Fisher&Paykel
appliances

Service Manual

ELECTRONIC COMPACT SERIES REFRIGERATOR FREEZER

Models

E169T, E249T, E240B

517795

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The specifications and servicing procedures outlined in this manual are subject to change without notice.

The latest version is indicated by the reprint date and replaces any earlier editions.

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1 INTRODUCTION

The service manual covers the implementation the compact series electronic models E169T, E240B, E249T.

1.1 Electronics

Changes to the compacts are that an electronic module has replaced the defrost timer and relay. A variable resistor replaces the thermostat.

With the introduction of the electronic module, some of the current functions of the product will also change. These will be covered under the appropriate headings.

The operational components such as evaporator, condenser and cabinet do not change.

1.2 Product Specification

1.2.1 Compressors

Product Model	Compressor Part Number	Refrigerant Charge
E169T	207108	85 grams R134a
E249T	207108	95 grams R134a
E240B	207109	95 grams R134a

1.2.2 Compressor Specification

Brand	EMBRACO	EMBRACO
Model	EMY45HSC	EMY60HSC
Part Number	207108	207109
Volts	220 – 240	220 – 240
Hertz	50	50
Nominal BTU	372	491
Output Watts	109	144
Input Watts	70	92
Run Current (Amps)	0.33	0.43
Start Resistance (Ohms)	39.55	15.54
Run Resistance (Ohms)	35.07 Ohms	23.56
Relay	F&P Electronic	F&P Electronic
Overload **Part Number** **Description**	 207152 4TM189KFBYY-53	 207152 4TM189KFBYY-53
Run Capacitor **Part Number** **Description**	 207160 3uF 400V	 207161 5uF 400V

1.3 Condenser Layout

The new compressors have no oil cooler lines, therefore the re-routing of the condenser is as follows:
Discharge line from the compressors runs directly to the condenser on the back panel. From the back panel it enters the LH side condenser, through the cross rail heater (if applicable) then into the RH condenser, then into the filter dryer. The remaining layout remains unchanged.

2 ELECTRONICS

2.1 Control Module

The electronic control module is situated in the unit compartment. It is connected to 220-240 volt supply for switching of the compressor, defrost heaters and FC fan. The compressor is switched through a solid state Triac and relay, and the defrost heater through a relay. The compressor has an external overload. Sensors are located in the PC and FC and, along with a variable resistor, which replaces the thermostat, are used to cycle the refrigerator. The defrost timer has also been replaced by the control module.

2.2 Light Operation

The light globe remains at 230V 15 watt and is switched using the same light switch mechanism as for compacts. The light switch is operated by the plunger being depressed by the dairy cover to turn the light on and off. If the P.C. door is left open longer than 90 seconds, the alarm will sound. This will repeat every 30 seconds until the door is closed, and will sound continuously after the door has been left open for 5 minutes. The control module measures the current drawn by the P.C. light to determine whether the door is open or closed. If the P.C. lamp circuit is open circuit (e.g. lamp is blown or missing) the door open alarm will not operate.

2.3 Beeper

This is a piezo electric device located in the control module to provide the user with feedback on fault alarms. If a fault occurs, the alarm only sounds when the PC door is opened. It turns off when the door is closed.

2.4 Temperature Sensors

These are temperature sensing devices, the resistance of which change with respect to temperature. They have a single connector on the printed circuit board to ensure the integrity of the resistance of the sensor is measured. Two sensors are located in the product. The PC sensor is located in a pocket attached to the left-hand side of the PC evaporator and senses the temperature for switching on and off the compressor. The FC sensor, which is the defrost sensor, is located immediately above the FC evaporator for defrost termination temperature sensing.

2.5 Thermistor Sensors Resistance Table

Temperature (^{O}C)	Resistance (K Ohms ± 5%)
-30.0	25.17
-25.0	19.43
-20.0	15.13
-15.0	11.88
-10.0	9.392
-5.0	7.481
0.0	6.000
5.0	4.844
10.0	3.935
15.0	3.217
20.0	2.644
25.0	2.186
30.0	1.817
35.0	1.518
40.0	1.274
45.0	1.075
50.0	0.9106

2.6 FC Fan

The fan is a 240v shaded pole motor. The fan cycles with the compressor but remains on when the door is opened.

2.7 Defrost Heater

A 230/240V, 350watt heating element positioned beneath and around the FC evaporator is used to defrost the ice accumulated on the evaporator.

There are two thermal fuses mounted in the wiring harness of the defrost element, having a tripping temperature of 72^{O}c. Once open circuit they cannot be reset. Replacement is part of the element heater assembly.

These fuses in both leads of the element protect the refrigerator from any over heating through failure of the element itself or a triac failure in the control module. Both sides are protected in case polarity is reversed.

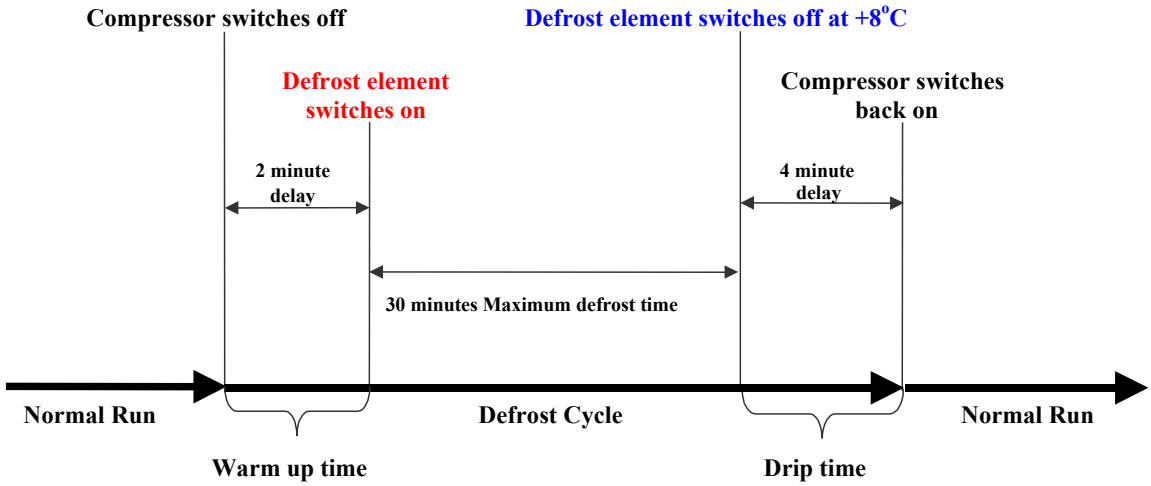
NOTE: Care should be taken if manually defrosting the evaporator if using heat guns, that the thermal fuses are not over heated.

In normal conditions the defrost period is terminated by the control module when the FC evaporator sensor (defrost sensor) reaches +8^{O}C.

2.8 Defrost Cycle

The defrost heater is controlled by the control module, which switches it via a relay. The defrost interval can vary from between 8 hours of compressor run time to 16 hours of compressor run time, depending on the duration time of the last defrost. When the control module switches the compressor off for a defrost, there is a 2 minute delay before the defrost heater is turned on. The defrost is terminated when the defrost sensor reaches +8^{O}C. At the conclusion of the defrost, there is a 4 minute delay after the defrost element has been turned off before the compressor is turned on.

Defrost Cycle



2.9 PC Heater

The PC heater is located behind the cooling plate. The heater is connected directly to the control module.

2.10 Temperature Controller

A control, consisting of a variable resistor, located in the control box is used to set the desired temperature. The resistance range of this resistor is from 0Ω to 1KΩ. The PC evaporator temperature range varies between -17.5^{O}C at the lowest setting of 1, to –28^{O} C at the highest setting on 7. Mid setting of 4 is -23.5^{O} C.

2.11 Fault Alarm

If the control module detects a fault, which it is unable to recover, an alarm is sounded. The alarm only comes on when the PC door is opened. The numbers of beeps indicate the fault code. (Refer Fault Codes, Section 3.)
If the door is closed, the alarm discontinues until the door is opened again.

2.12 Compressor Starting

The compressor is started by the control module. It is a timed start, therefore if the compressor does not start within 1 second, the controller will cancel the start. If the compressor draws too much current, the overload will activate and cut power to the compressor.

3 FAULT CODES

If a fault should develop in the temperature measurement system, defrost system, temperature control variable resistor, or should the compressor fail to start, an audio fault alarm will sound when to P.C. door is opened. The alarm consists of a number of beeps emitted by the beeper located in the control module. The number of beeps emitted indicates the fault as shown in the Fault Code Table below.

3.1 Fault Code Table

Fault 2: 2 beeps

Reason:	Defrost sensor failed to reach +8°C within 30 minutes. This has happened in the last three defrosts, therefore probably defrost heater failure.
Action:	Check connections at the control module and inline connectors. Check defrost heater. If faulty, replace.

Fault 3: 3 beeps

Reason:	The resistance of both the temperature sensors is outside the normal range (> 45K Ohms).
Primary Action:	Check the 4 way connector at the control module.
Secondary Action:	Check sensor resistance. Re-terminate the 4 way connector.
Tertiary Action:	Replace the control module.

Fault 4: 4 beeps

Reason:	The resistance of both the temperature sensors is outside the normal range (< 660 Ohms).
Primary Action:	Check the 4-way connector at the control module.
Secondary Action:	Check sensor resistance. Re-terminate the 4 way connector.
Tertiary Action:	Replace the control module.

Fault 7: 7 beeps

Reason:	The resistance of the defrost sensor is outside the normal range (> 45K Ohms).
Primary Action:	Check sensor resistance. Check the sensor connection at the control module.
Secondary Action:	Replace the sensor.

Fault 8: 8 beeps

Reason:	The resistance of the defrost sensor is outside the normal range (< 660 Ohms).
Primary Action:	Check sensor resistance. Check the sensor connection at the control module.
Secondary Action:	Replace the sensor.

Fault 9: 9 beeps

Reason: The resistance of the PC sensor is outside the normal range (> 45K Ohms).
Primary Action: Check sensor resistance.
Check the sensor connection at the control module.
Secondary Action: Replace the sensor.

Fault 10: 10 beeps

Reason: The resistance of the PC sensor is outside the normal range (< 660 Ohms).
Primary Action: Check sensor resistance.
Check the sensor connection at the control module.
Secondary Action: Replace the sensor.

Fault 11: 11 beeps

Reason: The compressor has failed to start after 5 attempts.
Primary Action: Check the integrity of the compressor.
Secondary Action: Replace the control module.

Fault 12: 12 beeps

Reason: The control (variable resistor) has an open circuit fault.
Primary Action: Check the continuity of the circuit between the variable resistor and control module and the connections at the variable resistor and control module.
Secondary Action: Replace the variable resistor.

3.2 To Disable a Fault Alarm

Turn the variable resistor (control knob) fully clockwise and then fully anticlockwise within 5 seconds.

3.3 To Manually Force a Defrost

While pushing in the light switch knob, turn the variable resistor (control knob) fully clockwise and then fully anticlockwise within 10 seconds.

4 SERVICE PROCEDURES

Note: No work is to be carried out on the product while in a live situation. All components can be at a 230volt potential. The product is to be turned off and disconnected from the power source.

Electrical Safety Checks

Whenever any part of the electrical circuit is serviced or disturbed in the course of carrying out service adjustments or repair, it is essential that insulation and earth continuity tests are carried out using the appropriate test equipment.

4.1 Control Module

- Remove the drain pan/tray.
- Remove the two screws securing the module to the cabinet.
- Pull the module outwards.
- Remove all the connectors from the control module.
- Refit the module in reverse order making sure all wiring is secured in the module and the wiring harness is located in the module slot.

4.2 Compressor Overload

Remove the compressor cover. Once the cover is removed, the compressor connector from the control module needs to be removed before the overload is removed by pulling off the compressor terminals. An Ohmmeter is used to test for continuity of the overload.

4.3 FC & PC Sensors

The FC & PC sensor are tested at the module. The module is to be removed and the Sensor RAST connector can be removed for testing.

4.3.1 To Replace PC Sensor

- Unplug the refrigerator from the power source.
- Remove control housing and rear duct from housing.
- Disconnect all connectors to give access to PC sensor.
- Replacement of the sensor is done by cutting the wiring to the old sensor as close to the sensor as possible. Strip each wire back far enough (about 10mm) to allow it to be soldered to the wiring of the new sensor. Strip each wire of the new sensor back a similar amount and slide some heat shrink sleaving over each wire. Solder a wire from the new sensor to a wire of the harness that was going to the old sensor. Slide the heat shrink sleaving over the joint and heat to shrink. Repeat with the other wires.
- Reassemble in reverse order.
- Test light operation after assembly.

4.3.2 To Replace FC Sensor

- Unplug the refrigerator from the power source.
- Remove air duct (on B models). Note: Care should be taken in removing duct so as not to damage duct or cabinet.
- Remove rear evaporator cover, disconnect fan wiring and remove cover from refrigerator.

- Replacement of the sensor is done by cutting the wiring to the old sensor as close to the sensor as possible. Strip each wire back far enough (about 10mm) to allow it to be soldered to the wiring of the new sensor. Strip each wire of the new sensor back a similar amount and slide some heat shrink sleaving over each wire. Solder a wire from the new sensor to a wire of the harness that was going to the old sensor. Slide the heat shrink sleaving over the joint and heat to shrink. Repeat with the other wires.
- Reassemble in reverse order.

4.4 Variable Resistor

Testing of the variable resistor is carried out by using a multimeter set on Ohms. However, it is difficult to check the full resistance range of the variable resistor, therefore to check if the resistor is working correctly and there are not faults with the resistor, manually force a defrost. If the product does not defrost, then further checks must be carried out by removing the variable resistor.
If the product start the defrost, then the variable resistor has no fault.

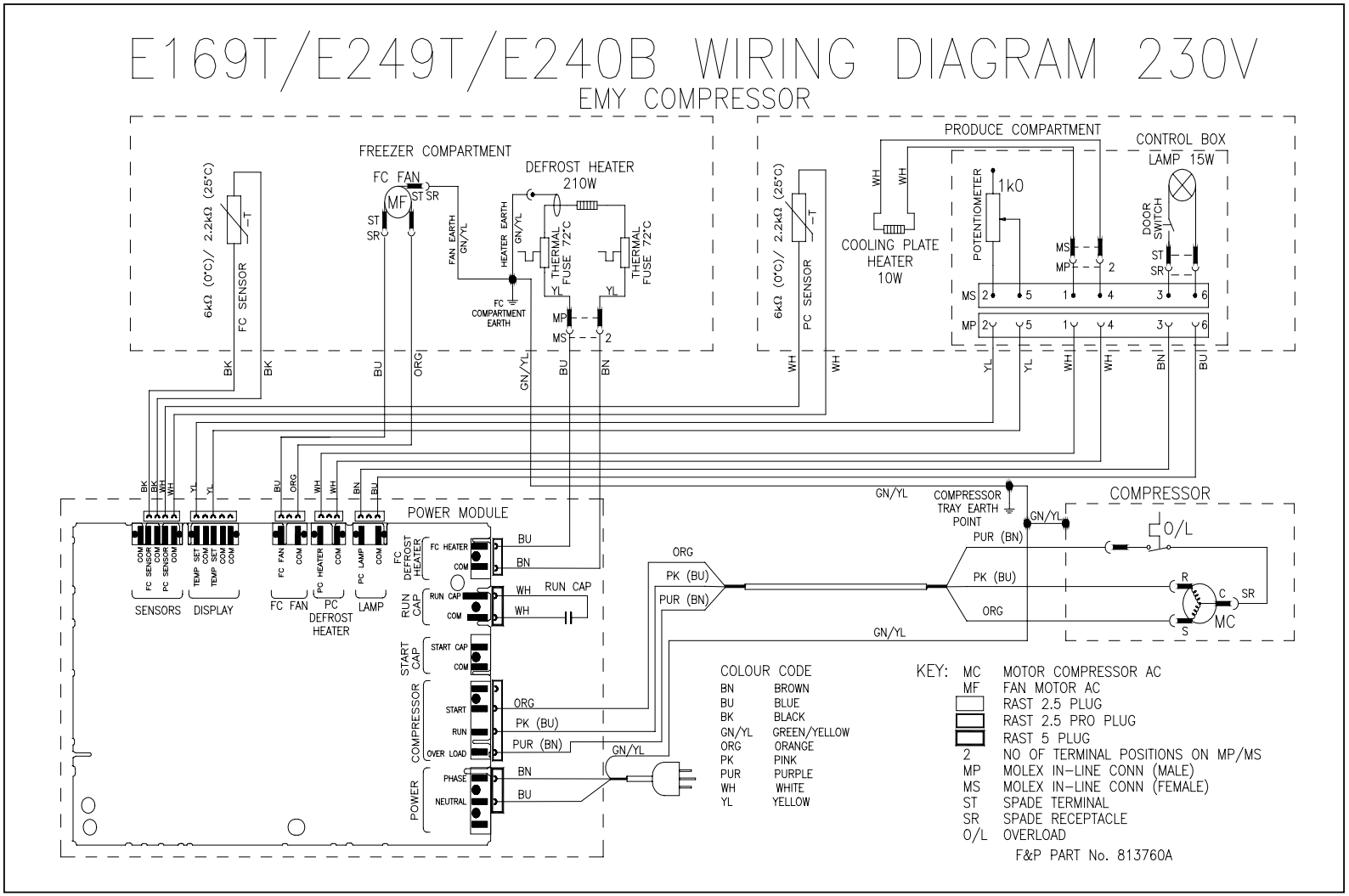
4.4.1 To Replace Variable Resistor

- Remove control housing.
- Disconnect variable resistor from harness.
- Remove knob from resistor.
- Loosen nut on resistor and remove.
- Reassemble in reverse order.

4.5 FC Defrost Heater

- Remove air duct (B Models).
- Remove FC evaporator cover, disconnect fan.
- Disconnect heater from the connector.
- Cut heater wires below fuses.
- Remove evaporator brackets, heater clips and deflectors.
- Lift evaporator outwards and separate the evaporator to remove old heater.
- Feed new heater from underneath evaporator.
- Connect new heater and position fuses.
- Reassemble in reverse order.

5 Wiring Diagram



6 FAULT FINDING

The following faults and probable cause/s have been listed with the assumption that all basic checks have been carried out. Example, product has power, door is closing correctly etc.

6.1 Compressor Won't Start

- Check continuity of overload. If no continuity replace overload.
- Check Start and Run Winding (as per specifications).
- Check Run Capacitor.

(Manual Compressor Starting Device can be used to confirm diagnostics.)

6.2 Compressor Starts, Runs And Then Stops

- Check connections at the fusite plug, overload and control module connections.
- Check supply voltage.

(Manual Compressor Starting Device can be used to confirm diagnostics.)

6.3 Compressor Humming

- Check continuity of overload. If no continuity replace overload.
- Check connections at the fusite plug, overload and control module connections.
- Check Start and Run Winding (as per specifications).
- Check Run Capacitor.

6.4 PC Too Cold

- Check resistance of variable resistor.
- Check resistance of PC sensor as per table.
- Check cooling plate for frost pattern. Full frost pattern is required. If not a full frost pattern, check product for shortage of refrigerant or inefficient compressor.
- Check temperatures of cooling plate both intake and exit of plate. If temperature of intake differs from exit temperature, further investigation is required.

6.5 PC Warm

- Check setting of control knob.
- Check resistance of variable resistor.
- Check resistance of PC sensor as per table.
- Check if cooling plate has normal frost pattern. If not, further investigation is required.

6.6 FC Too Cold

- Check setting of control.
- Check if PC sensor is in correct position.
- Check resistance of PC sensor as per table.
- Check if FC Evaporator has normal frost pattern. Checking temperature of the FC evaporator and cooling plate is recommended to rule out or confirm system or compressor fault/s.

6.7 FC Warm

- Check setting of control.
- Check door seal.
- Check frost pattern of FC evaporator. If fully frosted, check defrost by forcing a defrost.
- If defrost doesn't work, check defrost sensor and/or defrost heater and fuses.
- If defrost is working, checking temperature of the FC evaporator and cooling plate is recommended to rule out or confirm system or compressor fault/s.

6.8 Alarm Sounds When Door Is Opened

- Count how many beeps, check fault code table for probable cause.

6.9 Light Not Functioning

- Check light globe and ensure light is fully screwed in.
- Check connections.
- Is light switch depressing correctly? Check position of plunger and/or is the dairy cover in place.