Tip Temperature Display

Most conventional soldering systems provide temperature displays on their power units. The display is an indication of the operator set point, not the actual temperature measured by the internal temperature sensor. The actual temperature at the tip will differ from the heater temperature by an amount that is highly dependent upon the thermal resistance of the sensor and thermal losses of the tip. This variance introduces a degree of uncertainty into the soldering process.

Metcal's Connection Validation® SmartHeat® soldering systems feature a new solder tip temperature display. The solder tip temperature display is enabled by the combination of two technologies. SmartHeat® soldering systems **sense** the thermal load and instantly deliver the right amount of power directly to the joint. Power on Demand allows the user to solder and rework varying loads and only the power needed will be applied to the joint. Metcal has combined this Power on Demand technology with a globally patented (US 9,327,361 & US 9,516,762) intelligent soldering cartridge technology to provide a new soldering temperature display experience.

Metcal's heating technology incorporates multiple alloys to achieve 500, 600, 700, 800, and 900 temperature series heaters. The specific metallurgical properties define the maximum temperature achievable by the heater. This enables a customer to select the correct temperate range for the job by balancing performance versus risk factors like maximum board or component temperature, flux activation temperature, tip life, etc. During cartridge construction, each intelligent cartridge is programmed with key information which include values related to tip mass, thermal resistance, thermal efficiency, maximum achievable temperature, among others. Sensing the power requirements of the load and armed with the key cartridge information, the Connection Validation power supply calculates and displays the solder tip temperature. In fact, our solder tip temperature display achieves an accuracy of ±2% at idle for solder tip temperature. In addition to the real-time solder tip temperature display, the Connection Validation power supply does not require calibration as the temperature is calculated rather than relying on an imbedded sensor.

Metcal continues to lead the industry by providing a fast, safe and repeatable process with no manual adjustments required.

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Tip Temperature Measurement

Technique and accuracy can greatly affect the measured soldering tip temperature. Utilizing a consistent technique and knowing the accuracy of your measuring equipment will allow more repeatable results.

Technique

There are many valid ways to measure the tip temperature and the following significant variables should be carefully considered when measuring tip temperatures.

- Temperature probe technology
- Temperature probe size/mass
- Location on the soldering tip
- Orientation of the soldering handle and temperature probe
- Thermal resistance between the temperature probe and soldering tip

Metcal uses and recommends the following technique:

- Hold the hand piece/cartridge horizontally, turn on the power supply and allow sufficient time for the cartridge to heat.
- Reflow a small amount of solder onto top wet-able portion of the tip nearest the cartridge shaft.
- Place the thermocouple in the small bead of solder, the thermocouple should be held vertically.
- Allow sufficient time for the temperature to fully stabilize, note the measurement.

Measurement Equipment Accuracy

Important factors to consider regarding test equipment.

Typical measurement equipment used to conduct this test are:

- Single Input Digital Thermometer
- K type thermocouple

Typical single input digital thermometers have an accuracy of ±0.05% of reading + 0.3°C and a resolution of 0.1°C. For example, if you are measuring 450°C the accuracy tolerance due to the meter is ±0.525°C. This does not include thermocouple error.

A standard K type thermocouple has an error tolerance of ±2.2°C or ±0.75% of the reading, whichever is greater. If you are measuring 450°C the accuracy tolerance due to the thermocouple is (0.75%*450) ±3.375°C. This does not include meter error.

Special K type thermocouples are available with improved accuracy. The SLE (special limits of error) thermocouples can have an error tolerance of ±1.1°C or ±0.4% of the reading. In this case the accuracy tolerance when measuring 450°C can be improved to ±1.8°C. The combined measurement tolerance in our examples are ±3.9°C for standard wire, and ±2.325°C for SLE wire.

Equipment and material tolerances need to be taken into consideration during this type of testing.

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