Model 8702
DP-CALC®
Micromanometer

Operation and Service Manual

1980260, Revision F
July 2006

TSI®

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b. 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.
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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 (001 651) 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. If any are missing or damaged, notify TSI or your local distributor immediately.

Table 1. List of Components

Qty	Item Description	Part No.
1	Model 8702 DP-CALC	8702
1	Carrying Case	1319115
4	AA Alkaline batteries	1208013
1	AC Adapter (Optional)	
	115 V, NEMA-5	2613033
	230 V, European, CEE 7/16	2613078
	230 V, Great Britian	800169
	240 V, Australian	2613105
1	Operation and Service Manual	1980260

Parts Identification

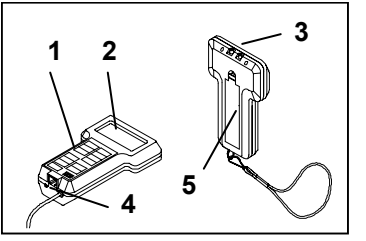

Figure 1-1: DP-CALC

1. Keypad
2. Display
3. Pressure Measurement Ports
4. RS-232 Printer Port
5. Battery Access Cover

Chapter 2

Setting-Up

Supplying Power to the DP-CALC

The DP-CALC 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 DP-CALC 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 at 20 °C is 40 hours for alkaline batteries, or 15 for NiCd batteries.

Using the Optional AC Adapter

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

Selecting the Display Units

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

Table 2. Choices of Measurement Units

Pressure	Velocity
in. H_2O	ft/min
mm Hg	m/s
Pa	

If you wish to change the display units on your DP-CALC, see Appendix B, DIP Switch Settings.

Connecting the Optional Portable Printer

To connect the printer to the DP-CALC, 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 DP-CALC. Always turn the DP-CALC on BEFORE the printer. If the printer prints question marks (??????), asterisks (******), or random characters, reset it by turning it off and then on again. If necessary, refer to the *Portable Printer Manual.*

Chapter 3

Operation

Overview

The model 8702 DP-CALC measures differential pressure and calculates velocity. It can store individual readings and compute the average of these readings.

Keypad Functions

When pressing the keys on the front panel, the DP-CALC will beep to confirm the function. If you press a key and the DP-CALC does not beep, then the DP-CALC does not allow that function during the selected mode. The beep function can be disabled by changing of the internal DIP switch (refer to Appendix B).

ON/OFF Key

Use the ON/OFF key to turn the DP-CALC on and off. When the instrument is first turned on it goes through a preprogrammed power-up sequence that includes an internal self-check. First, all displayable items will appear for a three seconds. If a problem is detected, the display will light "SErr" for one second and then "CAL" to indicate that it should be returned for servicing and calibration.

After completing the internal self-check, the approximate percentage of battery life remaining will be displayed. This feature is accurate for alkaline batteries only. When the battery voltage becomes very low, "LO" appears on the display.

Pressure Key

Press the PRESSURE key to display differential pressure measurements (the DP-CALC will automatically start in pressure mode). The pressure will be displayed in inches H_2O, mm Hg, or Pa depending on the setting of DIP switches #3 and #4 (refer to Appendix B).

To measure pressure, tubing must be connected to the pressure ports on the top back of the unit. Connect the other ends of the tubing to the measurement device or pressure source, with the more positive pressure connected to the port marked "+" and the more negative pressure connected to the port marked "-". When the pressure source is connected the same way the pressure ports are marked, the meter will display a positive number.

Zeroing Pressure

If the zero reading of pressure has drifted, the pressure function can be easily re-zeroed. To reset the zero, first make sure that both pressure ports are exposed to ambient pressure.

Press and hold the PRESSURE key down for at least three seconds. The DP-CALC will beep and the display will show "0 in. H_2O"(or whatever units have been selected). When the pressure key is released the pressure will be re-zeroed.

Velocity Key

Press the VELOCITY key to display velocity. The velocity will be displayed in ft/min or m/s depending on the setting of DIP switch #1 (refer to Appendix B).

Time Constant Key

Momentarily press and release the TIME CONSTANT key to view the current time-constant. To change the time-constant, press and hold the key. The available time-constant choices (1, 5, 10, 15 and 20 seconds) will sequence on the display. When the desired value is displayed immediately release the key. The DP-CALC will always reset the time constant to 1 second when turned off.

The time-constant is actually an averaging period. The DP-CALC display is always 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."

Using the Clear, Sample, and Average Functions

The DP-CALC has the ability to compute the average of a number of individual stored readings. Every time the SAMPLE key is pressed, the currently displayed reading is added to a storage buffer. When the AVERAGE key is pressed, the readings in the storage buffer are divided by the number of stored readings to get the average. The CLEAR key is used to clear out the storage buffer in order to start taking a new average. When the DP-CALC is turned off, all values stored in the buffers are cleared.

Sample Key

Press the SAMPLE key to store the currently displayed measurement. The display will show "SAMPLE" for one time constant and a number indicating the number of stored data

points that are in memory for about one second, and then the recorded value will be displayed.

The individual stored values can not be recalled. Only the average of the stored values can be recalled. There are two different store buffers: one for pressure and one for velocity. You can switch between measuring modes and store data without affecting data stored in the buffer for the other measuring mode. You can later return to any mode and add additional values to the already stored values.

Average Key

Press the AVERAGE key to display the average of the stored values of the current operating mode. The message "AVERAGE" will appear along with a number (between 1 and 255) indicating how many stored values are in the memory buffer. The average value is then displayed for one second. To keep displaying the average value, press and hold the AVERAGE key. You can store additional values after the AVERAGE key has been pressed. The next time the AVERAGE key is pressed, the additional values are averaged with those already accumulated.

Clear Key

Press the CLEAR key to erase the stored value in the buffer of the currently active function. Pushing the CLEAR key in one function will not affect the value stored in the other buffer. For example, pushing CLEAR while measuring velocity will not affect the values stored for pressure.

Arrow Keys

The arrow keys are used for field calibration only. For details on field calibration contact TSI for a copy of Application Note TI-112.

Printer Port

While pressing the SAMPLE, AVERAGE or CLEAR key the data is automatically transmitted to the printer port. If you have the Portable Printer connected, the readings will be printed.

Press the PRINT key to print the value shown on the display. To print out the averages of the stored pressures and velocities, press and hold the PRINT key until the display counts down to zero. Release the PRINT key while "0" is displayed to print.

Chapter 4

Maintenance

The DP-CALC requires very little maintenance to keep it performing well.

Recalibration

To maintain a high degree of accuracy in your measurements, we recommend that you return your DP-CALC to TSI for annual recalibration. For a reasonable fee, we will quickly recalibrate the unit and return it to you in "as new" working condition along with a Certificate of Calibration and NIST traceability. This "annual checkup" helps ensure that the DP-CALC is always in good working condition; 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 immerse the DP-CALC.

Storage

When storing the DP-CALC for more than a month, removing the batteries is recommended. This prevents damage due to battery leakage.

Chapter 5

Troubleshooting

Table 3 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the DP-CALC. If your symptom is not listed, or if none of the solutions solves your problem, please contact TSI.

Table 3. Troubleshooting the DP-CALC

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.
Display reads "CAL"	The DP-CALC has detected an internal fault	Return to factory for service.

Symptom	Possible Causes	Corrective Action
Display reads "LO"	Low battery charge	Replace or recharge batteries.
	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 "ERR"	You are trying to enter more than 255 readings	Read or record the average; clear the storage register and proceed.
Display says "OVER"	The pressure or velocity is too high	Use an alternate measurement method.

WARNING!
The pressure sensor is protected from damage for up to 7 psi (48 kPa or 360 mm Hg). At higher pressures it can burst!

Appendix A

Specifications

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

PRESSURE:

Range:	-5 to +15 in. H_2O (-1245 to 3735 Pa, -9.3 to 28.0 mm Hg)
Accuracy:	1% of reading ± 0.005 in. H_2O (±1 Pa, ±0.01 mm Hg)
Resolution:	0.001 in. H_2O (1 Pa, 0.01 mm Hg)

VELOCITY:

Range[1]:	250 to 15,500 ft/min (1.27 to 78.74 m/s)
Accuracy[2]:	1.5% of reading at 2,000 ft/min (1.5% of reading at 10.00 m/s)

INSTRUMENT TEMPERATURE RANGE:

Operating range:	32 to 158°F (0 to 70°C)
Storage range:	-40 to 185°F(-40 to 85°C)

AVERAGING CAPABILITY:

Range:	Up to 255 values each of pressure and velocity

TIME CONSTANT

Values:	1, 5, 10, 15, or 20 seconds

POWER REQUIREMENTS:

Batteries:	Four AA-size Alkaline or NiCd rechargeable
AC adapter:	7 VDC nominal, 300 mA
Approx. battery life:	40 hours (Alkaline), 15 hours (NiCd)

PHYSICAL:

External dimensions:	4.0 in x 6.6 in x 1.5 in (102 mm x 168 mm x 38 mm)
Weight (with batteries):	0.76 lb. (0.35 kg)
Display:	4-digit LCD, 0.6 in (15 mm) digit height

PRINTER INTERFACE:

Type:	Serial
BAUD rate:	1200

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

1 Pressure velocity measurements are not recommended below 1,000 ft/min (5.0 m/s) and are best suited to velocities over 2,000 ft/min (10.0 m/s).

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 on the following page shows the functions for each switch.

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

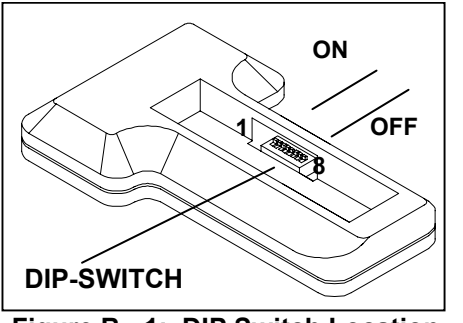

Figure B - 1: DIP Switch Location

Switch	Function	OFF	ON
1	Velocity	ft/min & ft^3/min	m/s
2	Reserved	Reserved	Reserved
3	Pressure	in. H_2O	Pa and mm Hg
4	Pressure*	Pa	mm Hg
5	Reserved	Reserved	Reserved
6	Calibration	Factory Calibration	User Calibration
7	Beep	Beep Disabled	Beep Enabled
8	Reserved	Reserved	Reserved

The ON position is away from the batteries and the OFF position is toward the batteries.

- To display pressure in Pa or mm Hg, DIP switch #3 must be in the ON position.

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