

Measuring Soldering Tip Temperature Accuracy

Our thanks to Weller for allowing us to reprint the following article.

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The Importance of Tip Temperature Accuracy

For soldering applications, tip temperature accuracy is an important factor in the performance of a soldering iron and station combination. Incorrect temperature readings or not knowing how accurate the readings are can lead to a number of issues.

Both soldering system overheating and lower than expected temperatures can contribute to problems while soldering:

- Overheating can cause trace lifting, circuit board damage (such as de-lamination or measling), poor solder joints, and damage to the components. High temperatures may also contribute to an increase in oxidation and/or erosion of the tip's surface plating. Fluxes may carbonize on the working surface of the tip, forming black residues that remain on the tip's working surface. Fluxes will also degrade at a much higher rate with high temperatures.
- Lower than expected temperatures may lead to longer dwell times and poor heat transfer, resulting in decreased productivity and the possibility of poor quality solder connections.

Measuring Tip Temperature Accuracy

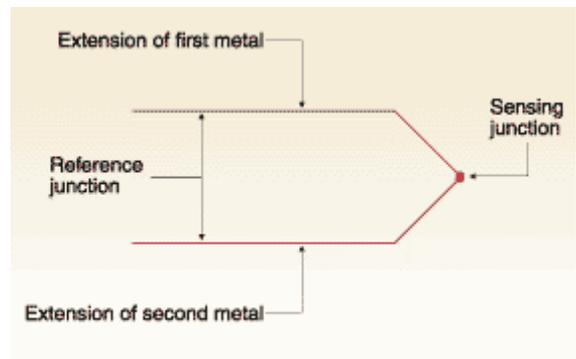
Soldering tip temperature accuracy can be measured with a wide variety of devices and equipment. There are two ways to measure tip temperature: Thermocouple and Contact Pyrometer.

There are a number of different instruments on the market that can accurately measure tip temperature using either of these methods. One of these is the Weller® WA2000 Soldering Analyzer, which has the capability of making both direct (welded) Thermocouple and Contact Pyrometer type measurements. In addition to the temperature measuring ports, some of these instruments, including the Weller WA2000, have the capability of measuring "Tip to Ground Resistance" and "Millivolt Potential" for the device being tested.

Thermocouple Measurement

Thermocouples are created by the joining of two dissimilar metals that produce a specific DC voltage (millivolt) reading at an absolute temperature. There are many different types of thermocouples used in the marketplace for temperature measurement. Weller chooses to use a Type "K" Thermocouple which is constructed of the dissimilar metals, Alumeland Chromel. The temperature range of this type of thermocouple is -200°C to +1350°C / -328°F to 2,462 °F.

Based on years of soldering iron tip measurements it has been determined that a Thermocouple bead welded to the surface of the tip is the most accurate method to provide a true reading of a soldering iron's tip temperature.



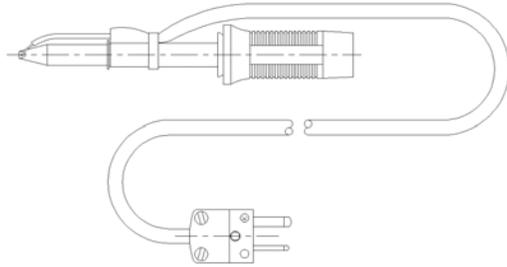
The two dissimilar metals are joined by "bead-welding" the wires together to create the "sensing junction." The bead-welded thermocouple is then spot or resistance welded to the working surface of the soldering tip, providing the most accurate temperature measurement possible.



Type K Thermocouple

The accuracy of the Type "K" thermocouple used in Weller products is an SLE (Special Limit of Error) and has a specified limit of error range of (1.1°C/ 1.9°F) or 0.4 %, whichever is greater.

The preferred method that Weller uses for tip temperature measurement is to attach a thermocouple to the working area of the tip. A 30 gauge, Type "K" Thermocouple is welded onto the tip as close to the working surface of the tip as possible. This ensures a precise measurement at the contact point of the soldering tip to the work.

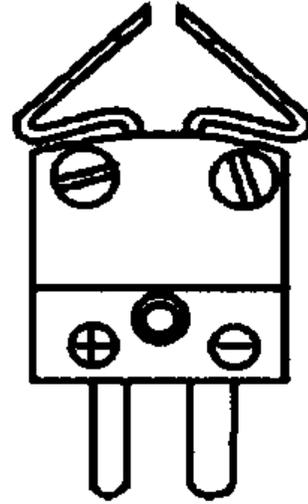


Pyrometer Measurement

Pyrometers are designed to measure tip temperature stability and are not generally recommended for measuring tip temperature accuracy. The Pyrometer currently provided with the Weller WA2000 Soldering Analyzer and the method used for measuring temperature stability using the Pyrometer is shown below.



NOTE: Actual temperature readings using the pyrometer method will most likely be greater than 30 to 60 degrees F lower than the soldering tip is actually operating at. Even though it is not intended to be an accurate form of measurement, the level of accuracy or how low it may read when measuring the temperature with a contact device is still based on many factors, such as the cleanliness of the tip, operator pressure, amount of solder on the tip, angle of contact, etc.



Documenting the Results through a Data Acquisition System

To document and chart the temperature measurements, the thermocoupled tip is connected to a Data Acquisition System and recorded through a PC connection. The Data Acquisition system that is used by Weller, allows up to eight (8) Type "K" input ports which allow multiple channels to be recorded at the same time. This maintains consistency and repeatability when all the test data is then converted to spreadsheets. This data is compiled for comparisons to existing Weller products as well as competitive products for review and documentation.

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