ICM441

Motor Protector

Installation, Operation & Application Guide

For more information on our complete range of American-made products – plus wiring diagrams, troubleshooting tips and more, visit us at **www.icmcontrols.com**

Caution

Installation of the ICM441 shall be performed by trained technicians only. Adhere to all local and national electric codes.

Disconnect all power to the system before making any connections.

Specification

ENVIRONMENTAL

Epoxy Encapsulated: For use in extreme environmental conditions
Connection Terminals: 0.25" male spade terminals
Temperature Range: -40ºC to 85ºC (storage) -40ºC to 70ºC (operating)
Maximum Operating/Storage Relative Humidity: 95% non-condensing
Sensor Shorted, Open, Over Temperature Detection: 0.1 second maximum
Power Loss Detection: 0.1 second maximum
Nominal anti-short cycle Time: 4 minutes (+/- 60 seconds)
Case Dimensions: 3"L x 3.25"W x 1.5"H

ELECTRICAL

User Selectable Operating Voltage: 90-140 VAC RMS and 185-270 VAC RMS (based on field wiring)
Low Voltage Cutout: 85 (+/-5.5) VAC RMS (using 120 VAC input) 170 (+/-10) VAC RMS (using 208 VAC input)
Over Temperature Trip: Any one sensor input in excess of 11KΩ (+/- 1KΩ)
Over Temperature Reset: All three sensor inputs must be less than 3KΩ (+/- 500Ω)
Shorted Sensor Trip: Any one sensor input less than 250Ω (+/- 50Ω)
Shorted Sensor Reset: All three sensor inputs must be greater than 500Ω (+/- 100Ω)
N.O. Relay Contact Rating (M1, M2): 2.5 amps resistive @ 277 VAC RMS 2.5 amps inductive @ 277 VAC RMS
Low Power Consumption: 23mA (nominal) @ 120 VAC @ 25ºC 21mA (nominal) @ 240 VAC @ 25ºC
Terminal "L2" is Not Internally Connected: Provided for backward compatibility to competitor models. Not required for new installations
Temperature Sensors: Monitors industry standard (3BA and 10BA sensors)

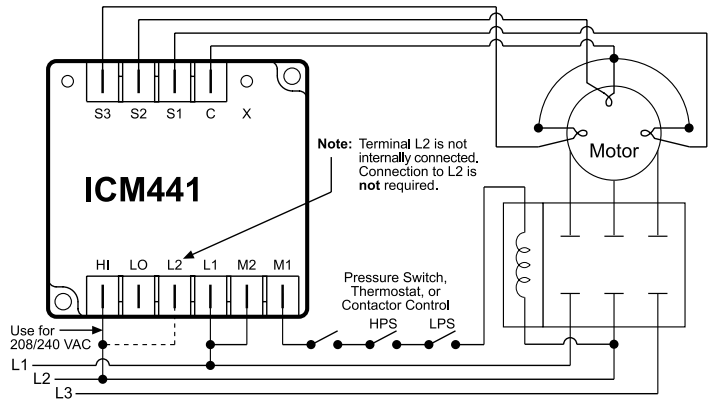
ICM441 Cross Reference Guide

ICM #	T.I. #	Mars #	Copeland #	Bristol #
441	31AA1606 E			241680
	15AA1603 B	37304	**Replaces:** 071-9800-01 **Used On:** Copeland: GR, SE	
	15AA1603 C	37306	**Replaces:** 071-9800-00 **Used On:** Copeland: GR, SE	
	31AA1600 E	37322	**Replaces:** 071-0376-01 071-0397-00 071-0424-00 071-0376-02 071-0397-01 071-0424-01 **Used On:** Copeland: 4R, 6R, BR, M, 2D, 3D, 4, 6, 8, both Reed & Discus models	
	15AA1600 B	37300	**Replaces:** 071-0376-02 071-0397-01 071-0424-01 **Used On:** Copeland: 4R, 6R, BR	
	15AA1600 C	37302	**Replaces:** 071-0376-01 071-0397-00 **Used On:** Copeland: 4R, 6R, BR	

Mode of Operation

The **ICM441** is designed to individually monitor 3 PTC temperature sensors which are wound into each phase winding of a motor. If any winding or incoming line power is beyond the safe operating range of the motor, the **ICM441** will lock the motor out of operation until the inputs fall back into the safe operating range. The **ICM441** can sense shorted or open sensors, in addition to providing isolation to each sensor to prevent damage to the monitor in the event a sensor shorts to a winding or case ground.

ICM441 System Wiring Diagram



Installation

This installation is only to be performed by a qualified electrician in accordance with NEC standards.

Ensure all power to both motor and control circuits is removed before starting installation. Verify there is no voltage present with a voltmeter.

This control is typically installed on a three phase motor, where the power for this control comes directly off one set of phases to the motor (see System Wiring Diagram). If you have an installation where a step-down transformer drops the voltage supply for this control, please see the section titled "Step-Down Transformer Installations."

In applications where this control replaces an existing motor protector of the same voltage and sensor ratings, label each wire connected to the defective unit before you remove it from that control. Terminal designations should correspond to terminals on the **ICM441**.

Step 1: Verify sensor integrity

There should be four (4) small gage wires coming from the motor housing, which connect to internally-wound sensors. There are three sensor wires, and one sensor common wire. At normal temperature, a motor which has been de-energized for at least one hour will have sensors with a normal operating resistance of approximately 1KΩ. A sensor must be in the range of 500Ω to 3KΩ when measured with a resistance meter between the sensor common wire and each sensor wire (S1, S2, and S3). If a sensor is found outside of this range, you must deactivate that sensor from all sensing, as described in the section labeled "Bypassing A Sensor."

Step 2: Connect all sensor wires

There should be four (4) small gage wires coming from the motor housing, which connect to internally-wound sensors. There are three sensor wires, and one sensor common wire. The sensor common wire connects with female 1/4" quick-connects to the **ICM441** terminal "C" (common). All of the individual sensor wires connect to the **ICM441** terminals "S1, S2, and S3" with female 1/4" quick-connects.

Connect sensor wire S1 to terminal "S1," connect sensor wire S2 to terminal "S2," and connect sensor wire S3 to terminal "S3." The order of these sensors is not important, simply ensure that each sensor wire is connected to a sensor input on the **ICM441**. Consult the System Wiring Diagram should any other questions arise.

Step 3: Connect the control circuit

There is always a contactor that supplies operating current to the motor this device protects. This contactor has an internally wound coil with a specific operating voltage rating. Ensure the operating voltage rating of this coil is in the range of 24 VAC to 277 VAC, since the **ICM441** has a maximum rating of 277 VAC on its internal control contacts.

Usually, one side of the contactor coil is connected to power common. Whether a transformer is used to step-down the control voltage (see the section titled "Step-Down Transformer Installations") or if it is powered by line voltage, one side of the coil is typically connected directly to this common. Leave this connection to the contactor coil as is.

The other side of the contactor coil typically is energized by "hot" through a series of switches, usually by some type of thermostat, pressure switch, or safety switch. Remove this "switched side" coil wire from the contactor coil and connect to the **ICM441** terminal "M2" using a 1/4" female quick-connect. Fashion another wire with female 1/4" quick-connects on both ends to connect between the **ICM441** terminal "M1" and the "switched side" of the coil you just removed the wire from. Consult the System Wiring Diagram should any other questions arise.

Step 4: Supply operating voltage to the ICM441

The operating voltage required for this unit is 120/240 VAC, 50/60 Hz. Determine what voltage range will be supplied to the **ICM441** and connect voltage as follows:

- 85-135 VAC: Connect Neutral (or "common" on step-down transformer applications) to the terminal labeled "L1" on the **ICM441**, via a 1/4" female quick-connect. Connect L1 (or "hot" on step-down transformer applications) to the terminal labeled "LO" on the **ICM441**, via a 1/4" female quick-connect. You may connect an additional wire between terminals "LO" and "L2" on the **ICM441**, but this option is not required. Terminal "L2" has no internal connection, it is provided for backward compatibility to other models of motor protector.
- 185-277 VAC: Connect L1 (or "common" on step-down transformer applications) to the terminal labeled "L1" on the **ICM441**, via a 1/4" female quick-connect. Connect L2 (or "hot" on step-down transformer applications) to the terminal labeled "HI" on the **ICM441**, via a 1/4" female quick-connect. You may connect an additional wire between terminals "HI" and "L2" on the **ICM441**, but this option is not required. Terminal "L2" has no internal connection, it is provided for backward compatibility to other models of motor protector.

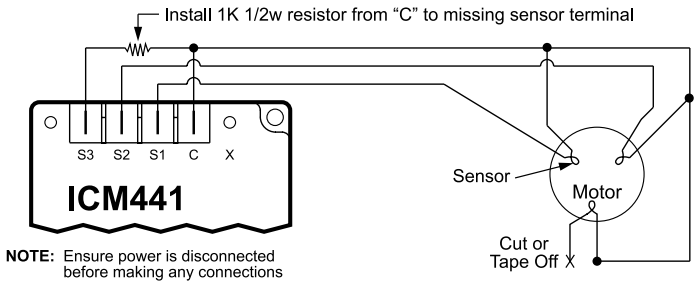
Consult the System Wiring Diagram should any other questions arise. Your **ICM441** is now ready for application of power to the motor and control circuits.

Bypassing A Sensor

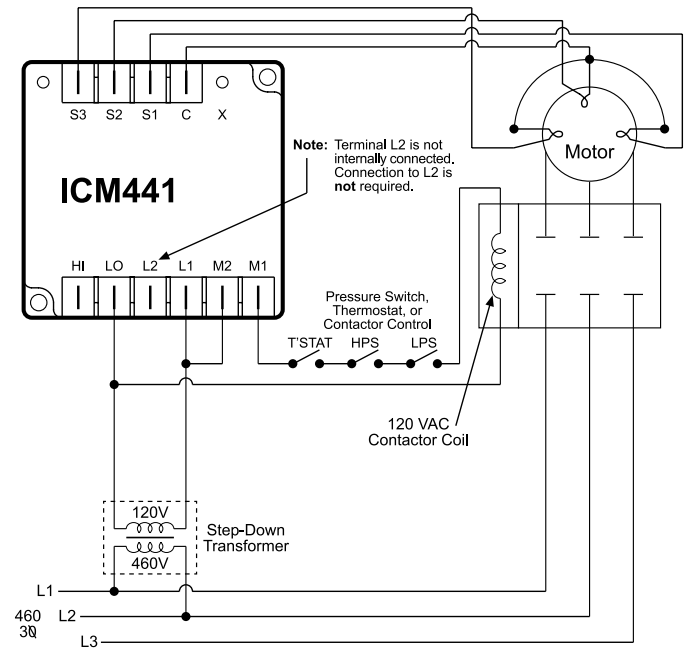
Since these sensors are internally wound into the winding of the motor, they are not field-replaceable. In the event that the resistance of a sensor is found to be outside of the 500Ω to 3KΩ range, the sensor must be properly bypassed in order for this motor protector to function.

To bypass a sensor, you must disconnect the defective sensor's wire from the **ICM441**, and connect a 1/2-Watt 1.0KΩ to 2.0KΩ resistor from terminal "C" to the open sensor terminal. These resistors can be purchased at any electrical hobby shop, such as Radio Shack. Consult the "Bypassing a Sensor" wiring diagram for an illustrative explanation.

Bypassing A Sensor Wiring Diagram

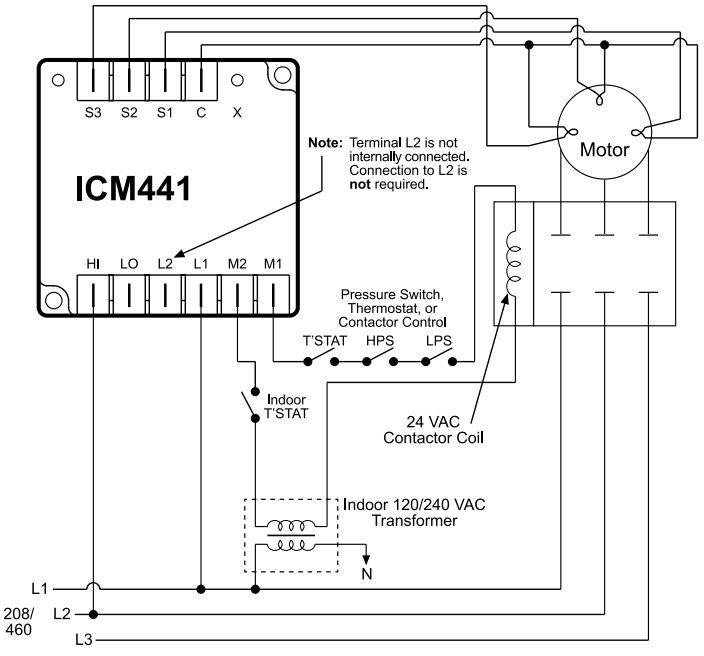


Step-Down Transformer Typical System Wiring Diagram (120-460 VAC)



Step-Down Transformer Powering ICM441 and Contactor

Step-Down Transformer Typical System Wiring Diagram (120-240 VAC)



Step-Down Transformer Powering ICM441 and Contactor

Troubleshooting

Problem	Possible Cause	Corrective Action
Motor does not energize	Your control circuit is not calling for motor to energize	Measure voltage across terminals M1 and M2. A 0 Volt reading indicates either **ICM441**'s contacts are closed OR your control circuit is not calling. Check safety switches or thermostat.
	Incorrect voltage range selected to power input of **ICM441**	Rewire **ICM441** as listed above
	Incoming voltage is low	Measure between L1 and LO (120 VAC) or L1 and HI (208-240 VAC). Spec is 85±5.5 VAC (120 VAC) or 170±10 VAC (208-240 VAC). It may also be possible that the motor pulls down the line **AFTER** it is energized. Measure line voltage with contactor closed.
	Sensor is out of specification	Allow motor to cool if sensor is > 3KΩ. Bypass sensor if sensor resistance is >25KΩ. Bypass sensor if sensor resistance is <500Ω. Sensor may be shorting to a winding or to ground during operation, repair as necessary.
Motor turns off right after energized	Low voltage	Ensure voltage does not drop below spec when motor is energized. Measure voltage between L1 and LO or HI during motor start.
	Bad sensor	Sensor may be shorting to a winding or chassis during motor operation. Measure resistance of sensors while bypassing terminals M1 and M2. Bypass sensor if required.
Motor turns off after running for a while	Winding overheating	Check for phase unbalance or phase loss to motor. Check for low-voltage during operation. Control circuit may have also opened, check pressure switches or thermostat.
Motor was on, but will not re-energize	Anti-Short-Cycle Timer	Wait 5-minutes for built-in anti-short-cycle timer to time out. Defeat anti-short cycle timer by shorting terminal "C" to hidden terminal "X."
Motor was on, but will not re-energize	Motor over temperature	Verify motor temperature with a temperature probe. Measure resistance of sensors, if any sensor was over 10K-ohms, the **ICM441** will not reset until ALL sensors return below 3KΩ.

ONE-YEAR LIMITED WARRANTY

The Seller warrants its products against defects in material or workmanship for a period of one (1) year from the date of manufacture. The liability of the Seller is limited, at its option, to repair, replace or issue a non-case credit for the purchase prices of the goods which are provided to be defective. The warranty and remedies set forth herein do not apply to any goods or parts thereof which have been subjected to misuse including any use or application in violation of the Seller's instructions, neglect, tampering, improper storage, incorrect installation or servicing not performed by the Seller. In order to permit the Seller to properly administer the warranty, the Buyer shall: 1) Notify the Seller promptly of any claim, submitting date code information or any other pertinent data as requested by the Seller. 2) Permit the Seller to inspect and test the product claimed to be defective. Items claimed to be defective and are determined by Seller to be non-defective are subject to a $30.00 per hour inspection fee. This warranty constitutes the Seller's sole liability hereunder and is in lieu of any other warranty expressed, implied or statutory. Unless otherwise stated in writing, Seller makes no warranty that the goods depicted or described herein are fit for any particular purpose.

ICM CONTROLS™

Patent No. 424,953

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