

FLOW CALIBRATORS

MODEL 4048/4148

USER'S GUIDE

P/N 6010051, REVISION A
JULY 2016



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	WARNING
	TSI flow calibrators employ a heated platinum sensor. They should not be used in the presence of flammable or explosive gases or mixtures.

	Caution
	TSI flow calibrators are not medical devices under FDA 510k and in no situation should they be utilized for human respiration measurements.

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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) or (001 651) 490-2811 (International) or visit www.tsi.com.

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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 parts are missing or damaged, notify TSI immediately.

Table 1-1. List of Components (see figures 1-1 and 1-2)

Qty	Item Description	Part/ Model
1	Flow Calibrator	4048 or 4148
1	Filter Model 4048: 22 mm ISO taper Model 4148: 63 mm HEPA filter with 0.25 in. (6.35 mm) fittings	1602292 1602317
1	Tubing Kit (<i>Model 4048 only</i>) 1 in. OD x $\frac{3}{4}$ in. ID – 24 in. (25.4 mm OD x 19.05 mm ID – 60.96 cm) $\frac{3}{4}$ in. x $\frac{1}{2}$ in. ID – 24 in. and 6 in. (19.05 mm x 12.70 mm ID – 60.96 cm and 15.24 cm) $\frac{3}{8}$ in. OD x $\frac{1}{4}$ in. ID – 6 in. (9.53 mm OD x 6.35 mm ID – 15.24 cm) $\frac{5}{16}$ in. OD x $\frac{3}{16}$ in. ID – 24 in. (7.92 mm OD x 4.75 mm ID – 60.96 cm)	3001185 3929420 3929408 3001248
1	Battery Pack	4199
1	Soft Carrying Case	1319289
1	Model 4048/4148 User's Guide	6010051
1	AC Adapter 115 V, North America, ungrounded 100–240 V, NEMA 5-15 plug, grounded 100–240 V, Europlug, CEE 7/16, grounded 100–240 V, Great Britain, grounded, fused 100–240 V, Australia/NZ	2613033 8918-NA 8918-EC 8918-GB 8918-AT



Figure 1-1. Model 4048 Components

- | | |
|-----------------------------|--|
| 1. Flow Calibrator | 5. High-Efficiency Inlet Filter |
| 2. Soft-Sided Carrying Case | 6. Tubing Kit (see Table 1-1 for diameters and length) |
| 3. Universal Power Supply | 7. Mounting Lugs (not shown) |
| 4. User's Guide | 8. 6 AA-size Batteries (not shown) |



Figure 1-2. Model 4148 Components

- | | |
|-----------------------------|------------------------------------|
| 1. Flow Calibrator | 5. High-Efficiency Inlet Filter |
| 2. Soft-Sided Carrying Case | 6. Mounting Lugs (not shown) |
| 3. Universal Power Supply | 7. 6 AA-size Batteries (not shown) |
| 4. User's Guide | |

Chapter 2

Setting-Up

Assembly Instructions for the Flow Calibrators

The calibrator can be quickly attached to the battery pack by screwing the mounting lugs into the threaded holes in the base of the calibrator. The lugs should then be placed over the receiving holes in the top of the battery pack and snapped gently into place. Insert the connector from the battery pack to the receptacle in the back of the calibrator. The calibrator is now ready to use.

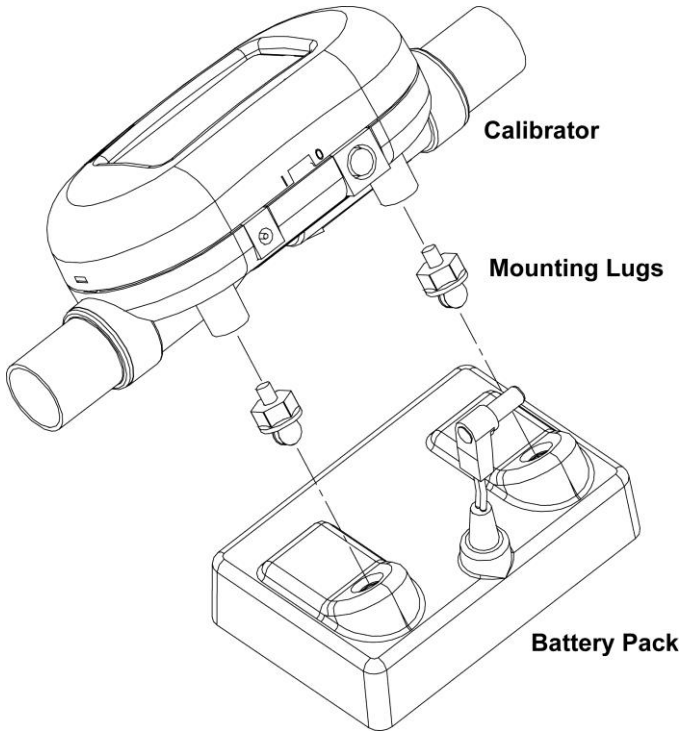


Figure 2-1. Flow Calibrator Assembly

Supplying Power

The calibrator can be powered in one of two ways: through the power jack using the supplied 4199 battery pack or using the AC adapter. The DC power input connector is shown below along with the power requirements.

Power Supply: 7.5 VDC \pm 1.5 V, 300 mA maximum



Connecting Filter and Flow Tubes

The Model 4048/4148 has a thermal sensor exposed to the air flow that must be protected from foreign matter and particles. TSI supplies a filter that should be connected to the inlet of the calibrator; however, any filter will work as long as it has a minimum efficiency of 99.9%.



Caution

Always use a filter on the inlet of the calibrator. Failure to filter the air flow may change the calibration and/or permanently damage the sensor.

Note: Flow direction is identified by the large arrow printed on the bottom side of the calibrator and on the bottom of the battery pack.

Attach the filter to the inlet of the calibrator using supplied tubing and/or adapters. Connecting a tube to the outlet of the calibrator will create back pressure. See [Appendix A](#) for calibrator accuracy specifications when operating at various pressures. In general, minimize back pressure on the calibrator by using shorter lengths of tubing to maintain highest level of accuracy.



Figure 2-2. Typical Setup Configurations

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Chapter 3

Operation

Overview

The Model 4048/4148 Flow Calibrator measures volumetric flow rate inside the flow tube. All measurements made by the Models 4048/4148 are NIST traceable.

ON/OFF Switch

Slide the switch to the ON position. The LCD displays volumetric flow in units of liters per minute (L/min).

Flow Rate Measurement

Flow rate data will be displayed on the Model 4048/4148 through the LCD.

Volumetric flow is displayed in units of liters per minute (L/min).

Setting Flow Rates and Calibrating Instruments

The Model 4048/4148 Flow Calibrator may be used to measure or set flow rates on Condensation Particle Counters or other instruments which draw an active flow sample. Be sure to follow all instrument manufacturer's flow setting and calibration procedures.

1. Start up the Model 4048/4148 Flow Calibrator and let it warm up (1 minute for Model 4048 or 10 minutes for Model 4148) prior to setting any flow rates or conducting any calibrations.
2. Connect the outlet of the Model 4048/4148 Flow Calibrator to the inlet of the active sampling instrument.

NOTE: Please contact TSI Technical Support at 800-874-2811 for instructions on connecting Model 4048 to TSI Filter Testers.

3. Follow the instrument manufacturer's flow setting and/or calibration procedures. The volumetric flow in units of liters per minute (L/min) will be continuously displayed on the LCD of the calibrator.

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Chapter 4

Maintenance

Flow Sensor

Periodically inspect the flow sensor by looking into the outlet of the calibrator. Remove dust, particles and fibers from the sensor with clean, dry compressed air. The flow sensor may break if touched.

Never run liquids through the calibrator and never touch the sensor with a brush. Dust or other deposits on the flow sensor will degrade the Model 4048/4148's flow accuracy.

	Caution
	The calibrator must be switched off for cleaning. Only use clean, dry, compressed air when attempting to remove contamination from the sensor.

Re-certification

To maintain a high degree of confidence in the measurements made by the Model 4048/4148, TSI recommends that the instrument be returned to TSI every 12 months for re-certification. The calibrator will be recalibrated and returned with a certificate of calibration to US National Institute of Standards Technology (NIST) traceable standards.

Cases

If the instrument case or storage case needs cleaning, wipe it off with a soft cloth dipped in isopropyl alcohol or mild detergent. **Never** submerge the calibrator or allow liquids to enter the flow tube.

Storage

When storing the calibrator, always cover the ends of flow tubes with the caps provided to prevent dust or other foreign matter from entering the tube.

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Chapter 5

Troubleshooting

Table 3 lists the symptoms, possible causes, and recommended solutions for common problems encountered with Model 4048/4148 Flow Calibrators. If the symptom is not listed, or if none of the solutions solve the problem, please contact TSI Technical Support at 1-800-874-2811 or 651-490-2811.

Table 3. Troubleshooting

Symptom	Possible Causes	Corrective Action
No display.	Unit not switched on.	Switch on the unit.
	No power to instrument.	Check power connection.
Temperature reads high at low or zero flows.	Temperature sensor is being heated from the flow sensor.	The temperature value will track the actual air temperature once the flow rate through the calibrator exceeds 1 L/min.
Flow readings fluctuate greatly.	The flow is fluctuating.	Improve inlet conditions.
Display shows flows over-range with no flow passing through flow tube.	The sensor may be damaged or broken.	Return calibrator to TSI for service.

Technical Contacts

- If you have any difficulty installing the Model 4048/4148, or if you have technical or application questions about this instrument, contact an applications engineer at TSI Incorporated, (651) 490-2811 or contact answers@tsi.com.
- If the Model 4048/4148 fails, or if you are returning it for service, visit our website at <http://rma.tsi.com> or contact TSI at:

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Appendix A

Specifications

	Specifications*
Flow Measurement Measurement Range Accuracy Air	Model 4048: 0 to 200 L/min Model 4148: 0 to 20 L/min Model 4048: $\pm 2\%$ of reading or 0.05 std. L/min, whichever is greater Model 4148: $\pm 2\%$ of reading or 0.005 std. L/min, whichever is greater at standard conditions (21.1°C and 101.3 kPa) See notes 1 through 5 below.
Instrument Temp. Range Operation, Ambient Storage, Ambient	0 to 50°C -20 to 60°C
Physical Dimensions External Dimensions Tube Adapters (Inlet & Outlet) Weight Flow Body Material	Model 4048: 7.2 in. x 2.5 in. x 2.1 in. (18.3 cm x 6.4 cm x 5.3 cm) Model 4148: 5 in. x 2 in. x 1.25 in. (12.7 cm x 5 cm x 3.2 cm) Model 4048: 0.5 inch O.D. straight Model 4148: 0.25 inch O.D. straight Model 4048: 1.2 lbs (0.5 kg) Model 4148: 1.7 lbs (0.8 kg) Polycarbonate
Warm-up Time	Model 4048 – 1 minute Model 4148 – 10 minutes
Power	Battery pack 7.5 VDC \pm 1.5 V, 300 mA maximum

Notes:

- 1** Accuracy stated at standard conditions of 21.1°C and 101.3 kPa.
- 2** Accuracy stated with air temperature and flow body temperature within $\pm 10^\circ\text{C}$ of one another.
- 3** Accuracy stated measuring dry air (less than 10% R.H.).
- 4** Includes $\pm 0.5\%$ of reading repeatability.

*Specifications subject to change without notice.

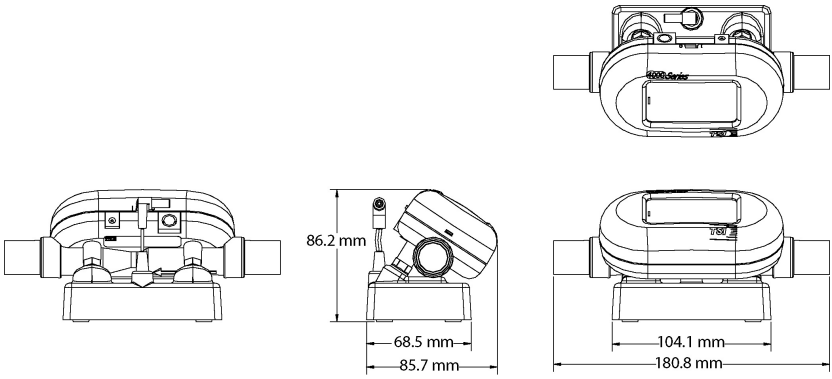


Figure A-1. Model 4048 Dimensions

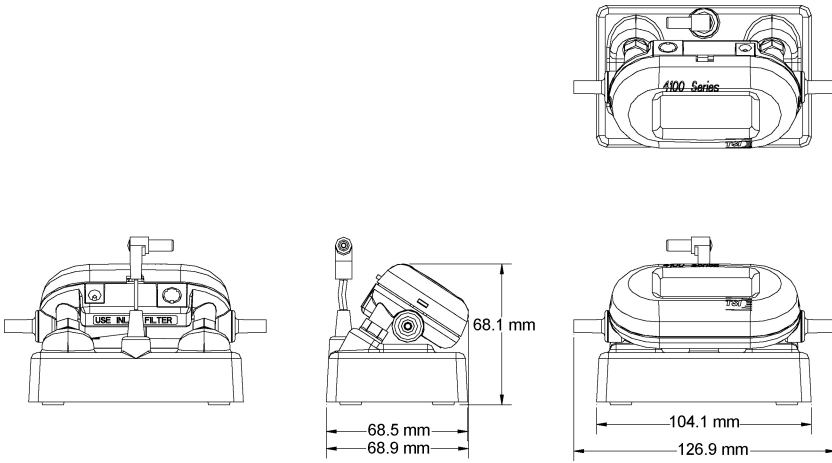


Figure A-2. Model 4148 Dimensions



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