Commercial Refrigeration
Temperature and Defrost Controls
UNI-LINE® PRODUCT KNOWLEDGE
Subjects We Will Cover In This Session

- Refrigeration System Overview
- Existing Product Lines
- Temperature Controls
  - Electronic Temperature Controls (ETC)
- Defrost Timer Controls
  - 8000 Series Defrost Timers
  - 9000 Series Defrost Timers
- Manufacturing Comparison
- Troubleshooting
- Where to Find Information
- Q&A
Refrigeration System

Pressure Control

Defrost Control

Temperature Control
Electronic Temperature Controller (ETC)

Features:
- Electronic Accuracy
- Wide Range (-30° to 220°F)
- Wide Differential Selection
- Easy Installation
- Temperature Display
- Easy Programming
- No Jumpers
- Contractor Preferred
- Sensor up to 400 Feet
- Averages Multiple Sensors
ETC Applications

- Retail store display freezers and reach-in coolers
- Supermarket display cases for produce and meats
- Retail store walk-in coolers and freezers
- Boiler operating control (used as a thermostat)
- Condenser fan cycling or staging
- Cooling tower pump and fan control
- Space and return air temperature control
- Bulk milk coolers
- Poultry houses and livestock barns
ETC Product Features

- Wide temperature range (-30°F to 220°F)
- Wide adjustable differential (1°F to 30°F)
- LCD display
- Sensor Temperature
- Control Settings
- Relay Status
- Onboard Diagnosis
- Simple Key Pad Settings
- Fahrenheit or Celsius
- Set for Heating or Cooling
- 8 foot long sensor cable, can be extended up to 400 feet
- Lockout switch to prevent set point change
- Operates on 120 or 240V AC (24V optional)
- One and two stage models available
- Optional 0 to 10 Volts analog output
- Settings retained in the event of a power failure
Top Five ETC Parts

• Ranco ETC is a microprocessor based electronic temperature control
• Designed to provide on and off control for commercial heating, ventilating, air conditioning and refrigeration

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Voltage</th>
<th>Stages</th>
<th>0-10 V Output</th>
<th>Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETC-111000-000</td>
<td>120/240</td>
<td>1</td>
<td>NO</td>
<td>STD</td>
</tr>
<tr>
<td>ETC-112000-000</td>
<td>24</td>
<td>1</td>
<td>NO</td>
<td>STD</td>
</tr>
<tr>
<td>ETC-212000-000</td>
<td>24</td>
<td>2</td>
<td>NO</td>
<td>STD</td>
</tr>
<tr>
<td>ETC-211000-000</td>
<td>120/240</td>
<td>2</td>
<td>NO</td>
<td>STD</td>
</tr>
<tr>
<td>ETC-141000-000</td>
<td>120/240</td>
<td>1</td>
<td>NO</td>
<td>NEMA 4X</td>
</tr>
</tbody>
</table>
Johnson Controls Version of ETC

• Johnson A419
  – Short cycle protection
  – Optional external setpoint change switch
  – LED lights when relay energized
  – Includes 3 configuration jumpers
  – Hard to remember programming

• Ranco® Electronic Temperature Control is Easier to Use!
  – No jumpers required
  – Simple programming
Installation for ETC Temp Control

1. Mount unit to wall or flat surface
2. Typical line voltage wiring diagram
3. Determine location of sensor
Troubleshooting Error Messages

- **E1**  Not in program mode
  - If the E1 message appears when no keys are being pressed, replace the control.

- **E2**  Settings are not properly stored in memory
  - Check all settings and correct if necessary.

- **EP**  Probe is open, shorted or sensing a temperature out of range
  - Check to see if the sensed temp is out of range. If not, check for probe damage by comparing it to a known ambient temp between -30°F and 220°F. Replace the probe if necessary.

- **EE**  EEPROM data has been corrupted
  - This condition cannot be field repaired. Replace the control.

- **CL**  Calibration mode
  - Remove power to the control for at least five seconds. Reapply power. If the CL message still appears, replace the control.
Poll Question #1

What is the temperature range of the Ranco® Electronic Temperature Controls (ETC)?

- □ -50 to 0º F
- □ -30 to 220º F
- □ -30 to 220º C

What voltages are available within the ETC family of products?

- □ 120 VAC
- □ 240 VAC
- □ 24VAC
- □ All of the above
Defrost Control Concept

• Defrost Control is heat output for electric and hot gas systems to prevent build-up of frost

• Manual or automatic defrost setpoints
  – Time
  – Temperature
  – Pressure

• Setpoints control initiation and termination

• Initiated defrost heats coil

• Disables fans until termination setpoint is met
Paragon® Universal Defrost Timer (UDT)

Why do I need a Defrost Control?

- Ice is a great insulator
- Frost build-up on evaporator coil makes it less efficient
- Defrost control will determine when to stop the cooling to allow the frost and ice build-up to thaw
- Decision is based either on a time schedule (defrost timer) or a precise reading of the temperature or pressure of your equipment (defrost control)
Why Paragon® Defrost Timers?

- Paragon Electrical Products are high quality time switches with sealed synchronous motors and metal gears.
- Commercial Refrigerators store valuable products.
- Refrigeration failures are costly in terms of lost product and business.
- Paragon Defrost Timers are UL certified as refrigeration controls, not as time switches.
8000 Series Timers (D80)

- 40 Amps
- Time Initiated, Time Terminated
- All are 60 Hz, some 50 Hz units available

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Volts / 60 Hz</th>
<th>Contact 2-4</th>
<th>Contact 3-N</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>8041-00</td>
<td>120</td>
<td>Closed</td>
<td>Closed</td>
<td>Electric Heat Defrosting</td>
</tr>
<tr>
<td>8041-20</td>
<td>208-240</td>
<td>Closed</td>
<td>Closed</td>
<td>Electric Heat Defrosting</td>
</tr>
<tr>
<td>8045-00</td>
<td>120</td>
<td>Closed</td>
<td>None</td>
<td>Electric, Hot Gas, Compressor</td>
</tr>
<tr>
<td>8045-20</td>
<td>208-240</td>
<td>Closed</td>
<td>None</td>
<td>Electric, Hot Gas, Compressor</td>
</tr>
<tr>
<td>8047-00</td>
<td>120</td>
<td>Open</td>
<td>Closed</td>
<td>Electric Heat Defrosting</td>
</tr>
<tr>
<td>8047-20</td>
<td>208-240</td>
<td>Open</td>
<td>Closed</td>
<td>Electric Heat Defrosting</td>
</tr>
</tbody>
</table>
8100 Series (D81)

- 40 Amp switches
- Time Initiated, Temperature or Pressure Terminated
- Provides complex three step defrost cycles with mechanical timer
- Pump-down, defrost, and fan delay

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Volts / 60 Hz</th>
<th>Contact 3-N</th>
<th>Contact 1-3</th>
<th>Content 2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>8141-00</td>
<td>120</td>
<td>Closed</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>8141-20</td>
<td>208-240</td>
<td>Closed</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>8143-00</td>
<td>120</td>
<td>Open</td>
<td>Closed</td>
<td>Open</td>
</tr>
<tr>
<td>8143-20</td>
<td>208-240</td>
<td>Open</td>
<td>Closed</td>
<td>Open</td>
</tr>
<tr>
<td>8145-00</td>
<td>120</td>
<td>None</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>8145-20</td>
<td>208-240</td>
<td>None</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>
Paragon® Mechanical Defrost Timers

1. 8145-20
2. 8141-00
3. 8145-00
4. 8045-20
5. 8045-00

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Time Initiated, Time Terminated</th>
<th>Time Initiated, Temperature or Pressure Terminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>8041-00</td>
<td>8041-20</td>
<td>•</td>
</tr>
<tr>
<td>8045-00</td>
<td>8045-20</td>
<td>•</td>
</tr>
<tr>
<td>8047-00</td>
<td>8047-20</td>
<td>•</td>
</tr>
<tr>
<td>8141-00</td>
<td>8141-20</td>
<td>•</td>
</tr>
<tr>
<td>8143-00</td>
<td>8143-20</td>
<td>•</td>
</tr>
<tr>
<td>8145-00</td>
<td>8145-20</td>
<td>•</td>
</tr>
</tbody>
</table>
The Latest Paragon® Defrost Timer

- Universal Defrost Timers (UDT)
- Works with multiple voltages
- Removes built up of ice and frost
- Easy to install
- Simple to program
- Part 9145-00 temp terminated
- Part 9045-00 time terminated
- Available as mechanism only without case
  - Add “M” to end of part number
Conversion Exercise - Converting 8145 to 9145
Universal Defrost Timer – Wiring

Convert to 9145

Convert 8141 to 9145

8141
N 3 1 2 4 X

9145
A B C D E F G

Convert 8143 to 9145

8143
1 3 N 4 2 X

9145
A B C D E F G

Convert 8145 to 9145

8145
3 4 X 1 2 N

9145
A B C D E F G

Convert to 9045

Convert 8045 to 9045

8045
2 4 3 N 1 X

9045
A B C D E F

Convert 8041 to 9145

8041
N 3 1 4 2 X

9145
A B C D E F G
## Manufacturer Analysis

<table>
<thead>
<tr>
<th>Feature</th>
<th>Paragon Universal Defrost Timer</th>
<th>Grasslin DTMV40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Voltage (120/208-240V AC)</td>
<td>Yes – Direct wire to terminals</td>
<td>Yes – Requires setting switches</td>
</tr>
<tr>
<td>UL 873 Listed as refrigeration controller</td>
<td>Yes – Listed as a refrigeration controller. Requires life test to 30,000 cycles at temperature extremes.</td>
<td>No – Listed as an electrical controller, UL917 clock operated switch. Requires life test to 6,000 cycles at room temperature.</td>
</tr>
<tr>
<td>Easy Programming</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>System Status Indicators</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lighted Display</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Real Time Clock</td>
<td>Yes – electronic</td>
<td>No</td>
</tr>
<tr>
<td>Power Loss Protection</td>
<td>Yes – Clock maintained by capacitor for 100 hours of lost power. Schedule stored in flash memory.</td>
<td>Optional – Can order battery backup which requires replacement.</td>
</tr>
<tr>
<td>Manual Defrost Initiation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Intuitive Display</td>
<td>Yes – Time and defrost schedule easy to understand.</td>
<td>No – Defrost duration is counter-clockwise.</td>
</tr>
<tr>
<td>Switch Ratings</td>
<td>Compressor – 1 HP @ 120V, 2 HP @ 240V, Defrost Heater – 30 Amps resistive, Fan – 1/4 HP @ 120V, 1/2 HP @ 240V, 15 Amps resistive</td>
<td>Compressor – 1 HP @ 120V, 2 HP @ 240V, Defrost Heater – 40 Amps resistive, Fan – 1 HP @ 120V, 2 HP @ 240V, 30 Amps resistive</td>
</tr>
<tr>
<td>Warning of Timer Failure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Informative Color Packaging</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Defrost Controls Manufacturers

- Paragon®
- Intermatic / Grasslin (DTMV)
- Supco
- Precision
Troubleshooting Defrost Timers

Purpose Of The Timer

- Shut off the refrigerator's compressor and evaporator fan motor
- Turn on the defrost system at regular intervals to rid the evaporator of frost

How They Fail

- Timer motor, motor bearing, or reduction gears wear out
- Occasional or constant noise comes from the part
- Runs sometimes but not others, causes occasional frost to build up gears jam or bearing piles up, timer stops rotating
- Motor coil burns out and becomes an open circuit, timer stops rotating
- Burnt out contacts stick together
Troubleshooting Defrost Timers

If timer stops, different situations will occur:

**Stops in run cycle**
- Refrigerator fails to automatically defrost
- Evaporator builds up with frost and restricts air flow

**Stops in defrost part of the cycle**
- Food in the freezer thaws
- Refrigerator components do not operate
Poll Question #2

What is the difference in part numbers ending in 00 vs. 20?
- Frequency □ Voltage □ Contact state

The UL standard used for temperature regulating (refrigeration) equipment is UL873.
- True □ False

The Paragon 9145-00 defrost control will terminate a defrost cycle based on which of these inputs?
- Pressure □ Temperature □ Time □ All of the above

What input voltage will not power a Paragon electronic UDT?
- 24 VAC □ 120 VAC □ 208 VAC □ 240 VAC
When You Have Uni-Line® Questions

**Telephone:**
- Technical Service 1-800-445-8299
- Technical Service Fax 1-630-260-7294
- Customer Service 1-800-304-6563
- Customer Service Fax 1-800-426-0804

**Websites:**
- General Information for: Robertshaw®, Paragon®, Eliwell™, Ranco®, and Publication Zone®
  - [www.InvensysControls.com](http://www.InvensysControls.com)
  - [www.RobertshawTstats.com](http://www.RobertshawTstats.com)
  - [www.ToolBox.InvensysControls.com](http://www.ToolBox.InvensysControls.com)

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