VelociCalc®/ VelociCalc® Pro Air Velocity Meter

Model 9600 Series

Operation and Service Manual

P/N 6016122, Revision C
August 2022

Start Seeing the Benefits of Registering Today!

Thank you for your TSI® instrument purchase. Occasionally, TSI® releases information on software updates, product enhancements and new products. By registering your instrument, TSI® will be able to send this important information to you.

As part of the registration process, you will be asked for your comments on TSI products and services. TSI's customer feedback program gives customers like you a way to tell us how we are doing.

Warranty

Copyright

Address

Fax No.

E-mail Address

Limitation of Warranty and Liability
(effective February 2015)

Seller warrants the goods, excluding software, sold hereunder, under normal use and service as described in the operator's manual, to be free from defects in workmanship and material for **24 months**, or if less, 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 and exceptions:

a. Hot-wire or hot-film sensors used with research anemometers, and certain other components when indicated in specifications, are warranted for 90 days from the date of shipment;

b. Carbon monoxide (CO) Electro-chemical sensors are warranted for 12 months from the date of shipment.

c. Pumps are warranted for hours of operation as set forth in product or operator’s manuals;

d. 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;

e. 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;

f. This warranty does not cover calibration requirements, and seller warrants only that the instrument or product is properly calibrated at the time of its manufacture. Instruments returned for calibration are not covered by this warranty;

g. This warranty is **VOID** if the instrument is opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the manual allow an operator to replace consumables or perform recommended cleaning;

h. This warranty is **VOID** if the product has been misused, neglected, subjected to accidental or intentional damage, or is not properly installed, maintained, or cleaned according to the requirements of the manual. 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. WITH RESPECT TO SELLER’S BREACH OF THE IMPLIED WARRANTY AGAINST INFRINGEMENT, SAID WARRANTY IS LIMITED TO CLAIMS OF DIRECT INFRINGEMENT AND EXCLUDES CLAIMS OF CONTRIBUTORY OR INDUCED INFRINGEMENTS. BUYER’S EXCLUSIVE REMEDY SHALL BE THE RETURN OF THE PURCHASE PRICE DISCOUNTED FOR REASONABLE WEAR AND TEAR OR AT SELLER’S OPTION REPLACEMENT OF THE GOODS WITH NON-INFRINGING GOODS.**

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 THE CASE OF SOFTWARE, SELLER WILL REPAIR OR REPLACE DEFECTIVE SOFTWARE OR IF UNABLE TO DO SO, WILL REFUND THE PURCHASE PRICE OF THE SOFTWARE. IN NO EVENT SHALL SELLER BE LIABLE FOR LOST PROFITS, BUSINESS INTERRUPTION, OR ANY SPECIAL, INDIRECT, 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 Customer Service department

Trademarks

TSI, TSI logo, VelociCalc and VelociCalc Pro are registered trademarks of TSI Incorporated in the United States and may be protected under other country's trademark registrations. Wi-Fi is a registered trademark of the Wi-Fi Alliance.

Contents

Safety

This section provides instructions to ensure safe and proper operation of the VelociCalc® Air Velocity Meter Series 9600.

WARNINGS

- The instrument must be used in the manner described in this manual. Failure to follow all of the procedures described in this manual can result in serious injury to you or can cause irrevocable damage to the instrument.
- There are no user-serviceable parts inside the instrument. Refer all repairs to a qualified factory-authorized technician.
- The VelociCalc® meter is not rated for intrinsic safety. **DO NOT** operate the VelociCalc® meter under conditions where there is a risk of fire or explosion.

Description of Caution/Warning Symbols

Appropriate caution/warning statements are used throughout the manual and on the instrument that require you to take cautionary measures when working with the instrument.

Caution

CAUTION

CAUTION means that failure to follow the procedures prescribed in this manual might result in irreparable equipment damage. Important information about the operation and maintenance of this instrument is included in this manual.

Warning

WARNING

WARNING means that unsafe use of the instrument could result in serious injury to you or cause damage to the instrument. Follow the procedures prescribed.

Caution and Warning Symbols

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:

	Warns that uninsulated voltage within the instrument may have sufficient magnitude to cause electric shock. Therefore, it is dangerous to make contact with any part inside the instrument.
	Warns that the instrument contains a laser and that important information about its safe operation and maintenance is included in the manual.
	Warns that the instrument is susceptible to electro-static discharge (ESD) and ESD protection should be followed to avoid damage.
	Indicates the connector is connected to earth ground and cabinet ground.

Labels

Advisory and identification labels or markings are attached to the instrument.

1. Example 	2. Example 
3. Example 	4. Example 
5. Example 	6. Example 

7. Example 	8. Example 
9. European symbol for non-disposable item. Item must be recycled. 	

RoHS

VelociCalc® 9600 Series instruments are RoHS compliant.

CE

VelociCalc® 9600 Series instruments are CE compliant.

Reusing and Recycling

As part of TSI® Incorporated's effort to have a minimal negative impact on the communities in which its products are manufactured and used:

- **DO NOT** dispose of batteries in the trash. Follow local environmental requirements for battery recycling.
- If instrument becomes obsolete, return to TSI® for disassembly and recycling.

Bluetooth® Safety and Compliance(9650)

This product uses Bluetooth® v4.2 to communicate with software applications.

Hereby, TSI® Incorporated declares that this Bluetooth® test and measurement instrument is in compliance with Directive 2014/53/EC.

Transmit Power Rating is +9 dBm, MAX @ 2.4 – 2.5 GHz.

NOTICE

This device may not cause interference; this device must accept any interference, including interference that may cause undesired operation of the device.

l'appareil ne doit pas produire de brouillage; l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules (FCC ID: 2AC7Z-ESP32WROOM32E). These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTICE

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

WARNING

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CHAPTER 1

Unpacking and Parts Identification

Carefully unpack the instrument and accessories from the shipping container. Check the individual parts against the list of components below. If anything is missing or damaged, notify TSI® immediately.

Standard Equipment

All standard equipment can be purchased separately if needed.

1. Carrying case
2. Instrument
3. USB cable
4. Static pressure tip (9630, 9650, 9650-NB)
5. Tubing (9630, 9650, 9650-NB)
6. Calibration certificate
7. Manual (English)

This manual supports the following models:

Model No.	Description
9600	Multi-Function Ventilation Meter
9630	Multi-Function Ventilation Meter with Differential Pressure
9650-NB	Multi-Function Ventilation Meter with Differential Pressure, and Workflows
9650	Multi-Function Ventilation Meter with Differential Pressure, Workflows, and Bluetooth® printing

Optional Plug In Probes

Telescopic Thermoanemometer Probes	
Model No.	**Description**
960	Air Velocity and Temperature, Straight Probe
962	Air Velocity and Temperature, Articulating Probe
964	Air Velocity, Temperature, and Humidity, Straight Probe
966	Air Velocity, Temperature, and Humidity, Articulating Probe

Telescopic Thermohygrometer Probe	
Model No.	**Description**
800220	Air temperature and relative Humidity

Rotating Vane Anemometer Probes	
Model No.	**Description**
995	4 in. (100 mm) Rotating Vane, Air Velocity, and Temperature

Indoor Air Quality (IAQ) Probes	
Model No.	**Description**
980	Indoor Air Quality Probe, Temperature, Humidity, CO_2
982	Indoor Air Quality Probe, Temperature, Humidity, CO_2 and CO

K-alloy Thermocouple Probes	
Model No.	**Description**
792	Surface Temperature Probe
794	Air Temperature Probe

Pitot Probes	
Part No.	**Description**
634634000	Pitot Probe 12" (30 cm) - 5/16" (8 mm) diameter
634634001	Pitot Probe 18" (46 cm) - 5/16" (8 mm) diameter
634634002	Pitot Probe 24" (61 cm) - 5/16" (8 mm) diameter
634634003	Pitot Probe 36" (91 cm) - 5/16" (8 mm) diameter
634634005	Pitot Probe 60" (152 cm) - 5/16" (8 mm) diameter
634634004	Telescoping Pitot Probe - 8" to 38" (20 cm to 96 cm)

Optional Accessories and Replacement Parts

Part No.	Description	Picture
800122	AC/DC Adapter/Power Supply	
802241	USB Thermal Printer	
801190	Bluetooth® Printer (9650 only)	
80211	Printer paper (5 rolls)	
800681	IAQ probe stand	
801748	Telescopic, articulated extension for 995 RV probe	
372000000	8 ft. (2.5 m) tubing	
3002017	Static pressure probe	
800533	Static Pressure Probes and Tubing Kit—contains two static pressure probes and two 4 ft. (1.2 m) lengths of tubing.	
634650002	Duct plugs, 3/8" (9.5 mm) diameter—1000 pieces	
634650003	Duct plugs, 3/8" (9.5 mm) diameter—5000 pieces	

Part No.	Description	Picture
800130	Carrying case, small: Accommodates (1) meter and up to (2) probes (IAQ or thermoanemometer)	

CHAPTER 2

Setting Up the VelociCalc® Meter

Providing Power to the VelociCalc® Meter

The Model 9600 Series VelociCalc® Air Velocity Meter can be powered in one of two ways: four (4) size AA batteries or the optional AC/DC power supply.

Installing the Batteries

Insert four (4) size AA batteries as indicated by the diagram located on the inside of the battery compartment.

Using the AC/DC Power Supply

The optional AC/DC power supply (800122) can be used to power the instrument. Be sure to provide the correct voltage and frequency, which is marked on the back of the AC/DC power supply.

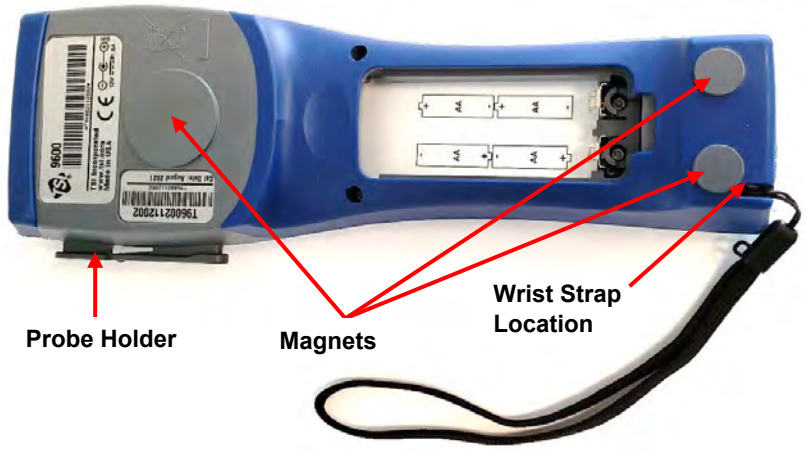
AC/DC Power Supply Input

When the AC/DC power supply is connected, the instrument will automatically turn **ON**. To turn the instrument off, disconnect the AC/DC power supply. If batteries are installed, press the power button for 3 seconds.

CAUTION
Use only the approved AC/DC power supply (TSI® part number 800122) and **DO NOT** substitute another adapter or use a computer to supply power. Use of an incorrect power supply can cause the measurements to be inaccurate.

Case Magnets, Probe Holder and Wrist Strap

The back of the case features built-in magnets that allow for hands-free operation. Two small magnets are near the bottom of the case and one large magnet in the top next to the serial number label. The instrument can be affixed to metal components such as sheet metal ductwork or frames of fume hoods. In addition, the case design incorporates a probe holder and wrist strap connection.



Connecting Ventilation or IAQ Probes

The ventilation and IAQ probes have a “D” shape overmolding on the mini-DIN connector which must align with the connector at the base of the 9600 series meter. This will ensure the probe is properly connected and remains so during use. Once connected and turned on, refer to the Display Order for displaying the desired measurements.

The telescoping probe contains the velocity, temperature, and humidity sensors. When using the probe, make sure the sensor window is fully exposed and the orientation dimple is facing upstream.

NOTICE

For temperature and humidity measurements, make sure that at least 3 in. (7.5 cm) of the probe is in the flow to allow the temperature and humidity sensors to be in the air stream.

Extending the Probe

To extend the probe, hold the handle in one hand while pulling on the probe tip with the other hand. **DO NOT** hold the cable while extending the probe as this prevents the probe from extending.

Retracting the Probe

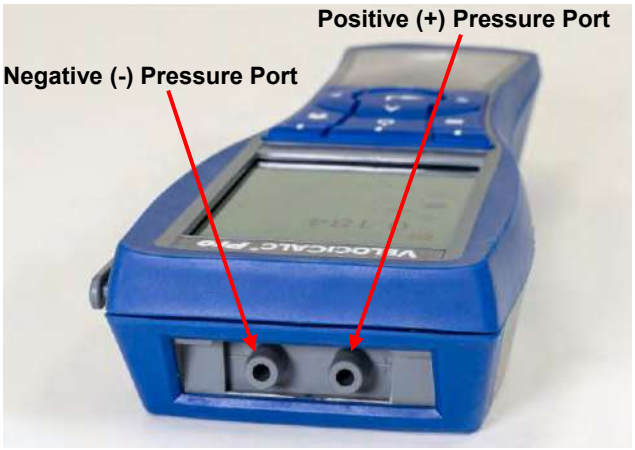
To retract the probe, hold the handle in one hand while gently pulling the probe cable until the smallest antenna section is retracted.

WARNING

DO NOT use the instrument or probes near hazardous voltage sources since serious injury could result.

Differential Pressure Capable Models (9630, 9650 and 9650-NB)

The 9630, 9650, and 9650-NB include pressure ports that can be used to measure static and differential pressures in ductwork. For more information, see Application Note TSI-107.



Connecting the Static Pressure Probe

The static pressure probe included with differential pressure capable meters is connected to the “+” port using the included tubing. The static pressure probe is used to measure the duct static pressure and features a magnet which holds the probe to the ductwork.

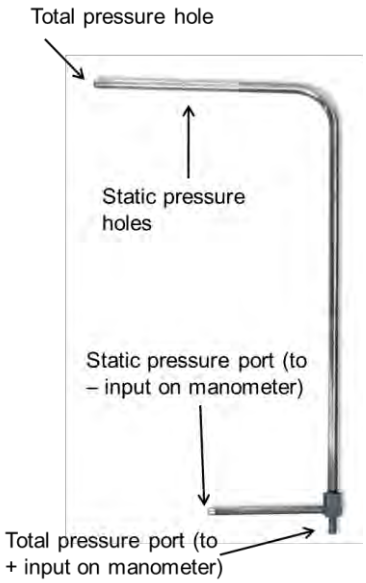
Connecting an Optional Pitot Probe

When connected to a pitot probe, air velocity or air volume can be measured. A pitot probe can be connected to the “+” and “-” pressure ports on the pressure capable VelociCalc® meters using two pieces of tubing of equal length. The total pressure port of the pitot probe connects to the “+” port on the meter, and the static pressure port of the pitot probe connects to the “-” port on the meter.

NOTICE

The pitot velocity needs a valid temperature to perform the standard or actual velocity correction. This is accomplished in the “Actual/Standard Setup” menu. If a thermocouple is plugged in, the meter will use the temperature reading from the thermocouple. If no thermocouple is plugged in, the meter will use the setting saved in the “Actual/Standard Setup” menu.

For more information on entering the temperature manually, refer to Chapter 4, Actual/Standard Setup section of this manual.



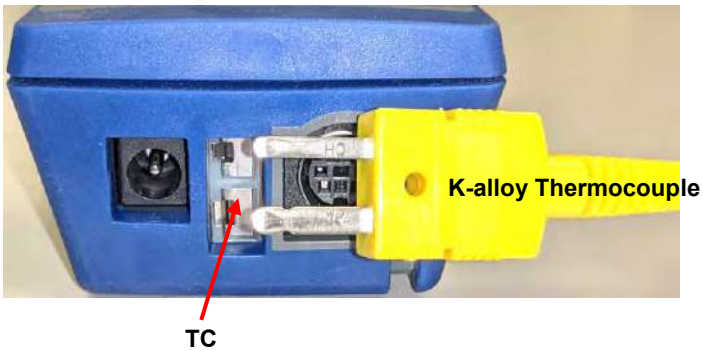
	WARNING
	DO NOT use the instrument or probes near hazardous voltage sources since serious injury could result.

Thermocouple Port

The 9600 Series VelociCalc® Air Velocity Meter includes a thermocouple port at the base of the meter. Any K-alloy thermocouple with mini-connector can be attached. See Chapter 4, Display Order for displaying the thermocouple measurement.

Connecting the Thermocouples

The K-alloy thermocouple with mini-connector has one terminal wider than the other. The wider terminal will be inserted into the bottom of the TC connector port.

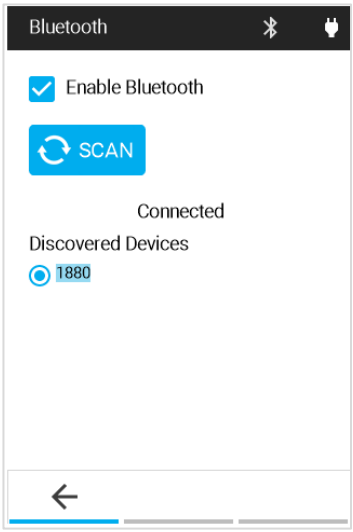


	WARNINGS
	• Thermocouples from an alternate TSI® supplier must have the metal sheath electrically isolated from the wires inside. Failure to meet this requirement may result in false readings, electrical shock, or fire hazard. • **DO NOT** use the instrument or probes near hazardous voltage sources since serious injury could result.

Connecting the Optional Bluetooth® Portable Printer Device (Model 9650 only)

To connect the Bluetooth® printer to the Model 9650, power on the unit and the printer.

1. Navigate to **Settings -> Bluetooth** and **Enable Bluetooth** checkbox.
2. Highlight **SCAN** and press **Enter**.
3. The unit will scan and find compatible Bluetooth® printers.
4. Highlight printer and press **Enter**.
5. The unit will display a message of “Connected” when successful.



Bluetooth is a registered trademark of Bluetooth SIG.

Connecting to a Computer

Use the Computer Interface USB Cable provided with the VelociCalc® meter to connect the instrument to a computer for downloading stored data.

USB Communications Port

	CAUTION
	Protection provided by the instrument could be impaired if used in a manner other than specified in this user manual.

CHAPTER 3

Operational Overview

Keypad Button Names

Button Names	Button Image
Programmable Soft Keys	
Main Menu	
Power	
Home (Dashboard)	
Navigation Keys	
Enter or OK	

Icons

Measurement Icons

The visibility of the following icons are dependent on the type of meter used and the probe connected.

	Barometric pressure
	Temperature from thermocouple probe
	Velocity from thermoanemometer or rotating vane anemometer probe

	Temperature
	Relative humidity
	Dew point temperature
	Wet bulb temperature
	Air flow from thermoanemometer or rotating vane anemometer probe
	Differential pressure
	Velocity from pitot probe
	Airflow from pitot probe or K-factor
	Carbon dioxide
	Carbon monoxide

Dashboard Icons

	Battery status
	AC power
	Manual Logging mode
	Continuous Logging mode
	Number of samples
	Bluetooth enabled (9650 only)
	Memory low warning when 90% full

Soft Key Icons

	Save a sample
	Cancel sample measurement in process
	Closes a TestID and automatically increments to the next available TestID
	Display average measurements of current TestID
	Close display of average measurements of current TestID
	Progress indicator
	Go back to previous screen
	Advance to next screen
	Add a configuration
	Delete
	Delete all
	Cancel and close Test ID
	Restore factory calibration
	Firmware update

Programmable Soft Key Icons

	Samples
	Statistics
	Manage data

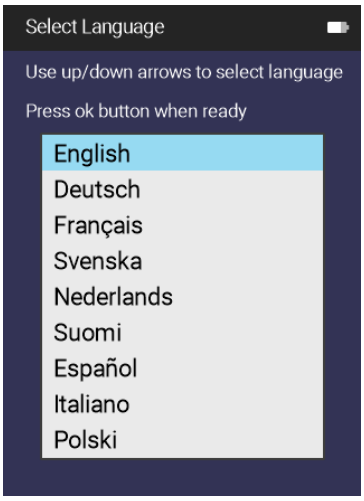
	Zero differential pressure (9630, 9650, 9650-NB)
	Print
	Logging profile
	Flow setup
	Display order
	Duct traverse (9650, 9650-NB)

Definitions

Out-of-Range (Calibration)	An Out-of-Range error during the calibration of a sensor means the sensor's offset or calibration slope adjustment has drifted outside of the TSI® recommended specification for continued use. Sensor should be replaced or sent to TSI® for recalibration.
Test Duration	The time over which the data will be logged while in **Continuous Save** mode. The test duration can be set from 0 seconds 0 hours and 0 minutes to 99 hours: 59 minutes: 59 seconds. If set to 0 seconds, 0 hours, 0 seconds, the meter will not stop logging in continuous save mode until the user presses the enter key.
Sample Duration / Time Constant	The sample duration / time constant is the time period where data is collected and averaged to produce a single value. For example, if the sample duration / time constant is set to 5 seconds, each 1 second sample will be averaged over the 5 seconds in a single value. The sample interval / time constant can be set to 1, 5, 10, 20, 30, 60 or 90 seconds.
Sample Interval	The frequency that the meter will log data while in **Continuous Save** mode.

Language Selection

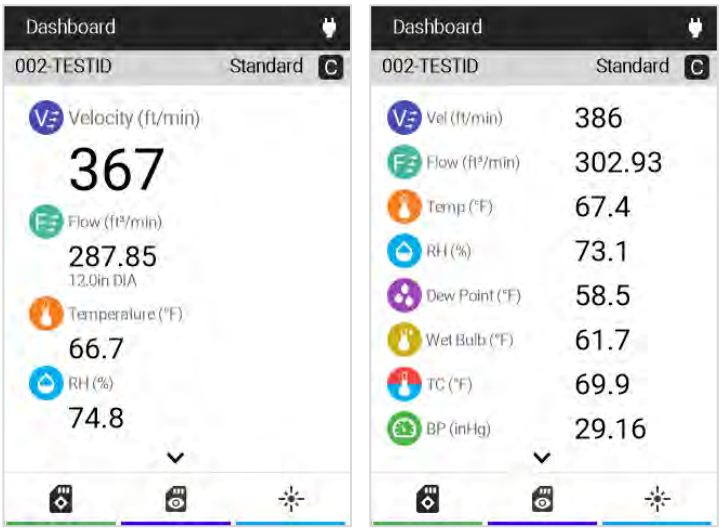
A language selection list is displayed the first time the meter is powered on.



Dashboard

Dashboard

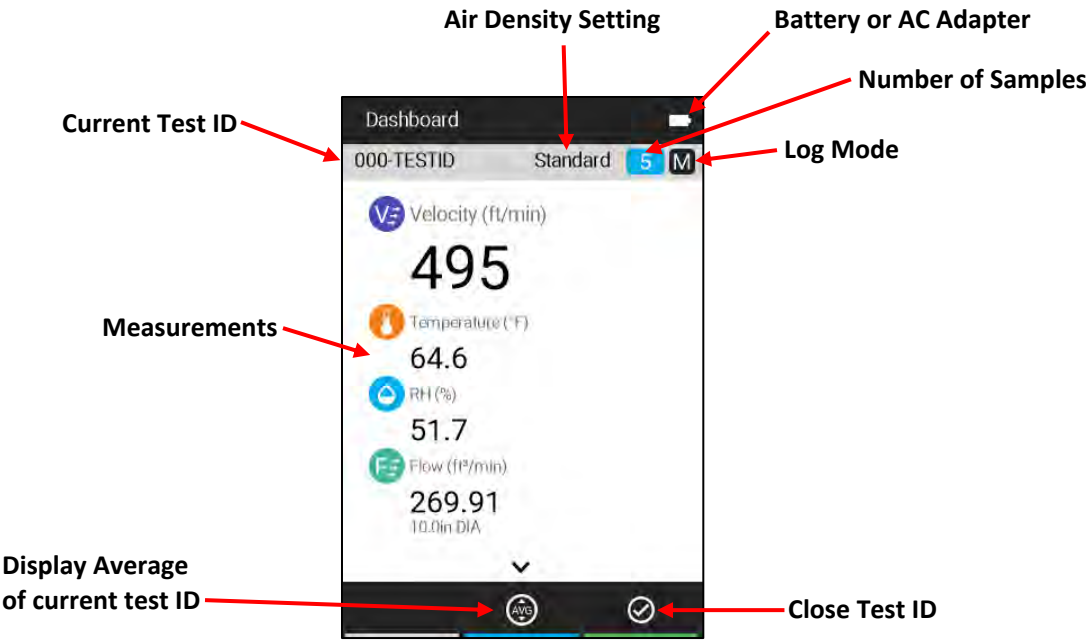
This is the main page for viewing live readings and logging data.



Press the any time to return to the **Dashboard** (Home) page.

If **v** or **^** is displayed, press the **Up** or **Down** button on the keypad to view additional measurements.

To change the dashboard to display more measurements in a list view, press the left or right navigation button on the keypad.



NOTICE

Measurements will only appear in the **Dashboard** page once they have been configured as visible in the Display Order page.

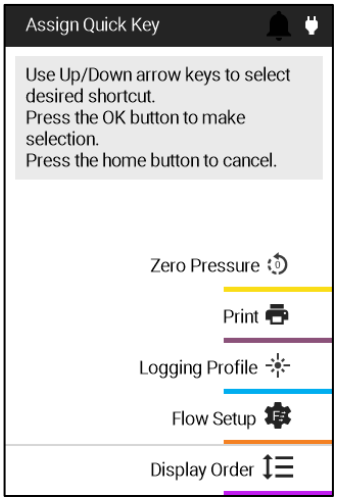
Assign Programmable Soft Keys

The Dashboard offers a feature called Programmable Soft Keys.

Programmable Soft Keys allows you to create shortcuts to other areas of interest in the meter.

Press and hold any of the top 3 keys (soft keys) for 3 seconds to configure.

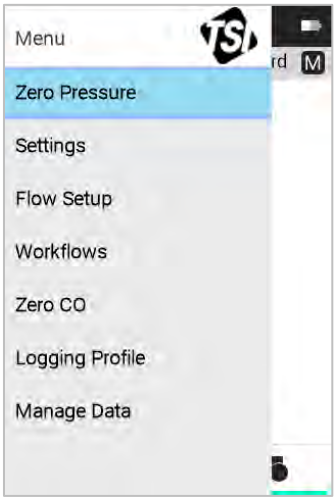
Programmable Soft Keys can be configured to reach the following screens or features with one button press:



- Zero Pressure (9630,9650, 9650-NB only)
- Print
- Logging Profile
- Flow Setup
- Display Order
- Duct Traverse (9650 and 9650-NB)
- Samples
- Statistics
- Manage Data

Main Menu

Press the button to bring up the main menu.



NOTICE

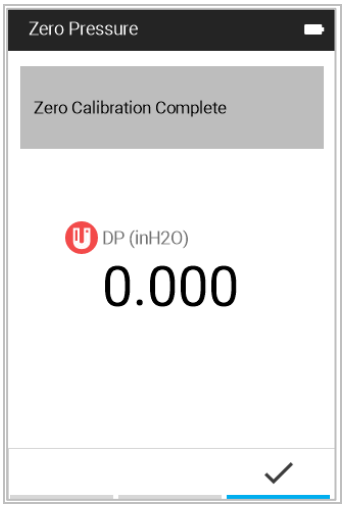
The **Main Menu** items displayed are dependent on the meter model and connected probe. **Zero Pressure** will be displayed on Models 9630, 9650 and 9650-NB. Zero CO will be displayed if the 982 probe is connected to any instrument model.

Zero Pressure

Select **Zero Pressure** from the **Main Menu** to zero the pressure measurement.

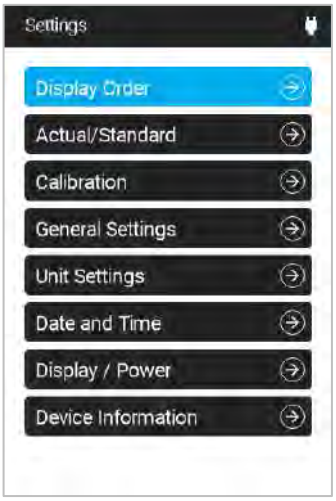
Press ⊘ to **Cancel**. When zeroing is complete, press ✓ or ↵ to **Save**.

Zero Pressure applies to Models 9630, 9650, and 9650-NB.



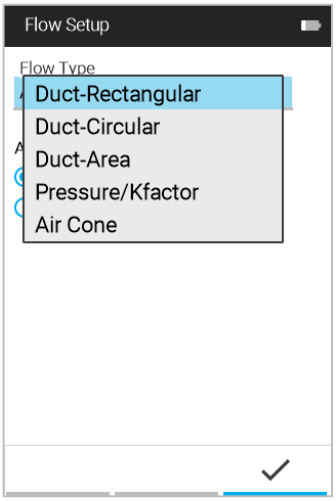
Settings

Select **Settings** from the **Main Menu**, to view the **Settings** page options. Refer to Chapter 4, Settings for detailed information about the device setting options.



Flow Setup

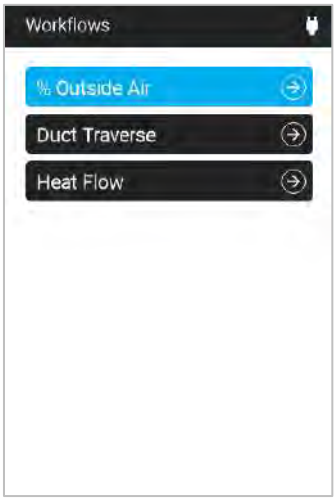
Select **Flow Setup** to define duct sizes and choose a duct shape. **Flow Setup** is also used to set up pressure K-factors on Models 9630 and 9650 or to select air cones when the 995 probe is connected to any meter model.



Workflows

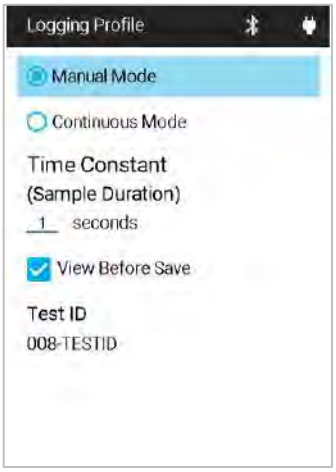
Select **Workflows** from the **Main Menu**, to view the **Workflow** options. Refer to Chapter 7, Workflows for detailed information about the device setting options.

Duct Traverse and Heat Flow are only available on the 9650 and 9650-NB.



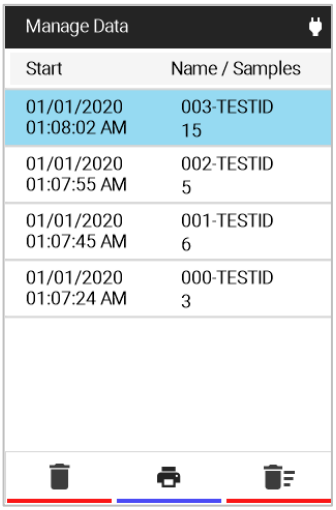
Logging Profile

Select **Logging Profile** to select between Manual Mode logging and Continuous Mode logging. See Chapter 5, Manual Mode Logging/Continuous Mode Logging for detailed information.



Manage Data

Select **Manage Data** to display logged data stored in the device. Refer to Chapter 6, Manage Data for detailed information.



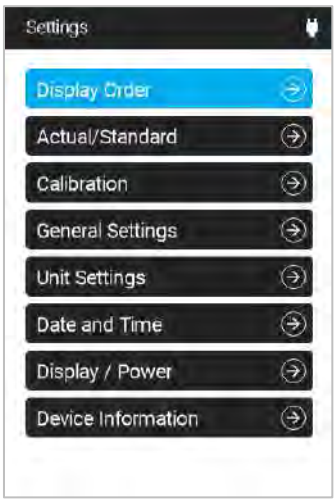
CHAPTER 4

Settings

Navigate to the **Settings** page by selecting **Settings** from the **Main Menu**.

The **Settings** page options are:

- Display Order
- Actual/Standard
- Calibration
- General Settings
- Unit Settings
- Date and Time
- Display/Power
- Device Information



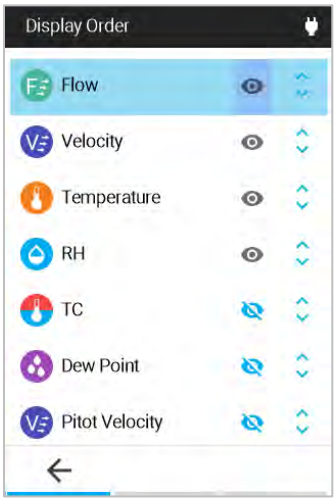
Display Order

The **Display Order** screen is used to configure what measurements are displayed on the **Dashboard** page, and the order they are displayed.

The list of measurements includes the following information:

- A measurement icon and name.
- A toggle icon to enable or disable the **Visibility** of the measurement on the **Dashboard** page.
- A positioning icon sets the order of measurements shown on the dashboard.

  Use the buttons to navigate the list and to make adjustments.

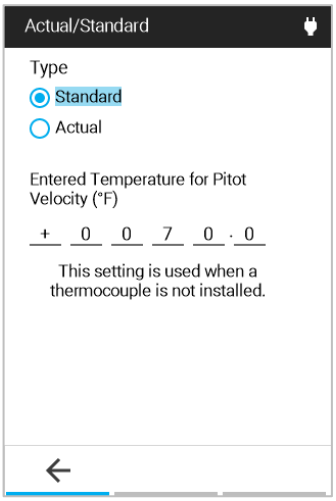


NOTICES

- The order of measurements on the **Display Order** page is the order shown on the **Dashboard** page.
- Only those measurements configured as visible on the **Display Order** page are logged to a TESTID.

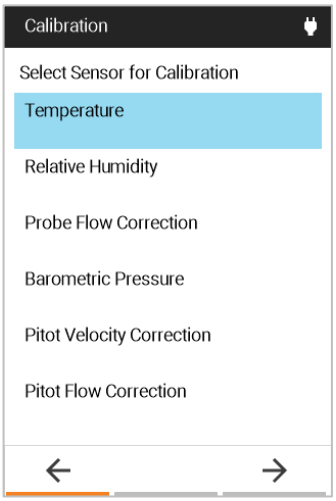
Actual/Standard

Select **Actual/Standard** to configure the settings used for velocity and flow measurements.



Calibration

The **Calibration** menu lists measurement parameters that can be adjusted in the field. The appropriate detachable probes must be attached to the VelociCalc® meter before adjustments can be made.



Calibration Offset Adjustments Applicable Models		
Temperature	**Barometric Pressure**	**Relative Humidity**
960, 962, 964, 966, 980, 982, 800220	9600, 9630, 9650, 9650-NB	964, 966, 980, 982, 995, 800220

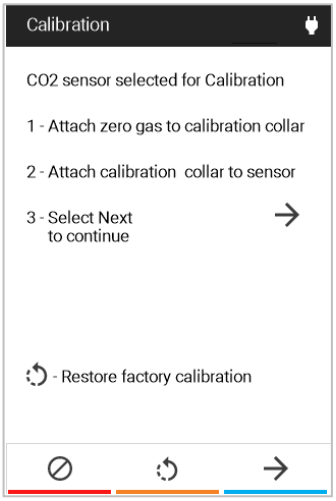
You can apply offset adjustments to temperature, relative humidity, and barometric pressure. The measurement displayed and logged will be the raw measurement added to the value you specify here. Offsets will be shown on the dashboard if the value is other than 1. Enter 0 to return to default.

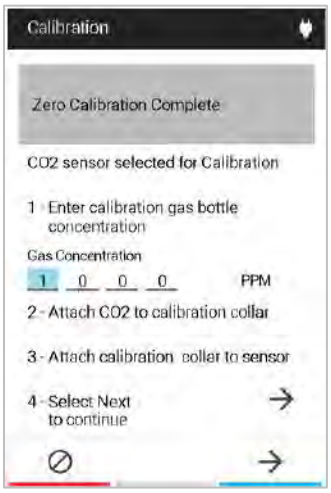
Correction Factors Applicable Models		
Pitot Velocity	**Pitot Flow**	**Probe Flow**
9630, 9650, 9650-NB	9630, 9650, 9650-NB	960, 962, 964, 966, 995

You can apply correction factors to pitot velocity, pitot flow and thermal anemometer and rotating vane air flows. The measurement displayed and logged will be the raw measurement multiplied by the value you specify here. Correction factors will be shown on the dashboard if the value is other than 1. Enter 1.000 to return to default.

IAQ Probe Calibration Applicable Models	
Carbon Dioxide (CO_2)	**Carbon Monoxide (CO)**
980, 982	982

A probe calibration collar (included with the 980 and 982 probes), zero calibration gas, span calibration gas, gas regulator and tubing are required to perform the calibration. The gas regulator used to control the flow should be capable of providing 0.3 L/min. Follow the on-screen instructions to complete the calibration, the procedure is the same for both carbon dioxide (CO_2) and carbon monoxide (CO).

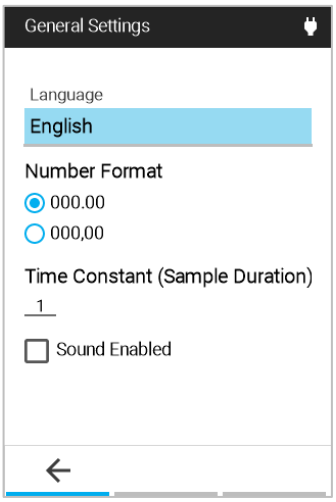




General Settings

The **General Settings** page is used to configure the following functions:

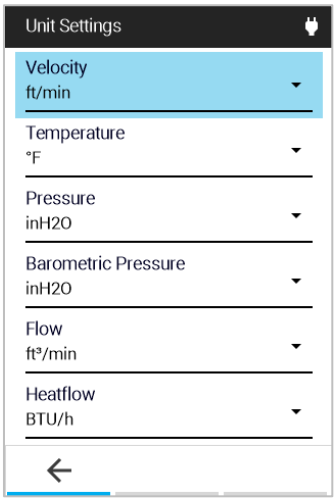
- **Language** is used to select the desired language shown on the instrument.
- **Number Format** is used to select the preferred decimal separator.
- **Time Constant (Sample Duration)** is used to adjust the averaging period for all measurements and to set the sample duration for logging.
- When **Sound Enabled** is active, the meter will sound when any button is pressed.



NOTICE
Time Constant is the display averaging period. The display will update every second; however, the displayed reading will be the average over the time constant period. For example, if the time constant is 5 seconds, the display will update every second, but the displayed reading will be the average of the last 5 seconds.

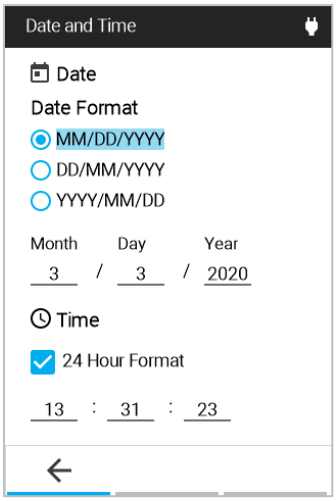
Unit Settings

The **Unit Settings** page is used to configure the desired unit of measure for each measurement.



Date and Time

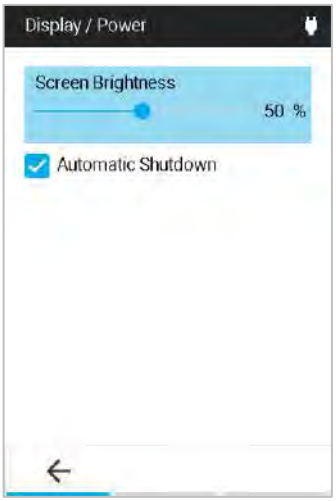
The **Date and Time** page is used to configure the desired formats for date and time and to set device date and time.



Display/Power

The **Display/Power** page is used to configure the following functions

- **Screen Brightness** adjusts the brightness of the display.
- **Automatic Shutdown** enables and disables automatic shutdown. If enabled, the meter will shut itself off after 20 minutes of inactivity.



Device Information

To display general information about the VelociCalc® Air Velocity Meter, select **Device Information** from the **Settings Menu**. The **Device Information** page lists the meter model number, serial number, and many other characteristics of the device, including information about the attached probe.

To update the VelociCalc® meter firmware, press the update firmware soft key ⓘ and follow the instructions provided.

CHAPTER 5

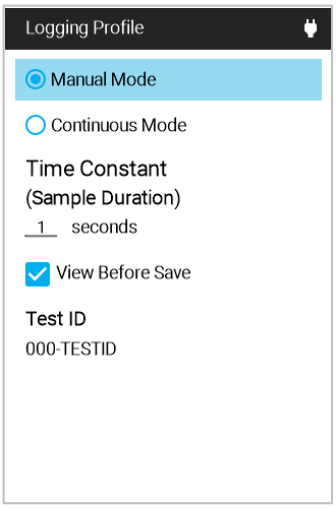
Logging Profile and Custom TESTID Labels

Manual Mode Logging

To configure the meter to log when the Enter button is pressed, select **Manual Mode**.

View Before Save prompts you to either **SAVE** or **DISCARD** once the sample is complete.

The **Time Constant (Sample Duration)** setting determines how long all measurements are averaged for.



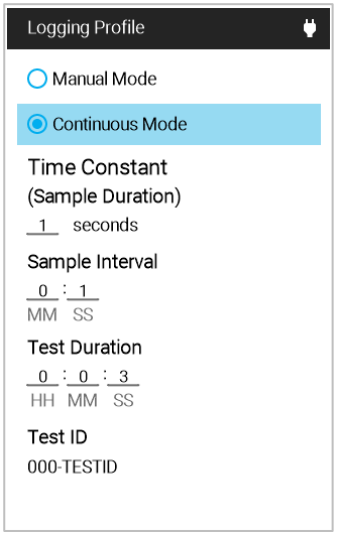
Continuous Mode Logging

To configure the meter to log continuously, select **Continuous Mode**.

The **Time Constant (Sample Duration)** setting determines how long all measurements are averaged for.

The **Sample Interval** sets the frequency that the meter will log measurements on the dashboard to a TESTID.

The **Test Duration** sets how long the meter will log data. If this setting is set to 00:00:00, the meter will log until the Enter button is pressed.



NOTICE

On-board memory is capable of storing data from all available measurements for more than 30 days when sampling data once a minute in continuous mode.

Customize TESTID Labels in Meter

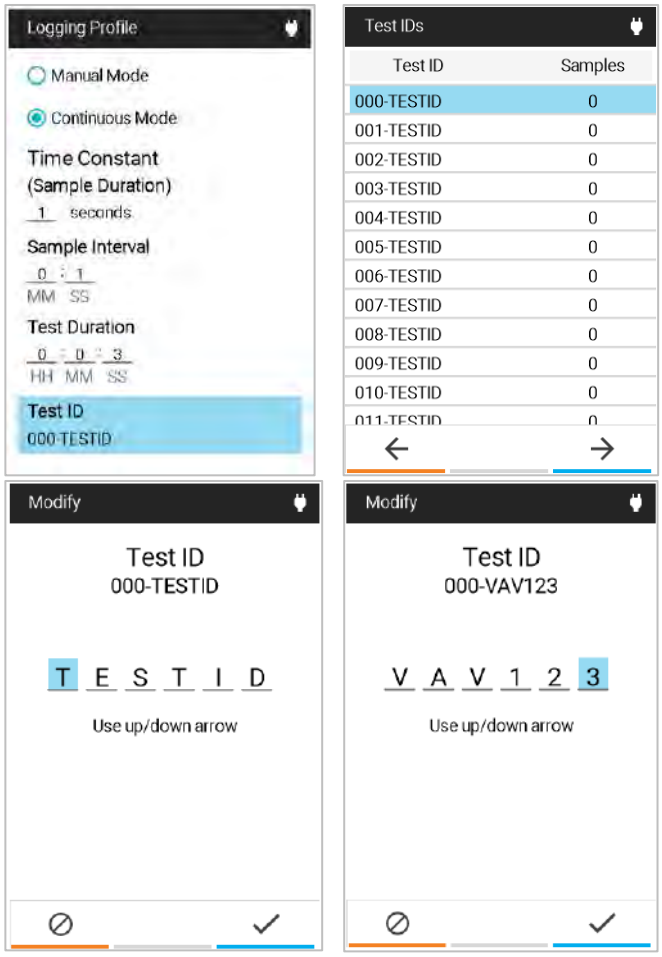
To change a TESTID label, highlight the **TESTID** field and press  .

Then highlight the desired **TESTID** and press .

Use the navigation keys to update the test ID label.

Press the **Check** key to accept the new label.

Press the **Cancel** key to discard label changes.



NOTICE

To scroll through the list of TESTIDs faster, press < to page down and > to page up through the list.

Customize TESTID Labels using TestID.csv

The VelociCalc® Air Velocity Meter also allows TESTID label updates using Excel® spreadsheet program.

Plug the VelociCalc® meter into a computer using the supplied USB cable.

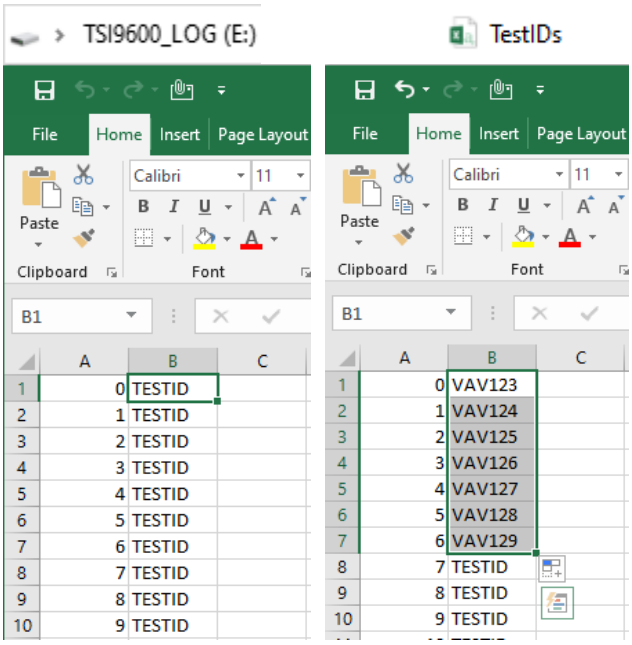
Navigate to the “TSI9600_LOG” drive and open the TestIDs.csv file.

Modify labels in column B.

Save the new TestIDs.csv file to the “TSI9600_LOG” drive and close the file. All TESTID labels that were changed will be updated in the VelociCalc® meter when the USB cable is disconnected.

NOTICE

TESTID labels are limited to 6 characters. Any additional characters will be discarded.

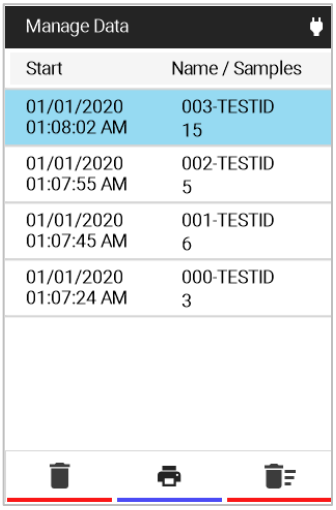


CHAPTER 6

Manage Data

From the **Main Menu,** select **Manage Data.**

The **Manage Data** page contains all TESTIDs on the device. You can select a log file for viewing or deleting, as well as scroll through a list of log files.

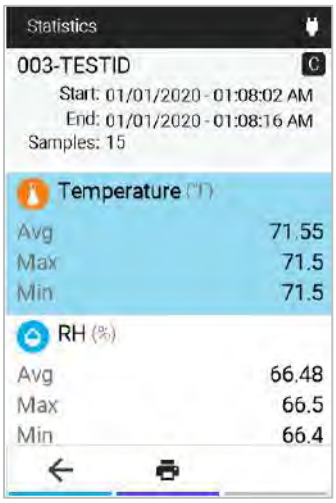


NOTICE

To scroll through the list of TESTIDs faster, press < to page down and > to page up through the list.

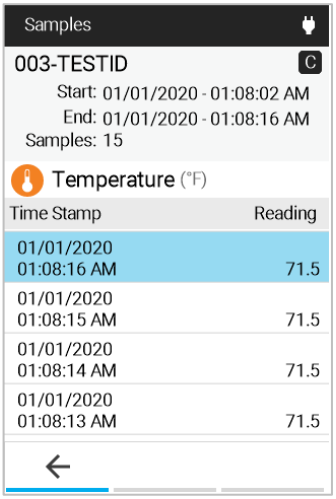
Viewing a Log File (TESTID)

To view a log file (TESTID), navigate to the log file on the **Manage Data** list and press the ↵ to open the **Statistics** page.



Viewing Samples

To view **Samples** in a log file TESTID, navigate to the desired measurement in the **Statistics** page and press ↵ key.



Delete Log Files

Select a log file then select the 🗑 icon to delete it. Next select **YES**.

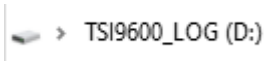
NOTICE
Deleted log files **CANNOT** be recovered.

Opening Log CSV Files on a PC

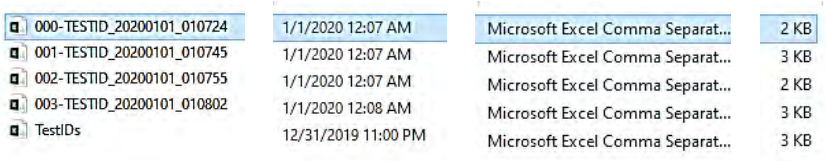
Log CSV files can be accessed on the VelociCalc® Series 9600 meters by connecting the meter to a computer using the supplied USB cable.

Connect the VelociCalc® meter to a PC over the supplied USB cable. A "**please wait**" message will appear on the VelociCalc® meter.

After the "**please wait**" message disappears, a **TSI9600_LOG** drive will show up on the computer that looks like this:



Open the **TSI9600_LOG** drive to view or download TESTID CSV files:



CHAPTER 7

Workflows

Workflows step you through the measurement process and assist in calculating and logging the measurement points.

The following workflows are available:

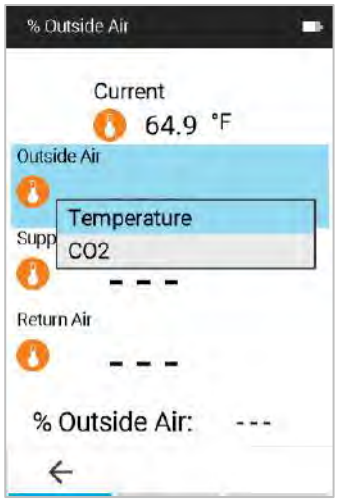
- Percent Outside Air (%OA) (9600, 9630, 9650, 9650-NB)
- Heat Flow (9650, 9650-NB with 964 or 966 probe)
- Duct Traverse (9650, 9650-NB)

NOTICE

Displayed workflows are dependent on instrument model and attached probe. Percent Outside air will be shown if a probe that measures air temperature or CO_2 is connected. Heat Flow will be shown on the 9650 or 9650-NB if a 964 or 966 probe is attached. Duct traverse will be shown on the 9650 or 9650-NB and is used with the differential pressure sensor or a connected probe that measures air velocity.

Percent Outside Air (%OA) Calculation Procedure

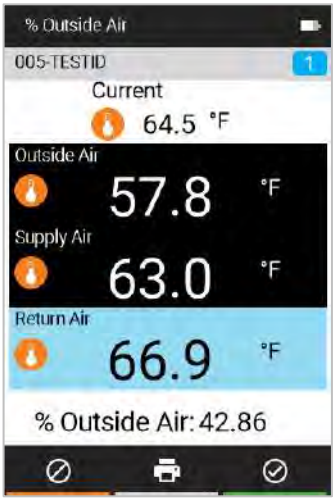
After selecting **Workflows** from the **Main Menu**, select **% Outside Air** to view the **% Outside Air** screen.



The **Percent Outside Air** feature offers the choice between using Temperature or CO_2 for the Percent Outside Air study if a probe that supports either CO_2 or Temperature is plugged in.

Three measurements are necessary for Percent Outside Air calculations: **Outside Air**, **Supply Air**, and **Return Air**.

The measurements may be taken in any order by using the navigation keys and  . The **Percent Outside Air** calculation is displayed once the final measurement is taken.



IMPORTANT NOTICE

The VelociCalc® instrument is intended for indoor use only. Care should be taken when taking **Percent Outdoor Air** measurements so that the instrument is not exposed to rain, sleet, hail, snow, or other inclement weather conditions as exposure to these elements will void the factory warranty.

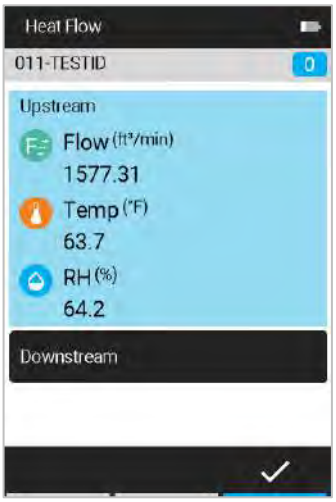
Heat Flow Procedure

The instrument calculates heat flow by making temperature, humidity, and flow measurements upstream and downstream of the coil in the duct. The following steps are utilized to make the heat flow measurement:

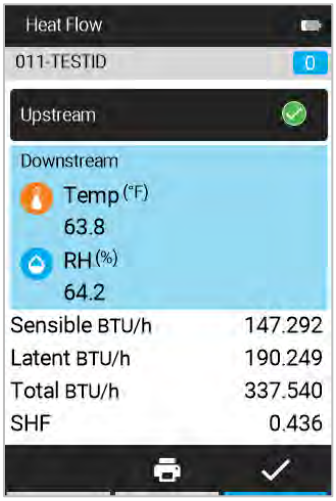
- Select **Heat Flow** under the workflows menu.

NOTICE

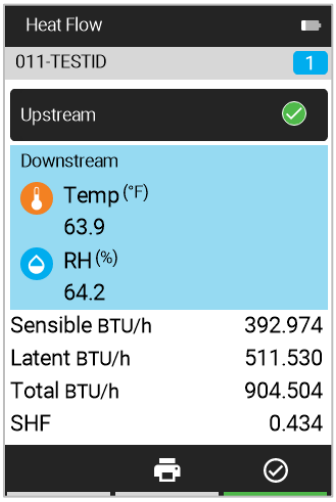
Heat Flow will only be available with probes that measure Velocity, Temperature, and Humidity (964 and 966 probes).



- Upstream measurements of Flow, Temperature, and Humidity are displayed. Press ↵ to capture these upstream measurements.
  - o Press ✓ to accept the upstream readings
  - o Press ↵ to retake upstream readings



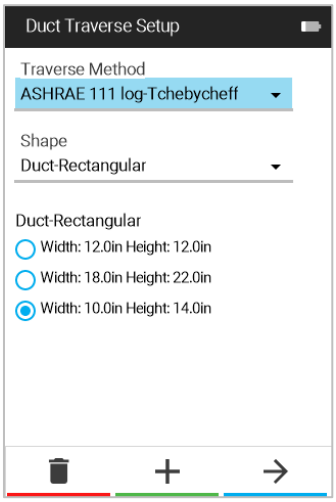
- After upstream measurement has been accepted, place probe downstream of the coil.
  - o Press ↵ to capture these upstream measurements.
  - o Press ✓ to accept the upstream readings
  - o Press ↵ to retake upstream readings
- Press ⊘ to save and close the test ID.



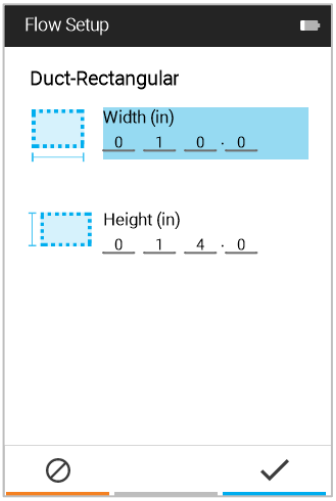
Duct Traverse Procedure (9650, 9650-NB)

After connecting any TA Probe or Pitot tube and selecting **Workflows** from the **Main Menu**, select **Duct Traverse** to view the **Duct Traverse Setup** screen.

To add a new duct size press +.

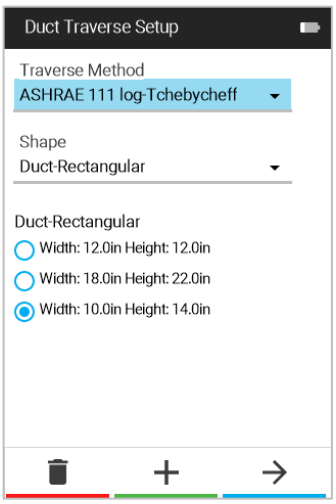


After pressing + to add a new duct size, you are brought to the **Flow Setup** page. To change the dimensions, use the arrow keys to navigate between Width and Height then press ↵ to begin editing the numbers by using the arrow keys. Press ✓ to save the new duct size.



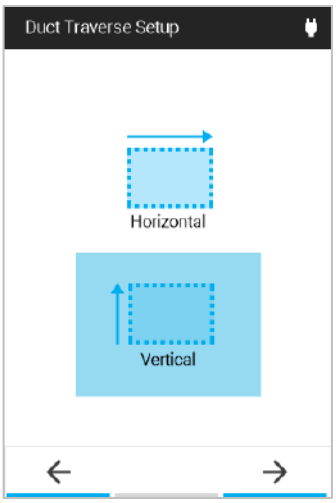
To create a circular duct, select **Duct-Circular** on the Duct Traverse Setup screen before adding a duct size.

Creating a new duct size will bring you back to the **Duct Traverse Setup** screen. Select the desired Traverse Method and Duct Shape with the drop-down menus and select the desired duct size using the navigation keys.



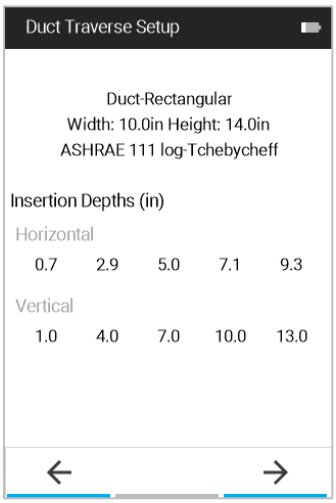
Press → to move onto the next screen.

After choosing the traverse method and duct shape and size, you will select a traverse orientation (rectangular only, screen is skipped for circular ducts). For traverse holes on the side of a rectangular duct, select horizontal traverse. For traverse holes on the bottom of a rectangular duct, select vertical.



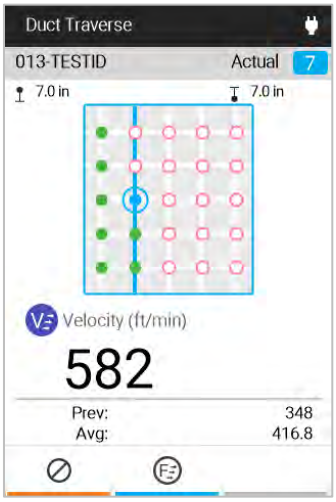
Press → to move on.

After selecting the traverse orientation (or after selecting a circular duct), the **Insertion Depths** screen will be shown. Note these insertion depths before proceeding.

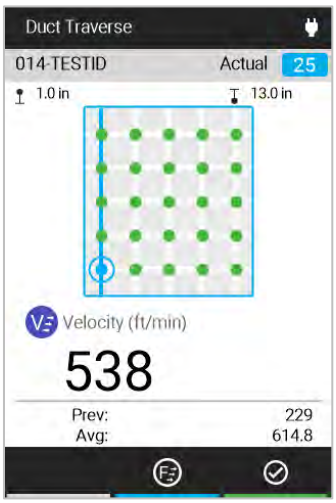


Press → to proceed to the **Duct Traverse** working screen.

Insert your probe into the first position indicated by the blue circle (traverse starts in the bottom left of the grid). If you prefer to start at a different point, use the navigation arrow keys to navigate to a different spot in the grid first. To take a velocity measurement, press ↵. The position will automatically move up to the next measurement point after taking a measurement. Note that the Previous measurement and the Average of all measurements taken will display across the bottom. Pressing F2 will display flow measurements and V2 to display velocity measurements.



After taking a velocity measurement at every grid location, the traverse is complete and you will be prompted to press ✓ to accept the traverse. Before accepting the traverse, you may go back and retake any measurement by navigating to that point with the navigation keys. When you are ready, press ✓ to complete and accept the Duct Traverse. The traverse will save to the TESTID noted in the top left.



CHAPTER 8

Maintenance

Cleaning/Disinfecting

- Ensure the VelociCalc® meter is turned off and not plugged into the AC/DC power supply.
- **DO NOT** spray directly onto the product.
- **DO NOT** get liquids inside the unit.
- For cleaning, wet a soft lint-free or microfiber cloth with a mild soapy solution then wipe the screen and meter case in a gentle motion to remove dust, oil, or fingerprint smudges.
- For disinfecting, the following is a recommended list of disinfectant solutions:
  - Household bleach solution (1/3 cup or 79 ml of bleach per one (1) gallon or 3.8 L of water)
  - Isopropyl alcohol (≤ 70% alcohol)
  - 6% Hydrogen peroxide (H_2O_2)
- Hot water with soap can be used to remove sticky substances when necessary.
- Wipe any moisture excess with a dry lint-free or microfiber cloth to finish cleaning before turning the meter back on.

CAUTION

DO NOT use strong solvents like ammonia to avoid damaging the meter's display.

DO NOT use paper-based cloths like paper towels to avoid scratching surfaces.

DO NOT use disinfectants that contain phenol.

DO NOT clean with strong aromatic, chlorinated, ketone, ether, or Esther solvents, sharp tools or abrasives.

Bi-Annual Maintenance Checks

- Make sure there are no cracks on the meter case. Cracks can create inconsistencies with how the electronics are supported inside the case, which can lead to damages.
- Inspect the power supply and cable to make sure they have not degraded. Replace if you find any cracks in the power supply or cable as it might cause shorting.

CHAPTER 9

Troubleshooting

Table 1 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the VelociCalc® Air Velocity Meter. If your symptom is not listed, or if none of the solutions solves your problem, please contact

Table 1. Troubleshooting the VelociCalc® Air Velocity Meter

Symptom	Possible Causes	Corrective Action
No Display	Unit not turned on	Switch unit on.
	Low or dead batteries	Replace batteries or plug in AC/DC power supply.
	Dirty battery contacts	Clean the battery contacts.
Velocity reading fluctuates unstable	Fluctuating flow	Reposition probe in less turbulent flow or use longer time constant.
Instrument shows a memory full message and cannot log more data	Memory is full	Download data if desired then DELETE ALL memory.
Probe Error message appears	Fault in probe	Factory service required on probe.

APPENDIX A

Specifications

Specifications are subject to change without notice.

960 Thermoanemometer Straight Probe Velocity and Temperature	
Range:	0 to 9999 ft/min (0 to 50 m/s), 0 to 200°F (-18 to 93°C)
Accuracy:	±3% of reading or ±3 ft/min (±0.015 m/s), whichever is greater1&2, ±0.5°F (±0.3°C)5
Resolution:	1 ft/min (0.01 m/s), 0.1°F (0.1°C)
962 Thermoanemometer Articulating Probe Velocity and Temperature	
Range:	0 to 9999 ft/min (0 to 50 m/s), 0 to 200°F (-18 to 93°C)
Accuracy:	±3% of reading or ±3 ft/min (±0.015 m/s), whichever is greater[1&2], ±0.5°F (±0.3°C)[5]
Resolution:	1 ft/min (0.01 m/s), 0.1°F (0.1°C)
964 Thermoanemometer Straight Probe Velocity, Temperature, Humidity, Wet Bulb, and Dew Point	
Range:	0 to 9999 ft/min (0 to 50 m/s), 14 to 140°F (-10 to 60°C), 5 to 95% RH
Accuracy:	±3% of reading or ±3 ft/min (±0.015 m/s), whichever is greater[1&2], ±0.5°F (±0.3°C)[5], ±3% RH[6]
Resolution:	1 ft/min (0.01 m/s), 0.1°F (0.1°C), 0.1% RH
966 Thermoanemometer Articulating Probe Velocity, Temperature, Humidity, Wet Bulb, and Dew Point	
Range:	0 to 9999 ft/min (0 to 50 m/s), 14 to 140°F (-10 to 60°C), 5 to 95% RH
Accuracy:	±3% of reading or ±3 ft/min (±0.015 m/s), whichever is greater[1&2], ±0.5°F (±0.3°C)[5], ±3% RH[6]
Resolution:	1 ft/min (0.01 m/s), 0.1°F (0.1°C), 0.1% RH
960 and 964 Thermoanemometer Probe Dimensions	
Probe Length:	40 in. (101.6 cm)
Probe Diameter of Tip:	0.28 in. (7.0 mm)
Probe Diameter of Base:	0.51 in. (13.0 mm)

962 and 966 Thermoanemometer Probe Dimensions (962, 966)	
Probe Length:	40 in. (101.6 cm)
Probe Diameter of Tip:	0.28 in. (7.0 mm)
Probe Diameter of Base:	0.51 in. (13.0 mm)
Articulating Section Length:.....	6.0 in. (15.24 cm)
Diameter of Articulating Knuckle: .	0.38 in. (9.5 mm)
Thermoanemometer Response Time	
Velocity:	200 msec
Temperature:	2 minutes (to 66% of final value)
Humidity:.....	<1 minute (to 66% of final value)
995 Rotating Vane 4 in. (100mm) Probe Velocity and Temperature	
Range:	50 to 6000 ft/min (0.25 to 30 m/s), 32 to 140°F (0 to 60°C)
Accuracy:.....	±1% + 4 ft/min (±0.02 m/s), ±2.0°F (±1.0°C)
Resolution:.....	1 ft/min (0.01 m/s), 0.1°F (0.1°C)
980 IAQ Probe CO_2, Temperature and Humidity	
Range:	0 to 5000 ppm CO_2, 5 to 95% RH, 14 to 140°F (-10 to 60°C)
Accuracy:.....	±3% of reading or ±50 ppm CO_2, whichever is greater[9], ±3% RH[6], ±1.0°F (±0.5°C)[5]
Resolution:.....	1 ppm CO_2, 0.1% RH, 0.1°F (0.1°C)
982 IAQ Probe CO, CO_2, Temperature and Humidity	
Range:	0 to 500 ppm CO, 0 to 5000 ppm CO_2, 5 to 95% RH, 14 to 140°F (-10 to 60°C)
Accuracy:.....	±3% of reading or ±3 ppm CO, whichever is greater[8], ±3% of reading or ±50 ppm CO_2, whichever is greater[9], ±3% RH[6], ±1.0°F (±0.5°C)[5]
Resolution:.....	0.1 ppm CO, 1 ppm CO_2, 0.1% RH, 0.1°F (0.1°C)
980 and 982 Probe Response Time	
Carbon Dioxide:.....	20 seconds to 90% of final value.
Carbon Monoxide: ...	<60 seconds to 90% of final value.
Temperature:	30 seconds (90% of final value, air velocity at 400 ft/min [2 m/s])
Relative Humidity:....	20 seconds (for 63% of final value)

792 and 794 Thermocouple Probes Temperature	
Range:	-40 to 1200°F (-40 to 650°C)
Accuracy[5]:	±0.1% of reading +2°F (±0.056% of reading +1.1°C)
Resolution:	0.1°F (0.1°C)
Pitot Tubes (9630, 9650, 9650-NB)	
Range[3]:	250 to 15500 ft/min (1.27 to 78.7 m/s)
Accuracy[4]:	±1.5% at 2000 ft/min (10.16 m/s)
Resolution:	1 ft/min (0.01 m/s)
Duct Size	
Range:	1 to 500 inches in increments of 0.1 in. (2.5 to 1270 cm in increments of 0.1 cm)
Volumetric Flow Rate	
Range:	Actual range is a function of actual velocity, pressure, duct size, and K-factor
Heat Flow (964 or 966 Probe with 9650, 9650-NB)	
Range:	Function of velocity, temperature, humidity, and barometric pressure
Measurements Available:	Sensible heat flow, latent heat flow, total heat flow and sensible heat factor
Units Measured:	BTU/hr, kW
Static/Differential Pressure (9630, 9650, 9650-NB)	
Range7:	-15 to +15 in. H_2O (-28.0 to +28.0 mm Hg, -3735 to +3735 Pa)
Accuracy:	±1% of reading ±0.005 in. H_2O (±1 Pa, ±0.01 mm Hg)
Resolution:	0.001 in. H_2O (0.1 Pa, 0.01 mm Hg)
Barometric Pressure	
Range:	20.36 to 36.648 in. Hg (517.15 to 930.87 mm Hg)
Accuracy:	±2% of reading
Instrument Temperature Range	
Operating (Electronics): .	40 to 113°F (5 to 45°C)
Operating (Probe):	14 to 140°F (-10 to 60°C)
Storage:	-4 to 140°F (-20 to 60°C)

Instrument Operating Conditions	
Altitude up to 4000 meters (only limited when plugged into the AC/DC adapter)	
Relative humidity up to 80% RH, non-condensing	
Pollution Degree II	
Overvoltage Category II	
Data Storage Capabilities	
Range:	162,200 samples and 200 TESTIDs (one sample can contain multiple measurement types)
Logging Interval	
Intervals:	1 second to 1 hour
Time Constant	
Intervals:	User selectable
External Meter Dimensions	
3.2 in. × 9.5 in. × 1.6 in. (8.1 cm × 24.1 cm × 4.1 cm)	
Meter Weight	
Weight with Batteries:.....	0.9 lbs (0.41kg)
Power Requirements	
Four (4) AA-size batteries (included) or AC/DC power supply P/N 6013125	
Input:.....	100 to 240 VAC, 50 to 60 Hz, 1.0A
Output:.....	12 VDC, 3.0A

1 Temperature compensated over an air temperature range of 40 to 150°F (5 to 65°C).

2 The accuracy statement of ±3.0% of reading or ±3 ft/min (±0.015 m/s), whichever is greater, begins at 30 ft/min through 9999 ft/min (0.15 m/s through 50 m/s).

3 Pressure velocity measurements are not recommended below 1000 ft/min (5 m/s) and are best suited to velocities over 2000 ft/min (10.00 m/s). Range can vary depending on barometric pressure.

4 Accuracy is a function of converting pressure to velocity. Conversion accuracy improves when actual pressure values increase.

5 Accuracy with instrument case at 77°F (25°C), add uncertainty of 0.05°F/°F (0.03°C/°C) for change in instrument temperature.

6 Accuracy with probe at 77°F (25°C). Add uncertainty of 0.1% RH/°F (0.2% RH/°C) for change in probe temperature. Includes 1% hysteresis.

7 Overpressure range = 190 in. H_2O (7 psi, 360 mmHg, 48 kPa).

8 At 77°F (25°C). Add uncertainty of ±0.2%/°F (0.36%/°C) for change in temperature.

9 At calibration temperature. Add uncertainty of ±0.28%/°F (0.5%/°C) for change in temperature.