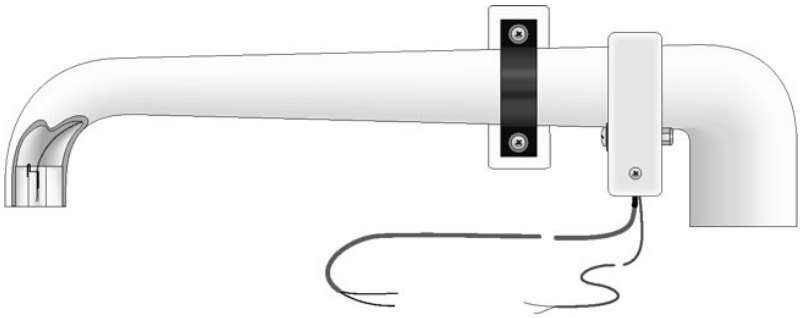
INSTRUCTION MANUAL

Model ASPTC Aspirated Shield with Fine Wire Thermocouple

Revision: 6/10



Warranty and Assistance

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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To obtain a Returned Materials Authorization (RMA), contact Campbell Scientific, Inc., phone (435) 753-2342. After an applications engineer determines the nature of the problem, an RMA number will be issued. Please write this number clearly on the outside of the shipping container. Campbell Scientific's shipping address is:

CAMPBELL SCIENTIFIC, INC.
RMA#_____
815 West 1800 North
Logan, Utah 84321-1784

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ASPTC Table of Contents

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Figures

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 (TCDiff in CRBasic or Instruction 14 in Edlog) is recommended to measure the ASPTC, because a differential measurement reduces noise.

1.1 Specifications

Weight: 1.9 lbs (0.86 kg)

Shield

Material: UV stabilized polyethylene

Dimensions

Length:	21 inch (53.3 cm)
Height:	5.8 inch (14.7 cm)
Large Outer Diameter:	2.3 inch (5.8 cm)
Small Outer Diameter:	1.8 inch (4.6 cm)

Fan

Air Velocity at Thermocouple:	5.5 m/s @ 12 Vdc
Life Expectancy:	65,000 hrs @ 30°C
Current Drain:	260 mA @ 12 Vdc
Operating Voltage:	9 to 13 Vdc
Operating Temperature:	-10° to 70°C

Reverse Polarity Protected

Thermocouple

Type:	Chromel-Constantan
Diameter:	0.003 inch (0.0762 mm)
Typical Output:	60 μV/°C
Accuracy:	Refer to the "Thermocouple Measurement" section in your datalogger manual.

1.2 Power Considerations

The ASPTC should be powered by an external 12 VDC deep cycle, battery with an SP20R solar panel or the PS100 with the AC charger. A PS100 with a solar panel will not have enough reserve power for overcast days.

2. Mounting

The ASPTC can be mounted on the Campbell Scientific's Bowen Ratio arms (see Figure 2-1) or UT018 crossarm (see Figure 2-2).

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. ASPTCs Mounted to Bowen Ratio Arms

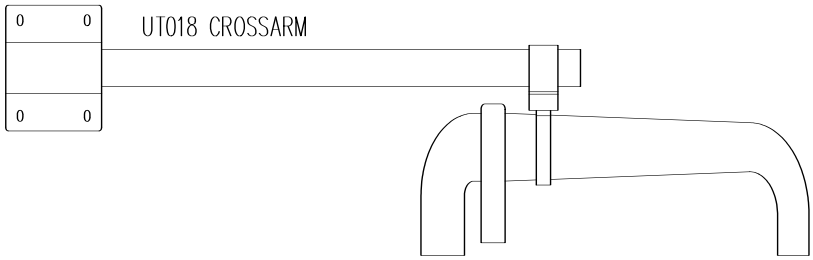

FIGURE 2-2. ASPTC Mounted to the UT018

3. Programming

3.1 Absolute Temperature

The ASPTC is wired to the datalogger as shown in Figure 3-1.

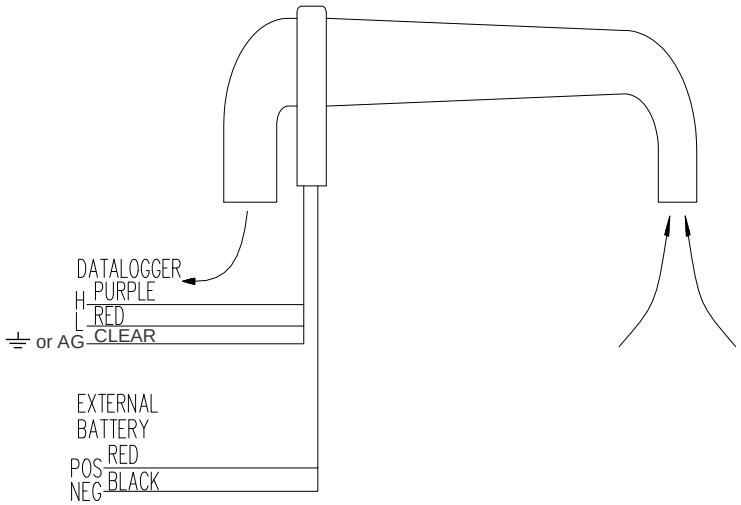

FIGURE 3-1. Wiring for a Single ASPTC

3.1.1 CRBasic

CRBasic is provided in our LoggerNet, PC400, and RTDAQ datalogger support software. Dataloggers that are programmed with CRBasic include our CR800, CR850, CR1000, CR3000, CR5000, and CR9000(X). These dataloggers use the TCDiff instruction to measure the ASPTC.

A reference temperature measurement is required. To provide this measurement, a thermistor is built into the wiring panel of our CR800, CR850, CR1000, CR30000, and CR5000 dataloggers. The PanelTemp instruction is used to measure the datalogger's built in thermistor. For the CR9000(X), a PRT is built into the CR9050 and CR9051E input modules. The ModuleTemp instruction measures the CR9050 or CR9051E's built in PRT.

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 CR1000 program for measuring Absolute Temperature with ASPTC

```
'CR1000
'Declare Variables and Units

Public PTemp_C
Public Temp_C
Units PTemp_C=Deg C
Units Temp_C=Deg C

'Define Data Tables
DataTable(Table1,True,-1)
    DataInterval(0,60,Min,10)
    Average(1,Temp_C,FP2,False)
EndTable

'Main Program
BeginProg
    Scan(1,Sec,1,0)
        'Wiring Panel Temperature measurement PTemp_C
        PanelTemp(PTemp_C,_60Hz)
        'Type E (chromel-constantan) Thermocouple measurements Temp_C
        TCDiff(Temp_C,1,mV2_5C,1,TypeE,PTemp_C,True,0,_60Hz,1,0)
        'Call Data Tables and Store Data
        CallTable(Table1)
    NextScan
EndProg
```

3.1.2 Edlog

Edlog is provided in our LoggerNet and PC400 datalogger support software. Dataloggers that are programmed with Edlog include our CR7, CR10(X), CR23X, and 21X. These dataloggers use Instruction 11 to measure the ASPTC. A reference temperature measurement is required.

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 CR23X and 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. For the CR7, a PRT is included in the CR723T input card. This built-in PRT is measured with Instruction 17. 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 2. Sample CR10(X) 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. 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 the TCDiff or 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 TCDiff or 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.

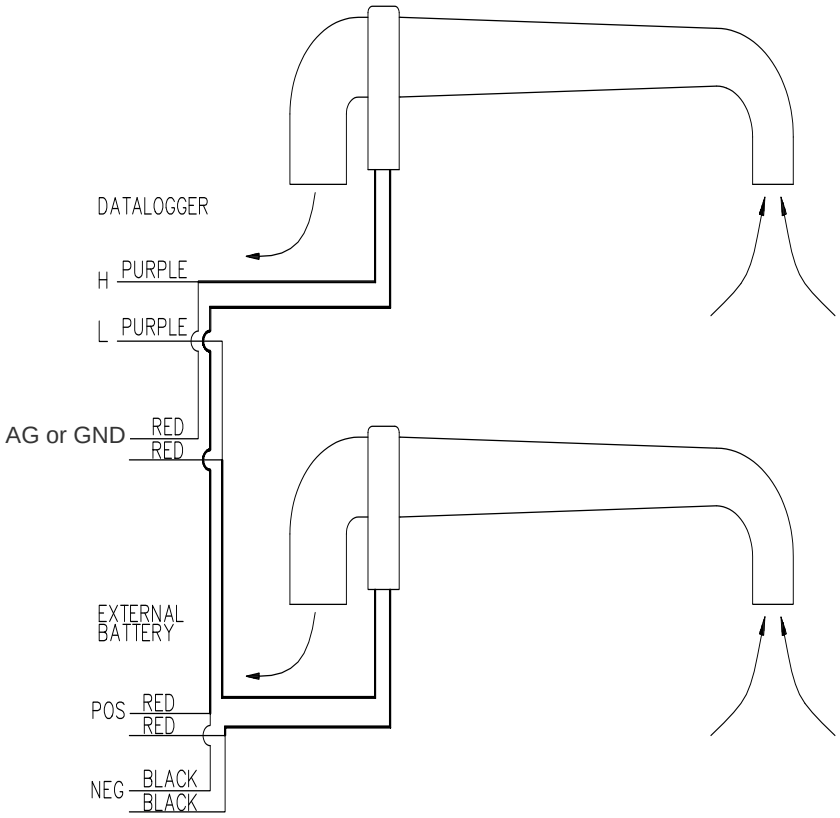

FIGURE 3-2. Wiring for a Pair of ASPTCs

EXAMPLE 3. Sample CR1000 program for measuring Temperature Gradient with the ASPTC

```
'CR1000
'Declare Variables and Units

Public PTemp_C
Public AirTemp(2)
Alias AirTemp(1)=Temp_C_1
Alias AirTemp(2)=Temp_C_2
Public Delta_Temp_C
Units PTemp_C=Deg C
Units AirTemp=Deg C
Units Delta_Temp_C=Deg C

'Define Data Tables
DataTable(Table1,True,-1)
    DataInterval(0,60,Min,10)
    Average(1,Temp_C_1,FP2,False)
    Average(1,Temp_C_2,FP2,False)
    Average(1,Delta_Temp_C,FP2,False)
EndTable

'Main Program
BeginProg
    Scan(1,Sec,1,0)
        'Wiring Panel Temperature measurement PTemp_C
        PanelTemp(PTemp_C,_60Hz)
        'Type E (chromel-constantan) Thermocouple measurements Temp_C
        TCDiff(Temp_C_1,2,mV2_5C,1,TypeE,PTemp_C,True,0,_60Hz,1,0)
        Delta_Temp_C=Temp_C_1-Temp_C_2
        'Call Data Tables and Store Data
        CallTable(Table1)
    NextScan
EndProg
```

EXAMPLE 4. Sample CR10(X) 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 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.

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