

High Ambient Temperatures in Australia and Enphase Microinverters

Enphase® Microinverters are engineered and tested to function in the harshest environments found in Australian PV installations.

This technical brief details the effect that high ambient temperatures have on the internal temperatures reported by the microinverters. Over 67,000 data readings were gathered from more than 170 Enphase systems across Australia. These locations include sites in New South Wales, Western Australia, Queensland, Victoria, South Australia, and Tasmania.

Designers must consider high temperatures when designing and installing a solar array. Enphase has conducted studies to demonstrate that installation practices such as providing airflow and maintaining minimum clearances, as recommended in the installation manual, mitigate the effects of high rooftop temperatures.

Extreme Weather Conditions

A period in January 2014 was selected because of the extremely high temperatures reported throughout Australia.

Adelaide set a record for extreme temperatures with 12 days of 40°C or above. The previous record of consecutive days over 40°C had stood for 117 years. Melbourne had its hottest 24-hour period, with an average temperature of 35.5°C, and Perth had its hottest-ever night and its second-hottest summer on record.

- Source: Climate Council, ABC News

Enphase M215 Microinverter Internal Temperatures

Enphase Microinverters record their internal temperatures together with other data. The data is gathered and stored on the Enphase Enlighten monitoring platform. The internal temperature is measured inside the sealed microinverter. In practice, the internal temperature is affected by factors including ambient temperature, radiant heat from the sun, and the heat the microinverter generates during operation.

The M215 data sheet lists a maximum internal operating temperature of 85°C.

Site Data

From the 1st to the 20th of January 2014, data was collected from more than 2,000 Enphase Microinverters across 170 system locations.

Figure 1 shows an Enlighten Manager screen capture of an M215 Microinverter located in the middle of a four by two module array in Adelaide, SA. The temperature and production information displayed includes the hottest day recorded in Adelaide in 2014. Ambient temperatures on this day were recorded up to 45.1°C. The maximum internal temperature recorded by this microinverter was 65°C, well below the 85°C listed on the data sheet and only 19.9°C higher than the ambient temperature.

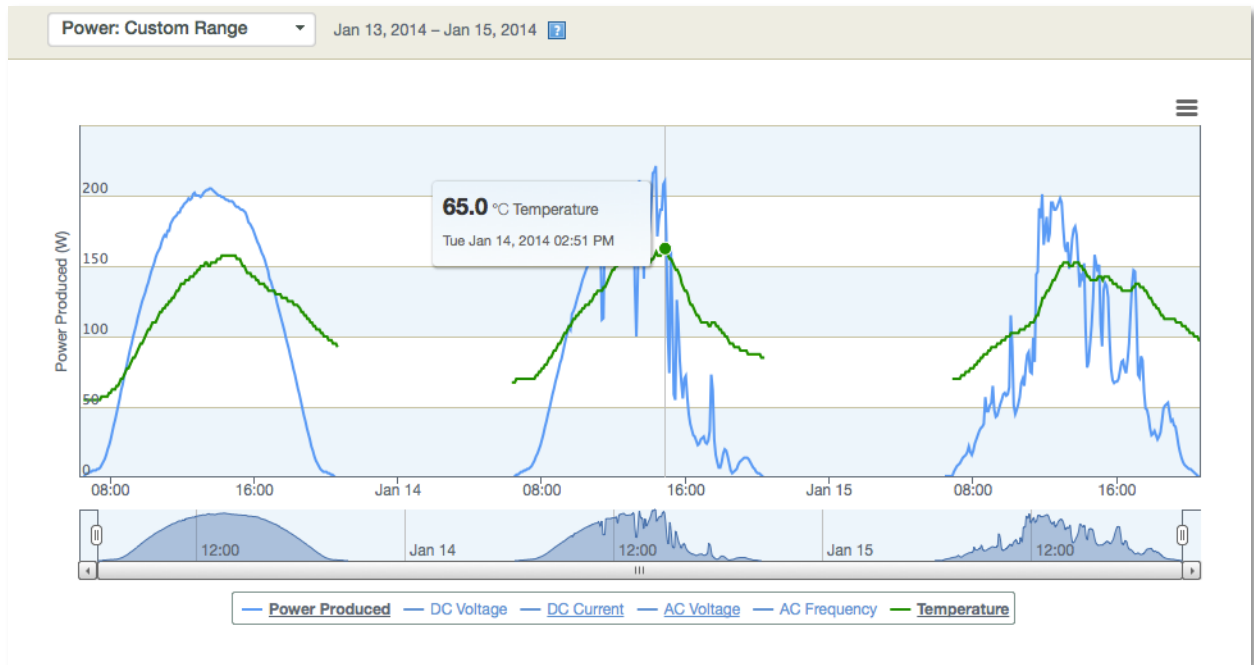


Figure 1: Enphase M215 Microinverter internal temperature data (14/1/2014)

During the period between the 1st and 20th of January 2014, fewer than 1% of all Enphase Microinverter internal temperature readings for Australia exceeded 70 degrees. The maximum recorded internal operating temperature across all sites was 79°C. This is well below the rated maximum operating internal temperature of 85°C. **No Enphase Microinverter across Australia shut down due to temperature.**

Table 1 highlights peak ambient temperatures recorded in each state between January 1 and January 20, 2014, and it also lists the corresponding maximum M215 internal temperatures:

STATE	Maximum Ambient Temp(°C)	M215 Maximum Internal Temp (°C)
QLD	38.7	78
WA	40.7	73
TAS	32.7	63
SA	45.1	79
NSW	43.3	73
VIC	45.2	77

Table 1: Data for Australian temperature records for January 1-20, 2014

The highest recorded internal operating temperature of 79°C for all systems in Australia was recorded by a single microinverter. This system was located in Adelaide, SA and recorded on January 14, 2014. On this day, the peak ambient temperature for Adelaide was 45.1°C. This was recorded at the Adelaide Kent Town Weather Station according to the Australian Bureau of Meteorology.

Another installation of Enphase Microinverters located only 5km away reported a highest recorded M215 internal temperature on the same day of 62°C. This site was found to have followed all installation guidelines.

Installation Guidelines

Follow all recommended installation practices listed in the installation manual (<http://enphase.com/global/au>). The following are key installation guidelines:

- Do not mount the microinverter in a location that allows long-term exposure to direct sunlight, that is, the PV module should cover the microinverter.
- Allow a minimum of 1.9 cm between the roof and the bottom of the microinverter and at least 1.3 cm between the back of the PV module and the top of the microinverter.
- Ensure that it is possible for air to circulate under the array.

Conclusion

During the extreme high temperature events of January 2014, all Enphase Microinverters reporting to Enlighten operated continuously, thus demonstrating that Enphase Microinverters are suitable for installation under modules in the hottest locations across Australia. Ensuring that the microinverters are installed to meet Enphase guidelines minimises internal temperature rise in the microinverters.