

Pressure Gauge Operation Manual For Model Solo



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Important equipment-related safeguards

Read and save these instructions

When using electrical appliances, basic safety precautions should always be followed. If Retrotec equipment is used in a manner that does not follow the information provided in this manual, safety to the operator and equipment performance may be impaired.

The risk of fire, electric shock, and injury to persons may result during cleaning of the gauge. To avoid these risks, unplug or disconnect the gauge from the electrical power supply and turn the gauge off before cleaning. Clean only by wiping with a soft dry cloth. There are no user serviceable parts on the gauge.

To protect against the risk of fire, electric shock, and injury to persons during gauge operation:

Do not operate any gauge with a damaged electrical cord. Discard gauge or return to an authorized service facility for examination and/or repair.

Do not run cord under carpeting. Do not cover cord with throw rugs, runners, or similar coverings. Do not route cord under furniture or appliances. Arrange cord away from traffic and where it will not be tripped over.

Do not place this equipment or power cord in water or other liquid.

Use only the included power plug to charge and/or operate the gauge.

Turn the unit off and unplug the charger (if in use) from electrical outlet before moving.

For use under indoor conditions only, where there is no exposure to water or dusty substances or explosive materials or flammable materials.

Do not use equipment for other than its intended use.

Equipment is intended for diagnostic testing and must be operated by a qualified operator.

Failure to follow these instructions carefully may result in bodily injury, damage to property and/or equipment failure. Failing to operate equipment as intended may void warranty and compliance with CE mark and other listings.

1. Introducing the Retrotec Solo Digital Gauge

Experience precision and adaptability with the Solo Single Channel Manometer. This cutting-edge digital gauge is accurate and versatile, all while maintaining affordability.

Solo boasts exceptional accuracy, providing measurements with precision up to 1/100th of a Pa. It utilizes the same digital sensor and filtering technology as our DM32X and features auto-zeroing technology for hassle-free operation.

Adjust Time Averaging directly from the gauge itself, eliminating the need for complicated app pairing.

A Responsive Display Screen quickly changes directions when maneuvering the gauge from Landscape into Portrait mode.

Charging is a breeze with two hour fast charging via USB-C.

In most cases, an app isn't required when this tool is used. Therefore, wireless connectivity is not included, only high-precision readings. This keeps the cost down and makes it the perfect tool to introduce HVAC contractors to home performance.

For Energy Auditors, Solo pairs effortlessly with a running blower door. Connect the gauge to a Mini Probe or Pressure Pan & efficiently detect / pinpoint external air leaks, enhancing your energy audit capabilities.

Easily switch between units of measurement: change from measuring "Pascals" to "Inches of Water Column" when assessing static pressure, making it a valuable tool for HVAC diagnostics.

Upgrade your measurement precision with the Solo Single Channel Manometer: the essential tool for professionals seeking the highest standards of accuracy and flexibility.

New Features Include

- Auto - zeroing technology for hassle free operation.
- Adjust Time Averaging directly on the gauge. Eliminates the need to pair with an app.
- Responsive Display Screen changes directions when maneuvering from Landscape into Portrait mode.
- 19 hour continuous battery life. 2-hour fast charge via USB-C.
- Magnetized clip for convenient HVAC placement.
- Test at multiple units of measurement.
- Unmatched accuracy in the most demanding environments.
- Most affordable high precision Micro Manometer on the market.



Solo digital gauge has been turned on and is ready for action.

2. Gauge overview

The front of the gauge has a round screen which rotates to allow easy viewing regardless of gauge orientation. There are two buttons below the screen, an On/Off **[Power]** button on the left side, and the **[Menu]** button on the right side.

The bottom of the gauge has two color-coded pressure tube ports, and a Control output port.

The top of the gauge has USB-C port for battery charging and gauge-computer communications.

The screen will display the gauge pressure differential reading in multiple units, as well as the current battery charge level.

2.1 Make connections to the gauge

Physical connections to a computer or power adapter are on the top of the gauge.

Pressure tube ports on the bottom of the gauge are color-coded to distinguish where pressure tubes are connected. Retrotec has a specially designed pressure tube port that grips pressure tubes well, but releases them without tearing after long-term use. This exclusive connector is designed by Retrotec to make contact with both the tube internally and externally with a shallow taper.



Connect tubes on the bottom ports

Table 1: Physical connections from gauge to fan are on top of gauge

	gauge port	connection
Center	Speed control port	Not used currently.
Right	Blue pressure port: "input A (+)"	Input port, used if you want to reference a pressure in a duct or other space.
Left	Red pressure port: "ref A (-)"	Reference port is the reference side of the sensor. Typically left open to where you are standing with the gauge.

Pressure tubes should be clean and not stretched in order to make a proper connection. If a pressure tube is damaged, simply slice a short piece of tube off the end to ensure a clean fit. Tubing can crack in cold weather, but can be heated in hot water before being handled. Be careful to dry all water from the tubing prior to connecting since water in the tube is a major source of measurement error.

Connections on the top of the gauge provide a USB-C charging input, which can also connect the gauge directly to a PC.



Connect charger

2.2 Charge the battery in the gauge

The gauge is charged at the factory, but you can plug it in to ensure a full charge before each test. Connect the USB cable to the AC power adapter or other USB port to charge the gauge battery.

With USB fast charging, a full charge will be completed in about two hours. A fully charged gauge will last for approximately 19 hours without a recharge. Plugging the gauge into power will also turn it on. While charging the unit cannot be powered off.

2.3 Power the gauge on and off

To power the gauge on, press and release the left side **[Power]** button. To power it off, press and hold the **[Power]** button for 5 seconds.

Plugging the gauge into power will also turn it on. While charging the unit cannot be powered off.

Please note that the clicking noise you hear periodically is normal, this is the AutoZero feature. See 2.6 for further detail.



2.4 Read Results

The home screen is the main display that shows up when powered on. It will display the default pressure unit and reading. By default, the unit should be Pascal (pa).

Rotating the gauge will cause the displayed text to also rotate, to allow easy viewing.

- The reading will be negative if there is a higher pressure on the “-” (red) pressure port
- The reading will be positive if there is a higher pressure on the “+” (blue) pressure port

2.5 Use keys to control gauge operation

2.5.1 Pressure Units

The display always shows the pressure difference between the blue pressure port “input A” and the red pressure port “ref A”.

The pressure units can be displayed in units of Pa, In H2O, PSF, mBarr, or PSI. To change the simply press on the right side [**Menu**] button. It will cycle to a new unit at each short press.

2.5.2 Settings Menu

To enter the settings menu, long press the [**Menu**] button for two seconds or until the screen changes to the setting screen.

This menu will allow you to set the Time Averaging Setting, Gauge Timeout, and Default Pressure unit displayed. Simply short press the [**Menu**] button to cycle between settings options.

To edit an option, long press the [**Menu**] button. The cursor will move to the right, allowing you to again short press the [**Menu**] button to toggle between the available setting options. When satisfied with your result, long press the [**Menu**] button to save your selection.

To exit the settings menu, use the [**Menu**] button and short press to highlight “exit”. Long press [**Menu**] to select “exit”.

2.5.3 Time Averaging Setting

The “Time Avg” value determines what period the readings are averaged over. This is a moving window that will always show the average of the readings within the selected time period.

Time Averaging periods of 1s, 5s, 10s, 30s can be selected.

Tip: Wait for twice the Time Averaging period to elapse before taking a reading. Taking a reading too quickly can lead to recording incorrect results.

2.5.4 Gauge Timeout Setting

The “Gauge Timeout” value determines after what time the gauge powers off. As of 6/25/24, the setting value is fixed but will be editable in future firmware updates.

2.5.5 Default Unit Setting

The “Default Unit” value determines which pressure unit is shown on startup. As of 6/25/24, the setting value is fixed but will be editable in future firmware updates.

2.6 Gauge compensates for sensor drift with Auto Zero

Over time, the pressure readings can start to drift away slowly from the true pressure value. The longer the gauge remains on, the larger this error could become. The “Auto Zero” is an automatic feature on the gauge that will automatically correct these errors at regular intervals. This is the clicking noise you hear from the gauge.

2.7 Reset gauge

Press and hold the [**Power**] button until the gauge powers off. If the gauge will not restart, try connecting it to power to ensure the batteries are not depleted.

3. Verify your gauge accuracy between factory calibrations

Recommended calibration interval for the Solo is 5 years. The question is when did the gauge go out of calibration? Last week or last year?

What is needed is a quick field check to check your gauge regularly and before any important test. Moreover, gauge calibration, where errors are typically a few %, are not as frequent a cause of problems when compared to blocked, leaking or pinched tubes that happen more often and can yield errors of 10 to 90%. Sending your gauge in for calibration does not address those problems, but regularly carrying out this field check will.

Because the Solo is a single channel manometer, there is no standard field check option like you'd find on other Retrotec dual channel manometers. Instead, you will require a second gauge to compare readings to, this known as a cross-gauge check.

Here is how to check the tubes to be sure they are not blocked, pinched or leaking:

Connect one tube between Channel on the Solo and another gauge's Channel A using any tubing that you know is not blocked or pinched. The measured pressure on each gauge is in the same units, and match within 2% both that tube and the gauge ports used are OK.

To perform a cross port check

1. Set both gauges and channels to measure pressure in Pascals (Pa).
2. Connect the Input port of the Solo to the Input port of another gauge's Channel A using any tubing that you know is not blocked or pinched. The measured pressure on both gauges should be within 2% of each other.
3. Disconnect the tubing, and then connect the Reference ports of both gauges using the same piece of tubing. The measured pressure on both channels should be within 2% of each other again. The reading will be inverse value from the last reading.



Gauge field check configuration: Cross gauge check

When performing a gauge calibration with two gauges, if one gauge is known to be calibrated accurately, it can be used as a reference for the second gauge. In that case, the measured pressure on the tested gauge should be within 2% of the measured pressure on the calibrated gauge.

4. What to do if you have trouble with the gauge

Knowing the common causes of erroneous readings will increase your confidence in the results. It is often assumed the gauge must be regularly calibrated to get accurate readings, but this thought obscures the fact that most gauge problems do not result from incorrect calibrations. The following list provides approximate percent probabilities based on our experience for certain types of gauge problems. Notice that gauge calibration is one of the smallest, and even that can usually be eliminated by following the gauge check procedures in section 3 of this manual.

Table 2: Causes of common problems with gauges

Problem caused by	Error frequency	Error range	Comments
Tubing is crimped shut	5%	25 to 90%	Usually noticeable because gauge does not move, but the blockage may be partial, which could cause an erroneous result.
Water in tubing	10%	75-90%	Possible only in wet areas. If gauges sent in to be repaired or calibrated, the water evaporates and the user never discovers the cause.
Improper use of reference tube for pressurization	5%	25%	Pressurization is seldom used, but if the technician is improperly trained, they may not set the equipment up properly for this test.
Time averaging set too high or too low	25%	5 to 10%	If the gauge is fluctuating too much it will be difficult to read. If the time averaging is too high, the pressure may have changed but that change is not reflected in the reading.
Wind	25%	10%	These errors can be eliminated by long-term averaging or by multiple pressure pickups.
Out of calibration	5%	1-50%	Gauges can go out of calibration in a week or may take 10 years. It is impossible to tell unless the readings seem unreasonable.
Out of calibration with regular checks	0.5%	1-2%	Regular gauge checks can eliminate most of the calibration problems, by identifying large errors immediately, and before erroneous test results can be taken. It is unlikely that errors in excess of 2% would occur if the gauges checked before each use.

Proper training can eliminate almost all the above errors.

4.1 Moving tubes might cause fluctuating pressure readings

If the measured value is fluctuating back and forth, in a way that doesn't correspond with any of the current testing conditions, it's possible that the pressure tube is moving. A moving tube can cause a significant error.

Outdoor pressure tubes need to be sheltered from the wind. In spite of standards that require tubes be attached to walls, this strategy does not work particularly well for limiting wind related fluctuations. What does seem to work is taking the outdoor pressure pickup tube 25 feet away from the building, and setting it in a flat area. Cover the end of the tube with a heavy flat sheet of half-inch plywood or place the tube into a box, for example, to reduce wind fluctuations.

It's never a good idea to leave a tube hanging in the air, either between two points, or out of a window. The pressure tube should sit securely on the ground and be kept still as much as possible. The effects of a moving tube are very similar to the effects of wind on a tube, which is described below.

To see the effect of a moving tube

1. Connect a pressure tube (10 feet or longer) to the blue port of the gauge.

2. Set Time Averaging to one second.
3. Wave the end of the tube through the air. Notice the fluctuations.
4. Hold the end of the tube still, and swing the middle of the tube. Notice the fluctuations.

4.2 Check if large, fixed errors are caused by pinched tubes

A pinched pressure tube can create a very high reading on the gauge, which is erroneous. In other cases, a pinched tube will prevent the pressure measurement from reaching the gauge at all. In cases where tubes get stepped on, they are seldom sealed off completely, but will still cause the gauge readings to jump around.



Errors in pressure reading from a pinched tube.

If the gauge begins to display an unusually high or unexplained pressure, check the tubing to ensure that it has not been compressed in any way.

- Be careful that no one steps on the tubes, or creates a kink in any of the lines while performing a test. If this happens, wait a few seconds for the effects to subside before taking any readings from the gauge.
- Use the metal tube provided with the gauge to pass tubes through tight spaces (such as under closed doors) to prevent pinching.

4.3 Check if large, fixed errors are caused by water in the tube

Water can also cause significant errors if a drop is pulled into the pressure tubes. It is very easy to get a water drop inside the end of a tube. Simply drag it over a shallow puddle of water, and a drop of water will get pulled into the tube by capillary action.

Water can cause either a positive or a negative pressure, based on which way the drop of water is pulling. If a drop of water is facing downward, it pulls out of the tube, creating a negative pressure. Point the tube upward, and the water drop falls back into the tube, creating a positive pressure.

To fix this problem:

- Whip the end of the tube around to remove excess water.

- If this doesn't work (in extreme cases), water can be blown out from the other end. Be sure to not have the gauge connected when blowing water from the tube.

4.4 Check if large fixed errors are caused by sun heating the tubes

If air inside the exterior heats up due to the Sun shining on it and if the tube end is above or below the point where it leaves the enclosure, a stack pressure will build up inside the tube that will create a steady pressure that may increase as the tube gets hotter.

4.5 Check if wind is causing fluctuating pressure

Wind blowing across the tip of a tube can cause significant error, even if the tube is not moving. High fluctuations of bias (baseline) pressures on the gauge (greater than 2 Pa) are a good indication that wind may be a large source of error.

4.5.1. Use Time Averaging feature to reduce the effects of wind

Variable readings caused by changing input pressures can be rectified by increasing the Time Averaging. Quadrupling the Time Averaging typically halves the pressure variation due to the effects of wind. The suggestion is to wait for at least double the time average period before a reading is taken.

4.5.2. Let Time Averaging take effect before making readings

While the Time Averaging feature is useful to help minimize the effects of wind, it can also cause problems if not used correctly. Whenever Time Averaging is on, it is important to wait at least twice the time averaging period before taking a reading.

If a reading is taken from the gauge before the full time averaging period has passed, then the displayed pressure may not be accurate.

Glossary

Term	Definition
air leakage	Pertains to how leaky an enclosure may be; The movement/flow of air through the building Envelope, which is driven by either or both positive (infiltration) or negative (exfiltration) pressure differences or test pressures across the building Envelope.
CFM	Cubic feet per minute, the units of volumetric flow
Control port	Control port on a Retrotec fan, labeled "Control"
Depressurization	The process of creating a negative pressure in the enclosure by blowing air out of it. Air is drawn in from outside to replace it, showing up as "geysers" when checked with an air current tester.
digital gauge	A gauge with an electronic pressure sensor and digital display that is capable of reading in tenths of a Pascal.
Door Fan	A test instrument that fits into an open doorway in order to pressurize or depressurize an enclosure. It is a calibrated fan capable of measuring air-flow, and is used while mounting it into a doorway. A Door Fan is often called a "Blower Door" or an "Infiltrometer™".
Door Panel	A solid or flexible panel used to temporarily seal off a door way while allowing for the installation of a fan for the purpose of blowing air into the building in order to measure the air leakage rate or to provide a pressure to assist in the location of air leaks.
enclosure	The surface bounding a volume, which is connected to outdoors directly. For example an apartment whose only access to outdoors was through a doorway that leads directly outdoors. Or, a building with a series of apartments or offices whose only access to the outdoors is through a common hallway then the enclosure would be the volume that bounds all of the apartments or offices.
Envelope	The surfaces composed of floor and walls and floors that separate the test volume from volume surrounding the test volume. Also see "enclosure"
HVAC	Heating Ventilating and Air conditioning system.
Leakage	A general term used to describe holes or the area of holes in or around an enclosure.
Leakage Area	This is the same as "Leakage" but expressed in sq ft or sq m.
micromanometer	A digital gauge that is capable of reading in tenths of a Pascal.
outdoors	Outside the building in the area around the building.
Pascal (Pa)	A very small metric unit of pressure. There are 249 Pascals in 1 inch Water Column (the pressure required to push water 1 inch up in a tube of a water filled manometer). One Pascal = 0.000145 psi.
Pressurization	The process of creating a positive pressure in the house by blowing air into the enclosure. Air is pushed out through all the leaks, causing the smoke to move away from the operator when checked with an air current tester.
reading	A set of simultaneous Room Pressure and Fan Pressure readings. Sometimes referred to as a data set or test point because it is plotted as one point on a graph.
reference pressure	The pressure at which the ELA or ACH is calculated, usually at the test pressure.
room	See "Enclosure".
room pressure	The pressure difference created by the Door Fan between inside and outside of the enclosure. This pressure is commonly measured by Channel A on the gauge.
Speed Control port	Output Control port on the gauge, to control fan speed, labeled "Speed Control"

Term	Definition
time averaging	Refers to the digital gauge display that must have an adjustable averaging from 1 second to 1 minute for the purpose of averaging fluctuating pressure signals. Averaging can be block averages that will update for the length of the average or rolling (moving) averages that will update continuously by displaying the average over the past time period.