare sensor installed on the S4 terminal of the four-post feedthru. Call HCI Application Engineering department for problems in locating the spare sensor installed in the compressor.
- If the spare sensor is used, it is recommended that a note be placed on the outside to inform future Service Technicians.
- If, after using the spare sensor, there is still a defective sensor, contact the HCI Application Engineering department for further instructions.


TYPICAL WIRING DIAGRAM (41AA)