



Two Speed  
ECMotor Controller

Installation and Owner Manual

## **WARNING**

The installation of this device should be done only by competent personnel, experienced in electrical wiring, and familiar with electrical codes. Contact with lethal voltages is possible during installation. Turn off the cooling system power and check with a voltmeter to determine that no voltage is present before beginning the installation.

## **Attention**

The Frigitek® ECMotor Controller is designed for use with Regal-Beloit two-speed EC motors only, and will not operate with single speed or variable speed motors.

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## Overview

### **EC motors and the Frigitek ECMotor Controller**

EC Motors are a recent invention in the field of small electric motors. The EC (Electronically Commutated) motors use internal electronic circuitry to control the operation of a permanent-magnet motor, resulting in dramatic efficiency improvements over other motors.

Because of lowering the amount of electricity used by EC motors, the amount of heat produced by them is also reduced. It is widely recognized that conventional shaded-pole evaporator fan motors contribute a significant amount of heat inside a refrigerated space. In fact, during periods when there is no traffic in and out of the refrigerator, the cooling system operates mostly to remove this motor heat from the refrigerator. EC motors typically produce only 45% as much heat as a shaded pole motor, and at low speed, (under Frigitek control), the heat output is reduced by 97%. Because of this heat reduction, and the resulting reduction of work required by the compressor, the energy saved at the compressor is nearly equal to the energy saved directly at the fan motors.

The Frigitek ECMotor Controller is a patent-pending product, designed especially for use with the Regal-Beloit two-speed EC motors. This Controller, when used with these motors provides the ultimate in energy conservation for the evaporator coils of walk-in coolers and freezers



The Frigitek ECMotor Controller functions by sensing the operational status of the refrigeration system—either cooling or idle. When the system is cooling, the Controller operates the evaporator fans at normal high speed. When the thermostat set point is reached and the cooling system goes to idle mode, the Controller switches the EC motors to low speed, reducing heat 97% and energy consumption by 95%.

The Frigitek ECMotor Controller can control any number and size of Regal-Beloit EC motors in an evaporator.

# System Components

## **Frigitek ECMotor Controller**

This patent-pending Controller allows operation of the EC motor(s) at two different speeds, depending on the cooling system status. It increases the savings provided by the use of the EC motor(s).

## **EC Motor(s)**

These are the motors, which will be used to replace the existing shaded pole motors in the evaporator. Normally they have modular connectors on their power cords, which match the connectors in many evaporator wiring harnesses.

## **Temperature Differential Sensor (TDS)**

The TDS senses the temperature difference across the evaporator's expansion valve. When refrigerant is flowing, there is a difference in temperature. When there is no refrigerant flow, there is no temperature difference.

## **Ice Sensor**

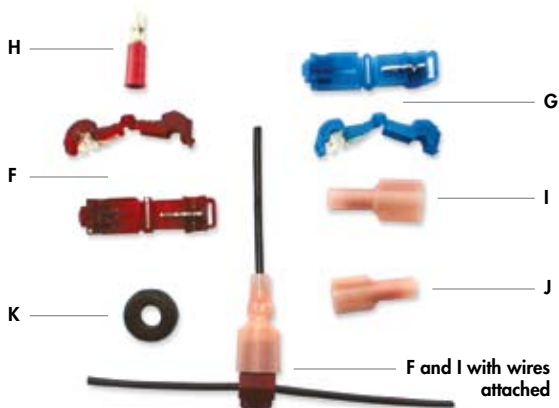
The Ice sensor is a thermistor which is inserted into the fins of the evaporator coil, and detects icing of the coil. It is not used in freezers.

## Accessory Kit

The Accessory Kit contains connectors and wire necessary for the installation of the EC motors and the Controller.

### Accessory Kit Contents

- A** Four-pin power source wire assembly (2 feet)
- B** Three-pin TDS wire assembly (15 feet)
- C** Split foam spools (2 each)
- D** Two-pin Ice Sensor wire assembly (5 feet)
- E** 18 gauge black wire (15 feet)
- F** Tee Taps Maroon 18-22 AWG (7)
- G** Tee Taps Blue 14-16 AWG (2)
- H** Male bullet connector (1)
- I** Female disconnects (6)
- J** Male disconnects (5)
- K** Rubber grommets (2 @ 1/4" x 3/8")
- L** Decal for outside of evaporator case (1)



## Installation Sequence

This is a list of the installation steps. Each step will be explained in detail in the following pages.

- 1** Turn off the cooling system power and check to see that no voltage is present before beginning work!
- 2** Determine that motors are compatible.
- 3** Remove all fan guards and fan blades.
- 4** Remove the old motors.
- 5** Remove both end panels from the evaporator coil.
- 6** Mount the Frigitek ECMotor Controller.
- 7** Install the 4-pin power source wire.
- 8** Install the Speed Control wire.
- 9** Install the ice sensor.
- 10** Install the Temperature Differential Sensor Assembly.
- 11** Install the EC motors, and fans.
- 12** Re-energize and test the system.
- 13** Replace end panels and fan guards.
- 14** Apply exterior decal label.

# Installation Steps in detail

## **1. Turn off power to the cooling system and check to see that no voltage is present before beginning work!**

It is common practice for the evaporator fans to be on the same electrical circuit as the thermostat circuit. Where this is the case, turning off the fans will have the effect of turning off the compressor also. If shutting off power to the fans does not stop the flow of refrigerant to the coil, it may be necessary to accomplish this through some other means such as finding the appropriate circuit breaker. We discourage adjusting the thermostat to accomplish this, but if that is the most practical means of stopping the flow of refrigerant to the coil, special care must be taken to insure that the thermostat is returned to the exact same setting after the installation is completed. This might include putting a pencil mark on the thermostat dial before moving it.

## **2. Determine that motors are compatible.**

Before investing time in an installation, determine that the motors about to be installed are compatible replacements for the existing motors. Check voltage, mounting, rotation (right or left), depth and shaft size and length. To do this will probably require removal of the fan guard from one of the motors.

### **3. Remove all fan guards and fan blades.**

Before removing the fans, notice the position of the fans in relation to the coil apertures so that they are reinstalled in the original position. This is important because mis-positioning the fan blades can cause the air flow to be less than required.

### **4. Remove old motors.**

Care should be taken not to damage the old wiring harness.

### **5. Remove both end panels from the evaporator coil case.**

### **6. Mount the Frigitek® ECMotor Controller.**

The ECMotor Controller is normally mounted inside the end of the evaporator case which contains the electrical wiring. Before determining the location for mounting, be sure that you leave adequate room for the three connectors on the left side of the controller. For convenience choose a location that will allow the use of a power screwdriver. If less than four screws are used, be sure that one of them is the grounding screw. The controller may be mounted in any position but mounting with the connectors on the top, should be avoided due to concern for moisture. It is also recommended that it not be mounted on the panel that separates the wiring cavity from the coils (on some makes) as the self-tapping screws could damage the coil tubing.

## **7. Install the 4-pin power source wire.**

Install one Tee Tap on each of the two power source wires to the fans. It is important to use slip joint pliers when closing the Tee Tap so that the jaws of the pliers are parallel. Squeeze just hard enough so that the two halves of the Tee Tap lock together. Do not strip insulation off of the wires before installing the Tee Tap. After both Tee Taps are installed, the two ¼" male disconnects may be plugged into each Tee Tap. If incoming power wire is larger than 18AWG use the blue Tee Taps supplied.

## **8. Install the Speed Control wire.**

Use the 18-gauge black wire, in the accessory kit, to make up the speed control harness. The male bullet connector will be installed on the end that connects to the third wire of the four-pin connector assembly. From there the wire should trace the fan wiring harness. At each fan motor, a leg from the speed control wire will be installed using the red Tee Taps furnished. From the end of the 18-gauge black wire, cut off a piece long enough to connect to each EC motor pigtail. This short leg will be plugged into the signal wire using the male disconnect, furnished. At the other end of the short leg, install one of the ¼ inch female disconnects. Follow the same procedure for each motor except the last one where you will install a female disconnect, after cutting off surplus wire.

## **IMPORTANT PRECAUTION**

**After each connection is made, from the bullet connector to the final disconnect, check the integrity of the connection by pulling on it. The best insurance for making sound connections is to use a high quality crimping tool.**

### **9. Install the Ice Sensor.**

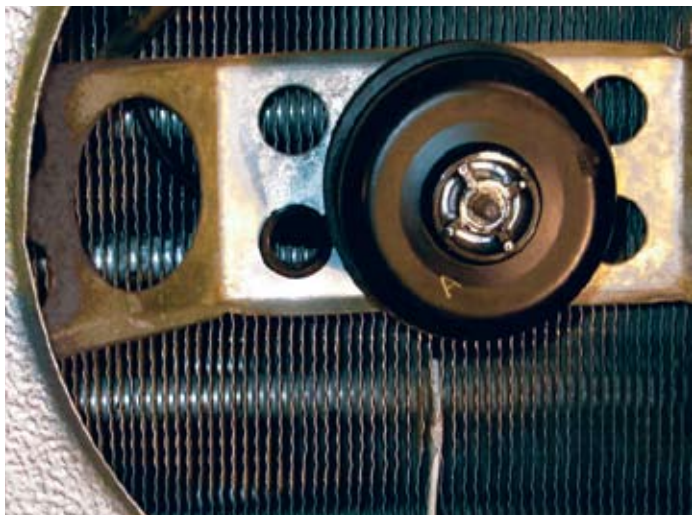
The Ice Sensor is used only in systems where the thermostat setting is above freezing.

## **IMPORTANT**

**It must never be used in a freezer, and serves no useful purpose in refrigerators equipped with a mechanical defrost system. It is strongly recommended that the ice sensors be used on all other systems.**

In boxes without a mechanical defrost system a high premium is paid in energy cost to maintain the box close to the freezing temperature. Persistent icing can have a number of causes. It can be the result of the thermostat being set too low for the system. It can be the result of dirty coils or doors being left open, or low refrigerant or even an undersized system.

The Ice Sensor, with the two-pin connector, is installed by placing the black sensor tip between the coil fins, immediately behind the fan motor nearest the controller. Ideally the tip of the sensor will terminate against and



#### Step 9: Ice Sensor Installation

slightly behind one of the horizontal tubes in the coil. Crimp the fins lightly over the wire to hold it in position as illustrated in the photo.

Do not, at this time, attach the two-pin connector to the controller nor remove the dark plastic cover from the two-pin receptacle. This will be done as a part of step 12. The brass wool inside the plastic cap provides continuity between the two pins. Without this continuity, the fans will run only in high speed. Therefore, this cap must be left in place, with the brass wool in it when the ice sensor is not used.

## 10. Installation of Temperature Differential (TDS) Assembly.

Assuming the evaporator coil is not mounted against the ceiling of the box, drill a  $\frac{7}{16}$ " hole through the upper portion of the coil housing at both ends. Beginning at the end with the electrical wiring, feed the forked end of the TDS assembly up through the  $\frac{7}{16}$ " hole and across the top of the box and down through the hole at the other end.



The TDS sensor ends installed on the piping in the evaporator coil.

One of the split foam spools will be installed on the incoming refrigerant line before it connects to the expansion valve. The second spool will be placed around refrigerant tubing down stream of the expansion valve, usually around one of the manifold lines. The zip ties may now be placed around the spools, **but left loose**, until after testing is complete (see photo). Install the two split rubber grommets into the  $\frac{7}{16}$ " holes around the TDS wire.

## **11. Install EC motors and fans.**

Install the new motors and connect them to the wiring including the signal sensor wire. After the motors are connected and mounted, install the fans. Be sure that the fans are properly placed in the aperture and the setscrews are sufficiently tight.

## **12. Re-energize and test the system.**

Before turning on the power, plug-in the three and four pin connectors. Turn on the power to the fans. They should run at low speed because the cover is still on the Ice Sensor connector and the TDS ends are at the same temperature. Assuming the Ice Sensor is employed, remove the two-pin cover. The fans should shift to high speed until the Ice Sensor connection is made. With the Ice Sensor connected the fans should now be running at low speed. If not, this might indicate that the coil temperature is below 33°F. If that is the condition, re-insert the Ice Sensor terminal cover (*including brass wool*). The fans will now shift to low speed. To test the TDS, grip one of the two black ends of

the TDS wire in your hand or otherwise warm it. Within 15 to 30 seconds the fans will shift to high speed. Similarly warm the second black tip and the fans should shift to low speed. Place the black tips of the TDS, one under each spool and snug up the zip ties just enough to hold the ends in place against the refrigerant tube.

### **13. Replace end panels and fan guards and install decal.**

Assuming all tests are positive, replace the end panels and the fan guards. Before the job is finished, install the decal, item “k” of the kit, on the outside of the end panel and reset the thermostat back to its original setting if it had been moved.

## Notes

## **ENERGY CONTROL EQUIPMENT, INC. LIMITED WARRANTY**

The Frigitek® Evaporator Fan Controller ("Unit") is warranted for Five (5) years from the date of original installation against defects in materials or workmanship. Energy Control Equipment, Inc., ("Manufacturer") will repair or replace this Unit, at its option and at no charge, with new or reconditioned parts or will exchange the Unit with a reconditioned Unit if found to be defective during the limited warranty period specified above. All replaced parts and/or replaced units become the property of Manufacturer and must be returned to Manufacturer. Replacement parts or units assume the remaining original warranty, or ninety (90) days, whichever is longer. Manufacturer authorized representatives must perform all warranty service, unless otherwise specified by Manufacturer. To seek warranty service, purchaser must first contact Manufacturer for problem determination and service procedures.

### **Coverage**

This limited warranty covers manufacturing defects in materials and workmanship encountered in normal use of this Unit and, as determined by Manufacturer, shall not apply to the following, including, but not limited to: damage which occurs in shipment; applications and uses for which this Unit was not intended; failures or problems which are caused by products or equipment not supplied by Manufacturer; accidents, misuse, abuse, neglect, misapplication, fire, water, lightning or other acts of nature; incorrect electrical line voltage, fluctuations or surges; damage caused by unauthorized installation, improper installation, or improper removal and reinstallation of the Unit; damage caused by failure to follow operating instructions; Unit alteration or modification; improper or unauthorized repair; cosmetic damage or Unit with altered serial numbers; use of non-Manufacturer or unauthorized parts, supplies, consumables, accessories or equipment which damage this Unit or result in service problems; failures or problems due to incompatibility with other equipment.

## Limits and Exclusions

There are no express warranties other than those listed and described above, and no warranties whether express or implied, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose, shall apply after the express warranty period stated above. No other warranty or guaranty given by any person, firm or corporation with respect to this Unit shall be binding on Manufacturer.

Manufacturer shall not be liable for loss of revenue or profits, failure to realize savings or any other benefits, or any other special, incidental or consequential damages caused by the use, misuse or inability to use this Unit, even if Manufacturer has been advised of the possibility of such damages. No recovery against Manufacturer of any kind shall be in an amount greater than the purchase price of the Unit sold by Manufacturer and causing the alleged damage.

Without limiting the foregoing, purchaser assumes all risk and liability for loss, damage or injury to purchaser, purchaser's goods and property, and to others and their property, arising out of the use, misuse or inability to use this Unit sold by Manufacturer not caused directly by the negligence of Manufacturer.

This limited warranty shall not extend to anyone other than the original purchaser of this Unit, is nontransferable and states your exclusive remedy.

Because some states do not allow the exclusion of limitation of liability for consequential or incidental damages, the above limitation may not apply to the purchaser. In such states, Manufacturer's liability is limited to the greatest extent permitted by law.



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