CIRA Engineering Technical Memo

# Receiver Temperature Sensor Repair and Failure

## Table of Contents


1 Introduction ..... 2

2 Investigation and Repairs ..... 2

3 Conclusion ..... 3

4 Pictures ..... 3


Date: 27 April 2016

Author(s):

# CIRA Engineering Technical Memo

## 1 Introduction

On 19th May 2016 (GPS 1147684035) the outside temperature sensor on receiver 7 started to increase without reference to the actual outside temperature. It reached a peak reading of 249.9 Celcius in approximately 10 minutes. After some hours some other air conditioner temperature sensors also started recording unrealistic temperatures, which caused the SBC to disable the DC rails due to over temperature warnings. The following report describes the investigation and repairs made.

## 2 Investigation and Repairs

When the lid was removed from the air conditioner plant (the next morning) there was no immediate indication as to the cause of the faulty temperature readings, which were still occurring at that time. It should be noted that even with the DC rails off, the air conditioner plant temperature sensors are still powered and recorded.

Suspecting the TO92 sensor itself was faulty, we stripped the heat shrink insulation from the sensor in order to measure the sensor output with a multimeter. Before we took a reading we observed evidence of water condensation in and around the leads, suspecting this could have caused leakage currents to flow into the sensor leads.

It is not immediately clear how this would cause other sensors in the same harness to subsequently record higher than the actual temperature. All the temperature sensors share common power supply and ground connections, and we suspect that moisture leaking into these connections could cause all temperature sensors to give faulty readings.

The connections were dried out, and a multimeter was used to verify the sensor output voltage had returned to approximately 19mV, and checking the temperature readings via the SBC console interface confirmed that they had all returned to normal.

We were uncertain as to the exact source of the moisture; we suspect that moisture had condensed on the inside of the receiver shelter canvas due to high humidity and low overnight temperatures. Early morning winds could then dislodge this moisture to be drawn into the air conditioner enclosure by the cooling fan. It would also be possible for very high winds to blow rain directly into the inlet airflow of the air conditioner system. This would not materially affect the air conditioner plant, as with the exception of the temperature sensors, it is fully sealed.

It was evident that the original heat-shrink tubing was insufficient to exclude moisture from the temperature sensor mounted between the condenser coil and the main air conditioner cover. Therefore we chose a small length of tubing, loaded it with silicone rubber and used that to enclose the temp sensor. Once the silicone rubber had fully cured, it became completely impervious to moisture, without materially affecting the thermal properties of the sensor. The only possible effect would be to slightly delay the sensor response after the actual outside temperature sensor changed.

Receiver 7's air-conditioning plant has performed without fault since that time, so this is now apparently a good cure for any future receivers that begin to show unusually high outside temperature sensors especially during conditions of high humidity.

Date: 27 April 2016
Author(s):

## 3 Conclusion

It was deemed too much effort and risk to warrant pre-emptively treating the other fifteen receivers at the time this repair was performed, the main purpose of this memo to record the issue and resolution so that future occurrences can be quickly treated.

## 4 Pictures

Figure 1: Temperature sensor before modifications

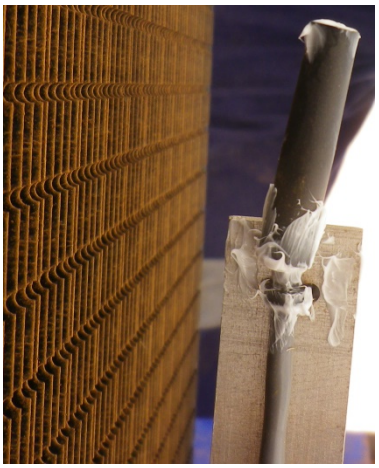

Figure 2: Temperature sensor with heat shrink and silicone fill