arroyo instruments

APPLICATION NOTE AN-005

Using an External Sensor Input

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One feature found on many Arroyo Instruments' mounts is the external sensor input (the 286 also features an auxiliary sensor input as well). Use feature is typically used when the DUT itself as a sensor output, and there is a need to control the temperature of the DUT using its own sensor. The benefit of this approach is that the temperature of the DUT is more accurately measured due to the proximity of the temperature sensor. By having the external input right on the mount, it is relatively easy to route this sensor input to the temperature controller for use as the control loop input. This article discussed the implementation of the external sensor input, and considerations for its use.

Considerations

One key consideration is the type of the sensor being used… it is supported by the temperature controller that will be used to control the mount? Thermistor inputs are universally supported by all Arroyo Instruments controllers, but if your sensor is an RTD, AD590, or LM335, make sure the controller supports your sensor before wiring it into the mount. Thermocouples are not currently supported by any Arroyo Instruments controller.

You also need to know the temperature conversion coefficients for your sensor. While thermistors and RTD are similar, your sensor's coefficients may not match those found in the controller, and the controller will need to be adjusted to match.

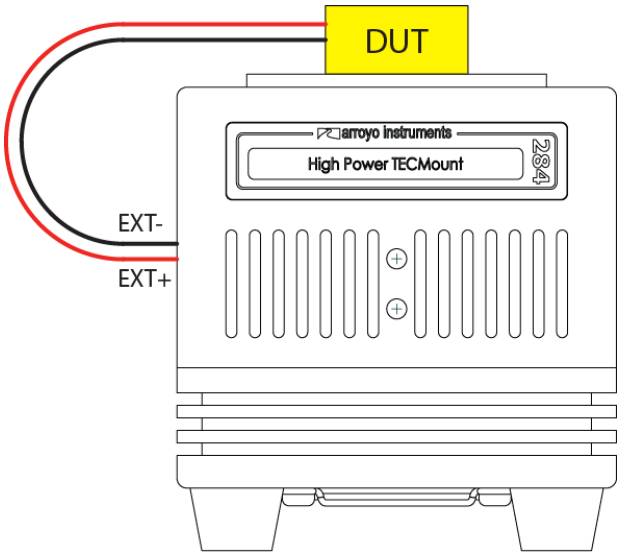
Because you are going to be sensing the temperature at the DUT, you are eliminating at least one, and possibly several, thermal interfaces, so the temperature of the DUT can be significantly higher than the temperature of the plate. As such, the actual plate temperature can be many degrees cooler than the DUT temperature, so more power will be required, and could possibly exceed the capacity of the mount. You may find that a more powerful mount is needed.

In addition to the greater power requirements as discussed in the preceding paragraph, because the plate temperature will typically be lower than the DUT temperature, if you are going to be operating the DUT anywhere near the dew point (the temperature at which water vapor condenses), it's very possible that while the DUT is above the dew point, the cold plate will be below the dew point, and water could condensate on both the cold plate and the device. A nitrogen-purged airspace should be used in these

conditions to prevent water condensation, which could lead to damage to the mount, and more importantly, to your device.

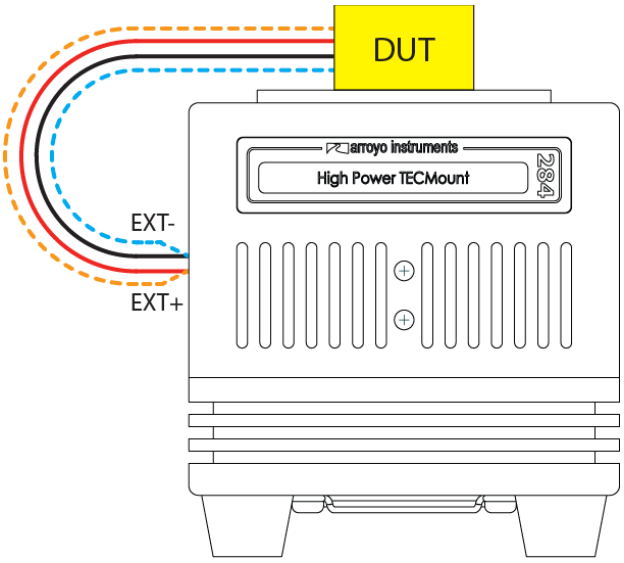
Wiring

Wiring is pretty straightforward… the most common sensor will be a thermistor or RTD. Because these two sensors are resistive devices, they are not polarized, and you can connect the two leads to the external sensor input without regard to polarity. If you are using an AD590 or LM335, these are polarized inputs, and the positive terminal of the sensor should be connected to the positive terminal of the external sensor input (and likewise for the negative or ground terminal).

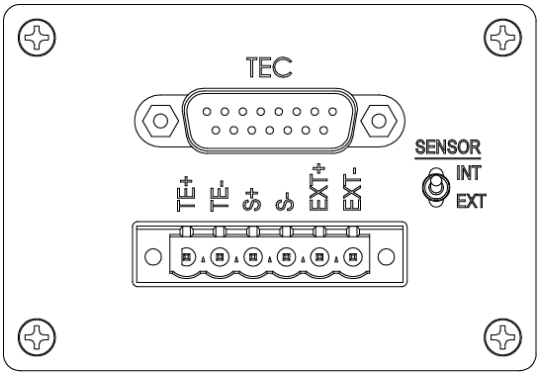


Wiring of 2-wire sensors

If you are using a 4-wire RTD, you will need to combine the force and sense leads together as you wire them into the external sensor input. The mount will then split them back out as a 4-wire connection on the DB15 or 17W2 connector. Below, the red and orange lines represent the positive force and sense leads, while the black and blue lines represent the negative force and sense leads… connect them together at the EXT+ and EXT- terminals.



Wiring of 4-wire sensors



Example inputs and SENSOR Switch from 284 TECMount

Controllers and Mounts with both EXT and AUX Inputs

Some mounts, such as the 286 TECMount, feature both an AUX and EXT inputs. The difference is now the signal is routed to the temperature controller.

For EXT wired sensors, the SENSOR switch on the mount selects which sensor is going to be connected to the temperature controller. When in the INT position, the sensor in the mount's cold plate will be connected to the temperature controller. When in the EXT position, the sensor wired to the EXT+/EXT- terminals of the mount will be connected to the temperature controller. The sensor is selected based on a physical switch position, and is the only option for controllers with a single sensor input, such as the 5200, 5300, or 6300 Series controllers.

When using a controller that supports multiple sensor inputs, such as the 5400, you should typically use the AUX input. This is because the controller is capable of measuring both the sensor in cold plate *and* the AUX sensor simultaneously, allowing you to receive continuous temperature measurements of both the DUT and the fixture. You also have an important benefit of selecting which sensor to use for the control loop from the front panel of the controller, or remotely via the computer interface, eliminating

the need for the use or operator to change the position of the sensor switch. You can also detech fault conditions, such as when the difference between the cold plate temperature and the DUT temperature exceed the expected values.

Setup and Use

Once the device is wired in, simply select INT or EXT sensor on the mount (if using the AUX input, see your controller's user's manual for instructions on how to use the multiple sensor inputs) and configure the sensor coefficients (if needed). The temperature should be correctly reporting on the display of the controller. You can then operate the controller and mount as you normally would.
When using the DUT, you may find that the Gain or PID parameters need to be adjusted, as you have changed the thermal characteristics of the system.