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Issue No.: 04/01
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Subject: ELECTRONIC DE-ICE CONTROLLER RELEASE VERSION 6: FIELD DIAGNOSIS OF OPERATION OR FAULTS
Units: VARIOUS OSA AND OPA UNITS

This Application Notice does not supersede Issue 02/98 but updates for the latest Version 6. Version 5 was never released into the market. For information relating to Versions 1-4 refer to Issue 02/98.

We have been fitting an electronic de-ice controller to various units since early in 1997. This Application Notice gives some additional background information that will be useful in understanding the version 6 method of operation and tracing of possible faults.

This version 6 of our De-Ice Controller was made to be a drop in replacement for its predecessors. It has therefore retained the same terminal configuration and labelling as before to minimise confusion.

Therefore the same wiring constraints as before apply. This means the relays on the De-Ice Controller, connect or break the "Neutral" path to devices connected to it, e.g. the Reversing Valve, (Indoor Fan) and the LP switch). This means **that the LP switch must be wired on the Neutral side of the compressor contactor.**

Operation:

The De-Ice Controller commences a De-Ice Cycle when the sensor (inserted into the fins at the bottom of the coil) measures a temperature of -4 degrees or less (provided it has been at least 30 mins since the previous De-Ice cycle). This results in the Outdoor Fan (and optionally the Indoor) stopping and the cycle changing to COOLING. (The "N/C" contact of the "Fan RIV" relay on the De-Ice Controller breaks the Neutral return for both the fan(s) and the Reversing Valve.) During De-Ice cycle the LP switch is also bypassed via the LP relay.

The De-Ice cycle is terminated when the coil warms up to +10 degrees or if the De-Ice Cycle has lasted for 10 minutes. This results in the fan(s) restarting and the operating cycle returning to HEATING. The LP remains bypassed for a further 2 minutes to avoid nuisance LP trips. The controller dictates that there will be a minimum of 30 minutes between De-Ice cycles (i.e. from the end of one cycle to the start of the next).

Initiation of a de-ice cycle may also occur under other circumstances:

1. If the coil sensor sees a temperature of between -2 and -4°C, and it stays there, a De-Ice cycle will be initiated after 1 hour.
2. If the coil sensor detects a temperature of between 0 and -2°C, and it stays in that range for 1 ½ hours, a De-Ice cycle will be initiated.
3. Immediately after **mains power** is applied to the Controller (such as could happen on a daily basis via time clock operation) a De-Ice cycle is allowed as soon as -4° is reached.

4. During 'Test' mode (via DIP Switch 1) which removes the 30 minute delay between cycles, once switched on, de-ice cycles can "start" and "stop" as frequently as the sensor achieves the -4°C "initiate" and $+10^{\circ}\text{C}$ "terminate" temperatures.
5. A Forced De-Ice Cycle (via DIP Switch 2) that is limited to 1 minute. On earlier versions this was indefinite which could have led to problems if field service personnel left this switch OFF. **N.B.** Termination is not dependant on reaching $+10^{\circ}$ either. It is purely time based.

Note:**To aid in diagnosis :**

There are now two amber/yellow LEDs (labelled "LD1" and "LD2") indicating Power is applied to the board. There is a green "Start" LED ("LD3") indicating a temperature below -4°C (also illuminated if the sensor becomes Open circuit), and a green "Stop" LED ("LD4") indicating a sensor temperature greater than $+10^{\circ}\text{C}$. There are two red LEDs ("LD5" and "LD6") located above each relay, which indicate when each is energised.

Fault Diagnosis - temperzone Release 6 De-Ice Controller:

Possible Fault No. 1: The unit never enters a De-Ice cycle despite ice on the outdoor coil.

Possible Causes:

1. There is no power applied to the De-Ice Controller.
 - a. Check the two amber/ yellow LEDs, "LD1" and "LD2". They should both be glowing. If neither is glowing then the nominal Mains voltage may not be present between the "P" and "N" terminals. Check this with a Voltmeter.
 - b. If only one amber LED is glowing there is a non-field serviceable fault with the De-Ice Controller. Replace it.
2. The Sensor may be faulty and is telling the controller that the coil is warmer than it really is.
 - a. Turn DIP switch 1 OFF. Unplug the sensor from the connector on the Controller. This is done by gently pulling the sensor wire, or the connector housing, directly away from the surface of the Controller's circuit board. The unit should commence a De-Ice cycle immediately. If it does not, the fault is on the Controller, or is within the wiring. Progress to "possible cause" 3, 4, 5 and 6 to further isolate the problem.
 - b. If it does commence a De-Ice cycle, allow the cycle to proceed for a minute or two to clear the ice then turn the unit off at the Isolator switch. N.B. The De-Ice cycle will take 10 minutes to stop if the sensor is left unplugged. It will not stop automatically when the ice has melted (indicated by the coil sensor detecting $+10^{\circ}\text{C}$). Check the Sensor's resistance against the chart below to see if it is approximately correct.

-5°C – 9.25 kohm	0°C – 7.15 kohm	5°C – 5.57 kohm
10°C – 4.37 kohm	15°C – 3.45 kohm	20°C – 2.75 kohm
30°C – 1.77 kohm	40°C – 1.17 kohm	50°C – 0.79 kohm

In order to achieve this a fine wire of approx. 1 mm diameter should be pushed into each of the two holes in the bottom of the sensor connector. You cannot measure the sensor's resistance while it is plugged on to the De-Ice Controller.

If the resistance appears significantly incorrect, the sensor should be replaced. Do not keep the old sensor. **N.B.** It is possible for the sensor to recover from a fault and appear fine one or two days after the original fault if simply removed and allowed to sit and dry out. Do not be deceived, the fault will return. Throw faulty sensors away.

An indication of the sensor's temperature can be deduced from the green "Start" (LD3) and "Stop" (LD4) LEDs. The Start LED illuminates as the temperature drops below -4 degrees. The Stop LED illuminates when the temperature rises above +10 degrees. The fact that the Start LED is illuminated does not mean that a De-Ice cycle should be occurring. The controller may be waiting for the 30 minute between De-Ice cycles timer to expire. An illuminated Start LED only means that the sensor thinks it is less than -4°C.

N.B. Only one Green LED should be on at a time. If both "LD3" and "LD4" come on together, then there is probably a fault with the De-Ice Controller. Replace it.

3. The Outdoor coil is not feeding evenly and the circuit that the De-Ice sensor is on, is actually warm enough to not need a De-Ice but other parts of the coil are icing up.
 - a. There must be a Refrigeration system fault, e.g. kinked feeder tubes, Low Gas etc.
4. The De-Ice sensor has fallen out of the hole in the end of the coil and is therefore only seeing ambient temperature inside the compressor compartment.
 - a. Re-insert it through the hole in the coil's end plate. Only push it in as far as the black "Heat shrink" sleeve around the lead entry end of the bulb allows. The heat shrink stays outside the fin, only the exposed metallic body of the sensor goes into the fin.
5. The link between the Mains In "Neutral" terminal of the Indoor unit, and the wire run from the "De-Ice" terminal in the Outdoor unit to the Indoor Unit's fan motor(s) neutral wire, is still connected. **N.B.** The wire from the Outdoor unit's De-Ice terminal to the Indoor unit's fan Neutral is fitted to enable the Indoor Fan to stop during De-Ice cycle.
6. The "Fan I RV" relay on the De-Ice Controller is not working.
 - a. Observe the left hand red LED labelled "LD5" on the Controller. See that it illuminates when a De-Ice Cycle is initiated and that it goes out when the De-Ice cycle finishes. If the green "Start" and "Stop" LEDs suggest that the relay should be switching and it isn't there must be a fault on the Controller. Replace the Controller.
 - b. If "LD5" is going on and off as expected but De-Ice cycles still do not occur then either the relay's contacts are not operating or the fault mentioned in point "5)" above exists. Check this wiring if it has not already been done. If the wiring is O.K. the fault must be on the Controller so replace it.

Possible Fault No. 2: The unit keeps De-Icing every half hour, even without ice on the coil.

Possible Causes:

1. The Sensor is "Open Circuit". This should result in the green "Start" LED remaining on.
 - a. The Sensor plug may have come off the De-Ice Controller board.
 - b. The Sensor lead may have been cut. Replace the sensor if this is the case.

2. The Sensor may be faulty and is telling the controller that the coil is colder than it really is. Check the Sensor's resistance against the chart given previously.
 - a. Once again an indication as to whether the sensor is registering a sensible temperature can be gained by observing the "Start" and "Stop" LEDs after measuring the Outdoor unit's fin temperature with a thermocouple thermometer.

Possible Fault No. 3: The unit keeps tripping on LP during De-Ice, or shortly after if finishes.

Possible Causes:

1. The LP relay is not operating. Observe the right hand red LED labelled "LD6". It should be illuminated throughout the De-Ice cycle and for 2 minutes after.
 - a. If the "LD6" LED never illuminates, but the other LEDs do at the appropriate time, then there is a fault on the De-Ice Controller circuit board. Replace the Controller.
 - b. If LD6 illuminates and goes off as expected yet LP trips still occur, possibly the relay contacts are not switching or there is a wiring fault. Check the wire from the "LP" terminal on the Controller to the LP switch connection on to pin 2 of the Anti-Rapid Cycle Timer. If the wiring is as shown in the unit's wiring diagram, there must be a fault on the De-Ice Controller. Replace it.
2. The Sensor may be faulty and is telling the controller that the coil is colder than it really is. Check the Sensor's resistance against the chart given previously.
 - a. Once again an indication as to whether the sensor is registering a sensible temperature can be gained by observing the "Start" and "Stop" LEDs after measuring the Outdoor unit's fin temperature with a thermocouple thermometer.

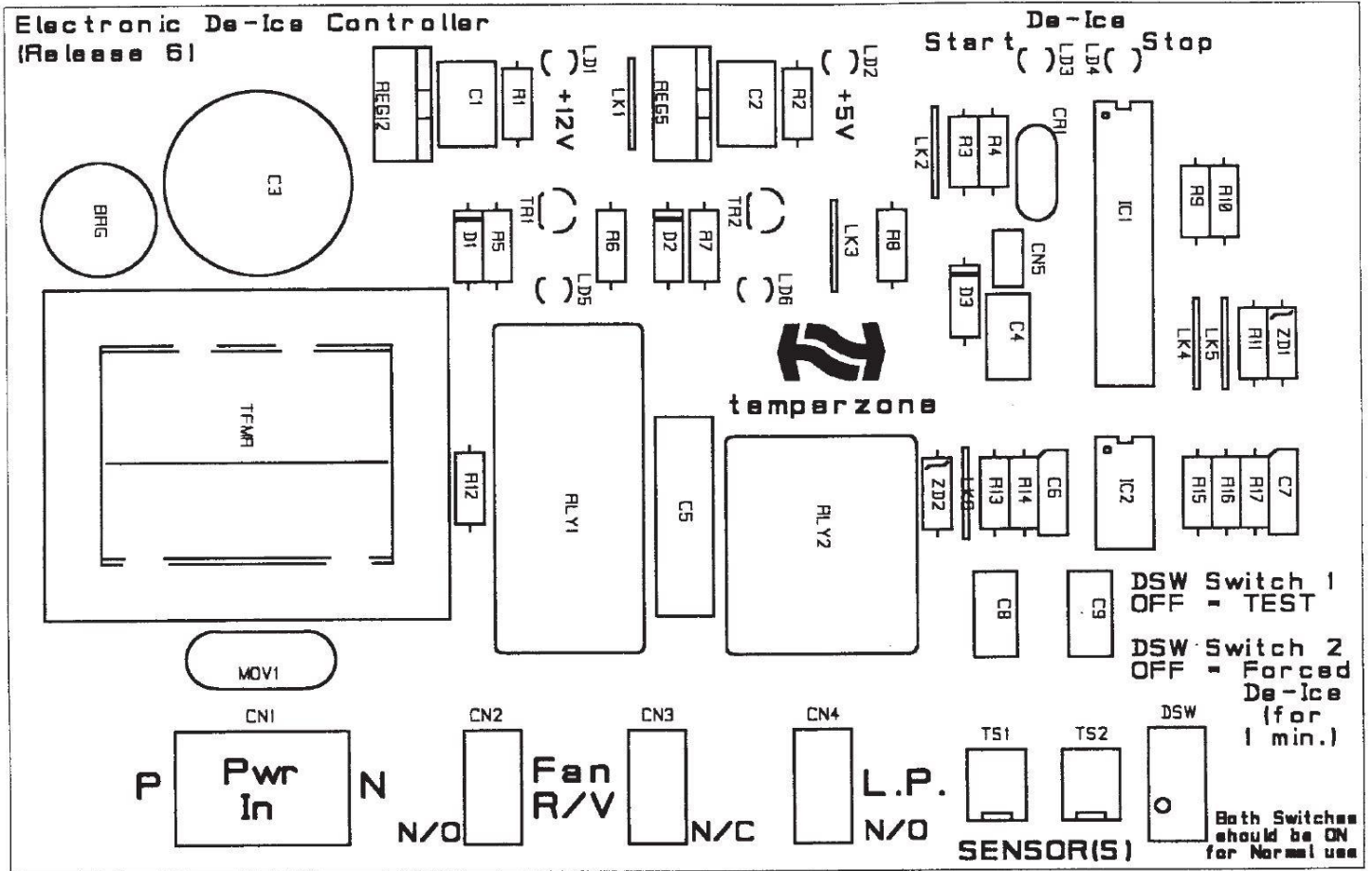
Possible Fault No. 4: The De-Ice Controller does not respond to either of the DIP switches.

Possible Causes:

1. If the two Amber LEDs "LD1" and "LD2" are lit up and yet the Controller still does not respond to the DIP switch operation by switching its relays, there must be a fault on the De-Ice Controller. Replace it.

The "Front On" view of the De-Ice Controller is shown below:

This shows the relative positioning of the LED's and connectors referenced in this document.



Wiring:

The 5 spade terminals along the bottom edge of the De-Ice Controller have the following functions:

- P** – Permanent "Phase" supply to the controller
- N** – Permanent "Neutral" supply to the controller
- Fan R/V N/O** – Normally Open contact of the "Fan R/V"
- Fan R/V N/C** – Normally Closed contact of the "Fan R/V"
- L.P.** – Normally Open contact of the "L.P." bypass relay

The single temperature sensor connects via a plug and socket arrangement to the "TS1" connector.