

W200P
Potentiometer Windvane

User Guide

Issued 19.6.02

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W200P Potentiometer Windvane

The W200P Windvane is manufactured by Vector Instruments Ltd. and is well suited for use with Campbell Scientific dataloggers. The windvane incorporates a 358° micro-torque potentiometer (wire wound type). The 2° gap is filled to ensure smooth operation and a long service life. The precision ball-bearing races are corrosion-resistant and protected against the entry of moisture and dust.

The W200P has excellent sensitivity and is suitable for remote operation. The fin is attached by a patented gravity-sensitive fastener allowing rapid attachment and release when the windvane is used as a portable instrument.

An optional anti-icing heater can be fitted if required (see Appendix B).

1. Specifications

Physical:	Overall height: 270mm
	Fin clearance: 180mm
	Body diameter: 56mm
	Cable length: 3m standard (other lengths to order – see Appendix A for use with long cables)
	Weight: 350g
	Materials: Anodised aluminium, stainless steels, and ABS plastics for all exposed parts
Performance:	Threshold: 0.6ms ⁻¹ (fin moves when aligned 45° to flow)
	Max. speed: > 75ms ⁻¹
	Range: 360° mechanical angle; full circle continuous rotation allowed
	Accuracy: ±2° obtainable in steady winds over 5ms ⁻¹
	Backlash: ±½° when fin removed and replaced (no backlash movement during use)
	Resolution: ±0.2°
	Repeatability: ±0.5°
	Linearity (potentiometer error): 0.5% of full scale output
	Temperature range: -50°C to +70°C (de-icing heater available to order – see Appendix B).
	Life: 5 x 10 ⁷ revolutions (equivalent to 10 years' typical exposure)
Electrical :	Potentiometer resistance: 1kΩ ±10%
	Electrical Continuity Angle: 357.7°±1.5° (2.3° gap at North)
	Electrical Variation Angle: 356.5°±1.5° (3.5° deadband)
	Temp. coefficient: ±50ppm/°C
	Max. Power Dissipation: 0.5W -50°C to 20°C; derate linearly to 0.25W at 70°C
	Insulation resistance: 50MΩ minimum
	Wiper current: 20mA maximum
	Voltage, case to potentiometer: 125V maximum
	Supply voltage: 20V maximum

Connections:	6-wire attached cable, two connections at each end of potentiometer, one wiper connection, connection to case
Fixing:	0.25" BSW/UNC (6° taper fitting type128-1 also available for portable applications) tapped hole and screw into base

NOTE

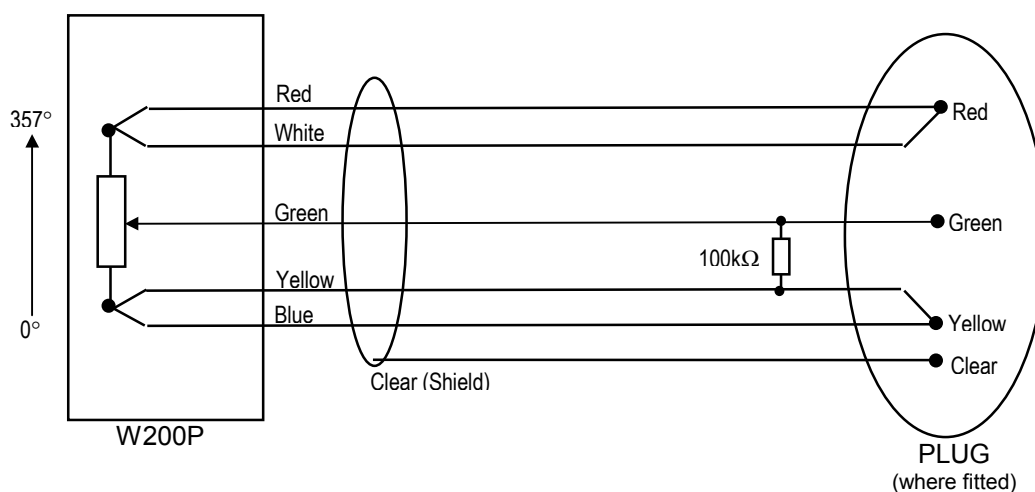
Windvanes and bases need to be used in matched pairs. Please ensure that the last two digits of the serial number on the windvane are the same as the last two digits of the serial number on the base.

2. Mounting

After unpacking, remove the white plastic tube which protects the spindle during transit. Looking down on the instrument from above, rotate the spindle so that the small indentation lines up with the right-hand side of the fin. Lightly push the fin down onto the spindle until it is positively located and secure.

Mount the vane using a 0.25" (6.4mm) BSW or UNC screw directly into the base of the instrument. Avoid screws which will project more than 0.3" (7mm) into the base of the instrument. In marine applications or where the W200P is exposed to extreme conditions, it is advisable to seal the joint with silicone rubber compound. After mounting, ensure that the 'N' marked on the side of the windvane points to North.

3. Connection to Datalogger



Connections

Red to Excitation Channel
 Green to Single-Ended Channel
 Yellow to (Analogue) Ground (AG on CR10/10X and CR510; $\perp$ on CR7, 21X and CR23X)
 Clear (screen) to Earth Ground

Figure 1 W200P Wiring Diagram

4. Programming the Datalogger

The following CR10X program fragment stores wind direction (in °) in input location 1. The program assumes that the red wire is connected to excitation channel 2 and the green wire to single-ended channel 8.

```
1:  Excite-Delay (SE) (P4)
  1: 1      Reps
  2: 5      2500 mV Slow Range
  3: 8      SE Channel
  4: 2      Excite all reps w/Exchan 2
  5: 1      Delay (units 0.01 sec)
  6: 1000   mV Excitation
  7: 1      Loc [ WindDir ]
  8: 0.357  Mult
  9: 0.0    Offset
```

The 10ms delay shown is adequate for cable lengths up to 10m with good quality cable. For longer cables, a good starting point is to use a delay of 100ms. (This can be reduced, if necessary, by holding the vane in a fixed position in the deadband and reducing the delay until the readings become unstable when the program is executed.)

CAUTION

Significant errors will be introduced if too short a delay is used, especially when the vane is positioned in the deadband.

If you have a cable length greater than 50m please refer to Appendix A.

5. Checking Alignment

It is easier to check on precise alignment after the vane is wired to the datalogger. Using a compass, rotate the fin until it is aligned in a North-South direction (or, alternatively, align it to another known bearing). While holding the fin in this direction, rotate the body of the windvane slowly, at the same time checking the datalogger display. When the datalogger shows a reading of 0° (or shows the figure corresponding to the known bearing) clamp the windvane body. To check vertical alignment, position a small spirit level against the spindle tube. Note that any deviation from the vertical by more than a few degrees can cause bias in the readings.

NOTE:

Only use the label marked 'N' on the windvane for initial directional setup. Sighting to a bearing and adjusting the body position will give the most accurate reading.

5.1 Removing the Fin

To remove the fin, invert the instrument and press the fin's hub to release the gravity-sensitive catch. The fin will now slide off easily.

NOTE

When this procedure is followed correctly, a force of 1-2kg is all that is required to dismantle the fin. Excessive force should not be used.

6. Avoiding Errors in the Deadband

W200P windvanes supplied by Campbell Scientific are fitted with a 100kΩ resistor to prevent the datalogger seeing an open circuit between 357° and 0°. This resistor is incorporated into the cable and is effectively in parallel with the output from the potentiometer (see Figure 1).

When the windvane enters the 'deadband' there is no connection between the green and yellow wires and the datalogger readings float randomly. With the 100k Ω resistor in circuit, a reading of approximately zero results within the deadband.

W200P windvanes supplied before October 1987 will not have this modification and will benefit from having a 100k Ω resistor fitted into the cable or into the W200P plug between the green and yellow wires (Figure 2).

Outside the deadband, the extra parallel resistance has only a slight effect on the readings, introducing a maximum error of 0.7°. Note that in addition to the mechanical gap there is an additional deadband (approximately 1°) where there is electrical contact but no change in wind direction will be registered.

See also Technical Note 31 (available on request) for a fuller discussion on general measurement errors of potentiometer windvanes.

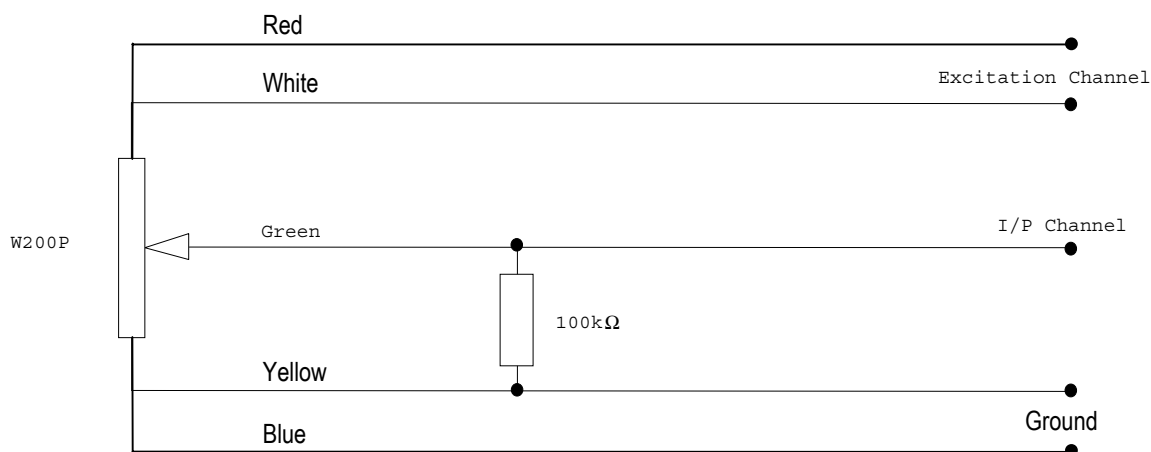


Figure 2 Addition of a 100k Ω Parallel Resistor

7. Replacement of Potentiometer

1. Switch off the power, disconnect the cable, remove the instrument from its mounting, invert it and remove the fin by pressing the hub and releasing. Replace the spindle protector tube.
2. Clean the windvane and fin using a damp cloth or soapy water (do not immerse).
3. Refer to Figure 3, below. Unscrew the nuts holding the base plate (18) using a 5 BA (5.5mm AF) nut-driver, pull off the base plate with body tube (16) and unsolder the wires from the potentiometer (10).
4. Remove the three servo mounting clips and take out the potentiometer with the spindle (3) attached.
5. Insert the new spindle with potentiometer if this has been obtained as an assembly. Alternatively, grip the spindle in a vice with soft jaws, unscrew the old potentiometer and screw on the new potentiometer. Clamp the potentiometer onto a rigid base and check the concentricity of the spindle using a DTI gauge. Adjust by bending to obtain concentricity to ± 0.002 " (0.05mm). Replace into top plate (4), and tighten the servo mount clips.

6. Re-solder the wires to the new potentiometer, yellow and blue to the brown pin (ACW end viewed from above), green to the black pin (centre) and red and white to the red pin.
7. Replace the 'O' ring fully against the flange on the top plate (the body tube may be sealed to the base plate with silicone rubber compound). Push on the body making sure that the wires do not touch the lower projection of the shaft on the potentiometer, and replace the nuts to hold the instrument together temporarily.
8. Use an ohm meter, replace the fin and rotate it to find the position of north (centre of gap), mark onto case, break down the instrument again and loosen the servo mount clips, rotate the potentiometer the required amount and re-tighten. Re-assemble the windvane.
9. Check that the N mark on the body is now correct.
10. Remove the fin and check that the spindle does not touch the top bearing (2) as it rotates.
11. On final assembly, apply non-drying silicone rubber compound around studs (6) and replace the washers (8) and nuts (9). Wipe off excess compound.

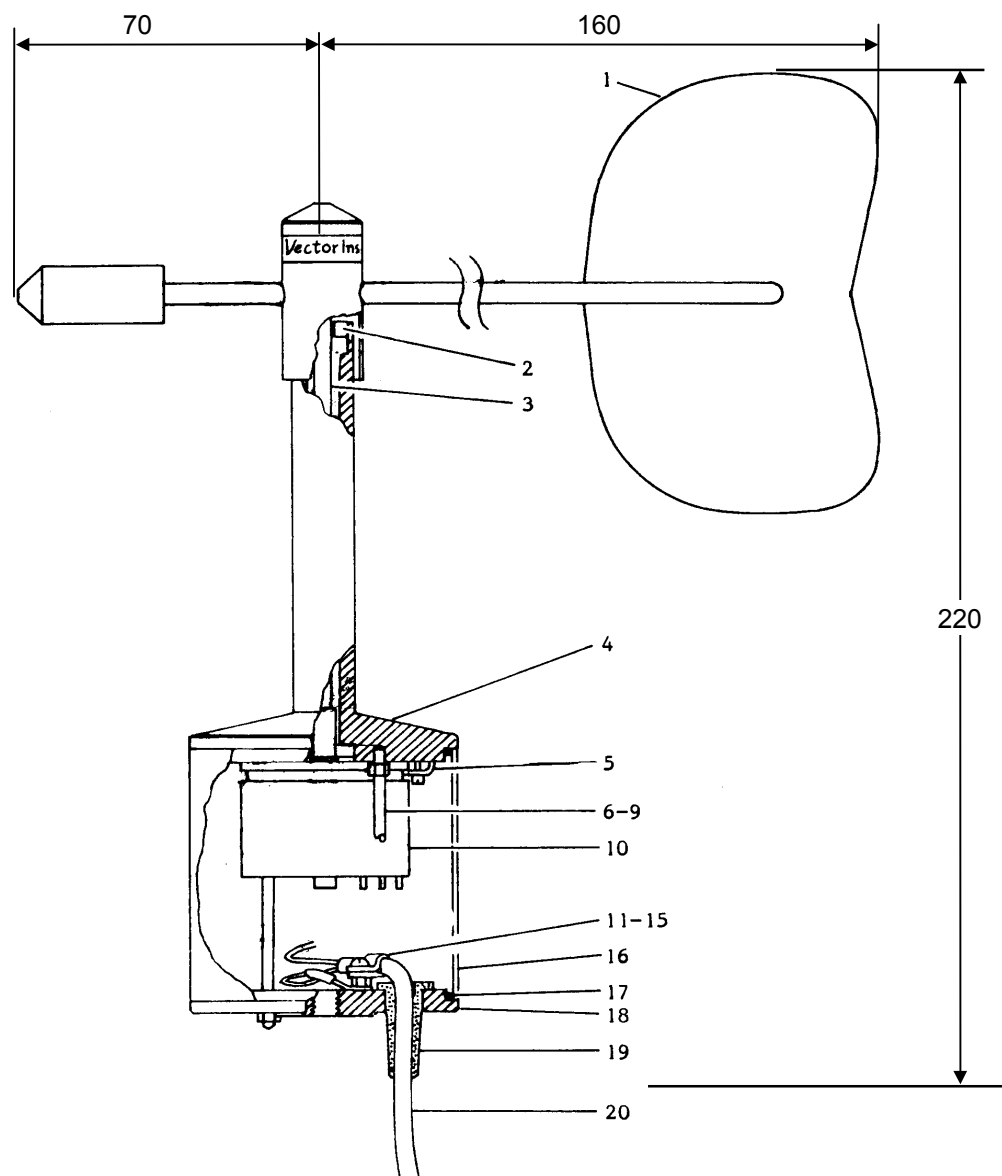


Figure 3 W200P Windvane — General Arrangement

Appendix A. Using the W200P with Long Cables

A.1 Introduction

Instruction 4 (Excite, Delay, Measure Single-Ended) is normally used to monitor measurements from the W200P, as shown in Section 4 of this manual.

However, cable length can have a significant effect on the windvane output. For example, a 1k Ω potentiometer windvane with a cable having a significant series resistance (greater than a few ohms) can cause errors in the wind direction measured. The reason for this is that the cable resistance causes the excitation voltage received at the windvane to be less than the value output by the datalogger. The windvane output voltage received by the datalogger suffers the same effect.

If you need to use long cables on your installation, you can compensate for the above effect by making an additional single-ended measurement with Instruction 4 and extra instructions in the datalogger program. An example program for a CR10/10X datalogger is given below.

If an additional single-ended input is not available it is also possible, for fixed installations, to correct the error by measuring the cable resistances and using appropriate corrections to the multiplier and offset parameters. Please contact Campbell Scientific for further advice on this technique.

NOTE

The error is usually insignificant if the cable is shorter than about 50m, and Instruction 4 can be used as shown in Section 4.

A.2 Programming

A typical CR10/10X program using Instruction 4 to compensate for the effect of long cables is shown below. The program uses two single-ended inputs and allows the option of 50Hz rejection. It assumes that the resistances for the excitation and ground conductors are identical. The voltage drop along the ground conductor is measured, and it is assumed that the voltage drop along the excitation conductor is the same.

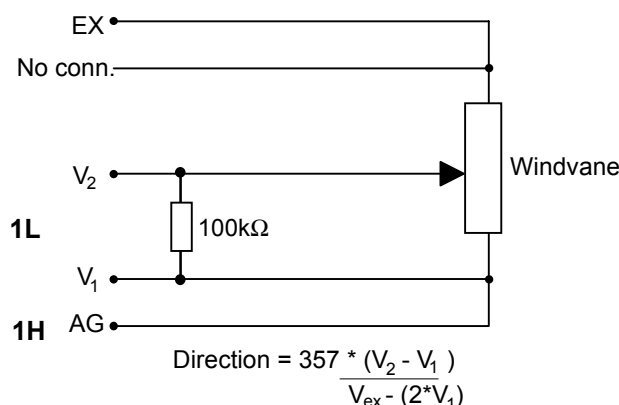


Figure A-1 Wiring Diagram for use with Instruction 4

A.2.1 Typical Program for CR10/10X Using Instruction P4

```
; {CR10X}
; Example program for W200P with dynamic correction of long
; cable lengths

*Table 1 Program
01: 60          Execution Interval (seconds)

; Measure both the output from the sensor and the voltage drop
; down one wire to the sensor with one call to P4.
; N.B. change the channel numbers to match your wiring. The
; first input is the sense wire for voltage drop down the cable.

1:  Excite-Delay (SE) (P4)
1:  2          Reps
2:  5          2500 mV Slow Range
3:  1          SE Channel
4:  1          Excite all reps w/Exchan 1
5:  2          Delay (units 0.01 sec) ;this can be increased for very long cables
6:  2500       mV Excitation
7:  1          Loc [ V_1          ]
8:  1.0        Mult
9:  0.0        Offset

; Deduct the voltage drop to the bottom of the potentiometer
; from the measured output from the wiper to give the true
; wiper voltage as would be measured at the sensor

2:  Z=X-Y (P35)
1:  2          X Loc [ V_2          ]
2:  1          Y Loc [ V_1          ]
3:  3          Z Loc [ V_wiper      ]

; Enter a fixed value for the excitation

3:  Z=F (P30)
1:  2500       F
2:  00         Exponent of 10
3:  4          Z Loc [ V_ex          ]

; Double up the measured voltage drop to give the total drop
; to, and from, the sensor

4:  Z=X*F (P37)
1:  1          X Loc [ V_1          ]
2:  2          F
3:  5          Z Loc [ V_drop        ]

; Calculate the true excitation at the sensor by taking the
; total voltage drop away from the excitation output by the
; datalogger.

5:  Z=X-Y (P35)
1:  4          X Loc [ V_ex          ]
2:  5          Y Loc [ V_drop        ]
3:  6          Z Loc [ V_true_ex     ]
```

```
; Divide the true wiper output by the true excitation to give
; a voltage ratio
```

```
6:  Z=X/Y (P38)
   1: 3          X Loc [ V_wiper  ]
   2: 6          Y Loc [ V_true_ex ]
   3: 7          Z Loc [ V_ratio  ]
```

```
; Convert the ratio to degrees
```

```
7:  Z=X*F (P37)
   1: 7          X Loc [ V_ratio  ]
   2: 357        F
   3: 8          Z Loc [ Direction ]
```

```
*Table 2 Program
```

```
02: 0.0000      Execution Interval (seconds)
```

```
*Table 3 Subroutines
```

```
End Program
```

```
-Input Locations-
```

```
1 V_1          5 2 1
2 V_2          17 1 1
3 V_wiper      1 1 1
4 V_ex         1 1 1
5 V_drop       1 1 1
6 V_true_ex    1 1 1
7 V_ratio      1 1 1
8 Direction    1 0 1
9 _____ 0 0 0
10 _____ 0 0 0
11 _____ 0 0 0
12 _____ 0 0 0
```


Appendix B. Fitting and Using the HE-1 De-icing Heater

*This Appendix gives the specification and details of the optional HE-1 anti-icing heater.
When specified at the time of ordering, the heater is fitted to the sensor during manufacture.
The information below gives full details of fitting the heater to an existing wind sensor.*

B.1 Introduction

The heating element must be supplied with a separate external 12V (AC or DC) power supply.

The effectiveness of the heater is dependent on the prevailing wind speed. Typically it will provide protection down to -10°C at wind speeds of up to 10m/s in dry air. The heater does not prevent snow and ice build up on the rotor/vane.

B.2 Specifications

Operating Voltage (AC or DC $\pm 5\%$):	12V
Nominal Current:	0.5A
Element Resistance ($\pm 5\%$)	24 ohms
Nominal Power Rating:	6W
Temperature Rise*:	5.2° [1.7] °C /W
Max. Allowable Temperature**:	70°C

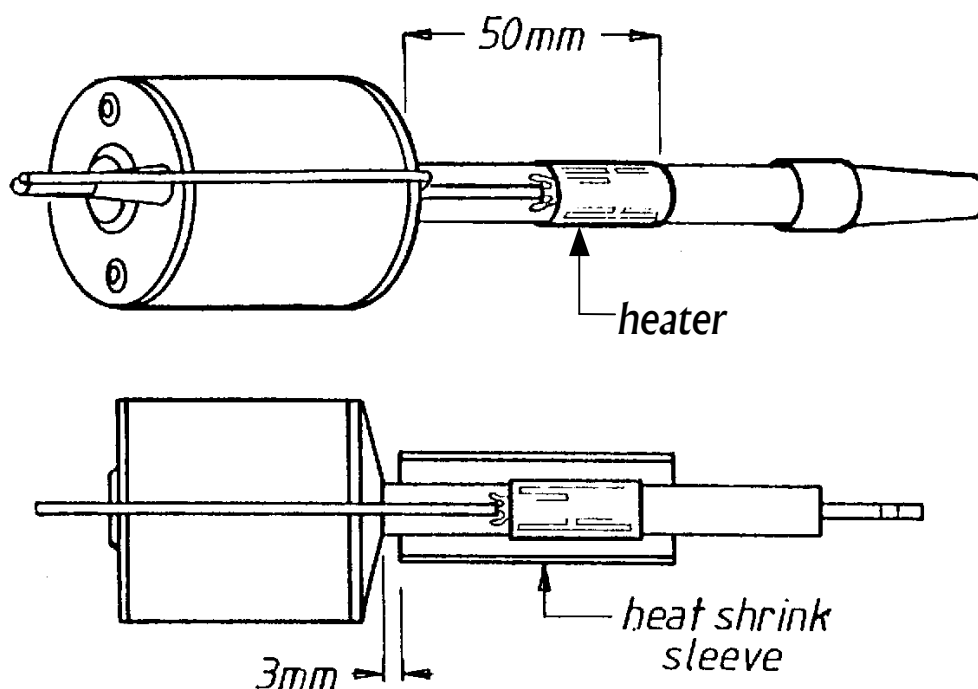
* In still air; figure in square brackets refers to 10m/s wind speed (i.e. anti-icing of bearings effective to -10°C)

** i.e. should not be operated continuously at ambient temperatures above 39°C

When supplied separately, the HE-1 is equipped with 3 metres of 6mm diameter, 2-wire cable to DEF61-12 part 5 – 0.2mm tinned copper stranded cores; nominal resistance 40mohms/m; overall braided screen and black pvc sheath. If extending the cable, use as low a resistance cable as is practical to avoid reducing the voltage supplied to the heater.

NOTE	The screen is isolated from the heater end of the cable. It should be earthed at the power supply end to give some protection in the event of lightning, and also to minimise any interference from noise on the power supply output.
-------------	---

B.3 Fitting the HE-1 to the Sensor



Referring to the above illustration, fit the HE-1 heater as follows:

- 1) Connect the two blue wires together and then connect the supply across the blue and white wires.
- 2) Thoroughly clean the surface of the tube.
- 3) Peel back the protective paper and apply the centre of the heater against the tube, and work outwards from the centre in both directions around the tube.
- 4) Place the heat-shrink sleeve over the element as shown. Using a heat gun (hot air blower), rotate the instrument slowly while applying heat evenly along the length of the sleeve so that the sleeve just shrinks sufficiently to touch the tube and element. While still rotating the instrument, move the heat gun closer in order to shrink the sleeve tightly. Start from the spindle end and work towards the base in order to exclude any trapped air.
- 5) Check that the sleeve is in all-round contact with the extension tube, and that molten adhesive can be seen at the ends.
- 6) Bend the leads neatly around the instrument, and tie or tape to the cable from the base.

B.4 Power Supply Connections

The power consumed by the HE-1 is much greater than the normal requirements of a standard weather station - e.g 1A at 12V for a wind sensor pair. It is not advisable to try to draw this power from the normal weather station supply (e.g. from the PS12E-LA power supply). An alternative 12V power source is recommended which would normally be provided from an AC mains supply.