

# INSTRUCTION MANUAL



**Model ASPTC Aspirated Shield**  
**with Fine Wire Thermocouple**

Revision: 9/96

# **Warranty and Assistance**

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The **MODEL ASPTC ASPIRATED SHIELD WITH FINE WIRE THERMOCOUPLE** is warranted by CAMPBELL SCIENTIFIC, INC. to be free from defects in materials and workmanship under normal use and service for twelve (12) months from date of shipment unless specified otherwise. Batteries have no warranty. CAMPBELL SCIENTIFIC, INC.'s obligation under this warranty is limited to repairing or replacing (at CAMPBELL SCIENTIFIC, INC.'s option) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to CAMPBELL SCIENTIFIC, INC. CAMPBELL SCIENTIFIC, INC. will return such products by surface carrier prepaid. This warranty shall not apply to any CAMPBELL SCIENTIFIC, INC. products which have been subjected to modification, misuse, neglect, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose. CAMPBELL SCIENTIFIC, INC. is not liable for special, indirect, incidental, or consequential damages.

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# MODEL ASPTC ASPIRATED SHIELD WITH FINE WIRE THERMOCOUPLE

## 1. GENERAL

The model ASPTC is an aspirated shield with a chromel-constantan thermocouple temperature sensor. One ASPTC can be used to measure absolute air temperature. Two ASPTCs are used to make delta temperature measurements. The differential voltage thermocouple instruction, Instruction 14, is recommended to measure the ASPTC, because a differential measurement reduces noise.

### 1.1 SPECIFICATIONS

#### Shield

UV Stabilized Polyethylene  
 Length 72 cm  
 Height 14 cm  
 Width 10 cm

#### Fan

Air Velocity at Thermocouple 5.5 m/s @ 12 VDC  
 Expected Life 60,000 hrs @ 25 °C  
 Current Drain 140 mA @ 12 VDC  
 Thermal Fuse Opens @ 640 mA  
 Operating Range 6-14 VDC  
*Reverse Polarity Protected*

#### Thermocouple

Type Chromel-Constantan  
 Diameter 0.003 inches

### 1.2 POWER CONSIDERATIONS

The ASPTC should be powered by an external 12 VDC deep cycle, battery with an MSX20R solar panel or the PS12LA with the AC charger. A PS12LA with a solar panel will not have enough reserve power for overcast days.

## 2. MOUNTING

The ASPTC can be mounted on the UT018 crossarm (Figure 2.1) or Campbell Scientific's Bowen Ratio arms.

When using the Bowen Ratio arms to mount the ASPTC, mount it to the side of the arm such that the ASPTC intake is at the same height as the water vapor intake.

The ASPTC may also be mounted on a user supplied crossarm with a square cross section (1.5 in. x 1.5 in.).

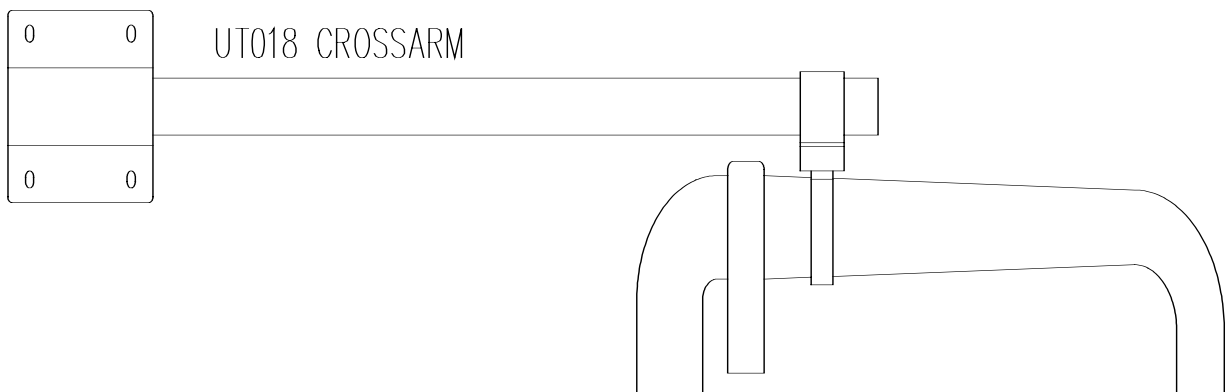


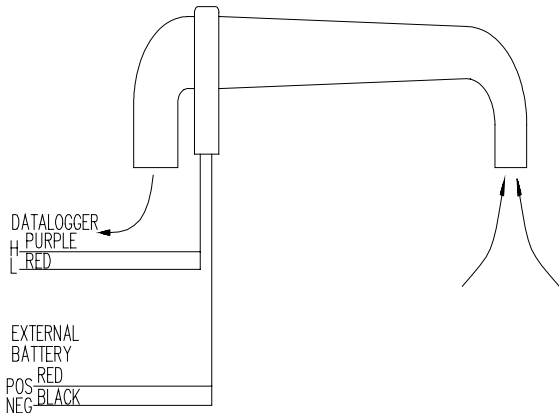
FIGURE 2.1. Mounting the ASPTC

# MODEL ASPTC ASPIRATED SHIELD

## 3. PROGRAMMING

### 3.1 ABSOLUTE TEMPERATURE

The ASPTC is wired to the datalogger as shown in Figure 3.1-1.



**FIGURE 3.1-1. Wiring for a Single ASPTC**

The temperature of the datalogger wiring panel is used as the reference temperature for the thermocouple measurement. The CR10(X) panel temperature is measured with the CR10TCR using Instruction 11. The 21X panel temperature is found using Instruction 17. The 21X panel temperature thermistor is located under differential input channel 4. Wiring the ASPTC into differential channel 4 reduces potential error caused by temperature gradients on the terminal strip. The terminal strip cover should always be installed on the datalogger wiring panel when measuring thermocouples.

**NOTE:** For a detailed discussion on thermocouple measurements, see the Measurement Section of the datalogger manuals.

**EXAMPLE 1. Sample CR10(X)/21X Instructions for measuring Absolute Temperature with ASPTC**

- 1: Temp (107) (P11)\*
  - 1: 1 Reps
  - 2: 1 SE Channel
  - 3: 3 Excite all reps w/E3
  - 4: 1\*\* Loc [ CR10TCR\_C ]
  - 5: 1 Mult
  - 6: 0 Offset

**CAUTION:** The CR10TCR reference temperature must be in degrees Celsius when used in Instruction 14.

- 2: Thermocouple Temp (DIFF) (P14)
  - 1: 1 Reps
  - 2: 21† ± 2.5 mV 60 Hz Rejection Range
  - 3: 6\*\*\* DIFF Channel
  - 4: 2 Type E (Chromel-Constantan)
  - 5: 1\*\* Ref Temp Loc [ CR10TCR\_C ]
  - 6: 2\*\* Loc [ ASPTC\_C ]
  - 7: 1‡ Mult
  - 8: 0‡ Offset

- \* Instruction 17 is used to find the panel temperature on a 21X.
- \*\* Proper entries will vary depending on the program.
- \*\*\* Differential input channel 4 on the 21X.
- † On the 21X the 5 mV slow input range is used.
- ‡ For degrees Fahrenheit use a Mult of 1.8 and Offset of 32.

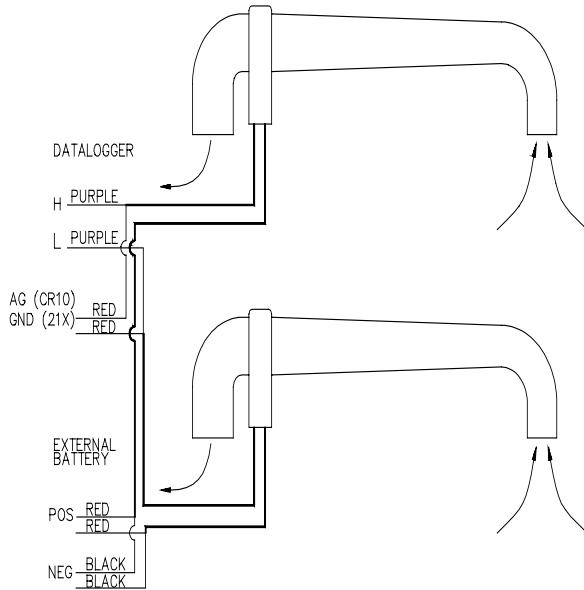
### 3.2 DELTA TEMPERATURE

Delta temperature can be measured with two ASPTCs. Wire them as shown in Figure 3.2-1. A voltage is induced between the lower and upper ASPTC and is directly related to the difference in temperature at those two levels. There is no inherent sensor offset error. The delta temperature is then measured directly with Instruction 14. The temperature of the lower ASPTC is used as the reference for the differential thermocouple measurement.

If the accuracy of the absolute temperature at both the lower and upper ASPTC is a concern, measure both ASPTCs with Instruction 14 (differential voltage thermocouple measurement) as outlined in Section 3.1. To find the delta temperature, simply subtract the upper temperature from the lower one.

If the 21X is used to power the fans (or any other 12 VDC sensor) the current drawn by the fans may cause a difference in ground potential between the 21X ground terminals and the reference ground point in the datalogger. This ground potential difference results in an offset on single ended measurements. In thermocouple measurements this offset can translate to as much as ±1°C. This offset does not affect differential measurements, thus, the delta temperature is not affected.

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**FIGURE 3.2-1. Wiring for a Pair of ASPTCs**

### EXAMPLE 2. Sample CR10(X)/21X Instructions for Measuring Temperature Gradient with the ASPTC

- 1: Temp (107) (P11)\*
- |    |     |                      |
|----|-----|----------------------|
| 1: | 1   | Reps                 |
| 2: | 1   | SE Channel           |
| 3: | 3   | Excite all reps w/E3 |
| 4: | 1** | Loc [ CR10TCR_C ]    |
| 5: | 1   | Mult                 |
| 6: | 0   | Offset               |
- 2: Thermocouple Temp (SE) (P13)
- |    |       |                                   |
|----|-------|-----------------------------------|
| 1: | 1     | Reps                              |
| 2: | 21†   | ± 2.5 mV 60 Hz Rejection<br>Range |
| 3: | 12*** | SE Channel                        |
| 4: | 2     | Type E (Chromel-Constantan)       |
| 5: | 1**   | Ref Temp Loc [ CR10TCR_C ]        |
| 6: | 2**   | Loc [ ASP_LWR ]                   |
| 7: | 1     | Mult                              |
| 8: | 0     | Offset                            |

**CAUTION:** The CR10TCR reference temperature must be in degrees Celsius when used in Instruction 14.

- 3: Thermocouple Temp (DIFF) (P14)
- |    |      |                                |
|----|------|--------------------------------|
| 1: | 1    | Reps                           |
| 2: | 21†  | ± 2.5 mV 60 Hz Rejection Range |
| 3: | 6*** | DIFF Channel                   |
| 4: | 2    | Type E (Chromel-Constantan)    |
| 5: | 2**  | Ref Temp Loc [ ASP_LWR ]       |
| 6: | 3**  | Loc [ ASP_UPR ]                |
| 7: | 1‡   | Mult                           |
| 8: | 0‡   | Offset                         |

- 4: Z=X-Y (P35)
- |    |     |                   |
|----|-----|-------------------|
| 1: | 2** | X Loc [ ASP_LWR ] |
| 2: | 3** | Y Loc [ ASP_UPR ] |
| 3: | 4** | Z Loc [ del_ASP ] |

\* Instruction 17 is used to find the panel temperature on a 21X.

\*\* Proper entries will vary depending on the program.

\*\*\* Single ended input channel 8 and differential input channel 4 on the 21X.

† On the 21X the 5 mV slow input range is used.

‡ For degrees Fahrenheit use a Mult of 1.8 and Offset of 32.

## 4. MAINTENANCE

Keep the intake and thermocouple free from debris. Debris can be blown away with a can of compressed air. Tweezers may also be used to pick the debris from the thermocouple. Be careful not to damage the junction.

**MODEL ASPTC ASPIRATED SHIELD**



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