User Manual for the

Anemometer

type AN3

AN3-UM-1

DELTA-T DEVICES

High Resolution anemometer, Type AN3

Operating Instructions

Introduction

The AN3 provides both an analogue and a digital output. It is the preferred sensor if measurement of near-instantaneous wind speed and real-time sensor interrogation are required. The AN3 needs to be connected to an appropriate power supply when a reading is taken. This sensor is made for Delta-T Devices Ltd by a manufacturer specialised in this field and their product specifications and information are included in these instructions. These Operating Instructions should be read in conjunction of those of the manufacturer.

Wiring Connections

The AN3 is supplied with a six core, screened cable which provides the following connections:

Red	Power supply positive.
Blue	Power supply zero volts.
Green	Analogue output signal HI, load resistance 5KΩ minimum.
Yellow	Analogue output signal LO.
White	Digital output HI.
Black	Digital output LO.
Braid	Cable screen. Not connected within sensor.

The yellow and blue leads are internally connected within the sensor.

When using the sensor with a Delta-T logger, the cable braid should be connected to a digital or frame earth terminal on the logger. If not using Delta-T equipment, please refer to the manufacturer’s instructions.

EMC requirements

The braid must be connected as above when used with the Delta-T loggers in order to comply with CE regulations for electromagnetic susceptibility and emissions.
If using the sensor with non-Delta-T equipment, please refer to the manufacturer’s instructions.

Connection to Delta-T loggers

Power requirements

The AN3 requires 6.5 - 28 V dc (unregulated), and consumes 2 mA. maximum.
If your logger is powered from a supply that is reliably greater than 7 V at all times, you can use it to power the AN3. If this is not the case, you must provide a separate battery of appropriate voltage and capacity.

Warm-up relays

Although the AN3 can be continuously powered and read, you can save significant amounts of power by using the Delta-T logger warm-up relay to switch on the power just before a reading is logged.
A warm-up time of at least 5 seconds is necessary to allow the circuit to settle before the reading is taken.

Analogue output

The analogue output is 0-2500mV corresponding to 0-150 knots (75m/s). This signal can be input directly into a differential analogue channel of a Delta-T logger if maximum wind speeds above 120 knots (62m/s) are not anticipated. To measure over the complete 150 knot range, a potential divider is needed to reduce the maximum sensor output from 2500mV to 2000mV, which is the maximum logger input voltage.
The conversion from voltage to wind speed is performed within the logger, and the following conversion factors should be used:

Range	Conversion factor	Zero offset	Potential divider needed
0-120 knots	16.667 mV/knot	0	no
0-62 m/s	32.377 $mV/m.s^{-1}$	0	no
0-150 knots	13.334 mV/knot	0	yes
0-75 m/s	25.87 $mV/m.s^{-1}$	0	yes

Digital output

The digital output is 0-1500 Hz corresponding to 0-150 knots (75 m/s). The output pulse amplitude is 5V. The conversion from voltage to wind speed is performed within the logger, and a conversion factor of 10Hz/knot or 19.43 $Hz/m.s^{-1}$ should be used as appropriate. This range is acceptable if using a DL3000 logger, but is beyond the frequency range of the on-board channels of the DL2e. If using a DL2e, it must be fitted with an optional DLC1 counter card.
For the DL2e, the pulse output from the sensor should be treated as a Frequency or Count signal, depending on whether wind speed or wind run is required. The maximum permissible logged wind speed will depend on the logging sampling frequency being used. A one minute sampling frequency will allow a maximum of 109 knots or 56 m/s.

For the DL3000, the sensor can be operated over its complete wind speed range. The sensor may be configured in several ways, each providing different functions. For details on this, please refer to your DL3000 documentation.

AN3-UM-A 25 Nov 1996

Title Page			Document 1 of 5
<u>Contents</u>			
Operating Instructions (this document)	010-118-04	OI-A100L-4	
Calibration Data (see overleaf)			
Module Wiring	014-107-02		
Chart, Non-Linearity	010-115-02	LPPL4L3X.XLS	
Specification, Low Power Anemometer	050-107-05	S-A100/L--LPP4-5	
Regular Maintenance & General Arrangement	013-101-03	M-A100-3	
			One Sheet
<u>Rotor Calibration</u>			
Test Certificate (in box with rotor)	010-108-02		RCD-9

CE *This instrument complies with the European CE Marking Directive (which includes ElectroMagnetic Compatibility - 'EMC') when used in accordance with these instructions provided that the recommended operating conditions are not exceeded. When used in this way, and when connected to other CE marked equipment intended to be used with this instrument, it should result in a system which also complies with the regulations (although this is not guaranteed). The instrument cable may be extended (using overall screened cable to DEF61-12 part 4 or similar with 7/0.2mm or 24AWG cores) up to 115m total length by use of junction box 2J-DS-A (2-way), 3J-DL-A (3-way), or 3JD-1L (3-way via. connectors). Application circuits are available on request. OEM users and Value Added Resellers may need to make their own CE conformity declarations.*

CE

s/n: 4598 onwards

Low Power Anemometer
Type: A100L2
Operating Instructions
(and Calibration Data)

Analogue and Pulse Outputs

A100L2, A100LPC3L2.

1. Remove protection cap and lightly push rotor onto spindle with the anemometer approximately vertical.
2. To remove the rotor first invert the instrument, press the rotor hub to release the gravity sensitive catch, and allow rotor to slide off. **Excessive force should not be used.**
3. Screw securely to mast top using a ¼ inch BSW screw directly into the base of the anemometer (or use Mast Adapter 405). The screw should not enter more than 0.38 inches; use of an excessively long screw may result in internal damage. Alternatively a Taper Spigot (128-1) and Taper Adapter (405T) will allow rapid removal and replacement in portable applications. The anemometer also accepts a standard tripod fitting.
4. Wire to base station as table below:-

WIRE COLOUR	WIRE FUNCTION
RED	SUPPLY POSITIVE: 7V TO 28V DC
BLUE	SUPPLY NEGATIVE (0V)
GREEN	ANALOGUE VOLTAGE OUTPUT POSITIVE (NOMINALLY 0-2.500V = 0-150KTS)
YELLOW	OUTPUT NEGATIVE (COMMON 0V)
WHITE	PULSE OUTPUT. (5V SQUARE WAVE: A100L2, A100LPC3L2)
BLACK	CONNECTED TO INSTRUMENT CASE.
SCREEN	CABLE SCREEN (INSULATED AT INSTRUMENT), CONNECT TO EARTH OR TO BLUE WIRE FOR MAXIMUM INTERFERENCE SCREENING.

Note that the wiring is such that this instrument may be introduced into a system which has used a standard A100H Porton Anemometer with minimal changes to the cabling, connections and calibration. There are three differences: 1) There is no calibration facility, which is unlikely to be used in low-power applications, often Blue and White on existing Porton units are commoned to disable the cal feature. 2) The analogue output signal is considerably less than that of the standard instrument. 3) The white wire should be insulated if the pulse output is not used. The white wire must NOT be grounded. Loading: Instruments are calibrated with a load of approx. 1Mohm (typical of a data logger) on the analogue output. Lower resistance loads will reduce the output signal, e.g. by approx. ½% for a 100Kohm load. It is recommended that terminal equipment should incorporate low-pass filtering with max. cut-off frequencies of 1KHz and 10KHz respectively for the analogue and pulse outputs.

Low Power Anemometer Type: A100L2

Analogue and Pulse Outputs.

Calibration Data

Anemometer Type:	A100L2	Serial No. [ ]
Wind speed range:	0 to 150 kts (see note[1])	
Output pulse frequency range:	0 to 1.5 kHz (see note[2])	
Nominal frequency calibration (f):	**10 Hz per kt.**	
Number of pulses per rotor revolution:	25 (disc type K)	
Theoretical corresponding rotor calibration:	$R = \frac{10 \times 60 \times 3600 \times 100}{25 \times 6080 \times 12 \times 2.54}$	(1m/s = 1.9426kts)

= 24 x 1.9426 = 46.62 rpm per m/s

Rotor and Pulse Output

Rotor Type, (delete as appropriate): R30K, R302K (band K2) Rotor Serial No. [ ]
Rotors in band K2 have 'R' within 46.62 ± ½%, i.e. 46.4 to 46.8 rpm per m/s (see note[3])

For any rotor, pulse output frequency: $f = \frac{25R}{60}$ Hz per m/s

$= \frac{5R}{12 \times 1.9426}$ = 0.2145 R Hz per kt.

Insert 'R' figure in box for rotor to be used, and complete other boxes as per example calculations

For a particular rotor of R = 46.8 rpm per m/s [ ]

f = 0.2145 x 46.8 = 10.039 Hz per kt. [ ] Hz per kt

Analogue Output

Nominal output voltage range:	0 to 2.5 V	
Nominal analogue output calibration:	2.5÷150 = 16.67mV per kt.	
Nominal ratemeter calibration (S):	1500÷2.5 = 600 Hz per V	[ ] Hz per V

However, for best linearity over the speed range, taking account of both rotor and ratemeter non-linearity, a 2.4% correction has been applied, and the output has been set to 2.441V at 1.5KHz. (see note[4])

Analogue output for the above example rotor: f÷S = 10.039 ÷ 600 = 16.73 mV per kt. [ ] mV per kt

To convert to mV per m/s, multiply by 1.9426 = 32.50 mV per m/s [ ] mV per m/s

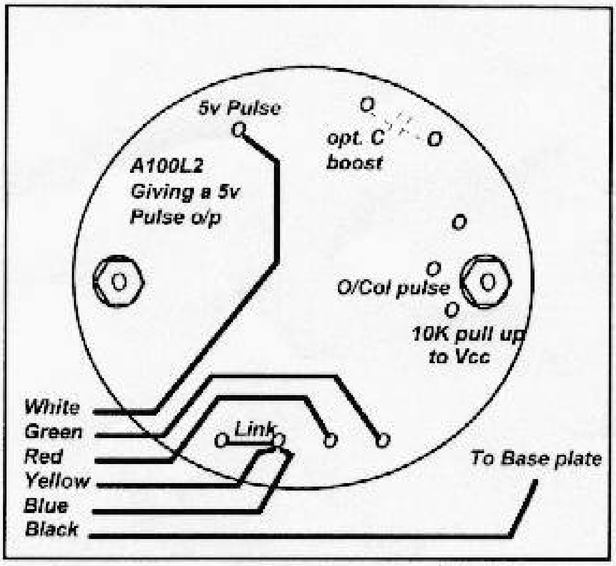
Notes

1. Units of knots used are UK knots, based on nautical mile of 6080 ft / hour. The alternative international knot is based on 1.852 Km (approx. 0.06% less).
2. 5volt pulse output only.
3. Calibration figure is for rotor speed of 425 rpm. See rear of rotor test certificate for speeds up to 3700 rpm, see 010-115 page 1 for pulse output correction for rotor non-linearity.
4. Non-linearity of the rotor and ratemeter combined output is shown on 010-115 page 2.

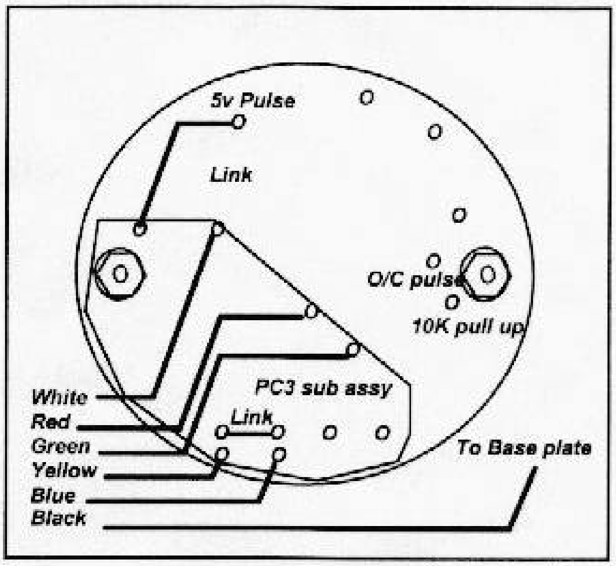
Module Wiring

Anemometer types:- A100L2 and A100LPC3L2

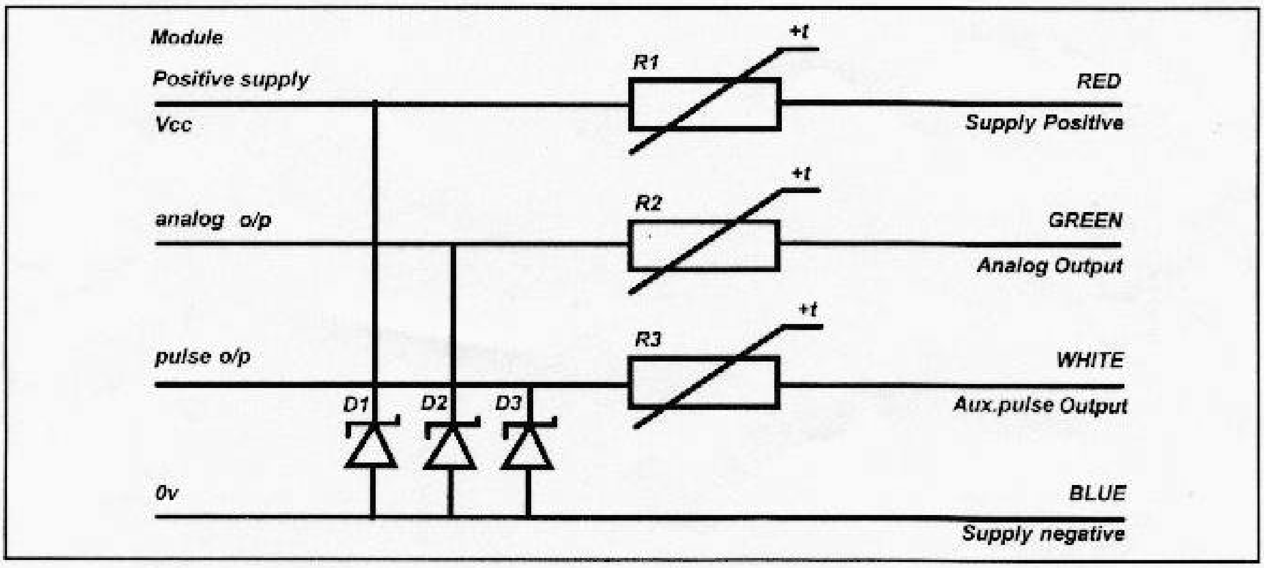
Standard
A100L2 Analalogue and 5V Pulse Outputs



With anti-surge option PC3L2
A100LPC3L2 Analogue and 5V Pulse with Protection

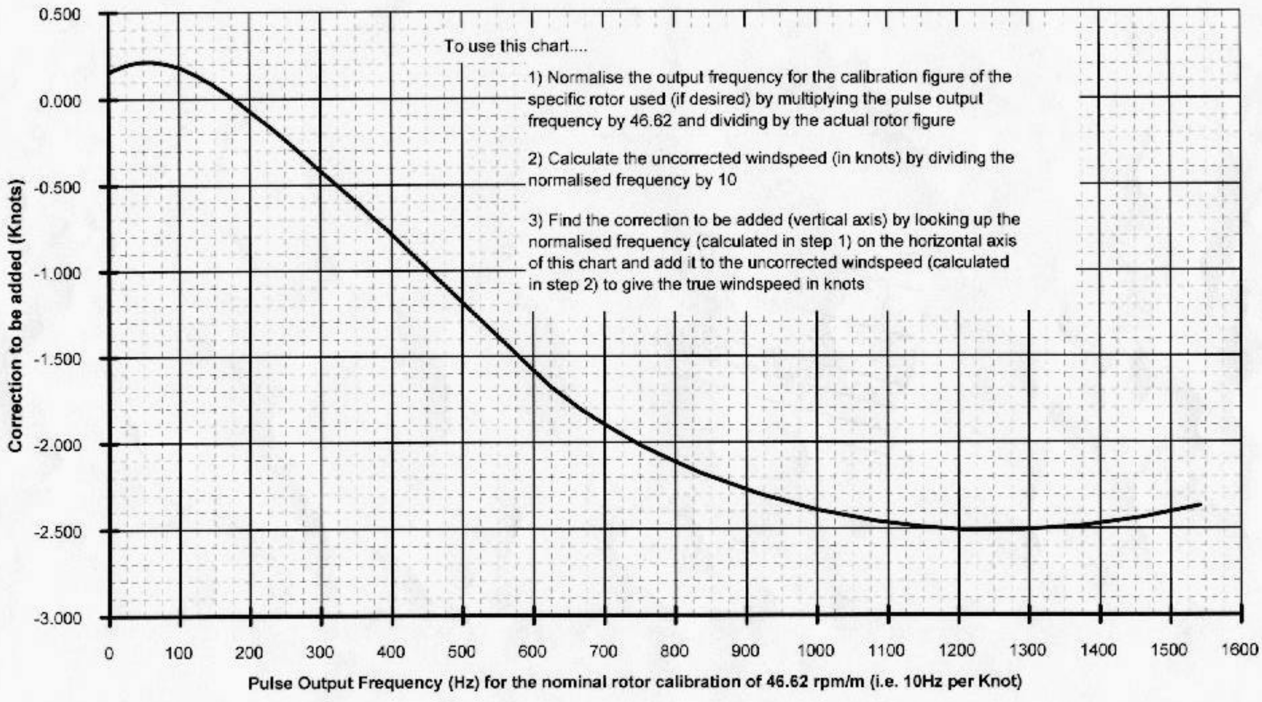


PC3 Protection circuit (anti-surge)

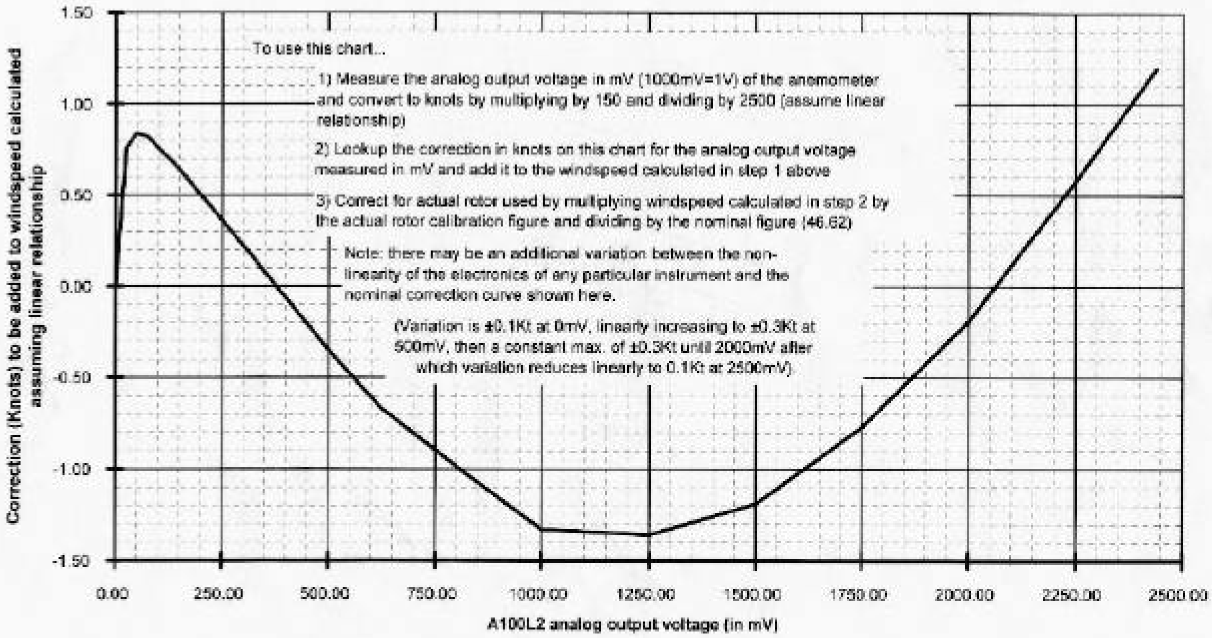


Note:
To use the internal 10K ohm pull up resistor to Vcc supply, Link open collector pulse to 10K pull-up resistor.

Correction of Pulse output of A100L2 for R30 Rotor non-linearity



Correction of Analog output of A100L2 for combined effects of ratemeter and R30 rotor non-linearity



Regular Maintenance (2 - 3 years)

For anemometer types: A100, A100H, A100E, A100L2, A100LK, A100LM, A100K, A100M, A100S, A101M.

Instructions for Replacement of Bearings (also for replacement of electronic module)

1. Switch off the power, disconnect the cable, remove the instrument from its mountings, invert the anemometer and remove the rotor by pressing the hub and releasing. Replace the spindle Protection cap.

2. Clean the anemometer and rotor using a damp cloth or soapy water (do not immerse).

3. Unscrew the baseplate [27] nuts using a 5.5mm AF (M3) nut-driver, pull off the baseplate.

4. If the electronic module [19] is to be replaced, unsolder the wires, pull back the body tube [25] and loosen the retaining nuts [16] (4 off). Loosen the nut that is against the top-plate [5] and remove one stud [15] only.

5. Hinge the electronic module to one side to clear the optical disc [14] and then remove.

6. Remove the protection cap [33]. Grip the spindle end using a hand-vice with soft jaws and unscrew the optical disc retaining nut [13] using a 6 BA (5mm AF) nut-driver.

7. Remove the washer, optical disc and the spacers. Unscrew the bearing retainer plate screws [8], and pull out the spindle with the bearing retainer plate and bottom bearing.

8. Remove the seal [2] using a watchmaker's screwdriver, and push out the old top bearing from below using the spindle. Clean all parts.

9. Put the bottom bearing [6] onto the spindle [4] by inserting the spindle end (threaded) into the packet of bearings (this is done to avoid any contamination to the bearings). Place bearing retainer plate [7] over the bearing and re-assemble onto the top-plate [5]. Screw in the bearing retainer screws.

10. Slide on the spacers [10 & 9], optical disc [14], spacer [11], washer [12], and screw on the optical disc retaining nut [13] loosely.

11. Slide on the top bearing [3] by inserting the spindle end into the packet of bearings. press the bearing into place using either a special jig, old (clean) bearing, or a small screwdriver (do not apply excessive pressure to the inner ring of the bearing). Ease in the rubber seal [2] (a new seal is usually used when renewing the bearings).

12. Retighten the optical disc retaining nut [13]. Lock this nut and the bearing retainer plate screws [8] with a drop of thread locking compound.

13. Replace the electronic module [19], the stud [15] and tighten the nuts [16], adjusting so that the optical disc is directly in the middle of the opto-switch slot.

14. Reconnect the electronic module and check its operation over the voltage range according to the specification.

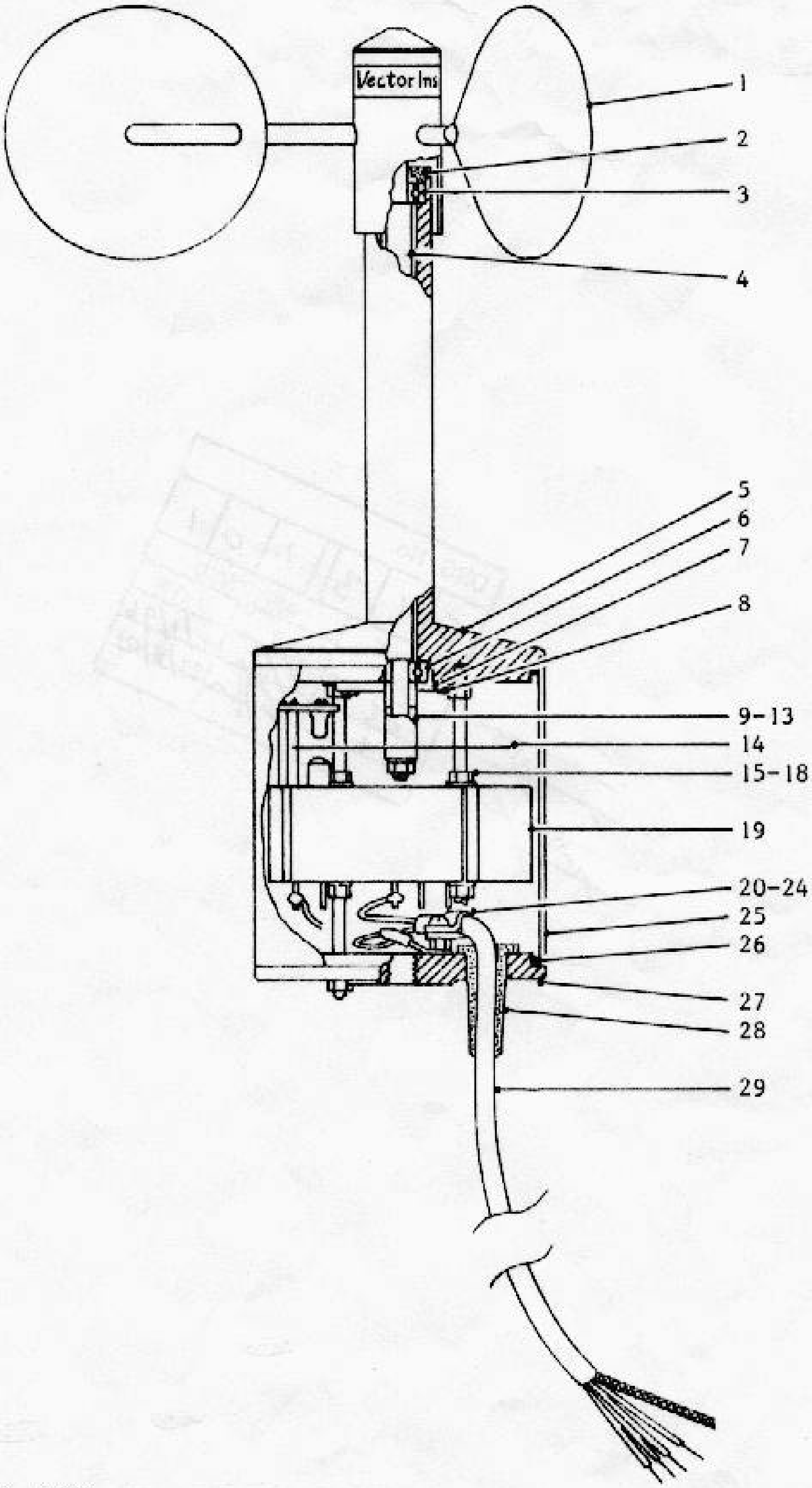
15. Ensure that the `O' ring is fully up against the flange on the top plate and push on the body tube. Ensure that the other `O' ring is in place on the base plate (rotate the `O' ring slightly when fitting so that it rolls into place). Replace the base plate with the cable entry on the opposite side to the soldered connections.

16. Apply a non-drying silicone rubber compound around the studs. Replace the washers followed by the nuts and wipe away any excees compound.

Do not lubricate the bearings as they are pre-lubricated during manufacture.

*The lower bearing is unshielded, the ball-cage being visible; the upper bearing can be identified by the shield which covers the ball-cage.

Vector Instruments, 115 Marsh Rd., Rhyl, Denbs., LL18 2AB, United Kingdom, Tel: (01745) 350700, Fax: (01745) 344206, International Fax: +44 (0) 1745 344206, e-mail: sales@windspeed.co.uk, website: www.windspeed.co.uk



ANEMOMETER A100

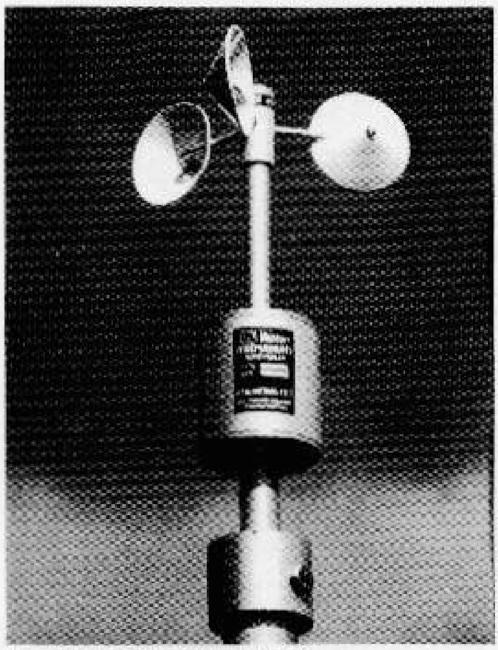
GENERAL ARRANGEMENT

VECTOR INSTRUMENTS
115 Marsh Road, RHYL
Clwyd LL18 2AB
Tel: (01745) 350700
Tx: 669755 Attn. Vector
Fax: +44 (0)1745 344206

LOW POWER A100L2 ANEMOMETER

(USING LPPL4 ANALOG OUTPUT MODULE)

SPEC SUMMARY



A LOW POWER CONSUMPTION ANALOGUE OUTPUT ANEMOMETER

In response to demand for an anemometer with an analogue voltage output like the proven Porton Anemometer but with reduced current consumption the type PL4 module from the Porton Anemometer has been developed to produce the LPPL4 resulting in an analogue output anemometer suitable for use with data loggers.

- *TRIED & TESTED 'PORTON ANEMOMETER' MECHANICS AND ROTOR*
- *0 TO 2½ V OUTPUT FOR 0 TO 150 KNOTS*
- *5V PULSE/FREQUENCY OUTPUT, 0 TO 1500HZ = 0 TO 150 KNOTS*
- *VARIANT A100LPC3L2 INCLUDES ANTI-SURGE PROTECTION OPTION*

Specification Summary:

Range of Operation:	Threshold:	0.3Kts (starting speed: 0.4Kts, stopping speed: 0.2Kts)
	Max. windspeed:	150Kts (75m/s)
	Standard measuring range:	0 to 150 Knots
Rotor:	Type:	R30, 3-cup rotor.
	Distance Constant:	2.3m ±10%
Pulse Output:	Rotor speed measurement:	By interruption of optical beam.
	Accuracy:	1% of reading (20 - 110Kts), up to 2% of reading (110 - 150Kts) 0.2Kts (0.2 - 20Kts).
	Non-linearity:	0.4% full range output frequency (correction curve supplied).
	Output Range:	0 to 1500Hz for 0 to 150Knots (10Hz per Knot)
	Resolution:	5.15cm.
	5V pulse output:	High 5V±5%, Low <0.2v, min. load res: 20K Ohms. Rise/Fall time approx. 25us, duty cycle 50%(±25%)
Analogue Output:	Nominal Factory Calibration:	0 to 2.500 V DC for 0 to 150 Knots single ended (16.67mV per Knot).
	Output Over-range:	5V ±10%
	Overall Non-linearity:	0.9% full range output for 0 to 150Knots (correction curve supplied for rotor+ratemeter).
	Temperature Coefficient:	±2% of output relative to 15°C value (-30 to +40°C)
	Response Time:	150ms first order lag typical (as Porton A100)
	Effect of supply variation:	±0.2% full range output over full supply range.
	Output Ripple:	Typically 13mV peak to peak at pulse frequency.
	Output Resistance:	Less than 500 Ohms.
	Recommended load resistance:	1M Ohm for calibrated output, (otherwise minimum 5K Ohms).
General:	Operating Temperature Range:	-30 to +70 °C
	Supply Voltage:	6½V to 28V DC
	Power-up Time:	5 sec.
	Current consumption:	2mA max, 1.6mA typical (no output loads).
	Standard Cable:	3m long, 6 core screened 7/0.2mm, PVC insulated.
Connections:	Red = Supply positive, Blue = Supply negative, Green = Analogue output +, Yellow = Analogue output - (Yellow is connected to Blue in the instrument permitting correction for zero offset caused by supply current in long cables), White = Pulse output, Black = Base plate, Screen = Not connected at anemometer.	
Calibration:	Calibration data for the anemometer and rotor are provided at one test speed to an accuracy of 1% at +15°C and +12V DC supply, with analogue output load = 1M Ohm. In-service calibrate/test facility is not fitted.	
Anti-surge options:	A100LPC3L2 variant has an extra surge protection module containing series resistance elements and clamping devices fitted to the base of the module in the standard anemometers. Note that these protection elements slightly affect certain specification parameters.	
Mechanical:	Dimensions, mm / Weight:	195 height x 152 rotor diameter x 55 body diameter. Net Weight: 490g.
	Mounting:	0.25 inch BSW/UNC screw into base (standard tripod fitting).

(Vector Instruments reserves the right to change this specification without notice in line with a policy of continued product improvement)

Vector Instruments, 115 Marsh Road, RHYL, Clwyd, LL18 2AB, United Kingdom.
Tel: (01745) 350700 Fax: (01745) 344206 International Fax: +44 1745 344206.