

User's Guide

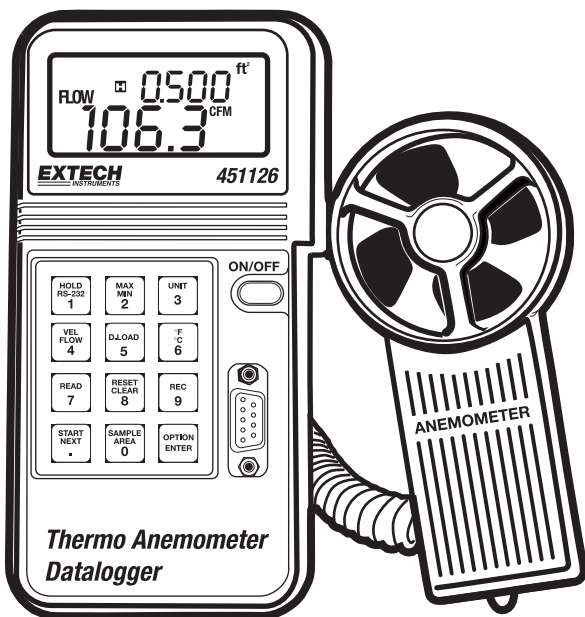
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Vane Thermo-Anemometer Datalogger

Model 451126



Introduction

Congratulations on your purchase of Extech's Thermo-Anemometer Datalogger. This Vane-type Anemometer can indicate Air Velocity in five units of measure: Feet per minute, Meters per second, Miles per hour, Kilometers per hour, and Knots with Temperature displayed in °C or °F units. The meter can also display air flow in CFM or CMM. The built-in datalogger can record up to 2000 readings and the RS-232 interface provides PC data transfer capability.

Specifications

General Specifications

Display	Dual 4-digit (9999 count) Multi-function LCD
Data hold	Locks latest reading on the LCD display
Sensor Structure	Air velocity sensor: Conventional twisted vane arm with low friction (sapphire) ball bearing. Temperature sensor: K-type thermocouple built into vane. 1/4" mounting nut provided
Memory Recall	Records Max/Min readings with push-key RECALL
Data Output	RS-232 PC serial interface
Operating conditions (Meter)	Temperature: 32°F to 122°F (0°C to 50°C); Humidity: <80% RH; Pressure: 500mB to 2 Bar
Operating conditions (Vane)	Temperature: 32°F to 140°F (0°C to 60°C); Humidity: <80% RH; Pressure: 500mB to 2 Bar
Storage temperature	Temperature: -40°F to 140°F (-40°C to 60°C)
Power Supply	9V battery; Battery life: 50 hours typical
Power Consumption	Approx. 3 mA DC
Weight	0.77 lbs. (350g)
Dimensions	Meter: 3.46 x 6.61 x 1.03" (88 x 168 x 26.2mm); Vane: 2.6 x 5.22 x 1.15" (66 x 132 x 29.2mm)
Accessories	9V battery and carrying case

Range Specifications

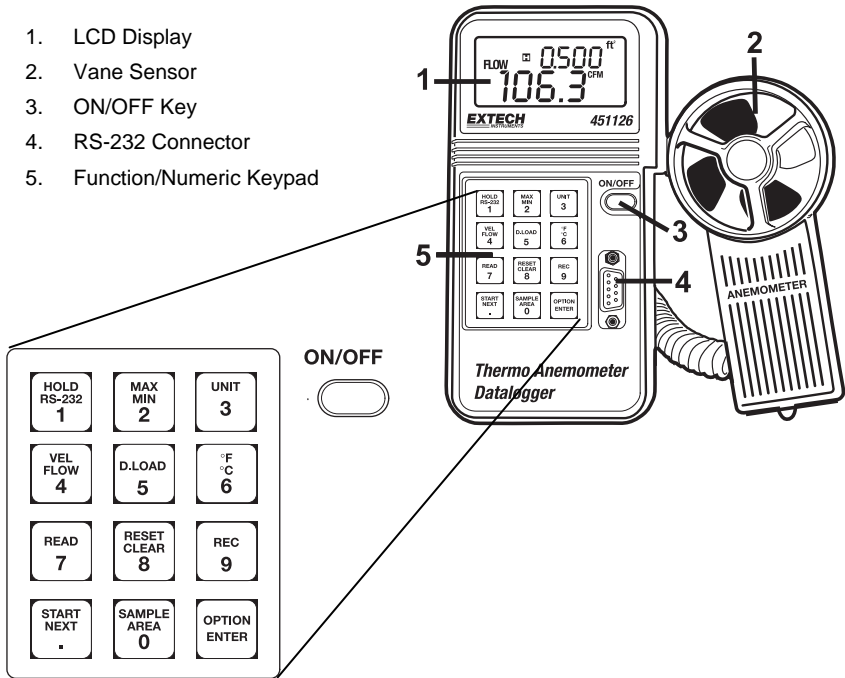
Air Velocity			
Measurement	Calibrated Range	Display Resolution	Accuracy
Feet per Minute (ft/min)	60.0 to 8800	0.1	± (3% + 20 ft/min)
Meters per Second (m/s)	0.30 to 45.00	0.01	± (3% + 0.1 m/s)
Kilometers per Hour (km/hr)	1.00 to 140.0	0.01	± (3% + 0.4 km/hr)
Miles per Hour (mile/hr)	0.70 to 100.0	0.01	± (3% + 0.2 mile/hr)
Knots	0.60 - 88.0	0.01	± (3% + 0.2 knots)

Temperature			
Units	Range	Converter Resolution	Accuracy
°C	0.0°C to 45.0°C	0.2°C	±1.0°C
°F	32.0°F to 113.0°F	0.4°F	±1.8°F

Air Flow and Area			
(CMM: 0 to 45.00 m/s; CFM: 0 to 8800 ft/min)			
	Range	Resolution	Area
CFM (ft ³ /min)	0 to 999900	0.001 to 100	0.001 to 9999
CMM (m ³ /min)	0 to 999900	0.001 to 100	0.001 to 9999

Meter Description

1. LCD Display
2. Vane Sensor
3. ON/OFF Key
4. RS-232 Connector
5. Function/Numeric Keypad






LCD Display Icon Definitions

AVE	Average reading mode is selected	°C	Temperature is displayed in degrees centigrade
MIN	Minimum reading mode is selected	°F	Temperature is displayed in degrees Fahrenheit
2/3V	2/3V Maximum mode is selected	CFM	Cubic feet per minute (ft ³ /min)
MAX	Maximum reading mode is selected	CMM	Cubic meters per minute (m ³ /min)
VEL	Air Velocity measurement	x100	Multiply reading by one hundred
READ	Recalling stored measurements	X10	Multiply reading by ten
REC	Appears when recording readings	m/s	Meters per second
RS-232	PC Interface is activated	ft/min	Feet per minute
ft²	Square feet	MPH	Miles per hour
m²	Square meters	Km/h	Kilometers per hour

Operation

NOTE: For all air velocity or flow measurements, the air should pass through the vane from back to front. The rear of the vane can be found by locating the mounting nut. The front of the vane has the engraving "ANEMOMETER". For more accurate results, maintain a 20° axis of air direction with the rear of the vane (refer to Fig.2).

Air Velocity

1. Power the meter by pressing .
2. Select Air Velocity measurement function by pressing  VEL will appear on the LCD.
3. Press  to select the desired unit of measure (ft/min, mph, km/h, m/s or knots)
4. Place the vane in the air flow with the air direction matching the direction of the arrows printed on the inner walls of the vane. If the unit does not have the printed arrows, have the tripod mount side of the vane facing the air flow (see Fig.2).
5. Air velocity will be displayed on the bottom line of the LCD.

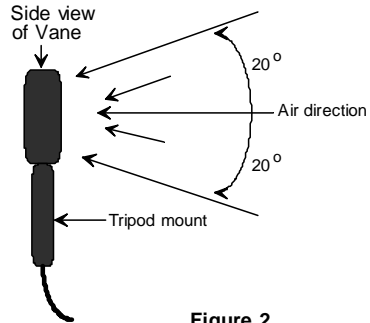








Figure 2


Temperature

1. When the meter is measuring Air Velocity, Temperature is simultaneously being measured by the vane's built-in type-K thermocouple.
2. Press  to select °C or °F. Temperature is displayed on the upper line of the LCD.

Air Flow

1. Power the meter by pressing .
2. Press  to select airflow. FLOW will display.
3. Press  to select the desired unit of measure. (CFM, CMM).
4. To enter the area value, press . The lower display line will blank waiting for the user to program new data. Use the numeric keys to enter a new area value **in square feet**. (REMINDER: if measurement is taken in inches, divide by 144 to obtain square feet). Press  when finished.







Airflow is based on the specific dimensions of the duct being measured. For the meter to correctly measure CFM the user must input the area of the duct. Failing to input the correct area dimensions will result in erroneous readings.

NOTE: If the AVE or the 2/3MAX display icons are displayed in the upper left hand corner of the LCD, press  until they extinguish.










5. Place the vane in the air flow (Fig.2).
6. Wait approximately 2 seconds for a stabilized Air Flow reading.
7. The equation below is used to calculate Air Flow:

$$\text{AIR FLOW} = (\text{AIR VELOCITY}) \times (\text{AREA})$$



2/3Vmax Air Flow

1. Power the meter by pressing .
2. Press  to select Air Flow. FLOW will display.
3. Press  to select the desired units (CFM, CMM).
4. The previously stored area value will be displayed on the upper LCD display line. To enter a new area value press . The lower display line will blank waiting for the user to program new data. Use the numeric keys to enter a new area value in square feet. Press  when finished.
5. Press  until the 2/3V MAX icon appears on the LCD.
6. Determine the direction of the air to be measured. Move the Vane around the center of the area being measured to read the maximum air velocity. The meter will use the maximum reading obtained to determine the 2/3MAX Air Flow.




Average Air Flow

1. Power the meter by pressing .
2. Press  to select Air Flow. FLOW will display.
3. Press  to select the desired units (CFM, CMM).
4. The previously stored area value will be displayed on the upper LCD display line. To enter a new area value press . The lower display line will blank waiting for the user to program new data. Use the numeric keys to enter a new area value. Press  when finished.
5. Press  until AVE appears on the LCD display.
6. Press  to clear the upper LCD.
7. Select a measurement location. Once a point is selected and a flow measurement is displayed, press  to average the flow reading.
8. Select the next measurement location and press  again to average the reading with previous readings. The value in the upper LCD line will increment for each reading taken to show how many readings were averaged. **The max is 12 readings.**

Data Hold




- Press  to freeze the reading. The display will hold and an 'H' will appear on the LCD.
- Press  again to return to normal operation.

MAX and MIN Measurements





1. Press  to enter MAX mode. The meter will only display the highest reading.
2. Press  again to enter the MIN. The meter will only display the lowest reading.
3. Press  to exit the MAX or the MIN mode.

Datalogging

Instantaneous (One-Shot) Datalogging

To record one data point at any desired time, set the sampling rate = 0 by pressing  in the VEL mode. The previously stored reading will be displayed on the upper LCD line. Enter a '0' sampling time and then press . Now, each time  is pressed, the present reading will be stored in non-volatile memory.



Automatic Datalogging

1. Set the Sampling rate for datalogging by pressing . The previous sample rate will appear.
2. Enter a value from 1 to 240 seconds using the numeric keypad. Press  when done.
3. Press  to begin storing readings in non-volatile memory every n seconds (n = the value entered in step 2. above).
4. The REC icon will appear on the LCD indicating that the datalogging mode is activated.
5. The maximum number of readings that can be stored is 2000.
6. To stop datalogging, press  again. The datalogger will automatically stop recording data when 2000 records have been stored.





See software section of this manual for instruction on viewing logged data.

IMPORTANT NOTE: If power is removed before datalogging is properly halted, data will be lost.


Reading Stored Data Sequentially

Press , the RECORD NUMBER will briefly display on the upper LCD line before the measurement data appears. Press  to return to normal operation.

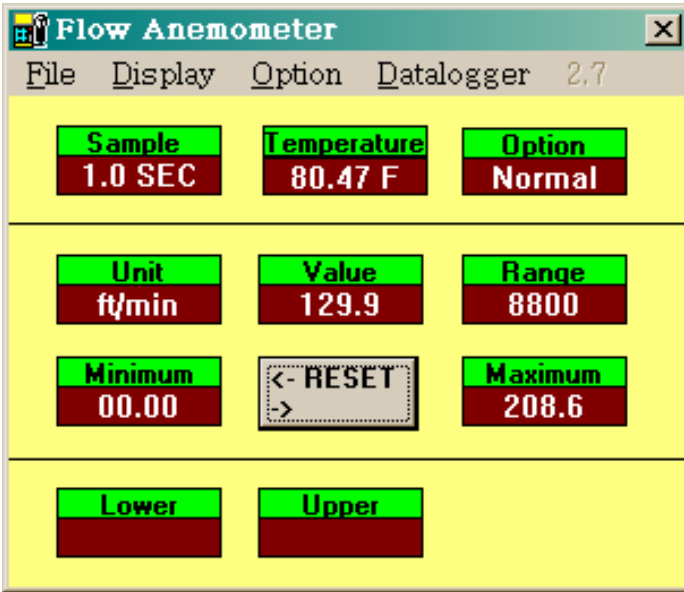
Reading Stored Data Randomly

1. Press  to enter the READ mode.
2. Press  and enter the number of the record in question.
3. Press  again and the desired data will be displayed.
4. Press  to return to normal operation.

Clearing Datalog Memory

Press and hold  while powering up the meter to clear the meter's datalog memory.

Software



The 451126 software lets the user:

- Download logged recordings from the meter's memory
- Record to the PC
- Graphically display readings from the meter

System Requirements

Hardware Requirements: 486 PC or better with COM 1 and COM 2 Serial ports

Operating System Compatibility: Windows™ 95/98/NT/2000/XP

Hardware Connection

The IR Thermometer connects to a PC with the supplied DB-9 to DB-9 interface cable.

Software Installation

The instructions on how to install the optional software are printed on the Software CD label. After reading the label's directions, load the software CD in the PC CD-ROM drive.

Starting the Software



1. Run the program by opening the program named "Flow Anemometer".

Flow Anemometer is in the programs folder of your Windows software.

2. Wait for the program to initialize and select COM 1 or 2 as required.

The program will load and the main display will appear.

A red NO COM icon will flash on the bottom right hand side of the display.

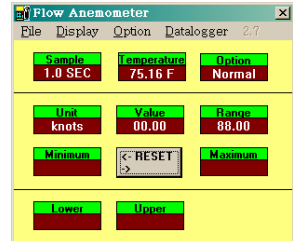
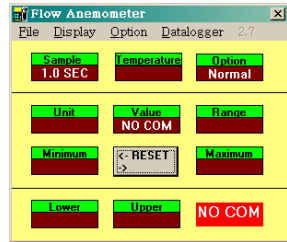
3. Press and hold  then power on the meter by pressing 

The RS232 icon will appear on the upper right hand side display of the meter.

The NO COM icon will disappear.

Communications has been established.

Values will appear in the display.



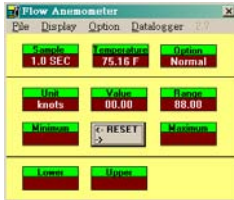
Operating the Software

Graphical Display Mode

The display command offers 5 different displays.

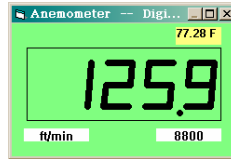
Click Display on menu bar to select.

Click Option to set Upper and Lower Limits. The software will then flag readings exceeding the limits.

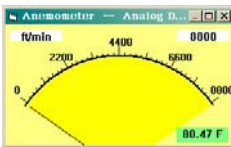


Main Display

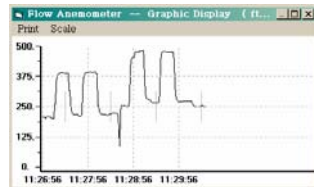
Click Reset button on main display to clear Min/Max



Digital Display



Analog Display



Graphical Display

Click Scale in Graphical Mode to change x and y axis scale.

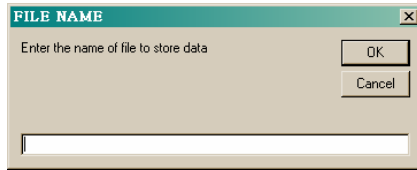
Time	Range	Range	Date	V/2500
11:22:08.0	ft/min	8800	376.0	79.41 F Normal
11:22:09.0	ft/min	8800	376.0	79.41 F Normal
11:22:10.0	ft/min	8800	366.1	79.41 F Normal
11:22:11.0	ft/min	8800	326.8	79.41 F Normal
11:21:59.0	ft/min	8800	299.2	79.41 F Normal
11:22:00.0	ft/min	8800	395.7	79.41 F Normal
11:22:01.0	ft/min	8800	324.8	79.41 F Normal
11:22:02.0	ft/min	8800	439.0	79.41 F Normal
11:22:03.0	ft/min	8800	348.4	79.41 F Normal
11:22:04.0	ft/min	8800	376.0	79.41 F Normal
11:22:05.0	ft/min	8800	370.1	79.41 F Normal
11:22:06.0	ft/min	8800	379.9	79.41 F Normal
11:22:07.0	ft/min	8800	383.8	79.41 F Normal

List Display

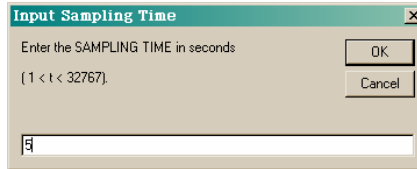
Data Acquisition Mode

In data acquisition mode the meter is connected to a PC with the data being saved directly to the PC's memory.

1. In the Flow Anemometer program, click **File**, and then click **Name**. Enter a file name and click **OK**
2. Click **Option** then **Sample**, enter a sampling interval and then click **OK**
3. Click **File** then **Start Recording**.
4. To stop the meter click **File** then click **End Recording**.



A dialog box titled "FILE NAME" with a close button (X) in the top right corner. The text inside reads "Enter the name of file to store data". There are two buttons: "OK" and "Cancel". Below the text is an empty text input field.



A dialog box titled "Input Sampling Time" with a close button (X) in the top right corner. The text inside reads "Enter the SAMPLING TIME in seconds" and "[1 < t < 32767]". There are two buttons: "OK" and "Cancel". Below the text is an empty text input field.

Viewing Files

Files can be view in table form or they can be plotted on a graph.

Viewing in a table:

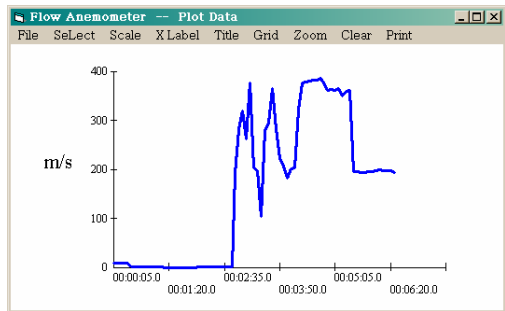
5. In the Flow Anemometer program, click **File**, and then click **View File**.
6. When the View screen opens click **File** then click **Open**.
7. In the **Look in** list, click the drive, folder, or Internet location that contains the file you want to open.
8. In the folder list, locate and open the folder that contains the file. The File will then open. Click **File** then **Print** to print records

Time	Speed (m/s)	Pressure	Temp 1	Temp 2	Status
00:00:05.0	m/s,	45.00,	08.31,	24.77	C, Ni
00:00:10.0	m/s,	45.00,	08.32,	24.77	C, Ni
00:00:15.0	m/s,	45.00,	08.40,	24.77	C, Ni
00:00:20.0	m/s,	45.00,	08.35,	24.77	C, Ni
00:00:25.0	m/s,	45.00,	08.36,	24.77	C, Ni
00:00:30.0	m/s,	45.00,	00.96,	22.61	C, Ni
00:00:35.0	m/s,	45.00,	00.57,	22.61	C, Ni
00:00:40.0	m/s,	45.00,	00.79,	22.61	C, Ni
00:00:45.0	m/s,	45.00,	00.89,	22.61	C, Ni
00:00:50.0	m/s,	45.00,	00.86,	22.61	C, Ni
00:00:55.0	m/s,	45.00,	00.81,	22.61	C, Ni
00:01:00.0	m/s,	45.00,	00.53,	22.61	C, Ni
00:01:05.0	m/s,	45.00,	00.66,	22.61	C, Ni
00:01:10.0	m/s,	45.00,	00.67,	22.61	C, Ni
00:01:15.0	m/s,	45.00,	00.00,	23.00	C, Ni
00:01:20.0	m/s,	45.00,	00.00,	23.00	C, Ni
00:01:25.0	m/s,	45.00,	00.00,	23.00	C, Ni

Current Block	Selected
1	1

Plotting a graph

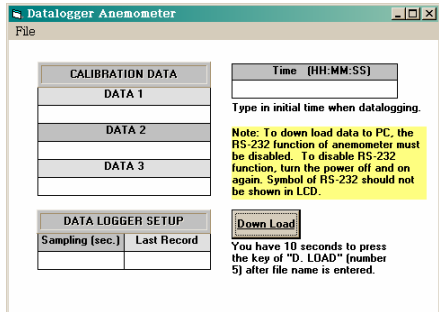
1. In the Flow Anemometer program, click **File**, and then click **Plot Data from File**.
2. When the Plot Data screen opens click **File** then click **Open**.
3. In the **Look in** list, click the drive, folder, or Internet location that contains the file you want to open.
4. In the folder list, locate and open the folder that contains the file. The File will then open. Click **Print** to print the graph. The graph can also be modified and manipulated by using the graphing commands.



Downloading Logged Data to the PC

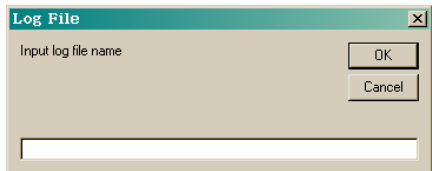
Note: The RS232 communication symbol should NOT be displayed in the LCD when downloading.

1. Click **Datalogger** on the menu. The Datalogger Anemometer screen will open.



2. Click the **Download** button. The Log File screen will open.


Enter a File name and click **OK** button.



The Status screen will open.

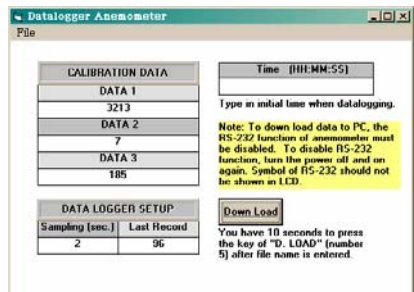
Status screen will count up the number of readings being transferred.



3. Press  to initiate data transfer from the meter to the PC
4. When transfer is completed click **OK**.

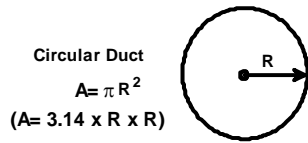
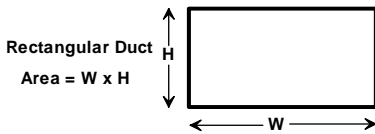


5. The datalogger screen will appear and display the number of records and the sampling rate they were taken at.
6. Click **File** and **Exit**. Data can now be viewed



Useful Equations and Conversions

Area equations



Cubic equations

$$\text{CFM (ft}^3/\text{min)} = \text{Air Velocity (ft/min)} \times \text{Area (ft}^2\text{)}$$

$$\text{CMM (m}^3/\text{min)} = \text{Air Velocity (m/sec)} \times \text{Area (m}^2\text{)} \times 60$$

Units Conversion Table

	m/s	ft/min	knots	km/hr	mph
1 m/s	1	196.87	1.944	3.6	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

Battery Replacement

The low battery indicator appears on the LCD display when it is time to replace the 9V battery, which powers the meter.

To replace the battery:

- Turn the meter off.
- Remove the battery compartment screw and remove the battery compartment cover.
- Replace the 9V battery and reinstall the compartment cover.
- Fasten the compartment screw

Appendix A: Real-time Datalog-to-PC transfer

Byte 1	0D (Hex)	Byte 9	Digit 2 in upper LCD
Byte 2	bit4: Velocity OL, bit5 Area OL, bit 6: Temp OL	Byte 10	Digit 1 in upper LCD
Byte 3	0: m/s, 1: ft/min, 2: knots, 3: km/hr, 4: MPH	Byte 11	Digit 0 (LSB) in upper LCD
Byte 4	bit2: MAX, bit3: MIN, bit4: 0:VEL 1:FLOW, bit 5: 0: DEG C, 1:DEG F, bit7: RS-232 enabled	Byte 12	Digit 3 (MSB) in lower LCD
Byte 5	bit0: 0:CMM, 1: CFM, bit3: low batt, bit4: Temp OL, bit5: AVE, bit6: 2/3Vmax, bit7: Instant	Byte 13	Digit 2 in lower LCD
Byte 6	Lower LCD decimal, bit0: x100, bit1: x10, bit2: x1, bit3: dp1 (rightmost), bit4: dp2, bit5: dp3 (leftmost)	Byte 14	Digit 1 in lower LCD
Byte 7	Upper LCD decimal, bit2: x1, bit3: dp1 (rightmost), bit4: dp2, bit5: dp3 (leftmost)	Byte 15	Digit 0 (LSB) in lower LCD
Byte 8	Digit 3 (MSD) in upper LCD		

Appendix B: Transferring Logged Data to the PC

Byte 0	0D (hex)	Byte 772	Digit 3 (MSB) in lower LCD
Byte 1	Calibration Data 0	Byte 773	Digit 0 (LSB) in upper LCD
Byte 2	Calibration Data 1	Byte 774	Digit 1 in upper LCD
Byte 3	Calibration Data 2	Byte 775	Digit 2 in upper LCD
Byte 4	Sampling time	Byte 776	Digit 3 (MSB) in upper LCD
Byte 5	Last record no. (low byte)	Byte 777	Upper LCD decimal, bit2: x1, bit3: dp1 (rightmost), bit4: dp2, bit5: dp3 (leftmost)
Byte 6	Last record no. (high byte)	Byte 778	Lower LCD decimal, bit0: x100, bit1: x10, bit2: x1, bit3: dp1 (rightmost), bit4: dp2, bit5: dp3 (leftmost)
Byte 7	Free area (low byte)	Byte 779	bit0: 0:CMM, 1: CFM, bit3: low batt, bit4: Temp OL, bit5: AVE, bit6: 2/3Vmax, bit7: Instant
Byte 8	Free area (high byte)	Byte 780	bit2: MAX, bit3: MIN, bit4: 0:VEL 1:FLOW, bit 5: 0: DEG C, 1:DEG F, bit7: RS-232 enabled
Byte 9	Decimal pt. for area (refer to byte 778)	Byte 781	0: m/s, 1: ft/min, 2: knots, 3: km/hr, 4: MPH
Byte 10 - 768	Reserved	Byte 782	bit4: Velocity OL, bit5 Area OL, bit 6: Temp OL
Byte 769	Digit 0 (LSB) in lower LCD	Byte 783	Not used
Byte 770	Digit 1 in lower LCD	Byte 784	Not used
Byte 771	Digit 2 in lower LCD	Byte 785 - 32768	Record No. 2 to Record No. 2000

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