FLOW ANEMOMETER

USER MANUAL
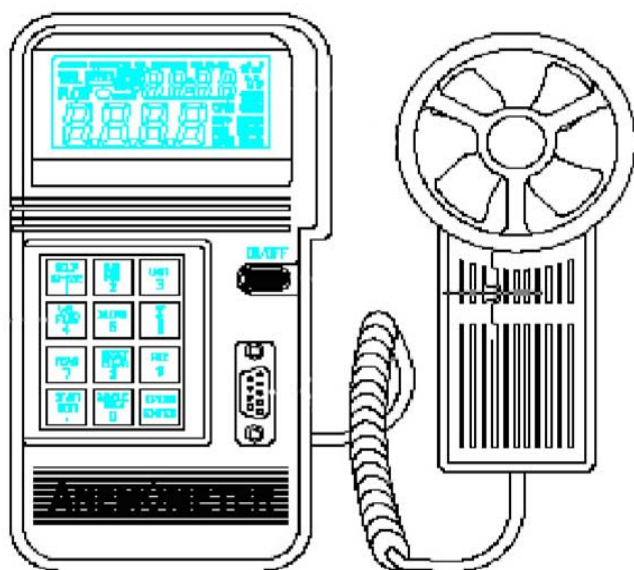
TABLE OF CONTENTS

I Features:

● Sensitive and accurate measurements due to ultra low friction turbine jewel bearing
● Flow measurement in CMM or CFM
● Velocity measurement in m/s, ft/min, knots, km/hr or mph
● Dual Display showing velocity + temperature or flow + area
● RS-232C interface
● °C or °F selectable
● Ergonomic and easy-to-use design
● Read while measuring via detached vane sensor
● Large 17mm 3½ digits Liquid Crystal Display
● Hold/Max/Min function
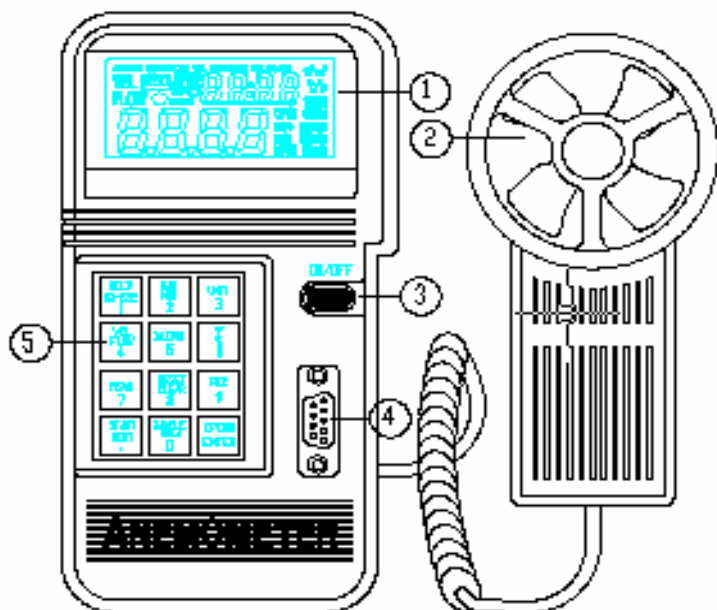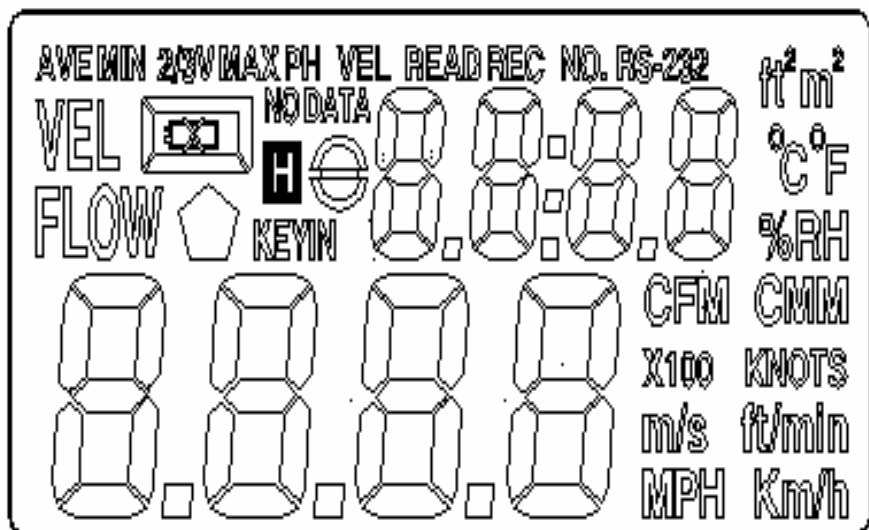● Build-in low-battery indicator

II Front Panel Description

Figure 1
1 LCD display
2 Detached vane turbine sensor
3 Power on/off button
4 RS-232C interface
5 Function and numerical keypad

II.1 LCD

AVE: When average flow measurement is selected by the OPTION button, this symbol will appear.

MIN: When the MAX/MIN button is pressed twice, this symbol will appear to indicate the measured minimum value for either velocity or flow as displayed on the LCD

2/3V: This symbol will be displayed together with MAX when the 2/3VMax method is selected by OPTION button in flow measurement.

MAX: When the MAX/MIN button is pressed once, this symbol will appear to indicate the maximum function is enabled.

VEL: When the VEL/FLOW button (number 4) is pressed, this symbol will appear to indicate the anemometer is measuring wind velocity.

FLOW: This symbol will be displayed when the

anemometer is measuring airflow.

RS-232: When the RS-232 function is enabled, this symbol will appear.

ft^2: This symbol indicates free area in square feet when in flow function.

m^2: This symbol is used to indicate free area in square metres when in flow function.

∘C: This symbol indicates the temperature in Celsius.

∘F: This symbol is used to indicate temperature in Fareinheit.

CFM: This symbol is used to indicate units are cubic feet per minute.

CMM: This symbol is used to indicate units are cubic meter per minute.

x100: This symbol is used to indicate the actual value is the value displayed in the LCD multiplied by 100.

x10: This symbol is to used indicate the actual value is the value displayed in the LCD multiplied by 10.

m/s: This symbol is to used indicate the units are metres per second.

ft/min: This symbol is to used indicate the units are feet per minute.

MPH: This symbol is to used indicate the units are miles per hour.

Km/h: This symbol is to used indicate the units are kilometers per hour.
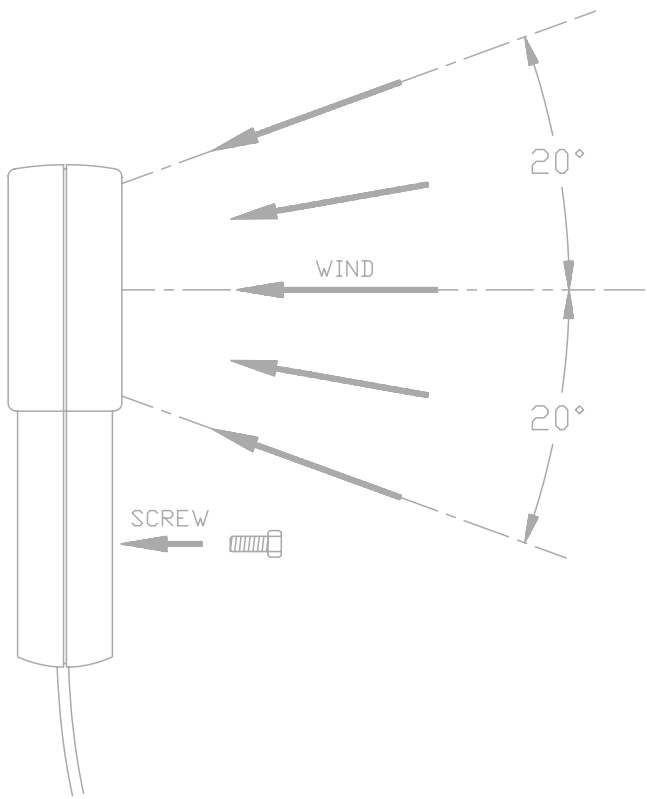
III Operation Instructions

Figure 2

III.1 Measurement of wind velocity (refer to figure 2):
1. Press the on/off button to turn the anemometer on.
2. Select the required function by pressing the VEL/FLOW button (number 4). The VEL symbol will appear in LCD when in velocity measurement mode.
3. Press the units button (number 3) to select the desired units.
4. Determine the approximate wind direction.
5. Hold the anemometer so that the air flow will pass through the vanes from the back to the front (the back is where the mounting thread is located).
6. Wait for 2 seconds for the reading to stabilize.
7. To maintain the measurement accuracy, keep the axis of the turbine vanes within 20° of the wind direction.

III.2 Measurement of wind or air temperature:
1. When the meter is measuring wind velocity, the termperature of wind is measured at the same time.
2. Select °C or °F by pressing the °C/°F button (number 6).
3. Allow the wind the pass through the vanes (A thermocouple is built into the centre of the vane).
4. Read the temperature on the LCD.

III.3 Measurement of wind or air flow (instantaneous air flow):
1. Press the on/off button to turn the anemometer on.
2. Press the VEL/FLOW button (number 4) to select FLOW function. The FLOW symbol will appear in LCD.
3. Press the unit button (number 3) to select the desired units: CFM or CMM.
4. The previous stored free area value will be displayed

in the upper part of the LCD. To enter a new free area value, press the AREA (number 0) button. The lower four digits will become blank and the anemoemter is ready for a value to be entered.

5. Press the OPTION button several times until none of the AVE or 2/3VMAX symbols are shown on the LCD.
6. Enter the free area value required by pressing the numerical keypad. After the free area is entered, press the ENTER button to store the value.   .
   The value will also automatically be stored after all 4 digits are entered.
7. Determine the approximate wind direction.
8. Hold the anemometer so that the air flow will pass through the vanes from the back to the front (the back is where the mounting thread is located).
9. Wait for 2 seconds for the reading to stabilize. The flow rate value will be displayed in the lower part of the LCD. This value equals velocity multiplied by the free area.

$$FLOW = VELOCITY \times (FREE\ AREA)$$

10. To maintain the measurement accuracy, keep the axis of the turbine vanes within $20\,^\circ$ of the wind direction.

III.4 Measurement of wind or air flow (2/3Vmax air flow)
   1. Press the on/off button to turn the anemometer on.
   2. Select the required anemometer function by pressing the VEL/FLOW button (number 4). The FLOW symbol will appear on the LCD.

3. Select the desired units; CFM or CMM by pressing the units button (number 3).
4. The previous stored free area value will be displayed in the upper part of the LCD. To enter a new free area value, press the AREA (number 0) button. The lower four digits will become blank and the anemoemter is ready for a value to be entered.
5. Press the OPTION button to select 2/3VMAX method.
6. Enter the free area value required by pressing the numerical keypad. After the free area is entered, press the ENTER button to store the value.   .
The value will also automatically be stored after all 4 digits are entered.
7. Determine the approximate wind direction.
8. Move around the center of free area to find the point of maximum wind velocity. The anemometer will record the maximum value and use it to calculate the wind flow by the following equation:

$$FLOW = \frac{2}{3} \times max(VELOCITY) \times (FREE\ AREA)$$

9. To maintain the measurement accuracy, keep the axis of the turbine vanes within 20° of the wind direction.

III.5 Measurement of wind or air flow (average air flow)
1. Press the on/off button to turn the anemometer on.
2. Select anemometer function by pressing the VEL/FLOW button (number 4). The FLOW symbol will appear in the LCD.
3. Select the desired units; CFM or CMM by pressing the units button (number 3).

4. The previously stored free area value will be displayed in the upper part of the LCD. To enter a new free area value, press the AREA (number 0) button. The lower four digits will become blank and the anemoemter is ready for a value to be entered.
5. Press the OPTION button to select AVE method.
6. Enter the free area value required by pressing the numerical keypad. After the free area is entered, press the ENTER button to store the value. .
   The value will also automatically be stored after all 4 digits are entered.

.

7. Press the START button (dot) to clear the upper LCD to zero.
8. Determine the approximate wind direction.
9. Select the measuring point in the free area and hold the sensor steady in position until the reading on the LCD stabilizes, then press the NEXT button (dot) to record this reading. Repeat this process for each new measuring point required. The value in the upper LCD will increment each time a reading is taken to indicate how many points have been averaged. The lower display will show the average value of all the readings taken. The maximum number of points is 12.

$$FLOW = \frac{1}{N} \ (VELOCITY) \times (FREE\ AREA)$$

10. Hold the anemometer so that the air flow will pass through the vanes from the back to the front (the back is where the mounting thread is located).

11. To maintain the measurement accuracy, keep the axis of the turbine vanes within 20 ° of the wind direction.

III.6 Holding the Reading
Press the HOLD button to hold the reading of values in LCD. Press again to return to normal measurement mode.

III.7 Finding the Maximum or Minmum values
Press the MAX/MIN button to record the maximum values of wind velocity and temperature or flow. Press again to record the minimum values and press again to return to normal measurement mode.

III.12 To Send Data Out to PC through RS-232C (AVM-07)
1. Press the power on/off button to turn the anemometer off. Hold the RS-232 button (number 1) and press the power on/off button to turn the anemometer on and enable the RS-232 function. The RS-232 symbol will appear in the LCD.
2. 15 bytes of data will be sent out through the RS-232C port every one second.

III.13 The data format sent out through the RS-232 port is as follows:

Byte1:	0D (hex)
Byte2:	bit4: Velocity OL, bit5: Area OL, bit6: temperature OL.
Byte3:	0: m/s, 1: ft/min, 2: knots, 3:km/hr, 4:MPH
Byte4:	bit2: MAX, bit3: MIN, bit4:0-VEL, 1:FLOW, bit5: 0-Degree C, 1-Degree F, bit7: RS-232 enabled.
Byte5:	bit0: 0-CMM, 1-CFC, bit3: Low Battery, bit4: temperature -OL, bit5: AVE, bit6: 2/3Vmax, bit7: Instant
Byte6:	Lower LCD decimal point. bit0: x100, bit1: x10, bit2: x1, bit3: dp1 (right most), bit4: dp2, bit4: dp3 (left most).
Byte7:	Upper LCD decimal point bit2: x1, bit3: dp1 (right most), bit4: dp2, bit5: dp3 (left most).
Byte8:	Digit 3 (most significant) in upper LCD.
Byte9:	Digit 2 in upper LCD.
Byte10:	Digit 1 in upper LCD.
Byte11:	Digit 0 (least significant) in upper LCD.
Byte12:	Digit 3 (most significant) in lower LCD.
Byte13:	Digit 2 in lower LCD.
Byte14:	Digit 1 in lower LCD.
Byte15:	Digit 0 (least significant) in lower LCD.

IV Windows™ application program
   IV.1 Installation of the Windows™ application program
      For Windows 95, 98, 2000, NT, or XP
        A. Start **Windows™**
        B. Insert the CD
        C. Press **START** button, then select **Run**
        D. Browse the CD drive and click on setup, then click on open, then click on OK.
        E. Follow the on screen instructions to install the programme.

IV.2 Description of Windows™ application program
Main Window:
When the program is executed, the program automatically search for the connected anemometer or available serial port. If no serial port is available, then a message of "No communication port" will be displayed,

and the program exits . Once communication port is established, the main programme window will be displayed on the screen as above:

Description of data fields:

Sample: The value under SAMPLE is the sampling time.
Temperature: Temperature of air or wind.
Option: Display option of anemometer: MAX, MIN, AVE, or

2/3Vmax.

Unit: Display units of velocity or flow (m/s, ft/min, knot, mph, kmh, CFM, or CMM)

Value: The value under VALUE is the reading from the anemometer.

Range: The text displayed under RANGE is the range of the unit selected at the anemometer.

Minimum: The absolute minimum value recorded by the PC.

Reset: Clear the minimum and maximum values recorded.

Maximum: The absolute maximum value recorded by the PC.

Lower: The minimum value of the range specified.

Upper: The maximum value of the range specified.

File: If you select File, a pull down menu will show six options: Name, Start Recording, End Recording, VIEW, Plot Data from File, and Exit.

    Name: Enter the required file name for the stored data as displayed in LCD at the specified interval.

    Start Recording: Start recording when selected

    End Recording: End recroding when selected.

VIEW FILE:

If the View option under FILE in the Main Window is selected, a view window is shown as below and the ASCII data file is displayed. If a printer is connected to the PC, a selection of the data content may be printed.

File: Open a data file by selecting this menu. Enter the required file name. After the name is entered, the program will read-in one block of data. The number of records in one block will depend on the memory size of the PC - the more memory, the more records in one block.

Blocks Read:
    Indicates how many blocks of records have been read.

Records Read:
    Indicates how many records have been read.

Chars./Record:

Indicates how many characters in one record.
Current Block:
    Indicates the current block number being reviewed.
Selected:
    Indicates the current record number being selected.

Plotting Data from File

If the "Plot data from file" option under FILE is selected in the
main window, a plot window will be shown and a curve of the
data file may be plotted. If a printer is connected, the plotted
curve may be printed.
File: Open the file to plot data from
Select: Select one of the parameters: velocity, temperature,
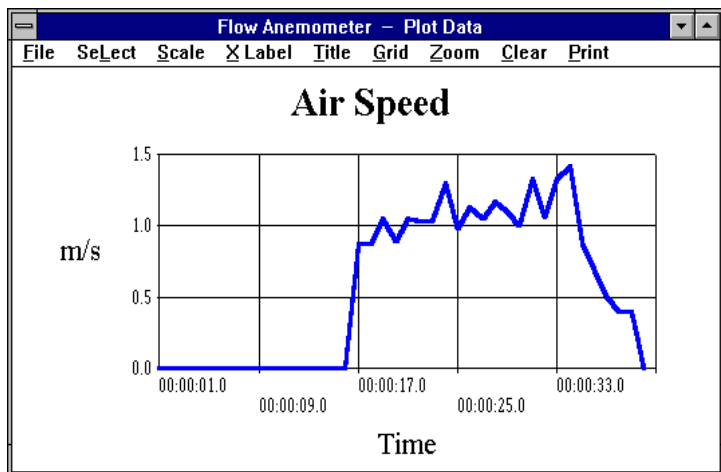   flow, or area to plot
Scale: Set the scale of the Y-axis.
X Label: A sequence of numbers (1,2,3,4,...), or time (12:00:01,
           12:00:05, ...) may be added as an X-axis label.
Title: Enter the title for X-axis, Y-axis, or Graph.
Grid: Draw horizontal or vertical grids, or both.
Zoom: Zoom into a section of the graph. The magnified area

is limited to 3600 points.

Statis: Statistics. This function allows a plot of the average value, standard deviation or best fit over the curve to be made. This function is valid only when the are less than 3600 data points. If there are more than 3600 data, the STATIS option will be disabled.

Clear: Clear the graphic screen.

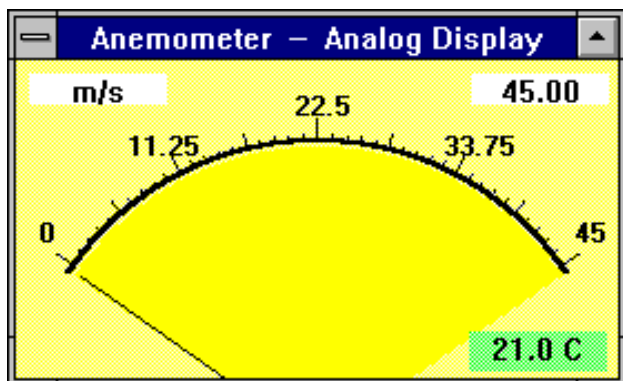Print: Print out the curve if a printer is connected to PC.

DISPLAY: DISPLAY menu has four options: DIGITAL, ANALOG, LIST, and GRAPHIC.

DIGITAL:
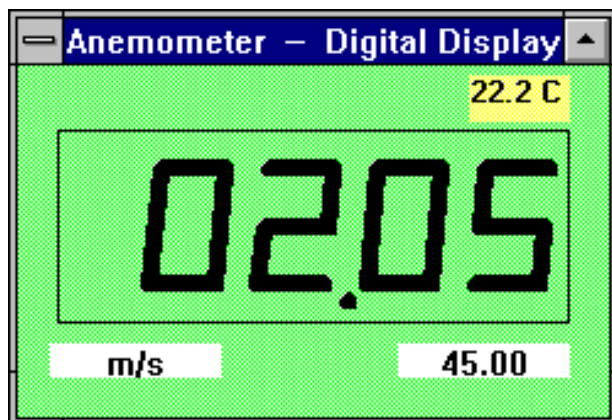
If this option is selected or CTRL+D is pressed, a window which emulates a multimeters' LCD display appears on the screen.
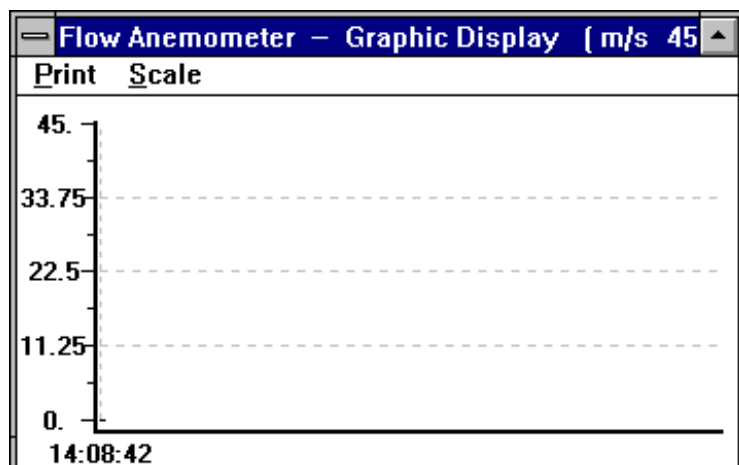
ANALOG:

If this option is selected or CTRL+A is pressed, a window which emulates an analog meter, appears on the screen.

LIST:

If this option is selected or CTRL+L is pressed, a window, which lists the date, function, range and value of every sample made appears on the screen.

GRAPHIC:

If this option is selected or CTRL+G is pressed, a window which emulates a strip chart recorder appears on the screen. The graphic window has two menu options; PRINT and SCALE. If the PRINT menu option is selected, the graphics will be printed through any printer connected to the PC. The SCALE menu allows setting of the minimum and maximum value for the Y (vertical) axis.

Option: If this option is selected, a pull down menu will show three options: Limits, sample rate and baud rate.

Upper Limit: Enter the upper limit. If the upper limit is

exceeded, an OVER message will be displayed on the screen.

Lower Limit: Enter the lower limit. If the displayed value is less than the lower limit, an UNDER message will be displayed on the screen.

Graphic Mode: Select method of display in the graphic windows. Dots or BAR.

Sample Rate: Select this option to enter the PC sampling time, or click on SAMPLE on the screen to enter the sampling time.

Baud Rate: 9600.

V Specifications($23 \pm 5^\circ$ C):

Range of wind velocity:

Units	Range	Resolution	Threshold	Accuracy
m/s	0.0 – 45.0	0.01	0.3	±3% ± 0.1
ft/min	0 – 8800	2	60	±3% ± 20
knots	0.0 – 88.0	0.02	0.6	±3% ± 0.2
Km/hr	0.0 – 140.0	0.04	1.0	±3% ± 0.4
mph	0.0 - 100.0	0.02	0.7	±3% ± 0.2

m/s: metres per second   ft/min: feet per minute
knots: nautical miles per hour   Km/hr: kilometers per hour
mph: miles per hour

Units conversion table:

	m/s	ft/min	knots	Km/hr	Mph
1 m/s	1	196.87	1.944	3.60	2.24
1 ft/min	0.00508	1	0.00987	0.01829	0.01138
1 knot	0.5144	101.27	1	1.8519	1.1523
1 Km/hr	0.2778	54.69	0.54	1	0.6222
1 mph	0.4464	87.89	0.8679	1.6071	1

Range of temperature:

	Range	Resolution	Accuracy
°C	0 - 45.0	0.2	±1.0
°F	32.0 - 113.0	0.36	±1.8

Flow (Auto-range, CMM: 0 to 45.00 m/s, CFM: 0 to 8800 ft/min)

	Range	Resolution	Area
CFM (ft³/min)	0 - 999900	0.001 - 100	0.001- 9999
CMM(m³/min)	0 - 999900	0.001 - 100	0.001- 9999

Sensor turbine bearing: Sapphire jewel

CFM (ft³/min)=Wind velocity(ft/min)x area(ft²)

CMM (m³/min)=Wind velocity(m/s)x area(m²)x60

Temperature sensor: K-type thermocouple
Mounting nut: 1/4" x 20 UNC
Operating temperature: Meter: 0 $^\circ$C ~ 50°C (32 $^\circ$F ~ 122°F)

                          Vane: 0°C ~ 60°C (32 $^\circ$F ~ 140°F)
Operating humidity: Less than 80% RH
Operating pressure: 500 mB to 2 Bar
Storage temperature: -40°C to 60°C (-40°F to 140°F)
Power consumption: Approx. 3 mA
Battery type: 9V IEC 6LR61
Battery life: 50 hours (for 300mA-hrs battery)
Dimensions:
     Meter: 3.46"x 6.61"x 1.03"(88x 168 x 26.2mm)
     Sensor: 2.60" x 5.22" x 1.15"(66 x 132 x
29.2mm)
Weight: 12.34oz. (battery included) (350g)
Accessories: Carrying case x 1
                          Users manual x 1
                          9V Battery x 1

VI Battery replacement:
When the low battery symbol is displayed on the LCD, replace the battery as follows.

1. Turn off the anemometer by pushing the On/Off button.
2. Remove the screw of the battery compartment cover and remove the battery compartment cover.
3. Replace the exhausted battery with a new one.
4. Replace the battery compartment cover and fasten the screw.