

Model 8372/73

***ACCUBALANCE[®] Plus
Air Capture Hood***

***Operation and Service
Manual***

*August 2000
P/N 1980336 Rev B*

Model 8372/73

**ACCUBALANCE[®] Plus
Air Capture Hood**

**Operation and Service
Manual**

August 2000

P/N 1980336 Rev B

SHIP TO:

TSI Incorporated
500 Cardigan Road
Shoreview, MN 55126

MAIL TO:

TSI Incorporated
P.O. Box 64394
St. Paul, MN 55164

U.S.

Sales & Customer Service:
(800)777-8356/(651)490-2711

Fax:
(651)490-2874

INTERNATIONAL

Sales & Customer Service:
+1-651-490-2711

Fax:
+1-651-490-2874

Copyright©

TSI Incorporated/August 2000/All rights reserved.

Address

TSI Incorporated/500 Cardigan Road
P.O. Box 64394
St. Paul, MN 55164/USA

Fax No.

(651) 490-2874

Limitation of Warranty and Liability

Seller warrants the goods sold hereunder, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for (24) months, or the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. This limited warranty is subject to the following exclusions:

- a. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment.
- b. Seller does not provide any warranty on finished goods manufactured by others or on any fuses, batteries or other consumable materials. Only the original manufacturer's warranty applies.
- c. Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, goods which are incorporated into other products or equipment, or which are modified by any person other than Seller.

The foregoing is IN LIEU OF all other warranties and is subject to the LIMITATIONS stated herein. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE.

TO THE EXTENT PERMITTED BY LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF SELLER'S LIABILITY FOR ANY AND ALL LOSSES, INJURIES, OR DAMAGES CONCERNING THE GOODS (INCLUDING CLAIMS BASED ON CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) SHALL BE THE RETURN OF GOODS TO SELLER AND THE REFUND OF THE PURCHASE PRICE, OR, AT THE OPTION OF SELLER, THE REPAIR OR REPLACEMENT OF THE GOODS, IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES. SELLER SHALL NOT BE RESPONSIBLE FOR INSTALLATION, DISMANTLING OR REINSTALLATION COSTS OR CHARGES. No Action, regardless of form, may be brought against Seller more than 12 months after a cause of action has accrued. The goods returned under warranty to Seller's factory shall be at Buyer's risk of loss, and will be returned, if at all, at Seller's risk of loss.

Buyer and all users are deemed to have accepted this LIMITATION OF WARRANTY AND LIABILITY, which contains the complete and exclusive limited warranty of Seller. This LIMITATION OF WARRANTY AND LIABILITY may not be amended, modified or its terms waived, except by writing signed by an Officer of Seller.

Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (651) 490-2711 or (800) 777-8356

CONTENTS

ABOUT THIS MANUAL	III
--------------------------------	-----

INTRODUCTION	IV
---------------------------	----

Chapters

1. SET UP	1
Unpacking	1
Parts Identification.....	3
Display	3
Display Units.....	5
Keypad.....	5
Changing the Real-Time Clock.....	6
Compliance Statement for Y2K.....	7
Changing the Baud Rate	7
Preparing the Instrument for Use	7
<i>Installing the Batteries</i>	7
<i>Hood Assembly</i>	8
Basic Operation	9
<i>Start-Up</i>	9
<i>Selecting Flow Direction</i>	9
<i>Taking a Flow Measurement</i>	10
<i>Turning the ACCUBALANCE Plus Off</i>	10
<i>Automatic Shut-off</i>	11
2. OPERATIONS IN MORE DETAIL	13
Keypad Functions	13
Field Calibration - Model 8372 Only.....	24
Additional Keypad Functions for the Model 8373.....	25
Field Calibration - Model 8373 Only.....	25
Changing Hoods.....	26
Changing DIP Switch Settings.....	30
Switch Number.....	31
Connecting the Optional Printer	31
Connecting to a Computer.....	33
Downloading Data to a Computer	33
Data Acquisition (Polling)	33
3. MAINTENANCE	35
Fabric Hood.....	35
Meter.....	36
Manifold.....	36
Cases.....	36
Calibration	36

4. TROUBLESHOOTING	37
Appendices	
A. BACK PRESSURE	41
B. SPECIFICATIONS	43

About this manual

This manual explains how to set up, operate and maintain the Model 8372/8373 ACCUBALANCE Plus Air Capture Hood. Read it thoroughly before using the instrument.

Formatting and Typography

Note that step-by-step instructions are numbered in boldface type: **1, 2, 3**, etc., set flush-left against the margin.

References to the front panel keys on the ACCUBALANCE Plus, along with the instrument's displayed readout, are represented in this manual by the typeface called Arial Narrow. In addition to the different typeface, displayed messages appear in quotes.

When reference is made to other sections of the manual, the section title is italicized.

Example: The "SAMPLE" message will appear along with a flow value after you have activated the SAMPLE key (from *Display* in Chapter 1).

HELP!

If you need technical assistance with this instrument, have questions about the manual, or your air capture hood needs repair or recalibration please call TSI's Environmental Measurements and Control Division at (651) 490-2711 or (800) 777-8356. Product application notes are designed to provide more information on the product to the user. Application notes, as well as other related material, can be obtained by calling TSI or by visiting the TSI web site at <http://www.tsi.com>.

Introduction

The TSI Models 8372/8373 ACCUBALANCE Plus are instruments designed to measure the air flow from diffusers and grilles or the air flow entering exhaust outlets. The ACCUBALANCE Plus is lightweight and easy to use. The instrument can display the measured air flow in four different units: standard cubic feet per minute (SCFM), standard liters per second (Std l/s), standard cubic meters per hour (Std m³/hr), and standard cubic meters per minute (Std m³/min). All readings may also be displayed in actual flow conditions.

The ACCUBALANCE Plus consists of a fabric hood, a molded plastic base which contains an electronic meter, and a flow sensing manifold located within the base. Air flowing through the hood is measured by a hot-film sensor located in the central hub of the flow sensing manifold. The twenty-four pairs of flow sensing ports in the manifold are strategically located so that the ACCUBALANCE Plus provides the highest degree of measurement accuracy, even in non-uniform flow conditions.

The ACCUBALANCE Plus is temperature-compensated to display a standard flow rate: SCFM, Std l/s, Std m³/hr, and Std m³/min. Standard flow rate is defined as the volumetric flow rate at standard conditions of 70°F (21.1°C) and 14.7 pounds per square inch (760 mmHg) barometric pressure. Standard flow rate is the measurement used most often in ventilation applications.

Chapter 1

Set Up

This chapter guides you through unpacking, setting up, and getting started using your ACCUBALANCE Plus. See Chapter 2 for a detailed description of all operating features.

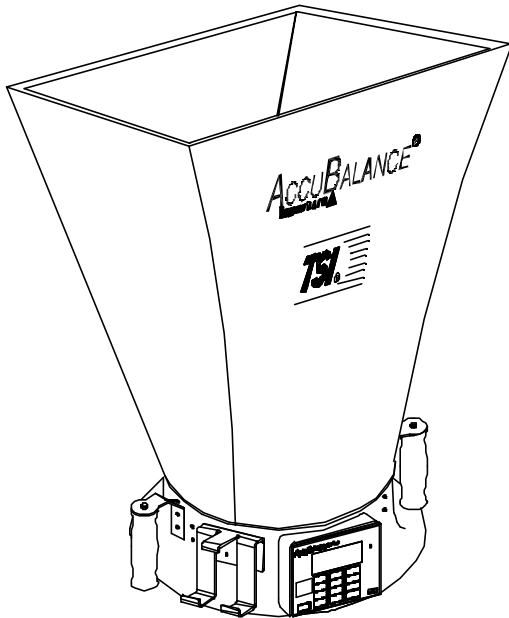


Figure 1: The ACCUBALANCE Plus

Unpacking

Carefully unpack the instrument and accessories from the carrying case. Check the individual parts against the list of components in Tables 1 through 3. If any are missing or damaged, notify TSI immediately.

Table 1 List of components

Qty	Item	Part No.
1	Model 8372/8373 base	N/A
1	2 ft x 2 ft (610 mm x 610 mm) hood fabric	1307060
6	Frame support poles	1081390
4	2 ft (610 mm) frame tubing*	1081262
6	Right angle tubing connectors*	1081584

Qty	Item	Part No.
1	Battery holder	1081279
4	C-size batteries	1208018
1	Battery compartment cover	1081458
1	Carrying case	1319067
1	Operation and Service Manual	1980336
1	Data download RS232 cable	1082798
3	3-1/2" floppies containing the "Logdat" data download software	800832

*Four of the 2 ft frame tubings and four of the right angle connectors are shipped assembled inside the top of the hood fabric.

Table 2 List of components: -3 Hood Kit (adds 2 hoods to the base kit)

Qty	Item	Part No.
1	2 ft x 4 ft (610 mm x 1220 mm)hood fabric	1801065
1	1 ft x 4 ft (305 mm x 1220 mm)hood fabric	1801066
6	2 ft (610 mm) frame tubing	1081262
4	1 ft (305 mm) frame tubing	1081260
6	Right angle tubing connectors	1081584
6	Straight tubing connectors	1302833

Table 3 List of components: -5 Hood Kit (adds 4 hoods to the base kit)

Qty	Item	Part No.
1	2 ft x 4 ft (610 mm x 1220 mm) hood fabric	1801065
1	1 ft x 4 ft (305 mm x 1220 mm) hood fabric	1801066
1	1 ft x 5 ft (305 mm x 1525 mm) hood fabric	1801067
1	3 ft x 3 ft (915 mm x 915 mm) hood fabric	1801068
6	2 ft (610 mm) frame tubing	1081262
4	1 ft (305 mm) frame tubing	1081260
6	Right angle tubing connectors	1081584
6	Straight tubing connectors	1302833
2	1x tube connectors	1081580

Included with this product is a registration card. Please complete and mail it promptly; it allows TSI to inform you of product updates. You may also register on line by visiting the TSI web site.

Parts Identification

Before proceeding with assembly and use of the ACCUBALANCE Plus, please familiarize yourself with the various parts of the instrument. Refer to table 1 through 3 for part descriptions and Figure 2 for general location of major items.

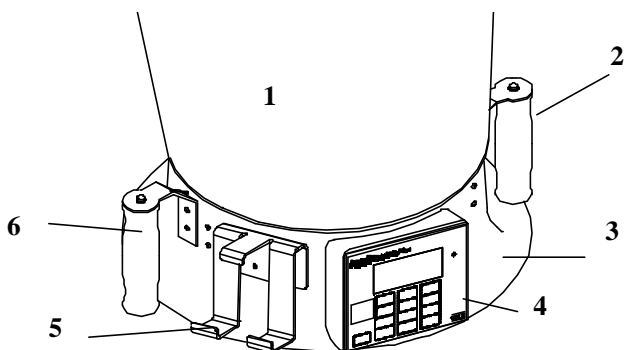


Figure 2: ACCUBALANCE components

- 1 Fabric hood - Basic hood assembly is covered later in this chapter, other hoods are discussed in Chapter 2.
- 2 Right handle with SAMPLE key - used for capturing information on the display.
- 3 Meter base
- 4 Electronic meter and display - Detailed key pad functions are covered in Chapter 2.
- 5 Printer bracket - Allows the Model 8925 to be attached to the ACCUBALANCE base for ease of use and recording of data.
- 6 Left handle with PRINT button - Used to print that which is on the display value to the portable printer.

Display

Each time the ACCUBALANCE is turned on, all segments of the display will be shown momentarily. Below is a list of items that will appear on the display and their use.

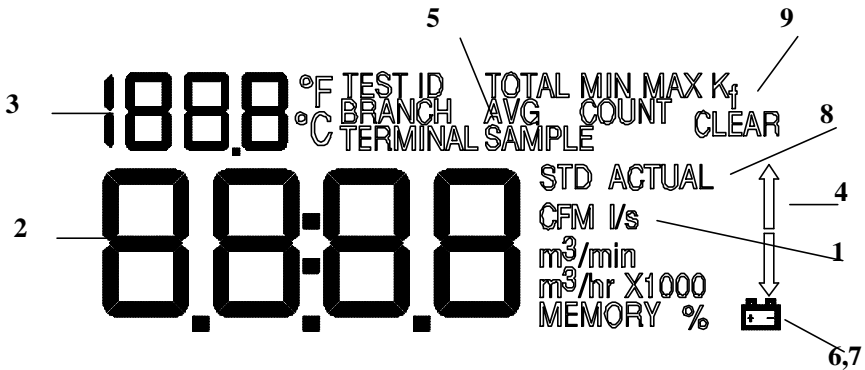





Figure 3: Display of the Model 8372/8373

- 1 Flow units: CFM (cubic feet per minute), l/s (liters per second), m³/hr (cubic meters per hour), and m³/min (cubic meters per minute). The ACCUBALANCE indicates flow already corrected to "standard" conditions. Actual flow conditions can be shown by pressing the ACTUAL/STANDARD key (See Chapter 2 for more detail operation)
- 2 Flow value: Large digits. See specifications for range and resolution.
- 3 Message area: Small digits. Simultaneous temperature measurement.
- 4 Flow direction arrows: Indicates if supply or return air flow calibration is being utilized by the ACCUBALANCE.

Notice: For Model 8372 - Be sure this arrow points in the direction of flow through the ACCUBALANCE Plus, otherwise the measurements made will be inaccurate. To change the direction of the arrow, press the SUPPLY/RETURN key. (The model 8373 senses direction automatically)

- 5 "SAMPLE" will appear every time you press the SAMPLE key or the button on the top of the right handle.
- 6 "%  " will appear along with a value on the display during power-up to indicate the percent of battery life remaining.
- 7 The  symbol will flash when the batteries have only about 10% life remaining. When the battery is too low for accurate measurements "LO  " is displayed momentarily before the instrument is automatically turned off.

- 8 "STD" or "ACTUAL" will be displayed at all times. "STD" refers to readings that are based on standard conditions of 29.92 in. Hg (760 mm Hg) and 70 °F (21.1 °C). "ACTUAL" refers to readings that are converted to local conditions based on temperature and barometric pressure.
- 9 "K": K factor symbol to indicate that the readings have an adjustment factored in.
- 10 "TOTAL", "MIN", "MAX", "AVG", "COUNT" will be displayed when viewing STATISTICS.
- 11 "TEST ID", "BRANCH", "TERMINAL" will be displayed when viewing data for a SAMPLE or when reviewing data.

Display Units

The ACCUBALANCE Plus is shipped with cubic feet per minute (CFM) as the default flow unit, °F for temperature, and in. Hg (inches of mercury) for barometric pressure (unless the metric version was ordered). If you wish to change the units to l/s (liters per second), m³/hr (cubic meters per hour), m³/min (cubic meters per minute), °C for temperature, and mm Hg (millimeters of mercury) for barometric pressure, see *Changing DIP Switch Settings* in Chapter 2. Please note that no units will be shown on the display for barometric pressure.

Keypad

Below is a drawing of the key pads, Figure 4, for the Model 8372, Figure 5, for the Model 8373. The keys are referenced in the *Basic Operation* section of this chapter and in Chapter 2 - *Operations in More Detail*.

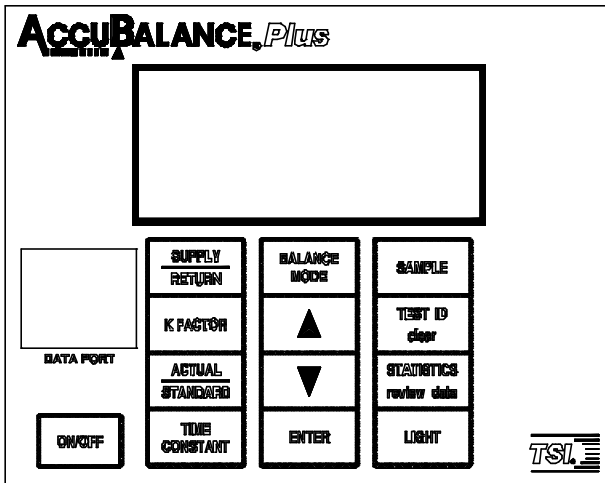


Figure 4: Keypad for the Model 8372

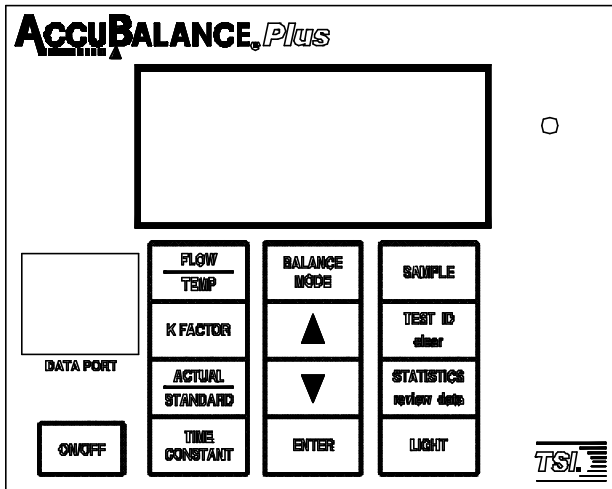


Figure 5: Keypad for the Model 8373

Changing the Real-Time Clock

The ACCUBALANCE Plus has an internal real-time clock that keeps track of the time of day (the format is HH.MM where HH is the hour in 24-hour format and MM is minutes) and the date. It is very important to set the time and date correctly, otherwise date and time stamping of recorded data will not be correct. This information has been set to Central Time (GMT - 6 hours) (Standard or Daylight Savings) at the factory before shipping. The ACCUBALANCE Plus does not self-adjust for Daylight Savings Time.

To change the time and date, press and hold either the ▲ or ▼ key during the power-up sequence when the time is displayed. Release the keys when the ACCUBALANCE Plus beeps twice. You will have an opportunity to view and/or change the hours, minutes, year, month, and day of month in sequence. Use the up and down arrow keys (▲▼) to change any settings. Use the ENTER key to store each setting and advance to the next one.

Compliance Statement for Y2K

The ACCUBALANCE Plus Models 8372 and 8373 will perform as follows:

- 1 No value for date will cause any interruption in operation.
- 2 Date-based functionality will behave consistently for all dates prior to, during and after the year 2000.
- 3 The instrument does not keep track of century, and all years are output in 2-digit format. Year 1999 prints as '99' and year 2000 prints as '00'.
- 4 The leap year for year 2000 will be recognized.

Changing the Baud Rate

The ACCUBALANCE Plus has a variable baud rate that is used when downloading or printing data from the instrument. By changing the baud rate to a higher rate, the data will be downloaded faster. **NOTE:** *The baud rate must be equal to that of your computer or printer.* The baud rate for the model 8925 printer is set as 1200.

The instrument baud rate is displayed during the initial power up sequence. To change the baud rate, press and hold either the ▲ or ▼ key during the power-up sequence while the baud rate is displayed. Release the keys when the ACCUBALANCE Plus beeps twice. Use the ▲ and ▼ keys to scroll through the available values of 1200, 2400, 4800, 9600, and 19200. Press ENTER to set the value that is displayed.

Preparing the Instrument for Use

Installing the Batteries

The ACCUBALANCE Plus requires four C-size batteries to operate. For your convenience, four alkaline batteries are included with the ACCUBALANCE Plus.

To install the batteries, follow these three steps:

- 1 The battery cover is located behind the electronic meter on the inner side of the ACCUBALANCE Plus base. To remove the battery cover, pull up on the latches located on the top and bottom of the cover.

- 2 Place batteries in the battery holder located inside the battery compartment. Follow the illustration on the battery holder for correct battery orientation.
- 3 Replace the battery cover. Notice that the battery cover is designed to fit only one way, with the tab pointing toward the fabric. Engage the latches by pressing down on them.

Notice: Remove batteries from the battery compartment during shipping, travel and transport. Jostling may jar the batteries loose and cause damage to the ACCUBALANCE Plus .

If fresh, new alkaline batteries are used, the value will be near 100-percent when first turned on. Other batteries, such as NiCd batteries, may show a lower value even when they are fully charged.

Notice: The percent power remaining will not be accurate for NiCd batteries because they do not discharge linearly with power use.

Hood Assembly

The ACCUBALANCE Plus is shipped from the factory partially assembled with the 2 ft x 2 ft nylon hood attached to the base. If you wish to use another hood size, see *Changing Hoods* in Chapter 2.

To complete the assembly of the 2 ft x 2 ft hood, follow these six steps:

- 1 Place the base of the ACCUBALANCE Plus on the floor.
- 2 Lift the top of the fabric. Insert one end of a support pole into its pole mount in the base of the ACCUBALANCE Plus. There is a cup in each corner of the frame to accept the other end of each support pole. Helpful Hint: This step is made simpler by temporarily resting the opposite corner of the fabric top on a table edge.
- 3 Grasp the support pole. Bend the pole slightly to insert the top end of the pole into the support pole cup located in the corner of the fabric frame as shown in Figure 6.

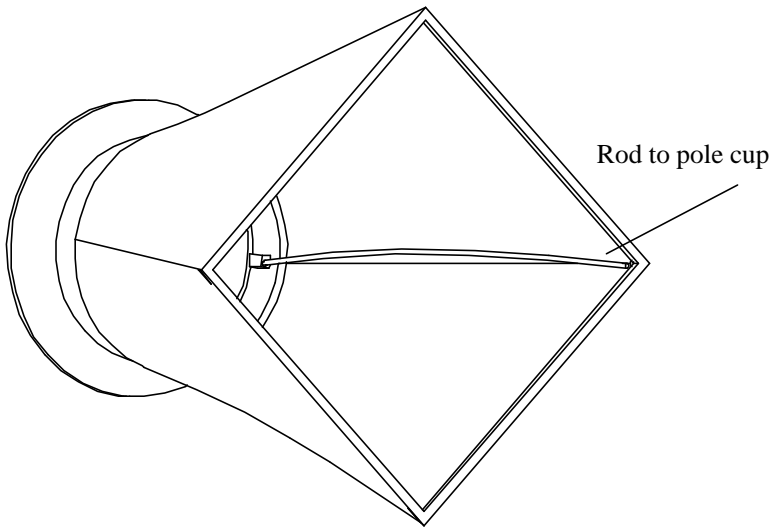


Figure 6: Installing a support pole

- 4 Insert the second support pole into the pole mount on the opposite side of the ACCUBALANCE Plus base.
- 5 Repeat step 3 for the second support pole.
- 6 Repeat steps 4 and 5 for the remaining two support poles.

Basic Operation

Start-Up

Press the ON/OFF key on the meter to turn on the power. The display will initially indicate the percent of battery power remaining.

During start-up, the ACCUBALANCE Plus performs a self test of its electronic functions. If an error is found, an error message will appear on the display. Refer to Chapter 4, *Troubleshooting*, if an error message appears. If no errors are found, the ACCUBALANCE Plus will automatically proceed to the measurement mode.

Selecting Flow Direction

Each ACCUBALANCE Plus is calibrated for supply and return air separately for increased accuracy. The ACCUBALANCE Plus will assume that air is flowing in the same direction as the arrow on the right-hand side of the display. Be sure this arrow points in the direction of flow through the ACCUBALANCE Plus, otherwise

measurements will be inaccurate. To change the direction of the arrow on Model 8372, press the SUPPLY/RETURN key. Model 8373 will automatically detect and indicate the direction of the flow.

Taking a Flow Measurement

You are now ready to start measuring flow rates. First, turn on the ACCUBALANCE Plus. For the Model 8372, select the appropriate flow direction. For measuring supply air flow, the arrow must point down away from the hood fabric; for return air flow measurements, the arrow must point up toward the hood fabric. Model 8373 will automatically sense the flow direction and it will be shown on the display.

Press the top of the ACCUBALANCE Plus against the perimeter edge of the diffuser or grille so as to form a seal.

The ACCUBALANCE Plus will begin to display values on a continuous basis. When you are ready to record a value press the SAMPLE key or the button on the top of the right handle. The display will show the word "SAMPLE" for the length of time as determined by the TIME CONSTANT. When the sample is complete, the value will remain on the display until SAMPLE is pressed again and the meter will return to continuous measuring mode.

If the readings are fluctuating, increase the TIME CONSTANT to a higher number. This is done by pressing and holding the TIME CONSTANT key. Use the ▲ or ▼ key to adjust the TIME CONSTANT value. Press ENTER to resume measurement mode. The ACCUBALANCE Plus is shipped from the factory with the TIME CONSTANT at 1 second.

When making a flow measurement, keep objects out of the flow path at the base of the ACCUBALANCE Plus (one foot clearance minimum). However, it is acceptable to have a hand supporting the air capture hood at the bottom of the base.

<p>Notice: You <i>must</i> keep the ACCUBALANCE Plus in place during the entire sample interval and until the time-averaged measurement appears on the display.</p>
--

Turning the ACCUBALANCE Plus Off

To turn off the ACCUBALANCE Plus, simply press the ON/OFF key.

Automatic Shut-off

The ACCUBALANCE Plus will automatically shut itself off if no keys or buttons have been pressed for 10 minutes. This feature minimizes accidental loss of battery power. This feature may be disabled by changing the factory settings. This is discussed in the *Changing DIP Switch Setting* section of the next chapter. Automatic shut-off is disabled during downloading of data to a printer or computer.

Chapter 2

Operations in More Detail

This chapter explains how to change fabrics and assemble different hood sizes and presents more detail on the various features of the ACCUBALANCE Plus.

Keypad Functions

ON/OFF

Press to toggle between having the instrument on and off.

The power ON/OFF key is located on the meter keypad of the ACCUBALANCE Plus. To turn the power on, momentarily press the ON/OFF key. The ACCUBALANCE Plus will immediately light all display digits and sound the buzzer. After a second, the approximate percent of remaining battery life will be displayed. If fresh, new alkaline batteries are used, the value will be near 100-percent. Other batteries, such as NiCd batteries, may show a lower value even when they are fully charged.

<p>Notice: The percent power remaining will not be accurate for NiCd batteries because they do not discharge linearly with power use.</p>
--

SUPPLY/RETURN

Press to toggle between measuring supply flow and return flow. The arrows on the display will indicate the direction of the flow (“↑” for return, “↓” for supply). This key does not appear on Model 8373 as automatic detection of flow direction is a feature.

K FACTOR

Volume measurements with the ACCUBALANCE Plus is a means to take readings more quickly than methods used in the past. However, all capture hood devices are affected by various types of diffusers, means of connecting the diffuser to the duct work, and the type of duct work. The ACCUBALANCE Plus is calibrated connected to a 2 foot x 2 foot, 4-way-throw diffuser. In some circumstances, it is necessary to traverse the ductwork to determine the “true” flow value. This true value is then compared to the ACCUBALANCE Plus. This comparison is a K Factor or correction factor. The ACCUBALANCE Plus has the ability to store 5 different K Factors.

Press the K FACTOR key to toggle the K factor on or off. The "Kf" symbol is shown on the display when a K factor is being used in the calculation. Press and hold the K FACTOR key to change the current K factor. When the "Kf" symbol appears and a number, 1 through 5, appears on the small display, release the key (the ACCUBALANCE Plus can store 5 different K factors). To change the K factor value on the large display, press the ▲ or ▼ key. To move to other K factors, press the K FACTOR key. Press ENTER at any time to accept the value and to return to measuring mode. The range of K factors allowed will be 0.1 to 2.00. The default value is 1.00 (using no K factor is equivalent to using a K factor equal to 1.00).

There are five K factor values stored in the ACCUBALANCE Plus. The last K factor used will appear when the K FACTOR key is next pressed.

ACTUAL/STANDARD

Press to toggle between displaying actual* and standard flow rate. "STD" or "ACTUAL" will light up on the display (standard is the default). Press and hold to view the barometric pressure and ambient pressure. For Model 8372, press and hold to adjust the barometric pressure and ambient temperature values. When the key is pressed and held, the barometric pressure entered will be displayed. Press the ▲ or ▼ key to change the value and ENTER to accept it. The ambient temperature will then be displayed. Press the ▲ or ▼ key to change the value and ENTER to accept it and return to measuring mode. Ambient temperature and barometric pressure can also be set by pressing either the ▲ or ▼ key when the parameter is displayed during power-up.

The Model 8373 automatically senses the barometric pressure and ambient temperature. These values cannot be changed. The values may be adjusted to match other calibration devices. To enter an adjustment, see the *Field Calibration* section later in this chapter.

TIME CONSTANT

Press to display the current time constant. Press ▲ or ▼ to scroll through the time constant choices, which are 1 s, 3 s, 5 s, 10 s, 15 s, 20 s. Press ENTER to accept choice and return to measuring mode. The default value is 1 s. When the SAMPLE key is pressed the instrument counts for one second and then displays the average value of 1 second. If the time constant is set to 5 seconds, the word SAMPLE will flash for 5 seconds. The instrument will then display the average value of the 5 seconds.

$$* \text{ Actual flow} = \text{Standard flow} * \left(\frac{\text{Actual temperature}}{\text{Barometric Pressure}} \right) * \left(\frac{\text{Standard Pressure}}{\text{Standard Temperature}} \right)$$

The flow sensor in the ACCUBALANCE Plus is extremely fast and actually samples flow at a rate of about 5 times per second. Thus, the values displayed in the 1 second interval represents an integration of 5 readings each. Likewise, the values displayed in the 5 second interval represents an integration of 25 readings each. By selecting the slower (5 second) display rate, you will therefore see less variation in the displayed values.

For best results, it is important to keep the ACCUBALANCE Plus in place during the entire sample period.

Left Handle Button (for printing)

Press to print the reading on the display.



Press to scroll through choices. To set time and date for both models, and to set barometric pressure and temperature for Model 8372, press either the ▲ or ▼ key when they are displayed during power-up. These keys are also used to adjust the baud rate, which must be performed during the power up of the instrument.

LIGHT

Press to toggle between having the backlight on and off. When the instrument is turned off, the backlight turns off and does not automatically turn on the next time the instrument is turned on.

BALANCE MODE

The BALANCE MODE is a feature that allows the user to have the instrument indicate how close a flow is to a desired flow rate. This is useful when a series of diffusers or outlets are designed for the same flow rate. To use the BALANCE MODE function, follow the steps below.

Press BALANCE MODE to start displaying in BALANCE MODE, with the real flow rate displayed on the large digits, and "BAL" is displayed on the smaller digits. While in this mode, the ACCUBALANCE Plus will start to beep slowly, approximately once every 2 seconds, when the reading is within 50% percent of the target reading, and it will beep faster, once every second or more, as the reading nears the target reading. When the reading reaches within the designated percentage the beep will change to a chirp, several beeps per second, informing the user that the setpoint window has been reached. Press a second time, while in BALANCE MODE, to display the difference between the real flow rate and the target flow rate on the large digits. Negative values appear when the real flow is below the target flow rate.

To change the values for the BALANCE MODE, press and hold to view, enter, or change the desired flow rate. When held, the last target flow rate entered will be displayed and "BAL" will appear on the small display. Release the key. Press the ▲ or ▼ key to change the flow rate and press ENTER to accept it. The acceptable target percentage is then displayed. The allowable range of flow rate settings is the full range of the instrument. The allowable percentage is 5-20%, and default is 10%. Press the ▲▼ to change the percentage and ENTER to accept it and return to BALANCE MODE.

Please note that while in BALANCE MODE the SAMPLE key is disabled. To store a value, press BALANCE MODE a third time to return to the measurement mode and then press SAMPLE to store a value.

ENTER

Press to accept a value or condition.

SAMPLE or Right Handle Button

The ACCUBALANCE Plus features the ability to store flow readings in a complete, convenient, and organized manner. The instrument's memory allows you to organize data into groups made up of "TEST IDs", "BRANCHES", and "TERMINALS". "TEST IDs" contain data organizes by "BRANCH". And "BRANCHes" contain the individual readings taken at the "TERMINALS". To understand how data is organized in the ACCUBALANCE Plus' memory the following examples are given:

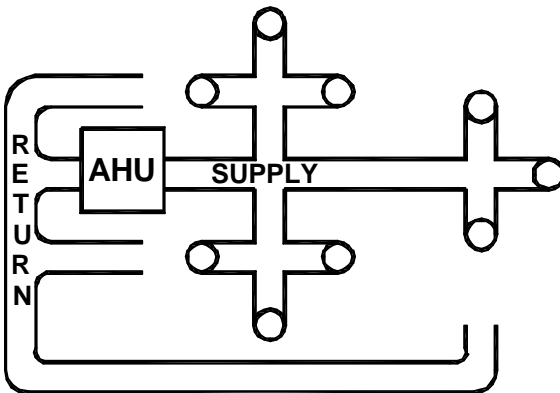


Figure 7: Building System

This highly idealized example, Figure 7, shows an Air Handling Unit (AHU) supplying air through nine diffusers and drawing return air through three

grills. Each diffuser and each grille is a "TERMINAL". where flow measurement would be taken using the ACCUBALANCE Plus.

There are a few simple rules that govern how an ACCUBALANCE Plus will store data:

Rule 1: SUPPLY and RETURN values can not both be stored in the same "TEST ID". In other words, each "TEST ID" can contain values of RETURN or SUPPLY readings, but not both.

Rule 2: A number identifying a "TERMINAL" may be used only once per Test ID. Therefore, it is not possible to have two SUPPLY "TERMINALS" (or two RETURN "TERMINALS") with the same "TERMINAL" number within a "TEST ID".

Rule 3: The total number of the "TERMINALS". + "BRANCHes" + "TEST IDs" must be less than 1,000 values.

Using these three rules, here are a few ways of organizing the data for our example.

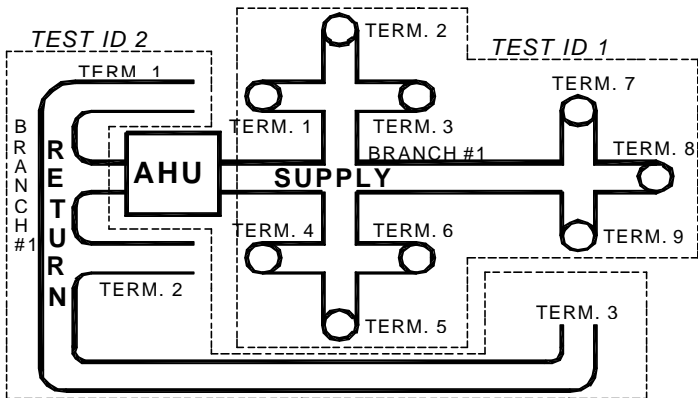


Figure 8: Building System With 2 Tests

Figure 8 shows the most basic way of organizing the data in our example. Ideally, the sum of the flows through the nine SUPPLY diffusers would equal the sum of the flows through the three RETURN grilles.

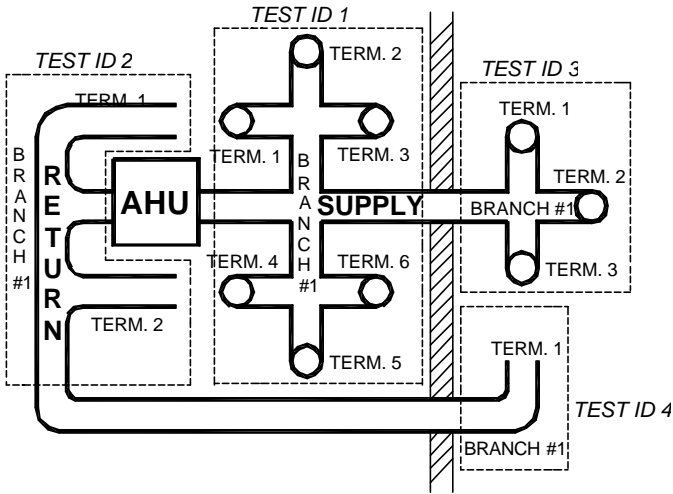


Figure 9: Building System With 4 Tests and 4 Branches

Figure 9 might be used if the AHU in our example served two rooms. In Figure 9 we organize the data into two sets of SUPPLY and two sets of RETURN flows. Notice how, in this arrangement, there is a "BRANCH" 1, "TERMINAL" 1 in each "TEST ID".

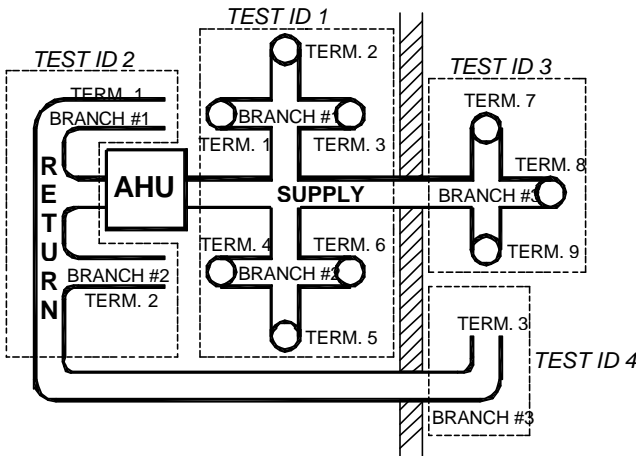


Figure 10: Building System 4 Tests and 6 Branches

Figure 10 is the same physical arrangement as Figure 9 with "BRANCHes" and "TERMINALS" identified in a slightly different manner. Notice that this illustration has each SUPPLY "BRANCH" and "TERMINAL" uniquely numbered,

and that the RETURN "BRANCHes" are numbered to correspond to the SUPPLY "BRANCHes".

These examples are provided to illustrate that there are a variety of ways that you can organize the data that is gathered using the ACCUBALANCE Plus. The final structure of the data will depend on individual preference or how to report the data gathered.

To store a reading into the memory of ACCUBALANCE Plus, follow the sequence of operations and key strokes.

- 1 Ensure that the ACCUBALANCE is on. Place the ACCUBALANCE over the diffuser. Values of flow rate will be displayed.
- 2 Press SAMPLE key. Meter counts based on the TIME CONSTANT while the word "SAMPLE" flashes on the display.

The unit does not allow you to store flows that are in different directions in the same Test ID. If the SAMPLE key is pressed after the flow direction has been changed, "TEST ID" will flash on the display and the next available higher "TEST ID" that has flow in the same direction will be shown on the small display. The stored value will be displayed on the large display. Press the ▲▼ keys to change the Test ID. Only Test ID's with the flow the same direction or new ID's will be displayed. Press the sample or enter key to accept the Test ID. The unit will then flash "TERMINAL" on the display. Proceed to step 3.

- 3 The average reading is held on the display. "TERMINAL" will flash and the first available terminal number will be displayed in the small digit part of the display.
- 4 Press ENTER to accept. To change the TERMINAL number press ▲ or ▼ keys. Press ENTER to accept the TERMINAL number.
- 5 The display now shows the reading along with "BRANCH" flashing and a number in the small digits.
- 6 Push ENTER to accept. To change the BRANCH number press ▲ or ▼ keys. Press ENTER to accept the new BRANCH number.
- 7 The display returns to continuous readings, ready for the next SAMPLE. For the next SAMPLE, the ACCUBALANCE will display TERMINAL just as in step 3 above. Proceed with step 4 as before.

- 8 To take several samples in the same branch, press SAMPLE as in step 4. This accepts the displayed "TERMINAL" and the current "BRANCH" and returns the display to continuous readings (allowing you to skip steps 5 and 6).

TEST ID (clear)

Test ID only

Press and release to display the current Test ID. "TEST ID" will be indicated on the display. Press the ▲▼ keys to change the Test ID and ENTER to accept it. The unit returns to measurement mode. For Test ID's with data in them, the big display has "SUP" and a ↓ to represent that it is a supply test ID. If the Test ID is a return Test ID the big display has "RET" and the ↑ indicated. If the Test ID is unoccupied, only the Test ID and # will appear on the display.

CLEAR only

There are three clearing functions: 1) Clear the most recent SAMPLE, one SAMPLE erased from memory; 2) Clear memory, all SAMPLES erased from memory; 3) No clear, no SAMPLES erased from memory.

- 1 To clear the most recent sample: Press and hold the TEST ID (CLEAR) key until a 5 to 0 countdown begins. Release the key *before* the countdown reaches 0. The display will show "CLR" and "SAMPLE" and will then return to measurement mode. This function can only be used to remove one value from memory. It cannot be used again until another sample is stored.
- 2 To clear the entire memory: Press and hold the TEST ID (CLEAR) key until a 5 to 0 countdown begins. Release the key when the countdown reaches 0. Display will show "CLR" and "MEMORY" and will then return to measurement mode. **ONCE THE MEMORY IS CLEARED, THERE IS NO WAY TO RECOVER THE ORIGINALLY STORED DATA.**
- 3 To keep data: Press and hold the TEST ID (CLEAR) key until a 5 to 0 countdown begins. Wait until after 0 and the countdown disappears. Release the key. No data will be erased and the display will then return to measurement mode.

STATISTICS (review data)

The statistics that are available to view by TEST ID and by BRANCH are:

TOTAL - The sum of all stored values in that TEST ID or BRANCH,

MINIMUM - The lowest value stored in that TEST ID or BRANCH,

MAXIMUM - The highest value stored in that TEST ID or BRANCH,
AVERAGE - The TOTAL divided by the number of stored values,
COUNT - The number of stored values in that TEST ID or BRANCH.

To view STATISTICS of the current TEST ID

- 1 Press STATISTICS to view the TOTAL of the current TEST ID. "TEST ID" and the current number of the TEST ID will flash on the small display. The "TOTAL" value will be displayed on the large display.
- 2 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT".
- 3 Press ENTER twice to return to continuous measuring mode.

To view STATISTICS of a different TEST ID.

- 1 Press STATISTICS to view the TOTAL of the current TEST ID. "TEST ID" and the current number of the TEST ID will flash on the small display. The TOTAL value will be displayed on the large display.
- 2 Press the ▲ or ▼ key to move to other available TEST ID. The "TOTAL" of the chosen TEST ID will be displayed.
- 3 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT".
- 4 Press ENTER twice to return to continuous measuring mode.

To view STATISTICS of the current TEST ID and the BRANCH STATISTICS

- 1 Press STATISTICS to view the TOTAL of the current TEST ID. TEST ID and the current number of the TEST ID will flash on the small display. The "TOTAL" value will be displayed on the large display.
- 2 Press ENTER. "BRANCH" and its number, and TEST ID and its number will flash alternately to identify the particular BRANCH selected. The "TOTAL" value will be displayed on the large display.
- 3 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT".
- 4 Press the ▲ or ▼ key to move to another available BRANCH. The "TOTAL" will be displayed of the chosen BRANCH.

- 5 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT" of the chosen BRANCH.
- 6 Press ENTER to return to continuous measuring mode.

To view STATISTICS of a different TEST ID and the BRANCH STATISTICS

- 1 Press STATISTICS to view the TOTAL of the current TEST ID. "TEST ID" and the current number of the TEST ID will flash on the small display. The "TOTAL" value will be displayed on the large display.
- 2 Press the ▲ or ▼ key to move to other available TEST ID. The "TOTAL" will be displayed of the chosen TEST ID.
- 3 Press ENTER. "BRANCH" and its number, and TEST ID and its number will flash alternately to identify the particular BRANCH selected. The "TOTAL" value will be displayed on the large display.
- 4 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT".
- 5 Press the ▲ or ▼ key to move to another available BRANCH. The "TOTAL" will be displayed of the chosen BRANCH.
- 6 Press STATISTICS repeatedly to display "MINIMUM", "MAXIMUM", "AVERAGE", and "COUNT".
- 7 Press ENTER to return to continuous measuring mode.

To review data of the current TEST ID

- 1 Press and hold STATISTICS key. Release the STATISTICS key when "TEST ID" and the number of the current TEST ID flashes on the small display. The big display has "SUP" and a ↓ to represent that it is a supply Test ID. If the Test ID is a return Test ID the big display has "RET" and the ↑ indicated.
- 2 Press ENTER. The small display will flash "TERMINAL" along with a number and will then flash "BRANCH" and a number. This identifies the value that you are viewing with the TERMINAL number and the BRANCH with which it is associated. The value will be shown on the large display.

- 3 Press the ▲ or ▼ key to move to other available TERMINALS in that BRANCH.
- 4 Press ENTER to return to continuous measuring mode.

To review data of a different TEST ID

- 1 Press and hold STATISTICS key. Release the STATISTICS key when "TEST ID" and the number of the current TEST ID flashes on the small display. The big display has "SUP" and a ↓ to represent that it is a supply Test ID. If the Test ID is a return Test ID the big display has "RET" and the ↑ indicated.
- 2 Press the ▲ or ▼ key to move to other available TEST ID.
- 3 Press ENTER. The small display will flash "TERMINAL" along with a number and will then flash "BRANCH" and a number. This identifies the value that you are viewing with the TERMINAL number and the BRANCH with which it is associated. The value will be shown on the large display.
- 4 Press the ▲ or ▼ key to move to other available TERMINALS in that BRANCH.
- 5 Press ENTER to return to continuous measuring mode.

To change stored data

Apart from clearing the last stored SAMPLE and clearing the entire memory, there is only one way to alter stored data. That is to change the BRANCH number associated with a particular TERMINAL. To do so, follow these steps:

- 1 Press and hold the STATISTICS key. Release the STATISTICS key when "TEST ID" and the number of the current TEST ID flashes on the small display.
- 2 Press the ▲ or ▼ key to select the TEST ID that contains the data you wish to alter.
- 3 Press ENTER. The small display will flash "TERMINAL" along with a number and will then flash "BRANCH" and a number. This identifies the value that you are viewing with the TERMINAL number and the BRANCH with which it is associated. The value will be shown on the large display.

- 4 Press the ▲ or ▼ key to find the terminal whose BRANCH association you wish to change.
- 5 Press and hold the ENTER key. The small display will flash “BRANCH” along with the current number identifier.
- 6 Press the ▲ or ▼ key to change the BRANCH number to the number you want.
- 7 Press ENTER. The small display will flash “TERMINAL” with its number and the “BRANCH” with the newly selected BRANCH number. If this is the desired BRANCH, press ENTER to accept the change and return the display to measuring mode. Otherwise, return to step 5 of this procedure.

Note: This action will affect the BRANCH STATISTICS (MIN, MAX, AVG, COUNT) of the original and the new BRANCH.

For Model 8373, at any point while reviewing individual data points you may press the FLOW/TEMP key to toggle between displaying the temperature data and the flow data.

Left Handle Button

Press to print the reading on the display. Press and hold to start a 5 to 0 countdown. Release key when ‘0’ is on the display to send all data stored in memory to a printer. If you hold past the zero, it returns to measurement mode without downloading or printing. If it is necessary to terminate the download, turn the ACCUBALANCE Plus off.

Field Calibration - Model 8372 Only

DIP switch 7 must be in the ON position.

To adjust the flow value, press either the ▲ or ▼ key to start the calibration procedure. Press the ▲ or ▼ key to change to a desired percentage adjustment and press ENTER to accept it. The percentage adjustment ranges from 0% to plus or minus 12.5%. To use the instrument with the adjusted values, DIP switch 7 must remain in the ON position. All adjustment values and offsets are stored in the instrument and will remain the same until changed again. To return to all factory settings, turn DIP switch 7 OFF.

Additional Keypad Functions for the Model 8373

FLOW/TEMP

Press to toggle between temperature on the small digits and flow on the large digits to only temperature on the large digits. No values can be sampled with the display on temperature. When SAMPLE is pressed (or the Right Handle Button) the display will change so that the large digits will display flow and the small digits will display temperature. Press SAMPLE again to store a value. During STATISTICS and review data, press the FLOW/TEMP key to toggle between flow and temperature values.

ACTUAL/STANDARD

Press to toggle between displaying actual and standard flow rate. "STD" or "ACTUAL" will light up on the display (standard is the default). The density correction is automatically calculated using the temperature and barometric pressure sensors (model 8373), or using the values the user has entered (model 8372). Press and hold the ACTUAL/STANDARD key to view the measured or entered barometric pressure. Press the ENTER key to view the measured or entered temperature. Press the ENTER key again to return to the measuring mode.

SAMPLE

If the flow direction changes while a sample is being taken, that sample is invalid. A double beep will sound and "DIR" and "↑↓" will flash on the display, "ERR" will be indicated on small display. The unit will return to measurement mode after 2 seconds.

Field Calibration - Model 8373 Only

DIP Switch 7 must be in the ON position.

- 1 Press and hold the ACTUAL/STANDARD key until "bP=" appears on the small display. Release the key. The barometric pressure will be displayed on the large display and "CAL" on the small display. The ACCUBALANCE Plus will chirp to inform you that you are in calibration mode.
- 2 To adjust the reading of the barometric pressure, press the ▲ or ▼ key. On the small display "ADJ" will appear along with 0 and % on the large display. The range of adjustment can be from minus 12.5% to plus 12.5%. Factory default is 0. Continue to press ▲ or ▼ key until the desired adjustment percentage is displayed. Press ENTER.
- 3 The ambient temperature will be shown on the large display and "CAL" will be on the small display.

- 4 To adjust the reading of ambient temperature, press the ▲ or ▼ key. On the small display "ADJ" will appear along with degree adjustment on the large display. The range of adjustment can be from minus 6° to plus 6° C or from minus 10.8° to plus 10.8° F. Factory default is 0. Continue to press the ▲ or ▼ key until the desired degree offset is achieved. Press ENTER to return to continuous measuring mode.
- 5 To adjust the reading of the volumetric flow, press either the ▲ or ▼ key to start the procedure. Release when the small display shows "ADJ" with 0 and % on the large display. The range of adjustment can be from minus 12.5% to plus 12.5%. Factory default is 0. Continue to press the ▲ or ▼ key until the desired adjustment percentage is displayed. Press ENTER to return to continuous measuring mode. DIP Switch 7 must remain in the ON position to display values with all previous adjustments (to barometric pressure and ambient temperature) influencing the value.
- 6 To return to factory calibration for all values, turn DIP Switch 7 to the OFF position. All adjustment values are retained in memory and can be reinstated by turning DIP Switch 7 ON again.

Changing Hoods

The ACCUBALANCE Plus is shipped with a 2 ft x 2 ft hood attached to the base. Four other hood sizes are available from TSI and can be purchased separately. Available hood sizes are identified by the dimensions of the frame structure at the top of the hood and include 2 ft x 4 ft, 1 ft x 4 ft, 1 ft x 5 ft and 3 ft x 3 ft .

To change hood sizes, first remove the hood currently attached to the base. To remove the attached hood, first unlatch the cinch belt where the fabric is attached to the base. Then remove the fabric from its frame structure by peeling back the Velcro® from the aluminum frame tubing. Notice that the fabric stretches around the outside, then up and over the frame structure. The Velcro on the fabric reaches down to mate with the Velcro on the frame structure. Notice also that all Velcro surfaces on the frame tubing face inward. Finally, fold up the fabric you just removed so that it can fit into one of the accessory pockets inside the ACCUBALANCE Plus carrying case. It is a good idea to fold the fabric so that the tag identifying its size remains visible for future reference.

2 ft x 4 ft Hood

To assemble and attach the 2 ft x 4 ft hood, carefully follow these 10 steps:

- 1 Build the 2 ft x 4 ft frame structure as shown in Figure 11 using six 2 ft aluminum frame tubing pieces, four right-angle tubing connectors, and two straight tubing connectors. Remember to construct the frame so that all Velcro surfaces face in (toward the center of the structure).

Notice: Make sure that all support pole cups in the aluminum frame tubing pieces are facing downward.

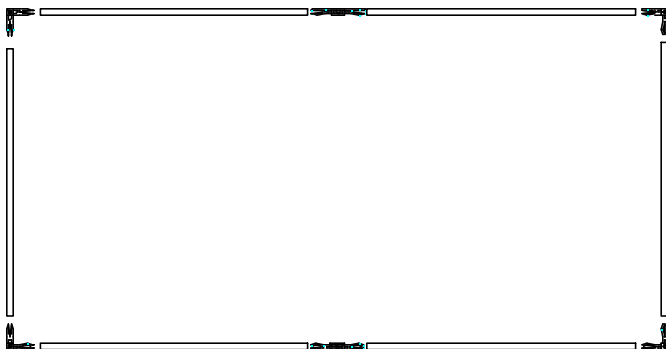


Figure 11: Diagram of 2 ft x 4 ft frame

- 2 Unfold the 2 ft x 4 ft hood fabric.
- 3 Insert the frame into the fabric and fasten the fabric to the frame using the Velcro surfaces. The fabric stretches around the outside, then up and over the frame structure. The Velcro on the fabric reaches down to mate with the Velcro on the inner surface of the frame structure. When completed, the soft rubber gasket material should lie in a straight line along the top surface of all four sides of the frame.

Notice: Be sure to press the Velcro surfaces firmly together. When completed, the hood fabric will be stretched fairly taut and will require good bonding of the fabric to the frame.

- 4 Stretch the cinch belt at the bottom of the fabric over the lip around the top of the molded plastic base of the ACCUBALANCE Plus. Align the seams of the fabric panels with the pairs of screw heads that hold the four pole mounts to the ACCUBALANCE Plus base. Align so that the cinch belt latch is on the side of the base opposite the electronics meter.
- 5 Pull the strap at the latch very tight to attach the fabric to the base. Make sure that the strap stays tucked under the protruding lip all

around the top of the base. Pay particular attention to where the strap passes the handles.

- 6 Now it is time to install the support poles. You will find four white marks on the inside top edge of the fabric. These marks identify the location of cups on the underside of the frame tubing that will accept the ends of the support poles.

At this time it is helpful to be near a table or some other thigh-high surface to help hold up the fabric while you install the first support pole.

- 7 With the base of the ACCUBALANCE Plus on the floor, lift the fabric frame up so that a white mark is directly in front of you. Support the opposite side of the frame structure on a nearby table or other level surface.

Take one support pole and insert one end into its pole mount in the ACCUBALANCE Plus base.

Bend the pole slightly to guide the other end into the corresponding support pole cup located on the underside of the frame near the white mark on the fabric.

- 8 Repeat step 7 until all four support poles are installed.

- 9 Now that the hood is assembled and the fabric is stretched tight, it is a good practice to check the rubber gasket around the top edge of the ACCUBALANCE Plus fabric. In order to achieve a good straight alignment of the rubber gasket along the top of the frame structure, you may need to peel back and re-attach small portions of the Velcro surfaces.

- 10 Finally, at the corners, tuck the straight rubber gasket flaps under the edges cut at an angle. This will create a virtually leak-free, soft, pliant seal.

1 ft x 4 ft Hood

To assemble and attach the 1 ft x 4 ft hood, carefully follow these 10 steps:

- 1 Build the 1 ft x 4 ft frame structure as shown in Figure 12 using four 2 ft aluminum frame tubing pieces, two 1 ft aluminum frame tubing pieces, four right-angle tubing connectors, and two straight tubing connectors. Remember to construct the frame so that all Velcro surfaces face in (toward the center of the structure).

Notice: Make sure that all support pole cups in the aluminum frame tubing pieces are facing downward.

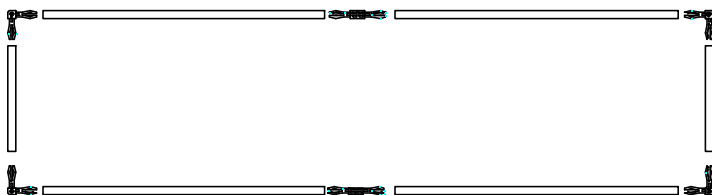


Figure 12: Diagram of 1 ft x 4 ft frame

- 2 Unfold the 1 ft x 4 ft fabric hood.

Continue with steps 3 through 10, beginning on page 27.

1 ft x 5 ft Hood

To assemble and attach the 1 ft x 5 ft hood, carefully follow these 10 steps:

- 1 Build the 1 ft x 5 ft frame structure as shown in Figure 13 using four 2 ft aluminum frame tubing pieces, two 1x tube connectors, two 1 ft aluminum frame tubing pieces, and four right-angle tubing connectors. Remember to construct the frame so that all Velcro surfaces face in (toward the center of the structure).

Notice: Make sure that all support pole cups in the aluminum frame tubing pieces are facing downward.

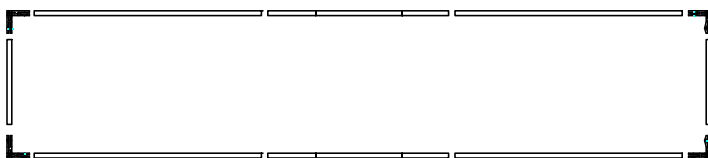


Figure 13: Diagram of 1 ft x 5 ft frame

- 2 Unfold the 1 ft x 5 ft fabric hood.

Continue with steps 3 through 10, beginning on page 27.

3 ft x 3 ft Hood

To assemble and attach the 3 ft x 3 ft hood, carefully follow these 10 steps:

- 1 Build the 3 ft x 3 ft frame structure as shown in Figure 14 using four 2 ft aluminum frame tubing pieces, four 1 ft aluminum frame tubing pieces, four right-angle tubing connectors, and four straight tubing connectors. Remember to construct the frame so that all Velcro surfaces face in (toward the center of the structure).

Notice: Make sure that all support pole cups in the aluminum frame tubing pieces are facing downward.

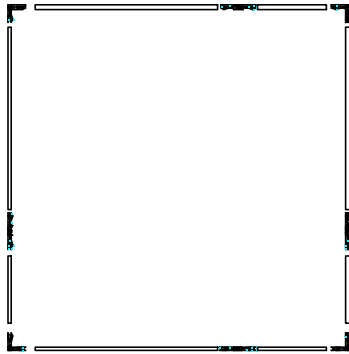


Figure 14: Diagram of 3 ft x 3 ft frame

- 2 Unfold the 3 ft x 3 ft fabric hood.

Continue with steps 3 through 10, beginning on page 27.

Changing DIP Switch Settings

You can change flow units and other parameters by adjusting the settings of the DIP switches located inside the battery compartment. To gain access to the DIP switches, first turn off the ACCUBALANCE Plus and lay down the instrument with the electronic meter facing down.

Remove the battery compartment cover by pulling up on the two latches. You will see the switches numbered 1 through 8 in the corner of the battery compartment. You may wish to remove or tilt up the battery pack to allow easier access to the switches as shown in Figure 15.

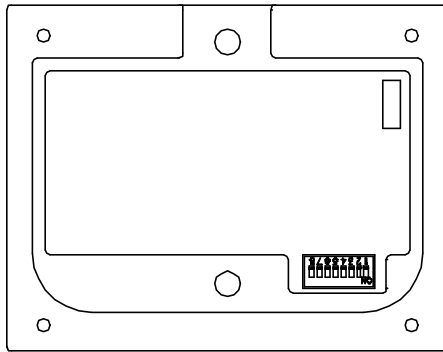


Figure 15: Location of DIP Switches

You may change the switch settings using the tip of a ball-point pen, pencil, compass, small screwdriver, or other small, pointed object. Refer to Table 4 for switch settings.

Table 4. DIP Switch Settings

Switch Number	Setting: Function
1,2	1 OFF, 2 OFF: Flow units = CFM 1 OFF, 2 ON: Flow units = m ³ /hr 1 ON, 2 OFF: Flow units = l/s 1 ON, 2 ON: Flow units = m ³ /min
3	OFF: Pressure units = in. Hg ON: Pressure units = mm Hg
4	OFF: Temperature units = °F ON: Temperature units = °C
5	OFF: Auto shut off = on ON: Auto shut off = off
6	OFF: Decimal for fractions ON: Comma for fractions
7	OFF: Field calibration disabled ON: Field calibration enabled
8	OFF: Audible buzzer on ON: Audible buzzer off

Connecting the Optional Printer

To connect the Model 8925 printer to the ACCUBALANCE Plus, locate the Printer Interface Cable (supplied with the optional printer) and connect the 9-pin end labeled “PRINTER” to the printer and the other end to the data port of the ACCUBALANCE Plus. The printer can be attached to the base of the ACCUBALANCE Plus by clipping it into the printer bracket located to the left of the display or by clipping to the belt of the user. The printer must be

set to the same baud rate as the ACCUBALANCE Plus. To change the baud rate of the printer, please refer to that operation and service manual. Always turn the ACCUBALANCE Plus on *before* the printer. If the printer prints question marks (?????), asterisks (*****), or random characters, reset it by turning it off and then on again. If necessary, refer to the *Model 8925 Portable Printer Operation and Service Manual*.

When viewing statistics, the statistic shown on the display for the current Test ID will be printed automatically when the STATISTICS key is pressed. When reviewing data, nothing will print. When taking a sample, the reading will be printed automatically each time the SAMPLE key is pressed. Figures 16 and 17 depict the printout of each unit. Note that on the printout for Model 8373, the symbol “^” is used. This indicates that the flow is RETURN flow.

```

ACCUBALANCE MODEL 8373
SERIAL NUMBER 12345678

STANDARD
Kfactor = 1.00
TC = 1 SEC
12/01/98
14:01:40 940 l/s 25.7 °C
14:01:49 940^l/s 25.7 °C
    
```

```

ACCUBALANCE MODEL 8372
SERIAL NUMBER 12345678

STANDARD
Kfactor = 1.00
TC = 1 SEC
12/01/98
14:01:40 940 l/s SUPPLY
14:01:49 940 l/s RETURN
    
```

Figures 16& 17: Samples of Data Printed Out on Optional Printer

Press the Left Handle Button to print the displayed reading to the printer. The ACCUBALANCE Plus allows printing of the entire memory or only the data stored within a particular Test ID. To print data from memory, press and hold the Left Handle Button. This will initiate a countdown from 5 to 0 on the small display with “PRNT” on the large display. When the small display shows “0”, release the button. If you release the key at any time other than 0 during the countdown, nothing will print. After the small display shows 0, the small display will then show the word “ALL”. To send all of the data that is in memory to the printer, press ENTER. To select a specific Test ID to print, before pressing the ENTER key, use the ▲ or ▼ key to select the desired Test ID, then press ENTER. The display will read “Send dAtA” while sending the desired information from the instrument memory. To stop printing at any time, turn the ACCUBALANCE Plus off.

NOTE: In order to print, the baud rate on the ACCUBALANCE Plus must be set to the same baud rate as the printer (default is 1200).

Connecting to a Computer

Use the Computer Interface Cable provided with the ACCUBALANCE Plus to connect the instrument to a computer for downloading stored data or for remote polling. Connect the 9-pin end of the cable to the computer COM port and the other end to the data port of the ACCUBALANCE Plus. A 9-pin to 25-pin adapter will be required if your computer has a 25-pin serial port connector.



Caution: This symbol is used to indicate that the data port of the ACCUBALANCE Plus is not intended for connection to a public telecommunications network. Connect the data port only to another RS232 port.

Downloading Data to a Computer

LOGDAT is a Windows®-based program designed to download the data stored in the memory of the ACCUBALANCE Plus to a computer. This data includes the test ID, branch, terminal, measurement, unit of measure, correction factors, actual/standard parameter, and time constant. This data is date and time stamped. In addition, the statistics for each test ID and branch are provided. The file containing the downloaded data is sorted and tab delimited to allow it to be imported into a spreadsheet for further data analysis.

To download data from the ACCUBALANCE Plus, connect the supplied computer interface cable to the ACCUBALANCE Plus and to a computer serial port. Any serial port from COM1 to COM4 can be used. Change the current disk drive and directory to the one containing the LOGDAT program. For example, if the LOGDAT program is located in the 'TESTDATA' directory on the 'C' drive, change to 'C:\TESTDATA'. Type 'logdat' at the prompt to start the program. The program is self-directing; it provides all the necessary instructions for downloading data.

Data Acquisition (Polling)

The ACCUBALANCE Plus is designed to allow the user to perform polling through the use of a computer. To do this the user's computer must be hooked up and in terminal mode and the baud rate for the computer and the ACCUBALANCE Plus must be set to the same value. The user then must send an upper case V to the instrument.

The user must write their own routine (program) to obtain information at specific intervals from the ACCUBALANCE Plus.

Chapter 3

Maintenance

The ACCUBALANCE Plus is designed for long-term field use. If the ACCUBALANCE Plus is used with reasonable care, it should be able to make precise measurements over a long time period. Some of the components can be cleaned periodically. When cleaning the components, please follow the instructions given below.

Fabric Hood

The hoods can be washed with mild detergent and cold water. When washing the hood, keep the hood away from objects with sharp corners or sharp edges. Careless cleaning may cause damage.

If the fabric gets ripped it should be replaced or repaired. Duct tape can be placed over the rip on both sides of the fabric for temporary repair.

To replace a damaged fabric or to order a different fabric size, contact your local TSI distributor. To determine who your local TSI distributor is, you may call TSI toll-free at 1-800-876-9874.

If you wish to order a new hood fabric, use the following part numbers shown in Table 5.

Table 5: Hood Fabric Part Numbers

Fabric Hood Size	Part Number
2 ft x 2 ft (610 mm x 610 mm)	800590
2 ft x 4 ft (610 mm x 1220 mm)	800591
1 ft x 4 ft (305 mm x 1220 mm)	800592
3 ft x 3 ft (915 mm x 915 mm)	800593
1 ft x 5 ft (305 mm x 1525 mm)	800594
Frame Kit	1081263

It is recommended that you purchase a frame kit whenever you purchase a hood other than the 2 ft x 2 ft size. The frame kit contains all extra frame tubing and connectors required to build frames for the various size hoods. The frame kit consists of the following parts:

- 4 pieces 1-foot frame tubing
- 2 pieces 2-foot frame tubing
- 6 pieces straight tubing connectors

Meter

The ACCUBALANCE Plus has a built-in electronic flow meter. Do not try to detach the meter from the base. The ACCUBALANCE Plus should be used and stored within the specified temperature range, 32 - 140° F (0-60° C). The meter case, display screen and membrane key can be cleaned using a damp cloth with mild detergent solution. Do not immerse the meter in water. Wipe the meter dry before use.

Manifold

If you observe the flow sensing taps of the manifold becoming clogged with dust or other material, clean them with a damp cloth. The manifold should be kept in place during cleaning. Do not apply excessive forces on the grid of the manifold. If any part of the grid is damaged, please contact TSI for repair information.

Cases

If the instrument case or storage case needs cleaning, wipe it off with a soft cloth and isopropyl alcohol or a mild detergent. Never immerse the ACCUBALANCE Plus. If the meter assembly of the ACCUBALANCE Plus becomes broken, it must be replaced immediately to prevent access to hazardous voltage.

Calibration

TSI recommends an annual calibration for the ACCUBALANCE Plus. For a nominal fee, TSI will calibrate the unit and return it to you with a certificate of calibration and NIST traceability. This 'annual checkup' assures you of consistently accurate readings. To calibrate the ACCUBALANCE Plus, please ship TSI the complete package that includes the meter, the base, the manifold and any fabrics used. Everything should be packed carefully within the ACCUBALANCE Plus carrying case and then inside a proper shipping box, such as the original shipping box.


Ship directly to: TSI, Inc.
 ATTN: Customer Service
 500 Cardigan Road
 Shoreview, MN 55126-3996

Chapter 4

Troubleshooting

Table 6 and 7 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the ACCUBALANCE Plus. If your symptom is not listed, or if none of the solutions solves your problem, please contact TSI.

Table 6: Troubleshooting the ACCUBALANCE Plus

Symptom	Possible Causes	Corrective Action
No display	Unit not turned on Low or dead batteries Dirty battery contacts Battery holder not connected	Press ON/OFF key. Replace the batteries Clean the battery contacts. Plug in battery holder.
 " " flashing on display	Low battery charge Dirty battery contacts	Replace the batteries. Clean the battery contacts.
"0" (Flow is under range)	Trying to read too low a flow Object is blocking flow through ACCUBALANCE Plus Sensor grid tubes are plugged ACCUBALANCE Plus is not sealing around diffuser	Flow may not be measurable using the ACCUBALANCE Plus. Remove obstruction. Clean the tubes. Reposition the ACCUBALANCE Plus to form a seal.
"OVER" (Flow is over range)	Trying to read too high a flow	Flow may not be measurable using the ACCUBALANCE Plus.

Symptom	Possible Causes	Corrective Action
Flow reading fluctuates badly	The flow is fluctuating	Use a longer time constant.
“ERR” appears in small letter and “dir ↑↓” blinks along with beeping	Flow direction changed while taking sample	Make sure flow stays in one direction (supply or return) during sample. Also, ACCUBALANCE must remain in place for one entire time constant during a sample. Movement of the ACCUBALANCE or removal from its measurement position too soon will cause errors.
"ERR1" appears	Temperature compensation sensor is damaged Unit is or was recently in ambient temperature outside of operating temperature	Return to the factory for service. Allow unit to stabilize in the operating temperature range of 32 - 140°F (0 - 60°C).
"ERR2" appears	The flow sensor is giving an erroneous reading	Return to the factory for service.
"ERR3" appears	The ACCUBALANCE Plus has detected a calibration fault	Return to the factory for service.
"ERR4" appears	Lithium Ion battery is low or dead	Return to factory for service.
"ERR5" appears	Data RAM is inoperative	Return to factory for service.

Table 7: Further troubleshooting of the Model 8373

Symptom	Possible Causes	Corrective Action
"ERR6" appears	Temperature sensor damaged	Return to factory for service
"ERR7" appears	Barometric pressure sensor damaged	Return to factory for service
"ERR8" appears	Flow direction sensor damaged	Return to factory for service

Appendix A

Back Pressure

It is commonly known that an air capture hood may induce a back pressure. In general, back pressures are caused by restrictions in the flow path as well as frictional pressure losses. In order to improve accuracy and sensitivity, all air capture hoods incorporate a contracted flow section. The contracted section restricts the flow through the hood which induces a back pressure. A hood having a more abrupt contraction than the ACCUBALANCE Plus may induce greater back pressure due to the turbulence caused by the abrupt contraction. In addition any apparatus within the hood, such as supporting poles and the flow manifold, also induces some frictional pressure drop.

Back pressure may cause slight errors in the flow measurements. Figure 18 shows the pressure drop through the ACCUBALANCE Plus over its entire flow range. As shown in the figure, the back pressure is only 0.05 in. H₂O at a flow rate as high as 1000 CFM.

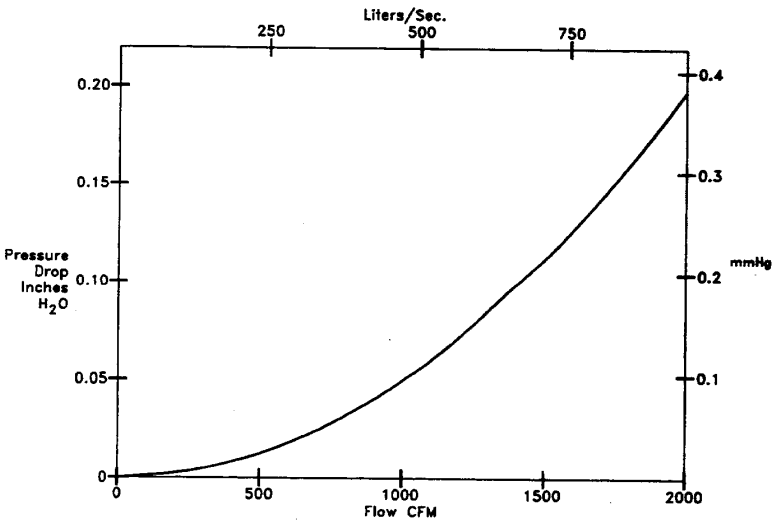


Figure 18: Pressure Drop Through the ACCUBALANCE PLUS

If you wish to make back pressure corrections, you must first determine the back pressure correction factor, C_b . The back pressure correction factor, C_b , can be determined as follows:

$$C_b = \frac{V_0}{V} \quad (1)$$

where V and V_0 are the average air velocities in the duct ahead of the diffuser with and without the capture hood in place, respectively. With the known correction factor, the back-pressure corrected flow can be determined using Equation (2):

$$\text{Back-pressure corrected flow} = \text{Displayed flow} \times C_b \quad (2)$$

Appendix B

Specifications

Flow Range	30-2,000 CFM (15.0-1,000 l/s, 50-3,500 m ³ /hr, 0.84-55.0 m ³ /min)
Accuracy	±5% reading ±5 CFM (±5% reading ±2.4 l/s, ±5% reading ±8.5 m ³ /hr, ±5% reading ±0.015 m ³ /min)
Operating Temperature Range	32-140°F (0-60°C)
Data Memory	1000 points = sum of systems + branches + terminals
Temperature (Model 8373 only)	
Range	32-140°F (0-60°C)
Resolution	.1°F (0.1°C)
Accuracy	±1°F (0.5°C)
Instrument Operating Conditions	Altitude up to 4000 meters Relative humidity up to 80% RH, non-condensing Pollution degree 1 in accordance with IEC 664
Weight (using 2 ft ´ 2 ft Hood)	7 lb 6 oz (3.4 kg)
Power	4 C-size batteries (4 alkaline batteries provided)
Battery Life	At least 40 hours of continuous use
Carrying Case	26 in × 26 in × 7 in (660 mm × 660 mm × 180 mm)

Hood Sizes Available

Standard: 2 ft × 2 ft; (610 mm × 610 mm)
Optional: 2 ft × 4 ft; (610 mm × 1220 mm)
1 ft × 4 ft; (305 mm × 1220 mm)
1 ft × 5 ft; (305 mm × 1525 mm)
3 ft × 3 ft; (915 mm × 915 mm)

RS-232C Output

ASCII Character codes
1200, 2400, 4800, 9600 and
19200 baud (selectable)
No parity
8 data bits
1 stop bit
No handshaking

These specifications are subject to change without notice.