AIRFLOW™

SPECIALISTS IN AIR MOVEMENT TECHNOLOGY

Anemosonic™ UA30 Handheld Digital Ultrasonic Anemometer. Operating Instructions.

CONTENTS.

Please read these instructions carefully before using the instrument.
Short form instructions are supplied on the back of the instrument

1. INTRODUCTION.

The Anemosonic™ UA30 (referred to as UA30 in this text) is a handheld instrument with digital LCD display which measures air velocity or volume flow, flow turbulence intensity and temperature. The instrument has the following features:-

* **Air flow velocities are measured directly.**

* **The UA30 head allows simultaneous monitoring of air flow, temperature and turbulence intensity.**

* **The UA30 unique method of measurement gives fast response to transient changes in flow and temperature which allows the flow turbulence intensity at any point to be monitored.**

* **Measurements may be displayed in either Metric or Imperial units.**

* **Manual or automatic logging of measurements for later analysis.**

* **Duct/grille areas may be either entered directly, or indirectly, by entering the linear dimensions of rectangular, round or oval duct shapes.**

* **An RS232 output is provided to enable data to be downloaded to a printer, data logger or computer.**

* **Auxiliary analogue outputs of Air flow and Temperature.**

* **The instrument is battery powered for portability, but a battery eliminator can be provided as an optional extra.**

The following equipment is supplied in an Executive style carry case:-

> 1-off UA30 handheld instrument.
> 1-off Ultrasonic anemometer head and cable.
> 1-off handle.
> 1-off telescopic rod (extends to a length of about 1m).
> 4-off 1.5 volt AA size batteries.

Check the equipment for any damage during transit. If any item is damaged, report this immediately to Airflow Developments Ltd., telephone High Wycombe (01494) 525252, or your local agent.

Please read these instructions carefully to familiarise yourself with the operation of the instrument prior to carrying out any work.

WARNING: the UA30 head is a delicate, precision instrument and must be treated as such. If any damage occurs, especially to any of the three vertical transducer columns, this may affect the accuracy of the calibration and, in the extreme, cause complete failure. Report any damage immediately to Airflow Developments Ltd.

Please note that the UA30 Head is matched to the instrument and is not transferable onto any other instrument unless re-calibrated by Airflow Developments, Airflow Lufttechnik or Airflow Technical Products.

2. SUPPLY INFORMATION.

2.1   **Battery supply**: a set of battery cells are provided in the carry case but, due to their limited shelf life, are not included by the Airflow standard warranty. For replacement, four 1.5 volt AA size cells are required which may be disposable or rechargeable types. Either 'Standard' or Alkaline disposable cells may be used but the 'Standard' type will exhibit a relatively short life and are, therefore, not recommended. Low battery condition is indicated by 'LOBAT' appearing on the instrument display; the cells must then be replaced as soon as possible to maintain optimum accuracy.

2.2   **Battery replacement**: the battery cells are accessed by means of a slide and 'snap in' cover at the rear of the instrument case . To remove the battery cover, press firmly on the cover and slide it in the direction of the arrow. The batteries may now be removed by pulling on the tape fitted in the battery compartment. When replacing the batteries ensure that the tape is fitted underneath and that each cell is replaced with the correct polarity as indicated. Rotate each battery cell slightly to ensure that it is properly seated.

Note: Stored readings are held in an EEPROM enabling stored data to be 'remembered' during a battery change.

2.3   **Battery eliminator**: this connects via the 2.5mm jack socket (item ref. 3.8 FIG.2). Supply requirements are 6 volt d.c. at a minimum current of 100mA with the jack tip being supply + ve. Airflow can supply a suitable unit under Part No's 9020897 (for 3-pin UK version) or 9020855 (for 2-pin European version).

Warnings: 1. Ensure that the output voltage and polarity switches are set correctly.
2. Switch the UA30 instrument OFF <u>before</u> plugging in or removing the battery eliminator.

3.1 DESCRIPTION OF THE INSTRUMENT (refer to diagram FIG.2).

Item 3.1: Instrument case.

Item 3.2: Keypad (refer to FIG.4).

This acts as a decimal keypad for entering data but each key is also assigned specific function(s) . For keypad functions refer to Section 4.

Item 3.3: Display.

This is a custom Liquid Crystal Display (LCD) and FIG.1 shows the display's principle features.

Note: FIG.1 shows the display with all the segments illuminated, this is a condition which, will not occur in normal use but only during the display test (see section 8.1).
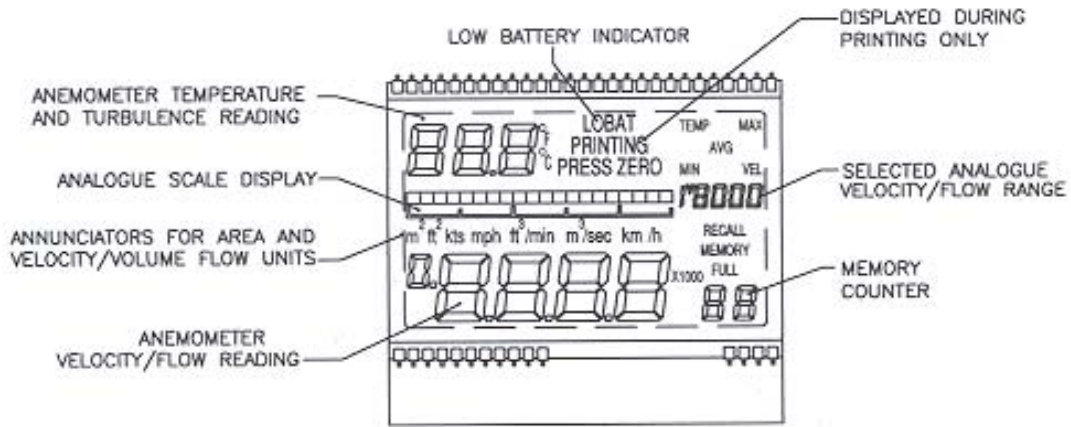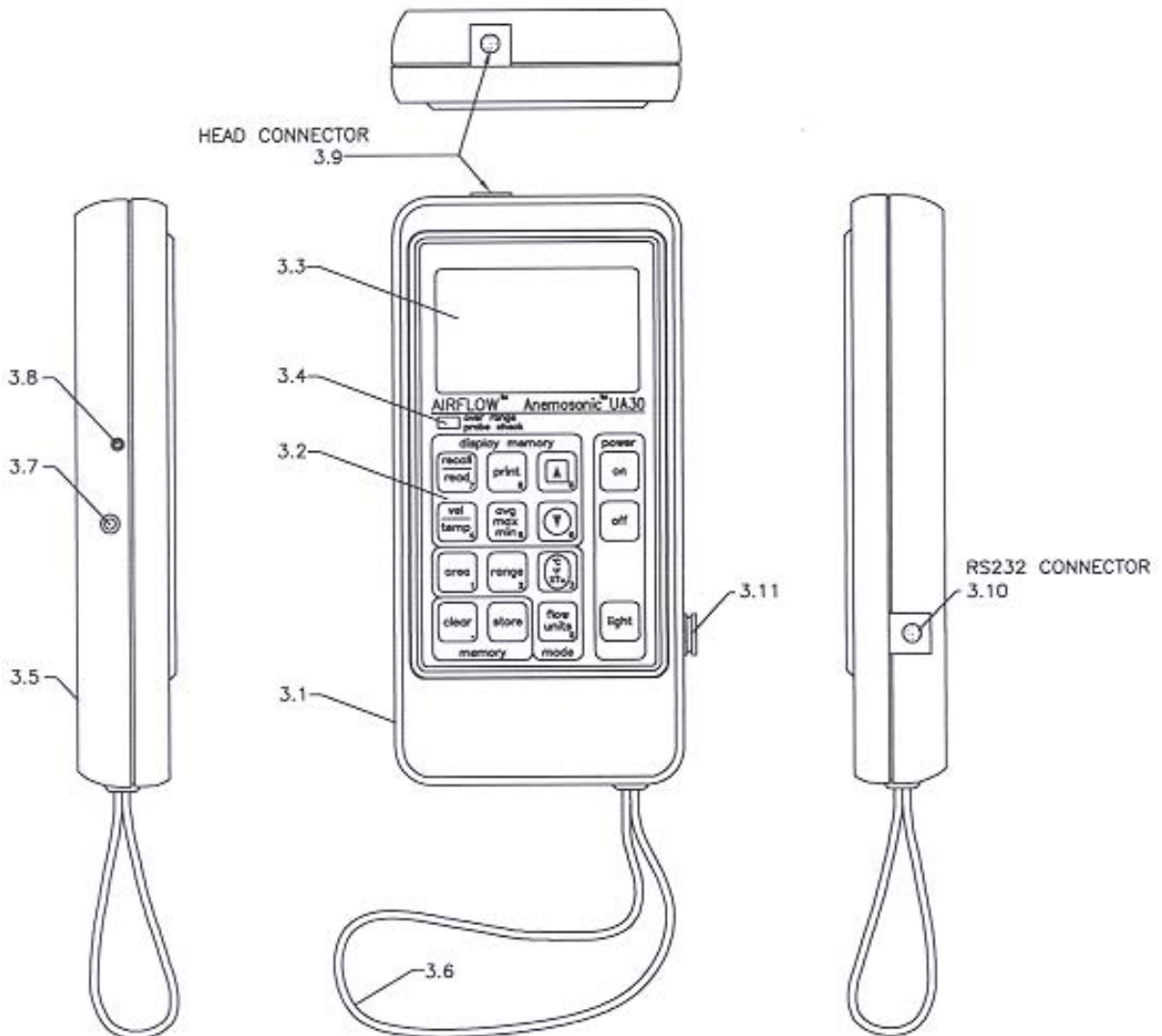

Fig 1 LCD Display

Fig 2 UA30 Instrument

Item 3.4: Probe over range check.

This is a red LED which will illuminate if the measured air velocity or temperature exceeds the pre-selected range. This red LED also briefly flashes on switch on.

Item 3.5: Battery cover.

This slides and 'snaps in' at the underside of the case.

Item 3.6: Wrist strap.

Item 3.7: 3.5mm 3-pole jack socket for analogue outputs of Air Flow and Temperature. (see section 6).

Item 3.8: 2.5mm jack socket for connection of battery eliminator.

Item 3.9: 8-pin mini-DIN socket for connection of the Ultrasonic Anemometer head.

Item 3.10: 8-pin mini-DIN socket RS232 port for connection of printer. This connector MUST be fitted with the supplied socket cap (item 3.11) whenever a printer is not connected, in order to fully comply with EMC requirements.

Item 3.11: Mini-DIN socket cap to protect the RS232 port (item 3.10) when not in use.

3.2 ULTRASONIC HEAD (refer to diagram Fig 3).

The 8-pin mini-DIN plug connects to its mating socket on the **top of handheld instrument; item 3.9 shown on Fig.2**. **Ensure that the pins are correctly aligned with the socket pins before inserting.**
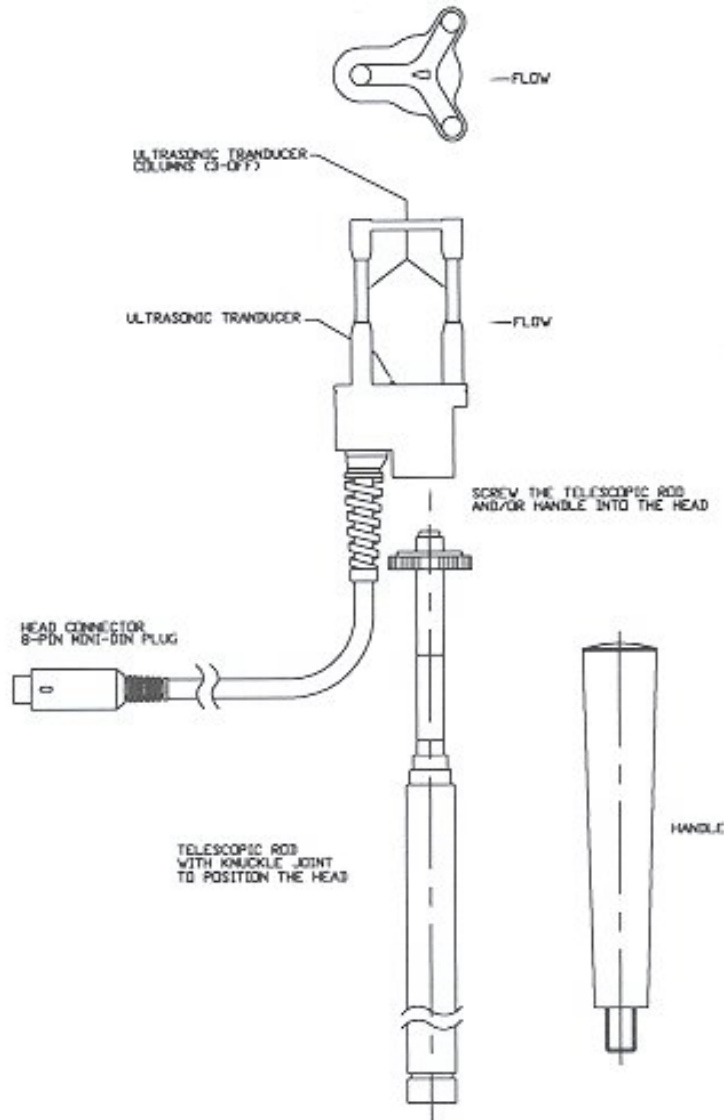

Fig.3 – Ultrasonic head

4. KEYPAD FUNCTIONS.

on — Press to turn the instrument power on. The instrument will remain on until either the **off** key is pressed or if the unit is not used, and no flow sensed, for a period of 3 minutes **(for 'auto-off':see section 5.1).**

off — Turns the power off to the instrument.
This key has a time delay to prevent inadvertent operation, press and hold down for at least 1-second

light — Press to operate the back light.

——— — Switches the unit between read mode and memory recall mode.

Fig. 4 - Keypad

vel / temp 4 — **In recall mode**: allows sequential selection of either velocity or temperature readings when examining maximum or minimum stored values **(see section 5.7.6).**

avg max min 5 — **In recall mode**: allows sequential selection of the average, maximum or the minimum of the readings held in memory **(see section 5.7.6).**

print 8 — **In read or recall modes**: press once to print current displayed value.
In read mode: double press to enter **'logging'** mode **(see section 5.7.2)**
In recall mode only: use the

▲ key or **▼** values key to select a required memory location and press twice to print out all stored from the selected location onwards. **(See section 5.8 for full details on printing).**

▲ — **In recall mode**: a single key press will increase the memory location by one. Holding this key down will continuously increment the memory location with rollover from the top memory location to location 01.
In area mode: press to select a rectangular duct shape.

▼ — **In recall mode**: a single key press will decrease the memory location by one. Holding this key down will continuously decrement the memory location with rollover from location 01 to the top memory location.
In area mode: press to select a circular duct shape.

area 1 — **Selects area mode**. The first press cycles the display through the current duct dimensions and will then display current duct area. Press **store** the key if acceptable.

A second key press will allow entry of a new duct area, using the decimal keypad.
When acceptable, press the **store** key.

To change the duct dimensions: press the **area 1** key, select the duct shape key required and enter the new dimensions, using the decimal keypad, as prompted on the display.
When acceptable, press the **store** key.**(See section 5.6 for full procedure on how to enter a duct area).**

flow units 0 — Each press allows the sequential selection of the following velocity/volumetric units
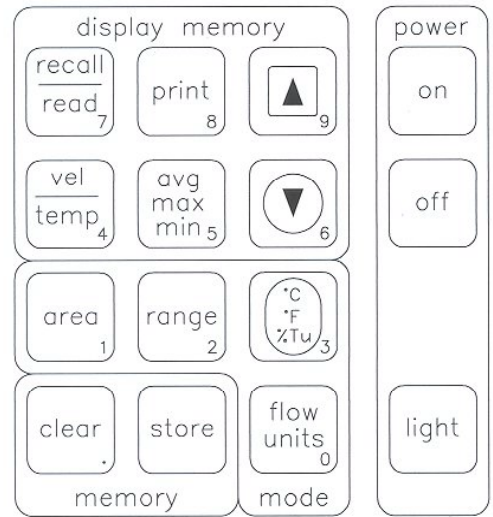
5

m/sec, m^3/sec, km/h, kts (knots), mph, ft/min, ft^3/min.

range 2

In read or recall mode: allows the full scale value of the analogue velocity/volume flow scale and analogue outputs to be changed.**(see sections 5.3.1 (3) or 5.6.2 (6)).**

In read mode: allows the sequential selection of readings of temperature in either Celsius or Fahrenheit units or turbulence intensity (T_U) . Note: Turbulence intensity is the ratio of the standard deviation of the air velocity to the mean air velocity expressed as a percentage. **Refer to section 5.5** for measuring turbulence.
In area mode: selects an oval duct shape

clear

In recall mode: press twice within a time of 2 seconds to clear all readings from memory.
In 'area' mode: press (repeatedly, if necessary) to abandon 'area' mode **(see section 5.6.1 (5)).**

store

In read mode: stores current reading in memory **(see section 5.7 for storing data into memory).**
**In 'area' mode:** stores entered values **(see sections 5.6.1 and 5.6.2 for programming areas.**

5. USER GUIDE.
5.1 Powering the instrument on/off.
(1)   Connect the Ultrasonic Anemometer Head to its socket **on the top of the hand-held instrument (FIG 2 item 3.9). <u>Ensure that the plug is orientated correctly before inserting</u>**.
   **Note:** if the head is not connected, the 'overrange probe check' LED will flash when the unit is powered up and **"CALC" or "EEEE"** will appear in the display.
(2)   Press   the   key to turn the instrument on.

on

The unit will remain on until either switched off manually using the **off** key, or automatically by means of the unit's 'auto-off' function.

'Auto-off' function: the UA30 senses when the unit has not been used, either from the keyboard or not receiving a flow input, for a period of 3 minutes and is programmed to turn the unit off automatically to conserve battery life.
The 'Auto-off' may be disabled as follows:-
Hold down the **avg max min** 5 key while simultaneously pressing the **on** key.

The analogue scale line on the display (see FIG.1) will flash three times to show that this command has been accepted before the display illuminates. Subsequently, the analogue scale line will continue to pulse as a reminder that the 'auto off' facility has been disabled.
The instrument can now be turned off <u>only</u> by use of the **off** key.

When the unit is powered up again, the 'Auto-off' function will be re-enabled.
5.2 Temperature Measurement.
   For air flow temperature measurement the UA30 Ultrasonic Head has an integral temperature probe fitted.
(1) Power the instrument up (see section 5.1); the instrument will power up in the 'read' mode. The temperature will be displayed on the 3-digit display in the top left hand corner of the display area (see FIG.1).
(2) The units of temperature measurement (^{0}C/^{0}F) are displayed on an annunciator adjacent to the displayed temperature reading. The units may be changed by sequentially pressing the   key.

The instrument is now ready to take air flow temperature measurements.

5.3 Velocity Measurement.
5.3.1 Initial setting up.

(1) Power the instrument up (see section 5.1): the instrument will power up in the 'read' mode. The flow reading will be displayed on the main 4-digit display at the bottom of the display area (see Fig.1).

   Notes: 1. The instrument may occasionally display 'CALC' in the flow display and inhibit readings. During this period the instrument is seeking the optimum reference threshold to maintain the accuracy of measurement.

   2. If the instrument repeatedly displays 'CALC', the display may change to 'EEEE' and inhibit readings. This indicates that more than the acceptable number of invalid readings are being acquired. Check that the head is not blocked and re-adjust the head position, if necessary. If this condition persists, after having turned the instrument off and on again, contact Airflow Developments Limited on High Wycombe (01494) 525252.

(2) The units for velocity measurement are displayed on an annunciator above the displayed flow reading. Select the units required, either m/s, km/h, kts (knots), mph or ft/min by sequentially pressing the $\boxed{\frac{\text{flow}}{\text{units}} \, 0}$ key.

(3) Select the required analogue scale display range (see FIG.1) by pressing the $\boxed{\text{range} \, 2}$ key.

The scale range will depend upon the velocity units previously selected in (2), as shown in the following table:-

Velocity units Selected	Analogue scale range selected					
	Lowest		Medium		Highest	
	Displayed	Actual	Displayed	Actual	Displayed	Actual
M/s	2	2	10	10	30	30
Km/h	L	7.2	M	36	H	108
Kts	L	3.89	M	19.45	H	58.35
Mph	L	4.47	M	22.35	H	67.05
Ft/min	400	400	2,000	2,000	6,000	6,000

The instrument is now ready to take air flow velocity measurements.

(4) The positioning of the head is tolerant to +/- 15^0 variation in pitch and yaw, however for the highest accuracy, point the head **directly** into the air stream.
   The reading obtained may be stored (see section 5.7.1) or printed out (see section 5.8.1).

(5) When measuring the velocity or volume flowrate over a large area, a number of readings must be taken, spaced to give an even coverage of the whole area and stored as detailed in section 5.7. It should be noted that quite large variations in readings may be observed and, in general, the more readings taken, the more accurate will be the mean velocity or volume flowrate.
   The average of the stored readings will give the mean velocity or volume flowrate as detailed in section 5.7.6.

(6) The UA30 normally takes measurements, calculates the average value and displays this over a 0.6 second period of time in order to avoid display jitter caused by turbulence. If the display jitter is still excessive, the display 'damping' may be increased as detailed in section 5.4.

5.3.2   In – duct measurements.

   (a) The head may be sited permanently in the duct attached to a stub by means of a spigot threaded M10 x 15mm. Pass the head cable through the duct via a suitable cable gland to allow the cable to be attached to the UA30 hand-held instrument in the normal manner.

   (b) To take traverse measurements across the duct, a 60mm minimum diameter duct access hole is required to allow the UA30 head to pass through the duct wall. Cover the duct access hole with a cover plate having a 20mm nominal diameter hole through which passes the telescopic probe arm. The telescopic rod may be marked to indicate the position of the head in the duct.
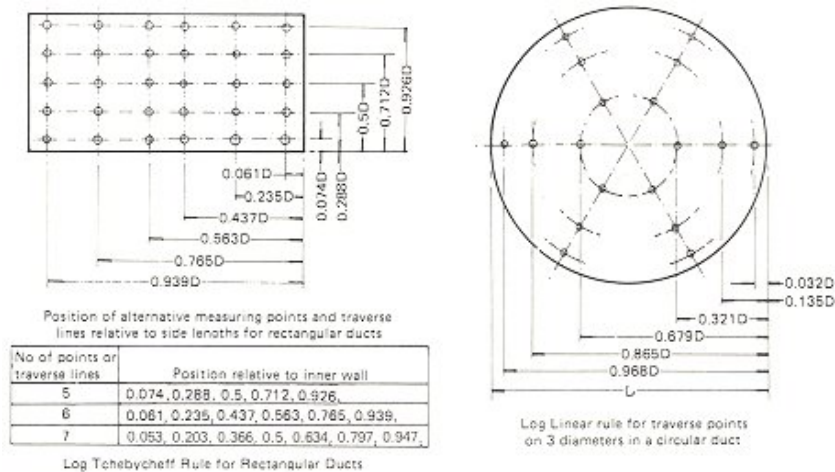
5.3.3   Measurement at grilles.

   Avoid intrusion of the arm and hand into the face area of the grille. The blockage effect could cause artificially high velocity over the remainder of the grille, leading to incorrect readings. The telescopic probe can be useful in avoiding this problem.

   Better measuring conditions can be obtained on grilles with adjustable direction vanes if the vanes are temporarily straightened before taking measurements. This should not significantly affect the flowrate so long as any built-in dampers are not accidentally disturbed. The instrument is suitable for both supply and extract grilles and the procedure is the same for both.

5.3.4   Possible source of errors.

   The above previous methods ignore the effects of the reduced velocity at the duct walls. A more precise method is shown in BS1042 Part 2 – the Log Tchebycheff method. The positions for siting the probe for circular or rectangular ducts or apertures is shown in the following figures:-

Position of alternative measuring points and traverse
lines relative to side lengths for rectangular ducts

No of points or traverse lines	Position relative to inner wall
5	0.074, 0.288, 0.5, 0.712, 0.926,
6	0.061, 0.235, 0.437, 0.563, 0.765, 0.939,
7	0.053, 0.203, 0.366, 0.5, 0.634, 0.797, 0.947,

Log Tchebycheff Rule for Rectangular Ducts

Log Linear rule for traverse points
on 3 diameters in a circular duct

Note:- Should difficulty in access
Make it impossible to traverse on
More than two diameters: these
Should be mutually at right angles
And the number of points on each
Line must be increased to 10.
The spacing should be as follows:
0.019D 0.077D 0.153D 0.217D 0.361D
0.639D 0.783D 0.847D 0.923D 0.981D

The above procedure is satisfactory for use in ducts and at unobstructed apertures, however significant errors may occur if the aperture is covered by a grille, particularly if this is of the type having adjustable vanes or dampers. The air stream issuing from such a grille is invariably very disturbed, consisting of many small areas of high velocity interspersed with areas of low velocity. The transitions between these areas are highly turbulent and there may even be some reversed flow.

If maximum accuracy is required, it is advisable to make up a short length of ducting which is just larger than the overall dimensions of the grille. This test duct can be of any convenient rigid material (such as stiff cardboard) and it should have a length of about twice the diagonal measurement of the grille. The duct should be placed over the grille, and sealed to the wall with adhesive tape. Measurements of flow can now be conducted, as already described, at the unobstructed end of the test duct.

For volume flow readings (refer to section 5.6), ensure that the cross-sectional area of the test duct (**not the grille**) is entered into the UA30.

5.4 To Set Display Damping.

If excessive display jitter is obtained when taking flow measurements, this may be smoothed out by increasing   the display damping time constant as follows:-

Switch the instrument off using the [off] key.

Turn the instrument back ON by simultaneously holding down the [Print 8] key and the [on] key.

The two left hand digits of the display which normally indicates the velocity reading will display 'dA' while the most right hand digit will display the damping time by means of a number 'n' according to the adjacent table:-

Number displayed 'n'	Display damping time Constant seconds
1	0.6
2	1.8
3	6.0
4	15.0

The display damping time constant number 'n' may be altered by means of the [▲] key and [▼] key.

Following selection of the new display damping time constant, switch the instrument into 'read' mode by using the [store] key to store the new value into the instrument's non-volatile memory and to exit the 'display damping' mode . This value will then be 'remembered' until changed by means of the above procedure.

Note: for display damping values of 'n' other than 1, 'AVG' will be displayed in the top RH of the LCD display when taking readings. The damping factor applies to displayed readings only and is not applicable when readings are stored or to turbulence measurement.

5.5   Measurement of flow turbulence intensity (T_u).

Flow turbulence intensity is the amount of variation of the flow from its mean value at any point measured as a % standard deviation and is defined as follows:-

The relative turbulence intensity $Tu = \dfrac{S_v}{v} \times 100\%$

Where S_v = the standard deviation of the sampled velocity readings =

$\bar{v}$ = the mean of the sampled velocity readings =

and N = the number of sampled readings

The UA30 calculates the flow turbulence intensity according to the above equations at any point in a room, duct, or grille over a sampling period of approximately 6 seconds and displays the result in the top LH display as a two digit percentage value.

To measure flow turbulence proceed as follows:-

1   1.   Follow the procedure outlined in section 5.3.

     2.   Select 'turbulence mode' by sequentially pressing the [key] key through ^{0}C and ^{0}F until two digital characters replace the normal temperature reading. The flow readings will be displayed as normal..

     3.   Upon selection, the display may flash '- -' until sufficient consecutive readings have been acquired to provide a meaningful calculation.

     4.   Readings may be stored manually or automatically as detailed in section 5.7

     5.   Readings may be printed out directly in 'read' mode or when in 'recall' mode as detailed in section 5.8.

     6.   Press the [key] key to revert back to 'temperature read' mode.

Note: in extremely turbulent flow conditions, or at very low mean velocities, the value of T_u can exceed 99%. Under these circumstances the display will flash '- -', to indicate over-range.

5.6 Volume flow rate measurement.

To enable volumetric flow rate measurements to be made, it is necessary to programme the instrument with the duct or grille cross sectional free area. If this area is known, then it can be programmed into the instrument directly as an area. If the area is unknown, the linear dimensions of the duct can be programmed into the instrument, which will then compute the area automatically.

The units used for duct area and duct dimensions **MUST** be consistent with those selected for volume flow rate as in the following table:-

Selected volume flow rate units	Duct area Constraints.	Duct linear dimension constraints.
Metric cubic metres per sec. (m^3/s)	Square metres (m^2) * Allowable input range:- 0.008 to 99.99 m^2	Metres (m) Input range:- 0.0001 to 9999 m **Input values are subject to minimum/maximum area limitations.**
Imperial. cubic feet per minute (ft^3/min)	Square feet (ft^2) * Allowable input range:- 0.0862 to 1076 ft^2	1)Up to 9ft 11 & 7/8 inches:dimensions may be entered in feet,inches and eighths of an inch. 2)Up to 99ft 11 inches: dimensions may be entered in feet and inches. 3)Up to $99^7/_8$ inches:dimensions may be entered in inches and eighths of an inch. 4)Up to 999 inches: dimensions in inches only. **Input values are subject to minimum/ maximum area limitations.**

Notes:-

1) Metric dimensions are keyed in as metres using the decimal keypad. For dimensions less than one metre, it is permissible to start with a decimal point and then key in up to four digits (i.e. up to four decimal places).
2) Imperial dimensions can be entered either in:- feet, inches and eighths of an inch

feet and inches only

inches and eighths of an inch

inches only.

Subject to the limitations stated in the above table.

The decimal point on the [clear .] key is used to separate the feet, inches and eighths of an inch inputs.

If the decimal point is input first, then this allows inches only to be input up to a maximum of either $99^{7}/_{8}$ or 999 inches. Inch dimensions are then converted to feet by the instrument for subsequent display and computation.

*3) If an area is input outside of these limits, the overrange LED will illuminate, the display will flash and will then display the previously entered value (i.e. the out of range value will not be accepted).

Examples:-

For a dimension of 7ft $9^{5}/_{8}$ inches use the decimal keypad to key in: **(7) (.) (9) (.) (5)**

For a dimension of $23^{1}/_{2}$ inches use the decimal keypad to key in: **(.) (2) (3) (.) (4) (note: $^{1}/_{2} = ^{4}/_{8}$).**

5.6.1 Programming a known duct area directly.

1) Power the instrument up (see section 5.1).
2) Select the units for volumetric flow measurement, either m^3/s or ft^3/min by pressing the key until the selected units are displayed beneath the analogue scale.

3) [flow units] the [area] key. Either the m^2 or ft^2 annunciator will be displayed depending upon volume flow units selected.

The instrument response will depend upon how it was previously programmed as follows:-

a) Instrument previously programmed directly with an area.

The instrument will display the previously programmed duct area with a flashing **'A'** in the top LH corner of the display.

b) Instrument previously programmed with an area indirectly (by using the duct dimensions).

The display will, firstly, scroll through the previously programmed duct dimensions as follows:-

for **circular** ducts: 'dia' (diameter of duct).

for **rectangular** ducts: 'L1' width and 'L2' height.

for **oval ducts**: 'd1' major axis dimension and 'd2' minor axis dimension.

The instrument will then display the computed duct area with the units above the top left hand corner of the computed area and a letter **'A'** flashing in the top left hand corner of the display.

4)   **If the displayed area value is acceptable**, press the [store] key. The 'A' will stop flashing and the instrument, after a delay, will return to its normal 'read' mode.

If the duct area is required to be changed, then press the key. The letter 'A' will stop flashing to indicate that a new value of area may be entered. Key in the new value of the duct area including any decimal points, then press the

[area] key [store] and the instrument will return to its normal **'read'** mode.

5.6.2 Programming a duct area by entering the linear dimensions of the duct. (indirect).

1) Power the instrument up (see section 5.1).
2) Select the units for volumetric flow measurement; either m^3/s or ft^3/min by pressing the key until the selected units are displayed beneath the analogue scale.

3) Press the [area] key. Either the m^2 or ft^2 annunciator will be displayed depending upon the volume flow units selected. **The instrument response will depend upon how it was previously programmed as follows:-**

a) [area₁] **Instrument previously programmed directly with an area.**
The instrument will display the previously programmed duct area with a flashing **'A'** in the top LH corner of the display.

b) Instrument previously programmed with an area indirectly (using the linear dimensions of the duct).
The display will, firstly, scroll through the previously programmed duct dimensions as follows:-
for circular ducts: 'dia' (diameter of duct).
for rectangular ducts: 'L1' width and 'L2' height.
for oval ducts: 'd1' major axis dimension and 'd2' minor axis dimension.
The instrument will then display the computed duct area with the units above the top left hand corner of the computed area and a letter **'A'** flashing in the top left hand corner of the display.

(4) **If the displayed information is acceptable without further change**, then press the [store] key. The displayed letter **'A'** will stop flashing to indicate that the existing information has been accepted, and the instrument will then return to its normal **'read'** mode.

If new values are required, the procedure will depend upon the shape of the duct as follows:-
a) For a circular duct:
Press the [▼] key. The instrument will display 'dia' together with its current value. Key in the new duct diameter and then press the [store]

b) For a rectangular duct:
Press the [▲] key. The instrument will display 'L1' together with its current value. Enter the new value for the duct width and then press the [store] key. The instrument will then display 'L2' together with its current value. Enter the new value for the duct height and then press the [store] key again.

c) For an oval duct:
Press the [°C °F °Tu] key. The instrument will display 'd1' together with its current value. Enter the new value for the duct major axis dimension and then press the [store] key. The instrument will then display 'd2' together with its current value. Enter the new value for the duct minor axis and then press the [store] key again.

The instrument will then display the new computed value for the duct area and return immediately to the **'read'** mode. **The settings may be checked by pressing** [area₁] **the key, and confirmed by pressing the** [store] **key.**

5) If at any point it is decided to abandon the programming area function, then press the [clear] key repeatedly if necessary) until the instrument returns to its normal read mode and its previous area value.

Note: once entered, the units of area may be changed between m^2 and ft^2 by means of the key.

5.6.3 Select the required analogue scale range by pressing the [range₂] key. [flow units]

The analogue scale range will depend upon the volumetric units previously selected in sections 5.6.1 (2) or section 5.6.2 (2) as   shown in the following table:-

Volume Flow units Selected	Analogue scale range selected					
	Lowest		Medium		Highest	
	Displayed	Actual	Displayed	Actual	Displayed	Actual
M^3/s	L	2 x duct area	M	20 x duct area	H	50 x duct area
Ft^3/min	L	400 x duct area	M	4,000 x duct area	H	10,000 x duct area

5.7 Logging measurements to memory.

Concurrent readings of flow, temperature and flow turbulence can be logged to memory either manually or automatically at   a preset time interval.

Note 1: If the memory has not been cleared (see section 5.7.4), data will be sent to the next available memory location.

Note 2: All flow data is stored as a velocity. The instrument will compute Volume Flow using the programmed area and will display volume flow in the selected units.

Note 3: The memory will store a maximum of 99 sets of temperature/turbulence/velocity readings, when this occurs 'MEMORY FULL' will be displayed above the memory counter reading.

5.7.1 Manual logging of readings to memory.

Press the [store] key when a reading is to be logged to memory. Note that the memory counter, in the

bottom RH corner of the display, increments each time a reading is stored.

5.7.2 Automatic logging of readings to memory.

Readings may be sequentially stored into memory at a preset time interval. The   sequence time interval may be set between a minimum of 1 second and a maximum of 99minutes 59 seconds as follows:-

Note ; Do not set below 5 seconds when logging to a Seiko Printer

(1) In **'read'** mode, double press the [Print 8] key. The instrument will display four digits representing the

auto-logging time in minutes and seconds. The first (left hand) digit will be flashing.

2) **Either:**

a) If the displayed time interval is acceptable, press [store] the key. The word 'PRINTING' and four

dashes will momentarily appear on the display followed by the re-appearance of the required time interval.

Or:

b) If the time interval is to be changed, key in the new time in minutes and seconds by entering the required number for each digit when it flashes. When the required time interval has been correctly entered, press the [store] key. The word 'printing' and four dashes will momentarily appear on the display followed by the appearance of the entered time interval.

3) When the automatic logging is to commence, press the [store] key again. The instrument will display the

current reading and memory counter reading. The word 'PRINTING' will be displayed, the current displayed reading will be logged and the memory counter will increment each time a reading is logged into memory. **Note:** during automatic logging the power 'auto-off' feature (see section 5.1) is disabled.

5.7.3 Stopping automatic logging of readings to memory.

1)   Double press the [Print 8] key. The auto-logging time interval will be displayed.

2)   Double press the [clear] key. The instrument will revert to the normal read mode.

5.7.4   Clearing the memory [clear] of stored readings (valid in 'recall' mode only).

1) From **'read'** mode, enter **'recall'** mode by pressing the [recall read 7] key.

The instrument will display 'RECALL MEMORY 1' in the bottom RH corner of the display and the data held in memory location 1.

2) Press the ⬚ key twice, within a time of 2 seconds, to erase all the data held in memory.

[clear .]

5.7.5 To Review data held in memory (valid in 'recall' mode only).

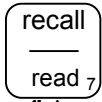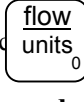1) From **'read'** mode, enter **'recall'** mode by pressing the [recall / read 7] key.

The instrument will display 'RECALL MEMORY 1' in the bottom RH corner of the display and will display the data held in memory location 1.

2) Index through the memory locations using the [▲ 9] & [▼ 6] keys. Holding down either of these key will scroll either up or down through the memory locations

The instrument will display the data held in each location.

3) At any memory location press the ⬚ key and the [°C °F °Tw 3] ey to index through all the different units of

measurement. The instrument will display the data in the units selected.

4) Press the [recall / read 7] key to revert bac[k to no]rmal **'read'** mode. [flow units 0]

5.7.6 The display of Average, maximum and minimum values of data held in memory (valid in 'recall' mode only).

1) From **'read'** mode, enter **'recall'** mode by pressing the [recall / read 7] key.

The instrument will display 'RECALL MEMORY 1' in the bottom RH corner and will display the data held in memory location 1.

2) Press the [avg max min 5] key. The instrument will display the following:-

Top RH corner: TEMP
                            AVG
                              VEL

Main (bottom) display: The average of the stored velocity or volume flow readings depending upon the
                         selection of the [flow units 0] key.

Bottom RH corner: Number of readings stored

Top LH corner: The average of the stored temperature readings.

3) Press the [avg max min 5] key again. The instrument will display the following:-

Top RH corner: MAX
                             VEL

Main (bottom) display: The maximum of the stored velocity/volume flow readings depending upon selection
                         of the [flow units 0] key.

Bottom RH corner: The memory location of the maximum velocity/flow reading*.
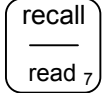Top LH corner display: The corresponding stored temperature reading at the above memory location.
Press the [vel / temp 4] key. The instrument will display the following:-

Top RH corner: TEMP   MAX
Top LH corner display: The maximum of the stored temperature reading.
Bottom RH corner: The memory location of the of the maximum temperature reading*.
Main (bottom) display: The corresponding stored velocity/volume flow reading at the above memory location.

4) Press the [avg / max / min 5] key again. The instrument will display the following:-

Top RH corner: TEMP
                  MIN
Top LH corner display: The minimum of the stored temperature reading.
Bottom RH corner: The memory location of the minimum temperature reading*.
Main (bottom) display: The corresponding velocity/volume flow reading at the above memory location depending upon the selection of the [flow / units 0] key.

5) Pressing the [avg / max / min 5] key again will revert back to normal 'recall' mode.

6) Press the [recall / read 7] key to revert to normal 'read' mode.

*note: multiple maximum or minimum's will be indicated by either 'min' or 'max' flashing in the top RH corner of the display. The lowest memory location is initially displayed, the other locations may be viewed by using the [▲] and [▼] keys.
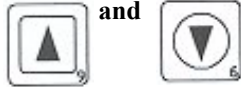
5.8 PRINTING.

Airflow can provide a compatible mini-printer and cable, please contact Airflow Sales Department for details.

1) Attach the printer to the RS232 socket (see Fig.2 item 3.10 page 3) **ensuring that the plug is orientated correctly**. Set the printer to the following transmission protocol:-

        19200 Baud rate
        8 bit, no parity, 2 stop bits (this allows compatibility with printers
        that expect either 1 or 2 stop bits).

2) Turn on the printer.

Note: during the time that the printer is actually printing, the keypad will be disabled and key presses will not be recognised.

5.8.1 Printing in read mode.

When a printout of a reading is required, press the [Print 8] key.
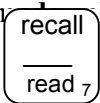
The word 'PRINTING' will appear at the top of the display and the current temperature, flow rate and flow turbulence readings will be printed in the units currently selected.

Auto Printing.

Readings may be sequentially printed at a presettable time interval by following the procedure detailed in section 5.7.2. The printout will continue until stopped by following the procedure detailed in section 5.7.3.

Note: in this mode, with the memory full, the UA30 will still continue to output values to the printer.

5.8.2   Printing a single stored reading (valid in 'recall' mode only).

1) From **'read'** mode, select **'recall'** mode by pressing the [recall / read 7] key.

'RECALL MEMORY' will be displayed above the memory counter reading and the instrument will display the readings from memory location 01 onwards.
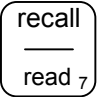
2) Index the memory counter to the required location by means of the [▲] and [▼] keys.

3) Press the [Print 8] key to obtain the required printout of velocity/volume flow, temperature and turbulence in the selected measurement units .

4) Press the [recall read 7] key to revert back to the normal **'read'** mode.

5.8.3 Printing a complete set of stored readings (valid in 'recall' mode only).

1) From 'read' mode, select 'recall' mode by pressing the [recall read 7] key. The instrument will display the readings from memory location 01.

2) Double press the [Print 8] key to obtain the printout of velocity/volume flow and temperature in the selected measurement units for all the stored readings
Note: turbulence values are not printed out in this mode, but can be obtained by single value print out, See 5.8.2 above.

3) Press the [recall read 7] key to return to the normal **'read'** mode.

5.8.4 Printing a sequential block of stored readings (valid in 'recall' mode only).
1) From 'read' mode select 'recall' mode by pressing the [recall read 7] key.

The instrument will display the readings from memory location 01.
2) Use the [▲] key to select the initial memory location.

3) Double press the [Print 8] key. The printer will print out velocity/volume flow and temperature values from the selected initial memory location and will continue to print until either it reaches the highest memory location or is commanded to stop printing (refer to 5.8.6).
Note: turbulence values are not printed out in this mode, but can be obtained by single value print out, see 5.8.2 above.

4) Press the [recall read 7] key to return to normal **'read'** mode.

5.8.5 Printing Average, maximum or minimum values of stored readings (valid in 'recall' mode only).
Display the required average, maximum or minimum of the stored velocity/volume flow or temperature readings   as detailed in **section 5.7.6**. Press the [Print 8] key to obtain the required printout.

5.8.6 To stop a printout.
Press and momentarily hold down the [Print 8] key and then press it again (keypresses will not be recognised during the actual printing process).

6. ANALOGUE / DIGITAL OUTPUTS.
6.1 Analogue
0 to 1volt full scale analogue D.C. outputs of velocity/volume and temperature are accessed via a 3.5mm 2-pole jack socket on the LH 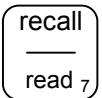side of the unit (FIG.2 item 3.7), to allow the data to be output to a chart recorder or a data logger. Airflow can provide a compatible data logger, please contact Airflow Sales Department for details.
The outputs may be factory set to between 0 - 0.5v minimum and 0 - 2.0v maximum on request.
The velocity/volume analogue output is connected to the tip of the jack plug.
The temperature analogue output is connected to the barrel of the jack plug.
The range of the analogue vel/vol output is selected by altering the analogue scale range, see sect.5.3.1 (3).

6.2   RS232

In order to conserve battery power the RS232 Output will only operate during the print command. This is effective; in a single reading use when in read mode, all printing commands in memory recall mode, and during auto logging to memory mode. Using the auto logging mode of operation a periodic output can be obtained on a time interval settable between 1 seconds and 99 minutes 59 seconds. See section 5.7.2

Note; Do not set below 5 secs when using Seiko printer

7. CALIBRATION.

The instrument and associated Ultrasonic anemometer head are calibrated to either British Maritime Technology (BMT) or National Institute of Standards and Technology (NIST) standards.

It is possible to modify the calibration to suit alternative standards. However, this SHOULD BE UNDERTAKEN BY SKILLED PERSONNEL USING A STABLE SOURCE OF AIR FLOW WITH THE REQUIRED CALIBRATION ACCURACY.

The calibration is linearised by means of software and therefore only needs a single point calibration. To ensure Maximum accuracy over the entire operating range it is recommended that the instrument is calibrated at, or near to its full scale value.

8. TEST FEATURE.

Display Integrity.

To establish that all the display annunciators are functioning, hold down the [range 2] whilst simultaneously pressing the [on] key.
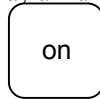
This will illuminate all the display segments as shown in FIG.1, followed by displaying the software version. The unit will then enter its normal operating mode.

9. TROUBLE SHOOTING.

9.1 No display on switch on.

This indicates that either:-

No batteries are fitted.

The batteries are inserted the wrong way round (incorrect polarity).

Or,   the batteries are exhausted.

9.2 The overrange/ probe check light illuminates on switch on and remains on.

This indicates that the ultrasonic anemometer head is either not plugged in, has been plugged in incorrectly, or either the head or its cable is faulty.

9.3 The overrange/ probe check light illuminates during measurement.

This indicates that measured values are exceeding the pre-selected range; change the range as detailed in   sections 5.3.1 (3) or 5.6.3.

9.4 The overrange/ probe check light illuminates during recall.

This indicates that the stored values are exceeding the pre-selected range; change the range as detailed in   sections 5.3.1 (3) or 5.6.3.

9.5 Memory.

Stored values will not be lost upon removal of the batteries or switching the instrument off.

Should a fault occur that cannot be resolved by any of the above, then contact either your distributor or Airflow Developments Ltd to discuss the fault and/or make arrangements to return the unit stating full details of the fault.

10. SPECIFICATION.

10.1

PARAMETER	METRIC MODE	IMPERIAL MODE
Velocity Range	0.0 - 30 m/sec	0.0 – 6,000 ft/min
Volume Range	0.0 - 3,000 m³/sec	0.0 – 6,456 x 1,000 cfm
Calibration	Better than +/- 1% of reading +/- 1 digit Or +/- 1% of reading +/- 0,01m/s whichever is greater	
Velocity Resolution	0.001 m/sec	1 ft/min
Temperature measurement range	0 - 60^{0}C	32 - 140^{0}F

Uncertainty of temperature measurement.	+/- 1.0^{0}C	+/- 2^{0}F	
Temperature Resolution	0.1^{0}C	1^{0}F	
Flow turbulence intensity (Tu)	2-digit display 0 – 99 % resolution 1%		
Area Input range	0.008 - 99.99 m^2	0.0862 – 1,076 ft^2	
Linear Dimension input range (subject to area max/min constraints)	0.0001 - 9,999 m	$^1/_8$ inch to 99 ft 11 inches	
Memory Size	99 readings of velocity, temperature and turbulence. (Note: flow data is always stored as a velocity)		
Auto Logging variable time base	1 second to 99 minutes 59 seconds		
Analogue Output	O - 1 volt standard (0 - 0.5v and 0 - 2v available on request)		
Digital Output	Serial RS232 at 19200 baud		
Power Supply	4 x 1.5 volt AA cells (rechargeable, zinc carbon or alkaline) or battery eliminator (optional extra).		
Battery Life	Approximately 20 hours continuous operating use with new alkaline disposable cells.		
Overall Dimensions	92 x 32 x 188 mm	3.6 x 1.2 x 7.4 inches	
Instrument Operating Ambient temperature range	-10^{0}C to +50^{0}C	14 – 122^{0}F	
Instrument Storage temperature range	-20^{0}C to +60^{0}C	-4^{0}F to +140^{0}F	
Ultrasonic probe ambient operating temperature range	0 - 70^{0}C	32 – 158^{0}F	
Weight (less battery cells)	440g	0.97lb	
Standard Kit	UA30 ultrasonic hand-held instrument and head Handle and telescopic extension rod 0.4 to 1.1 m (15 to 43 inches) with swivelling joint. Executive carry case Calibration certificate		
Optional Accessories	Battery eliminator for mains supply operation APU 10 Mini Printer and lead. Range of printer/PC cables		

10.2 Analogue scale display.

Bargraph Scaling							
Parameter		Range selected					
		Lowest		Medium		Highest	
		Displayed	Actual	Displayed	Actual	Displayed	Actual
Velocity	m/s	2	2	10	10	30	30
	Km/h	L	7.2	M	36	H	108
	Kts	L	3.89	M	19.45	H	58.35
	Mph	L	4.47	M	22.35	H	67.2
	ft/min	400	400	4,000	2,000	6,000	6,000
Volume flow	m^3/s	L	2 x duct area	M	10 x duct area	H	30 x duct area
	ft^3/min	L	400 x duct area	M	2,000 x duct area	H	6,000 x duct area

10.3 Analogue Flow Output.

Output on tip of jack plug = 0 to 1 volt (but 0 to 0.5v or 0 to 2.0 volt can be supplied on request).
Range selection as per the analogue scale display in table in section 10.2 with the exception of the Imperial velocity range as follows:-

Parameter	Range Selected					
	Lowest		Medium		Highest	
Velocity ft/min	Displayed	Actual	Displayed	Actual	Displayed	Actual
	400	394	4,000	3,937	10,000	9,843

Accuracy at 20^{0}C ambient	Within +/- 10 millivolts of displayed reading.

Output drift	I millivolt maximum per ^{0}C ambient
Resolution	5 millivolts

10.4 Analogue Temperature Output.

Output on barrel of jack plug = 0 to 1 volt (but 0 to 0.5v or 0 to 2.0v can be supplied on request).

Accuracy at 20 ^{0}C ambient	Within +/- 10 millivolts of displayed reading.
Output drift	1 millivolt maximum per ^{0}C ambient
Resolution	5 millivolts

10.5 RS232 Output.

(1) This provides a serial data output for sending to a printer (or other compatible device), via an 8 pin mini DIN, non latching socket (FIG.2 item 3.10). The attached device must conform to the following protocol:-

Emulation: DTE emulation as per IBM PC
Lines: 'TDX' Transmit data pin 3
     'CTS' Clear to send   pin 8
     'SG' Signal ground pin 5
CTS time out: 3 seconds
Baud rate: preset to 19,200 Baud
Transmission protocol: 8 bit, no parity, 2 stop bits. (this allows compatibility with printers that
     expect either 1 or 2 stop bits)
Output voltages: RS232 compatible   +10v nominal for logic low
     -10v nominal for logic high
     input +/- 3v minimum sensitivity

(2) The mating mini DIN 8-pin plug (Airflow Part No. 904180) connector pin number identification is shown in the following diagram:-

EXTERNAL VIEW
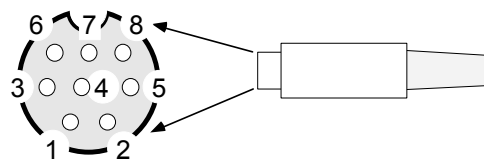
(3) Inter-connections to Airflow APU 10 Printer.   Airflow Cable (2m long) Part No.

UA30 8-pin   APU 10 Printer   UK/European - 72329605
Mini- DIN socket   (with 9-way D socket)   USA   -   72329606
TX pin 3 (o--------------------------o)   pin 3 DATA   (Cables are supplied with the printer).
SG pin 5 (o--------------------------o)   pin 5 SG
CTS pin 8 (o-------------------------o)   pin 8 BUSY

(4) Inter-connections to a PC or typical Printer.   Airflow Cable (2m long) Part No.

UA30 8-pin   PC or typical Printer
Mini- DIN socket   with 9-way D connector.
TX pin 3 (o--------------------------x pin 2 RD x – cable terminating in a 9-way D plug   - 72329601
SG pin 5 (o--------------------------x pin 5 SG x – cable terminating in a 9-way D socket - 72329602
CTS pin 8 (o-------------------------x pin 4 DTR

UA30 8-pin   PC or typical Printer
Mini – DIN socket.   with 25-way D connector
TX pin 3 (o--------------------------x pin 3 RD   x – cable terminating in a 25-way D plug - 72329603
SG pin 7 (o--------------------------x pin 7 SGx – cable terminating in a 25-way D socket - 72329604
CTS pin 8 (o-------------------------x pin 20 DTR

10.6 CE Marking.

The unit complies with the EEC Directive on Electromagnetic Compatibility (EMC) 89/336/EEC, applied
Harmonised Standards: EN50081-1 Radiated Emissions and EN50082-1 Radiated and ESD immunities.
Note: for full immunity to ESD, the instrument printer socket (FIG.2 item 3.10) MUST have the supplied
plastic plug fitted whenever a printer, or other device, is not connected to it.

11. SERVICE AND RECALIBRATION.

If a fault or the instrument's calibration is suspected, it should be returned to Airflow Developments for repair   or re-calibration to original standards. In any event, it is good practice to have the instrument checked at least once a year.

If an instrument is not working correctly or requires re-calibration, contact your nearest Airflow Agent or the Airflow U.K. Service Department on High Wycombe (01494) 525252 (International: +44 1494 525252).

Airflow Developments operate an Instrument Hire Service for the convenience of customers having equipment repaired or re-calibrated. If you intend to take advantage of this facility please contact our Service Department to make arrangements prior to returning your instrument.

12. SPARES LIST.

The following is a list of recommended spares:-

Description.	Part No.
UA30 Anemometer Head Assembly (Metal)	72406901
UA30 Anemometer Head Assembly (Plastic)	72427801
Battery cover	82372601
Mini - DIN Socket Cap	82345201

13. OPTIONAL EXTRAS.

Description.	Part No.
Battery eliminator: fitted with 3 pin UK power plug	9020897
fitted with 2 pin European power plug	9020855
APU 10 Mini-printer (battery powered) supplied with RS 232 cable – UK/European version	72313301
- USA version.	72313302
UA30/APU10 printer cable - UK/European version	72329605
- USA version	72329606
UA30 PC or typical printer cable - terminating in a 9-way D plug	72329601
- terminating in a 9-way D socket	72329602
- terminating in a 25-way D plug	72329603
- terminating in a 25-way D socket	72329604
Mini-DIN 8-pin plug	9040180

The statements and opinions contained in this document are made in good faith. Whilst every effort has been made to provide reliable information, Airflow Developments do not hold themselves responsible for possible errors of an editorial or other nature, however caused. Should you require a more detailed specification for a product described herein, please contact our Sales department. In view of our continuous programme of improvement we reserve the right to change the specification for any model or item described in this publication.

AIRFLOW™

QUALITY ASSURED TO ISO 9001

Airflow Developments Limited, Lancaster Road,
Cressex Business Park, High Wycombe,
Buckinghamshire HP12 3QP, England
Telephone: (01494) 525252/443821
Facsimile: (01494) 461073
E-mail: info@airflow.co.uk
WWW: http://www.airflow.co.uk

Airflow Lufttechnik GmbH, Postfach 1208, D-53349 Rheinbach, Germany.
Telefon: 02226/9205-0. Telefax: 02226/9205-11. eMail: airflow@t-online.de

Airflow Lufttechnik GmbH, o.s. Praha, Hostynska 520, 10800 Praha 10 - Malesice,
Czech republic. Telefon a fax: 02-77 22 30

Airflow Technical Products Inc, 23 Railroad Avenue, Netcong, N.J. 07857 USA
Telephone: 201-691-4825. Fax: 201-691-4703.