Model 8322 VELOCICALC®
Model 8324 VELOCICALC® Plus

Rotating Vane Anemometer

Operation and Service Manual

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TSI®

Model 8322 VELOCICALC®
Model 8324 VELOCICALC® PLUS

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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 (800) 874-2811 (USA) and 1 (651) 490-2811 (International).

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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 in Table 1-1. If any are missing or damaged, notify TSI or your local distributor immediately.

Table 1-1: List of Components

| Qty.	Item Description	Part/Model
1	Model 8322 VELOCICALC® *or*	8322
	Model 8324 VELOCICALC® Plus	8324
1	Carrying Case	1319114
1	Large Vane Head (calibrated for ft/min) *or*	802149
	Large Vane Head (calibrated for m/s)	802153
1	Vane Head Handle	1803055
4	AA Alkaline Batteries	1208013
1	Operation and Service Manual	1980364
1	Calibration Certificate	1081723
1	Computer Interface Cable-8324 only	8940
1	Downloading Software Disk-8324 only	800832
1	Optional AC Adapter	
	115 V, NEMA-5	2613033
	230 V, European CEE 7/16	2613078
	230 V, Great Britain	800169
	240 V, Australian	2613105
1	Optional Small Vane Head (ft/min)	802150
1	Optional Small Vane Head (m/s)	802156
1	Optional Portable Printer	8925
1	Optional Articulating Handle	802165

Parts Identification
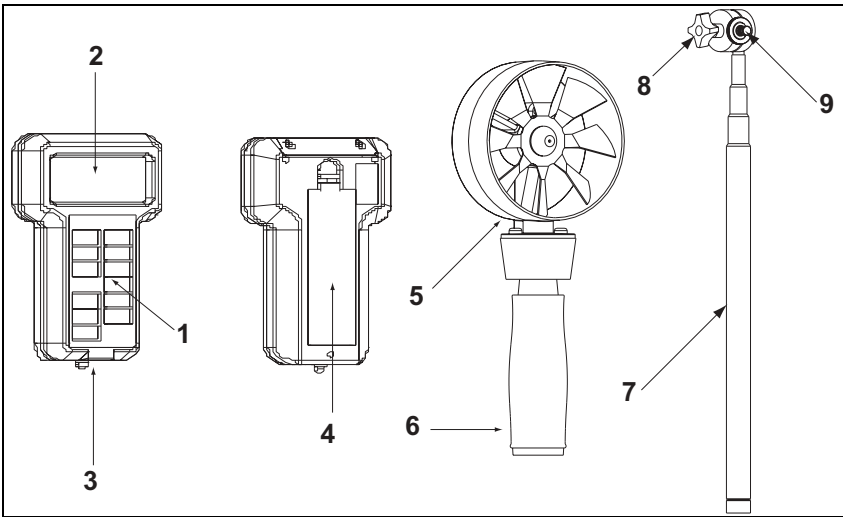
Figure 1-1: VᴇʟᴏᴄɪCᴀʟᴄ and Accessories

1. Keypad
2. Display
3. Printer Output/Communications Port
4. Battery Access Cover
5. Rotating Vane Head
6. Rotating Vane Handle
7. Articulating Extension (optional)
8. Swivel Adjustment Bolt
9. Knurled Knob

Chapter 2

Setting-Up

Supplying Power to the VELOCICALC
The VELOCICALC can be powered in one of two ways: four size AA
batteries or the optional AC adapter.

Installing the Batteries
Insert four AA batteries as indicated by the diagram located on the
inside of the battery compartment. TSI ships the unit with alkaline
batteries. The VELOCICALC is designed to operate with either alkaline or
NiCd rechargeable batteries. Carbon-zinc batteries are not recommended
because of the danger of battery acid leakage. Typical battery life for
alkaline batteries at 20°C is 24 hours. At 15% battery life remaining, the
battery light will indicate the batteries need to be changed. At this point,
you have about 2 hours of useful battery life remaining.

Using the Optional AC Adapter
The optional AC adapter allows you to power the VELOCICALC from a
wall outlet. When using the AC adapter, the batteries (if installed) will
be bypassed. The AC adapter is not a battery charger.

Auto Power Off Feature
The VELOCICALC's auto power off feature will automatically power the
instrument off after a specified time if no measurements are being taken.
In velocity mode, the instrument will power off after 15 minutes
provided that the velocity is zero and no keys have been pressed during
this time. In temperature mode, the instrument will power off after 15
minutes if no keys have been pressed.

This feature can be turned off if desired by switching DIP switch *#2* to
the ON position. See Appendix B for DIP Switch Settings.

> *Note:* *On the VELOCICALC 8322, any samples taken **will be***
> ***lost** when automatically powered off. However, on*
> *the VELOCICALC Plus 8324 **no** samples will be lost*
> *when automatically powered off.*

Selecting the Display Units

The VELOCICALC is capable of displaying the measured values in several different measurement units, as shown in Table 2-1.

Table 2-1: Choices of Measurement Units

Velocity	Temperature	Flowrate
ft/min	°F	ft^3 / min
m/s	°C	m^3 / hr
		l / s
		m^3 / min

If you wish to change the display units on your VELOCICALC, see Appendix B for DIP Switch Settings.

Using the Rotating Vane Head

The rotating vane head of the VELOCICALC contains the velocity and temperature sensors. Connect the head to the meter **before** turning on. Calibration coefficients stored in the head are read on startup. When using the rotating vane head, make sure the blades are free to move and the flow arrow points along the air flow path. To switch between the large head and the optional small head, turn the meter off **before** disconnecting and attaching the other head. If the vane head is not attached, the instrument will display "----."

Attaching the Handle

To attach the handle, screw the handle into the bottom of the rotating vane head until secure. Remove the handle after use to prevent damage to either the head or the handle.

Using the Optional Articulating Extension

The articulating extension allows you to secure the vane head at nearly any angle. Once you have attached the articulating extension, you can unscrew the swivel adjustment bolt, and adjust the angle of the elbow. You can then adjust the pivot position of the head by partially unscrewing the head from the handle and tightening it with the knurled knob, located underneath the vane head.

Using the Optional Small Vane Head

The smaller optional rotating vane head is primarily intended for tests with constricted flow area or those difficult to reach. The small rotating vane head functions like the large vane head.

Changing the Baud Rate

The VELOCICALC has a variable baud rate that is used when downloading or printing data from the instrument. By increasing the baud rate, the data will download faster.

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 power-up sequence while baud rate is displayed. Release the keys when the VELOCICALC beeps twice. Use the ▲ or ▼ key to scroll through the available values of 1200, 2400, 4800, 9600 and 19,200. Press ENTER to set the value that is displayed.

Connecting the Optional Model 8925 Portable Printer

To connect the Model 8925 printer to the VELOCICALC, 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 VELOCICALC. The printer must be set to the same baud rate as the VELOCICALC. See *Changing the Baud Rate* section for details on how to change the baud rate. To change the baud rate of the printer, please refer to the operation and service manual for the printer to properly set the printer's dip switch settings. 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.*

Connecting to a Computer

Use the Computer Interface Cable provided with the VELOCICALC to connect the instrument to a computer for remote polling. On the VELOCICALC Plus 8324 you may also use this cable for downloading stored data. Connect the 9-pin end labeled "COMPUTER" to the computer COM port and the other end to the data port of the VELOCICALC. A 9-pin to 25-pin adapter will be required if your computer has a 25-pin serial port connector.

For more information on how to download stored data, see *Downloading Data to a Computer* section in Chapter 3. For polling instructions, see the following *Data Acquisition (Polling)* section.

> **Caution:** The data port of the VELOCICALC is not intended for connection to a public telecommunications network. Connect the data port only to another RS232 port.

Data Acquisition (Polling)

The VELOCICALC is designed to allow you to perform polling through the use of a computer. To do this, your computer must be connected and in terminal mode. The baud rate for the computer and the VELOCICALC must be set to the same value. For details on viewing or changing the baud rate, see *Changing the Baud Rate* section in Chapter 2. You then must send an upper case V to the instrument.

You must write your own routine (program) to obtain information at specific intervals from the VELOCICALC. The meter will only send information when the SAMPLE key is pressed or after the computer has sent a "V" command to the VELOCICALC.

Chapter 3

Operation

Keypad Functions

When pressing the keys on the front panel, the VELOCICALC will beep to confirm the function. If you press a key and the VELOCICALC does not beep, the VELOCICALC does not allow that function during the selected mode.

WARNING! Do **not** expose the vane head to excessive heat—it can damage the vane head.

ON/OFF Key

Press the ON/OFF key to turn the VELOCICALC on and off. When the instrument is first turned on it goes through a preprogrammed power-up sequence that includes an internal self-check (when all displayable items are shown). The VELOCICALC displays percentage of battery life remaining (accurate for alkaline batteries only) and baud rate. At this point, the Model 8322 will start measuring in velocity mode.

The Model 8324 also displays the percentage of memory available and the time (HH.MM). At this point, the Model 8324 will start measuring in velocity mode.

If a problem is detected, the display will light 'CAL' to indicate that it should be returned for servicing and calibration.

> *Note:* *To skip the start-up displays, press* ENTER *at any time during the power-up sequence.*

Arrow Keys (▲▼)

The two arrow keys are used to scroll through and select values as needed for VELOCICALC functions. Pressing either arrow key on the start-up sequence will allow you to change the baud rate.

ENTER Key

Press the ENTER key to accept a value or condition. In start-up mode, you can also press the ENTER key to skip the start-up sequence.

VELOCITY Key

Press the VELOCITY key to display velocity measurements (the VELOCICALC will automatically start in velocity mode). The velocity will be displayed in ft/min or m/s depending on the DIP switch settings (refer to Appendix B). Place the rotating vane head in the location where you want to make the measurement. Make sure the blades move freely and the flow arrow points along the air flow path.

TEMP Key

Press the TEMP key to display air temperature readings. The VELOCICALC will display temperature readings in either degrees Fahrenheit (°F), or degrees Celsius (°C) depending on the DIP switch settings (refer to Appendix B).

FLOWRATE Key

The VELOCICALC's flowrate function can calculate flowrate using a known area. The VELOCICALC displays the volumetric flowrate in ft^3/min, m^3/hr, l/s, or m^3/min depending on the DIP switch setting (refer to Appendix B). The flowrate can be calculated for a round, square or rectangular duct. Once initially entered, the shape and size of the duct or flow area will be retained from the last entered value.

Entering Shape and Size

Press the FLOWRATE key to put the VELOCICALC in flowrate mode. You will be prompted to enter the shape and size, if this is the first time the flowrate function is being used.

To begin, press the ▲ or ▼ key to select the shape of the area, rectangular (square) or circular, being measured. Each time ▲ or ▼ key is pressed, the display will toggle between the circle and rectangle. When the desired shape appears on the display, press the ENTER key. This will enter the shape and the VELOCICALC will then ask for the size.

Use the ▲ or ▼ key to select the size of the flowrate area. For a circular flow shape, the VELOCICALC will ask for one size—the *diameter* of the circular area. Select the size and press the ENTER key to accept it. For a rectangular area the VELOCICALC will ask for two dimensions. First select the X dimension and press the ENTER key, then select the Y dimension and press the ENTER key.

To change the shape or dimensions after they have been entered, press the ▲ or ▼ key. Proceed as above to enter the shape and dimensions.

Model 8322 Functions

The VELOCICALC has the ability to determine some statistics from a number of individual sampled readings. When the SAMPLE key is pressed, a sample is taken and added to a sample buffer. The STATISTICS key is used to view statistics on the display. The CLEAR key is used to clear out the sample buffer.

TIME CONSTANT Key

Momentarily press and release the TIME CONSTANT key to view the current time constant. To change the time constant, press the ▲ or ▼ key for the options to sequence on the display. The available time constant choices are 1, 2, 5, 10, 15 and 20 seconds. When the desired value is displayed, press ENTER.

The VELOCICALC will store the chosen time constant when the meter is turned off. When the VELOCICALC is turned on again, the last time constant is used.

The time constant is actually an averaging period. The VELOCICALC display is updated every second. However, the reading displayed is the average reading over the last time constant period. For example, if the current time constant is set to 10 seconds, the display will show readings averaged over the previous 10 seconds, updated every second. This is also called a 10-second "moving average."

SAMPLE Key

Press and release the SAMPLE key to start the sample. The display will flash "SAMPLE" for one time constant along with a sample number. Then the sampled value will be displayed. Temperature, velocity and flowrate values will all be sampled, saved and taken into account for statistics.

The individual sampled values cannot be recalled. Only the statistics (average, maximum and minimum) of the sampled values can be recalled. All statistics data will be lost when the instrument is powered off.

Sweep Mode

Press and hold the SAMPLE key to start sampling. If the key is not released within one second, the instrument is in sweep mode. The display will flash "sample" while sampling and indicate the sample number. The instrument will continue sampling until the SAMPLE key is released. The sampled value will be displayed once sampling has ended. The sampled value represents the average of the values measured during the sample period. This mode works as if the time constant was changed to the length of time the key is pressed.

Samples taken in sweep mode are considered the same as other samples when calculating statistics. Even though your sweep sample may have a different sample period than your other samples, it is weighted the same as other samples.

STATISTICS Key

Press the STATISTICS key to display the statistics of the sampled values for the current operating mode. The VELOCICALC displays the number of samples taken, followed by the average of the samples. If you press STATISTICS repeatedly, the average, minimum and maximum values are displayed and repeated in that order. The VELOCICALC will go back to measuring mode if the statistics key is not pressed again.

Additional values can be sampled after the STATISTICS key has been pressed. The next time the STATISTICS key is pressed, the additional values are averaged with those already accumulated.

CLEAR Key

To erase the last recorded value, press and hold the CLEAR key. A count down from 5 to 0 will start, release the key any time *before* 0 is shown.

To clear all samples in the sample buffer, press and hold the CLEAR key. A count down from 5 to 0 will start, *while 0 is displayed*, release the CLEAR key.

> *Note:* Only the last sample recorded can be cleared without clearing the entire memory.

Printing Data Using the Portable Printer

If the optional Model 8925 Portable Printer is connected, the following will be printed while pressing the following keys:

- SAMPLE key: (sample #), sample value, units
- STATISTICS key: "AVG," (# samples), average value, units
- STATISTICS (again) "MAX," (# samples), max value, units
- STATISTICS (again) "MIN," (# samples), min value, units
- CLEAR (and released before 0) "CLEAR LAST SAMPLE"
- CLEAR (and released at 0) "CLEAR"

In flowrate mode, shape and size data is also transmitted when it is entered or changed. The value of the time constant is transmitted when it is changed.

> *Note:* In order to print, the baud rate on the VELOCICALC must be set to the same as the printer. The default is 1200.

The data will print in a format such as 12,345.67. If you desire, the VELOCICALC can print in a format such as 12345,67 by switching DIP switch #8 ON. See Appendix B for DIP Switch Settings.

Model 8324 Functions

The VELOCICALC Plus has the ability to data log, determine statistics and recall individual data points. When the SAMPLE key is pressed, the samples being taken are added to the memory. The STATISTICS (review data) key is used to view statistics or individual sample points. The NEXT TEST (clear) key is used to advance to the next test ID number, to clear the last sample taken, or to clear out the entire memory. The VELOCICALC Plus retains data even when it is turned off.

Setting the Real-Time Clock

The VELOCICALC Plus has an internal clock that keeps track of the time (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.

To set 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 VELOCICALC Plus beeps twice. You will have an opportunity to view and/or change the hours, minutes, year, month and day in sequence. Use ▲ or ▼ key to change any settings. Use the ENTER key to store each setting and advance to the next one.

TIME CONSTANT Key

The TIME CONSTANT key is used to set the time constant and logging intervals. Press to display current time constant. Use ▲ or ▼ key to scroll through the time constant choices, which are 1s, 2 s, 5 s, 10 s, 20 s and LOG, then press ENTER to accept the choice. Use ▲ or ▼ key to scroll through the logging interval choices, which are 1 s, 2 s, 5 s, 10 s, 20 s, 30 s, 1 m, 2 m, 5 m, 10 m, 20 m, 30 m, 60 m and OFF. Press ENTER to accept choice and return to measuring mode. If a logging interval is chosen that is shorter than the time constant, the time constant will be shortened to be equal to the logging interval.

> *Note:* *To operate the instrument in discrete data logging (or single point) mode, the logging interval must be set to OFF. To operate the instrument in continuous data logging mode, the logging interval must be set to something other than OFF.*

The time constant is an averaging period. The VELOCICALC display is updated every second. However, the reading displayed is the average reading over the last time constant period. For example, if the current time

constant is set to 10 seconds, the display will show readings averaged over the previous 10 seconds, updated every second. This is also called a 10-second "moving average."

SAMPLE Key

Setting Data Storage Options

Temperature and velocity values will always be sampled, saved and taken into account for statistics. You can set the "FLOWRATE" storage option to record flowrate as well.

In this section the terms "On" and "AutO" are used. The following brief explanations may help to understand what function is being performed. "On" means that flowrate will record whenever the SAMPLE key is pressed. "AUtO" means that flowrate will only record when in flowrate mode.

Press and hold the FLOWRATE key to view, enter, or change data storage options. Use ▲ or ▼ key to toggle between "On" and "AUtO," then press ENTER to accept the setting.

Discrete Data Logging (Single Point Measurements)

Discrete data logging allows you to record single data points. The instrument must first be in discrete data logging mode (default). See *TIME CONSTANT key* section above.

Press the SAMPLE key to take a sample. While the sample is being taken, "SAMPLE" will flash on the display along with the sample number. The sampling will last for the length of the set time constant. Then the VELOCICALC Plus will display the value that was recorded.

Continuous Data Logging (Multiple Readings Over Time)

Continuous data logging allows you to record samples continuously. To get into data logging mode and to select a logging interval, see *TIME CONSTANT key* section above.

Pressing the SAMPLE key once begins the sampling process. The instrument will display "LOG" briefly indicating samples will be recorded. After one logging interval has passed and whenever a sample is recorded, the instrument will display "SAMPLE" briefly along with the log sample value. The instrument continues taking samples until you press the SAMPLE key a second time. One sample is taken every logging interval and each sample is an average over the most recent time constant interval.

> *Note:*   *If you attempt to set the logging interval at less than the time constant, the VELOCICALC Plus will automatically set the time constant equal to the logging interval.*

The display will then scroll through the test ID number, number of samples stored, and sample average for that test ID. To see maximum, minimum, or individual data points, please see *STATISTICS (review data) Key* section.

> *Note:*   *When taking samples in logging mode, the auto power off feature won't turn off the VELOCICALC Plus until the sample key is hit a second time indicating sampling is finished.*

Sweep Mode

Sweeping is taking a sample the entire time the SAMPLE key is held. Press and hold the SAMPLE key to start the sample. If the SAMPLE key is not released within one second, the instrument is in sweep mode. The display will flash "sample" while you are sampling. The instrument will continue sampling until the SAMPLE key is released

> *Note:*   *If the word "LOG" appears, you are in continuous logging mode, and cannot sweep. See* TIME CONSTANT key *section above for instructions to turn off logging mode.*

The sampled value and units will be displayed once the sample is taken. The sampled value is the average of the values measured. This mode works the same as if the time constant was changed to the length of time the key is pressed.

Samples taken in different modes are considered the same as other samples when calculating statistics. Even though the sample may have a different sample period than other samples, it is weighted the same as other samples in calculating the average of the test ID.

NEXT TEST (clear) Key

Press NEXT TEST (clear) to advance to the next test ID. If the current test ID does not have anything stored, it will not advance to the next test ID.

To clear the last sample, press and hold the NEXT TEST (clear) key and the display will begin a countdown from 5 to 0. Release the key at any time during the countdown *before* zero is displayed.

The display reads "CLEAR SAMPLE" to indicate that the most recent sample has been erased from memory.

To clear *all* memory, keep holding key during the countdown. Release the key *while 0 is displayed*. The display will beep twice and flash "CLEAR LOG."

> ***Note*** *If you release the key* after *0 is displayed, it will not beep, and nothing will be deleted.*

The VELOCICALC Plus will automatically increment the test ID number under the following conditions:

- turning off the VELOCICALC (if there is stored data)
- taking a sample with a different duct size or shape than the last stored sample
- taking a continuous data logging sample
- taking discrete samples after taking continuous sample

> ***Note:*** *Only the last sample recorded can be cleared without clearing the entire memory. You cannot go back to a previous test ID and erase any of the values. You cannot add data to a previous test ID. Sample clear does not work in continuous data logging mode.*

STATISTICS (review data) Key
The STATISTICS (review data) key has two purposes. One is to view the statistics for the currently displayed parameter and the other is to review data for a particular test ID, including individual sample values.

To View Statistics
Press STATISTICS (review data) key to view statistics for the parameter currently shown on the display. The test ID, number of samples and finally the average will be displayed. Press STATISTICS (review data) again (before the average disappears from the display) to view maximum and minimum.

To Review Data
Press and hold STATISTICS (review data) key. The VELOCICALC Plus will beep twice. Release the key and the test ID number will be displayed. Use the ▲ or ▼ key to select the desired test ID. Press ENTER to accept the test ID number. Use the ▲ key to view average, maximum, minimum, total number of samples, and individual sample numbers and values for the selected test ID. The samples will be displayed in the order that they were taken.

To view a different test ID, press STATISTICS (review data) again to return to test ID. Use ▲ or ▼ key to chose a new test ID, then press ENTER to accept the choice and continue as above to review the data.

To review data of a different measurement type, press the desired measurement type button while AVG, MAX, MIN, number of samples, or individual sample is being displayed. If there is no data for that measurement type, "-----" will be displayed. Press another measurement type key to view more data or press ENTER to return to measuring mode.

Printing Data Using the Portable Printer

If the optional Model 8925 Portable Printer is connected, the following will be printed while pushing the following keys:

- SAMPLE key: (sample #), sample value, units
- STATISTICS key: "AVG," # samples, average value, units
- STATISTICS (again) "MAX," (#samples), max value, units
- STATISTICS (again) "MIN," (#samples), min value, units
- CLEAR (and released before 0) "CLEAR LAST SAMPLE"
- CLEAR (and released at 0) "CLEAR LOG"

In flowrate mode, shape and size data is also transmitted when it is entered or changed. The value of the time constant is transmitted when it is changed. In logging mode, it prints the same as if you are pressing SAMPLE every logging interval.

To print everything in memory, press and hold the ENTER key. This will initiate a countdown from 5 to 0. When the display shows zero, release the key and everything in memory will print to the printer. If you release the key at any time other than 0 during the countdown, nothing will print.

> *Note: In order to print, the baud rate on the VELOCICALC must be set to the same as the printer. The default is 1200.*

The data will print in a format such as 12345.67. If you desire, the VELOCICALC can print in a format such as 12345,67 by switching DIP switch #4 ON. See Appendix B for DIP Switch Settings.

Downloading Data to a Computer

"LOGDAT" is a windows-based program from TSI designed to download the data stored in the memory of the VELOCICALC Plus to a computer. This data includes the test ID, measurement, unit of measure, flow area, and time constant. This data is date and time stamped. In addition, the statistics for each test ID 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 load LOGDAT on your computer, use the following procedure, also found on the disk:
- For Windows 3.1: Select File, Run, and type "A:\setup.exe"
- For Windows 95: Select Start, Run, and type "A:\setup.exe"
- For Windows NT: Select Start, Run, and type "A:\setup.exe"

Once you open the program, it is self-directing and provides all the necessary instructions for downloading data.

To download data from the VELOCICALC Plus, connect the supplied computer interface cable to the VELOCICALC Plus and to a computer serial port. Any serial port from COM1 to COM4 can be used.

Chapter 4

Maintenance

Rotating Vane Head

Periodically inspect the rotating vane head to ensure that it is clean. Dust and oil deposits on the temperature sensor or rotating blades decrease the accuracy of the VELOCICALC.

Caution:	The VELOCICALC must be switched off for cleaning. Do **not** use high-pressure air or strong solvents to clean the sensor head; damage to the blades or temperature sensor could result.

To remove dust, blow it off with a gentle stream of air. To remove a combination of dust and oil, carefully wipe the blades and blade shield using a cotton swab soaked with isopropyl alcohol and then blow it off with a gentle stream of air.

Recalibration

To maintain a high degree of accuracy in your measurements, TSI recommends that you return your instrument for annual recalibration. For a nominal fee, we will recalibrate the unit and return it to you with a certificate of calibration and US National Institute of Standards and Technology (NIST) traceability. This "annual checkup" assures you of consistently accurate readings; it is especially important in applications where strict calibration records must be maintained.

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** submerge the VELOCICALC.

Storage

When storing the VELOCICALC for more than a month, it is recommended to remove the batteries. This prevents damage due to battery leakage.

Chapter 5

Troubleshooting

Table 5-1 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the VELOCICALC. If your symptom is not listed, or if none of the corrective actions solve your problem, please contact TSI.

Table 5-1: Troubleshooting the VELOCICALC

Symptom	Possible Causes	Corrective Action
No display	Unit not switched on	Switch on the unit.
	Low or dead batteries	Replace the batteries or plug in the AC adapter.
	Dirty battery contacts	Clean the battery contacts.
Battery symbol is blinking	Batteries are low, 15% or less life remaining	Replace or recharge batteries.
Display reads "LO"	Wrong AC adapter	Replace with the correct AC adapter.
	Low AC line voltage	Correct the AC line voltage or use batteries.
	Dirty battery contacts	Clean the battery contacts.
Display reads "CAL"	The VELOCICALC has detected an internal fault	Return to factory for service.
Display reads "OVER"	The velocity or temperature is too high	Use an alternate method to make measurement.
Temp. initially reads high or low	Temperature sensor is still adjusting to temperature	Allow sufficient time for the temperature to stabilize.
Display reads "ERR"	You are trying to enter more readings than memory can handle	Read or record the average; clear the sample register and proceed.
Velocity reading fluctuates badly	The flow is fluctuating	Reposition the probe in a less turbulent section of the flow or use a longer time constant.
Display reads "Lbat"	Low lithium battery power	Return to TSI for replacement.
Display reads "rAnn"	Datalogging RAM is inoperable	Return to TSI for service.
Display shows "----"	Vane head is not plugged in	Plug in vane head or try another vane head.

Appendix A

Specifications

Specifications are subject to change without notice.
Specifications in parentheses () indicate metric equivalents.

VELOCITY:

Range (100 mm head):	50 to 6,000 ft/min (0.25 to 30 m/s)
Accuracy (100 mm head):	±1.0% of reading or ±3 ft/min (±0.015 m/s), whichever is greater
Range (50 mm head):	80 to 3,000 ft/min (0.4 to 15 m/s)
Accuracy (50 mm head):	±1.5% of reading or ±5 ft/min (±0.025 m/s), whichever is greater

TEMPERATURE SENSOR:

Range:	32 to 176°F (0 to 80°C)
Resolution:	0.1°F (0.1°C)
Accuracy:	±1.8°F (±1.0°C)

INSTRUMENT TEMPERATURE RANGE:

Operating (electronics):	40 to 113°F (5 to 45°C)
Operating (vane head):	32 to 176°F (0 to 80°C)
Storage:	-4 to 140°F (-20 to 60°C)

VOLUMETRIC FLOWRATE:

Range[1]:	0 to 1,230,000 l/s
	0 to 4,360,000 m^3/hr
	0 to 2,604,000 ft^3/min

DUCT SIZE:

Range:	1 to 250 inches in increments of 0.1 inches
	(1 to 635 cm in increments of 0.1 cm)

TIME CONSTANT:

Intervals:	1 sec, 2 sec, 5 sec, 10 sec, 15 sec, 20 sec

LOGGING CAPABILITY (Model 8324 only):

Range:	Up to 2,849 samples and 1,000 test IDs
Intervals:	1 sec, 2 sec, 5 sec, 10 sec, 15 sec, 20 sec, 30 sec,
	60 sec, 2 min, 5 min, 10 min, 15 min, 30 min 60 min

EXTERNAL METER DIMENSIONS:
Size measurements: 3.9 in. x 6.6 in. x 1.5 in.
                                       (10 cm x 16.8 cm x 3.8 cm)

VANE HEAD DIMENSIONS:
Standard Head Diameter (100 mm):   4.0 in.
Optional Head Diameter (50 mm):   2.0 in.

METER WEIGHT DIMENSIONS:
Weight (with batteries):   1.5 lbs (0.68 kg)

METER DISPLAY DIMENSIONS:
Display: 4-digit LCD, 0.6 in. (15 mm) digit height

POWER REQUIREMENTS:
Four AA-size batteries (included) or
AC adapter (optional)

SERIAL INTERFACE:
Type: RS-232
Baud Rate: Selectable: 1200, 2400, 4800, 9600, 19,200

[1]   Actual range is a function of velocity range and duct size.

Appendix B

DIP Switch Settings

To access the DIP switches, remove the batteries from the battery compartment. On the inside of the battery compartment, there is a window with eight DIP switches. The table below shows the functions for each switch.

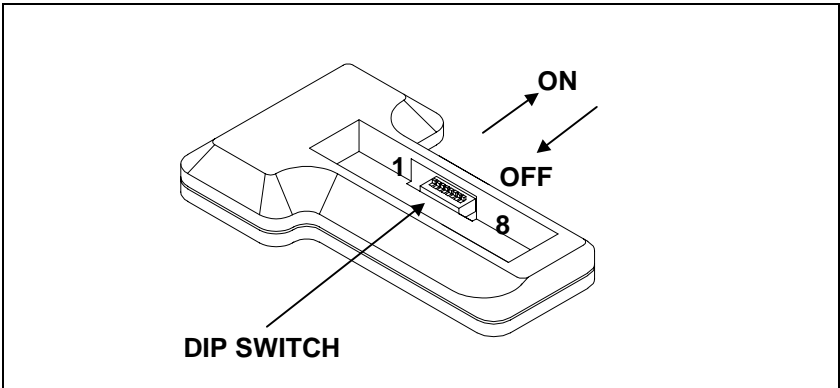> **Caution:** Make certain that power is turned off before changing DIP switch settings.

Figure B-1: DIP Switch Location

Table B-1: DIP Switch Settings

Switch	Function	Settings
1	Temperature	OFF: Degrees Fahrenheit (°F) ON: Degrees Celsius (°C)
2	Auto off	OFF: enabled ON: disabled
3, 4	Velocity/Flowrate	3 ON, 4 OFF: m/s, l/s (#1 is ON)* 3 ON, 4 ON: m/s m^3/min 3 OFF, 4 OFF: ft/min, ft^3/min 3 OFF, 4 ON: m/s, m^3/hr (#1 is ON)*
5	User calibration adjustment (temp.)	OFF: Normal ON: User calibration adjust mode (switch #7 must be ON)
6	User Calibration Adjustment (velocity)	OFF: Normal ON: User calibration adjust mode (switch #7 must be ON)
7	User Calibration Adjustment	OFF: Normal ON: User calibration adjust mode

Switch	Function	Settings
8	Data Format $(1_x 23)$	OFF: Decimals and MM:DD:YY ON: Commas and DD:MM:YY

The ON position is away from the batteries and OFF is towards the batteries. Always leave DIP switch #5, 6 and 7 in the OFF position (except when adjusting calibration, see Appendix C).

*To select flowrate to display l/s or m^3/hr, DIP switch #1 must be ON.

APPENDIX C

Field Calibration Adjustments

The VELOCICALC Rotating Vane Anemometer has field adjustment capability. This allows you to override the velocity and/or temperature calibrations of the instrument if necessary. These adjustments will be saved in the instrument's calibration EEPROM. This change is permanent until it is changed again. By changing these corrections back to 0.00, you can return to the original factory calibration settings.

These field adjustments are intended to make minor changes in calibration to match your calibration standards. These are simple linear multipliers or offset adjustments, and they do **not** permit multiple-point calibrations. This field adjustment is **not** intended as a complete calibration capability. For complete, multiple-point calibration and certification, the instrument must be returned to the factory.

Note: *It is recommended to make note of adjustment factors and offsets for tests which were performed with altered calibration so they can be identified later when test data is retrieved or printed from instrument's memory.*

Field Calibration Procedure

1. Velocity Calibration Adjust
Turn the instrument power off and remove batteries to gain access to DIP switches. Set DIP switches 7 and 6 to ON position. Replace batteries and turn the instrument on. The instrument is in the Velocity Calibration Adjust Mode and will display 0.0 (or any previously set value), units of measure and % sign. Use the ▲ or ▼ keys to set the display to a desired value and press ENTER key. The instrument will display dOnE. At this point turn the instrument off, remove batteries and reset DIP switches 6 and 7 to OFF position. Replace batteries and the battery cover. Turn the instrument on. During the start-up routine the display will show briefly the selected adjustment factor (the instrument does not display the adjustment factor if it is set to 0.0). This adjustment factor multiplies all velocity readings by the same percentage value. The adjustment range is ±12%.

To return to the original factory calibration settings, set the percentage adjustment factor to 0.0% following the steps described above.

2. Temperature Calibration Adjust

The temperature calibration adjustment adds or subtracts a constant number of degrees Fahrenheit (°F) or degrees Celsius (°C) from the displayed reading. The adjustment range is ±10.0°F or ±5.5°C. Temperature calibration adjustments can be done in either the °F or °C scale depending on temperature scale selected.

Turn the instrument power off and remove batteries to gain access to DIP switches. Set DIP switches 7 and 5 to ON position. Replace batteries and turn the instrument on. The instrument is in the Temperature Calibration Adjust Mode and will display 0.0 (or any previously set value) and the temperature scale (°F or °C). Using ▲ or ▼ keys set the display to a desired offset value and press ENTER key. The instrument will display dOnE. At this point turn the instrument off, remove batteries and reset DIP switches 5 and 7 to OFF position. Replace batteries and the battery cover. Turn the instrument on. During the start-up routine the display will show briefly the newly selected temperature adjustment offset (the instrument does not display the offset value if it is set to 0.0).

To return to the original factory calibration settings, set the offset adjustment factor to 0.0 following the steps described above.