

Pressure calibration with the Fluke 718

New design protects on-board pump from fluid damage

Application Note

Protect your tools

Pressure calibration typically involves a pneumatic calibration pump and a pressure calibration tool or reference gauge. The pump applies pressure to both the device under test (DUT) and the calibration tool (see figure 1).

The trick is that before you can apply pressure with a pneumatic hand pump, you absolutely must first drain all condensate and oil from the lines. Why? If there's oil or water trapped in the line when the pump is connected, that fluid can be pulled back into the pump when the pressure is released. That can either cause costly damage to the pump, or at the very least force you to disassemble and clean the pump before re-use.

For this reason, the updated 718 Fluke Pressure Calibrator now contains an innovative new pump design that is easily cleaned in the field and inhibits damage from process fluids.

Pneumatic pressure calibrators with integrated test pumps

Instead of the pump-plus-calibrator method described above, many technicians now use a handheld pneumatic pressure calibrator that includes an onboard pneumatic pump, marrying two devices into one handy integrated tool. While the integrated pump is more convenient and easier to use, it is doubly important to make sure process fluids are properly drained before making a connection. Because the pump itself normally needs to be removed from the calibrator before cleaning, rebuilding or replacement can be performed,

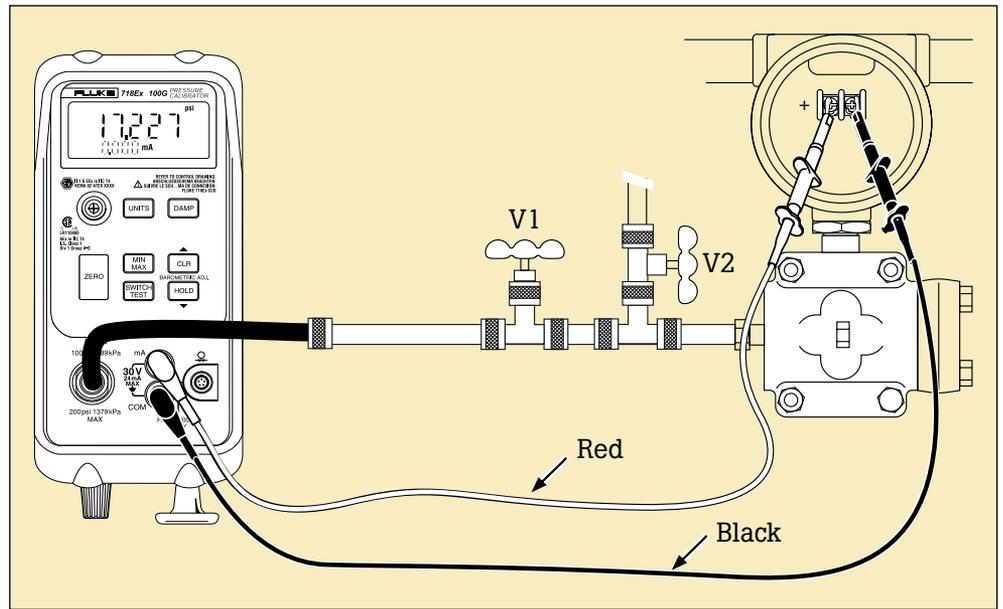


Figure 1. To drain process fluids, close V2 and open V1 before connecting the 718 Calibrator.

the complexity and cost of repair of a pump fouled by process media is normally higher than a stand alone pump.

Using the updated 718 Calibrator pump

The new Fluke 718 is a uniquely protected pneumatic pressure calibrator and pump. The new pump design uses protective check valves that allow air to pass through the pump for calibration but inhibits fluids from

entering the pump and causing damage. These two check valves allow the bi-directional flow of air into or out of the 718.

Even after draining the process fluid from the calibration port of the device under test, minute amounts of process fluids may often still be lurking behind. In the event these fluids enter the 718 pump cavities, the new pump design enables quick cleaning and maintenance, even in the field.

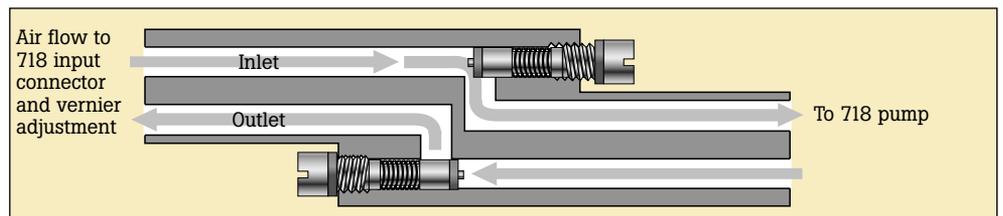


Figure 2. The Fluke 718 is designed to protect the hand pump and simplify maintenance.

Once the fluid is trapped in the 718 pump, cleaning out the fluid is about as difficult as changing a fuse. The valves, located on the back of the 718 calibrator are easily removed with a slotted screwdriver. Clean the valve and valve body with a cotton swab, re-install the valves and go back to work. With traditional pumps, once fouled, complete disassembly, cleaning and rebuild or replacement were required.

Fluke 718 Series specifications

Measuring less than 9 inches long and weighing just over two pounds, the rugged 718 is easy to carry into the field. The 718 is offered in 1, 30, 100, and 300 psi models. Media compatibility is dry air and non-corrosive gasses. A built-in pump generates pressure or vacuum. Min, Max, Hold and error% calculation functions are available. The 718 can also measure pressure using any of the 29 Fluke 700Pxx Pressure Modules, to cover applications up to 10,000 psi.

Model	Pressure				mA		
	Range	Resolution	Accuracy	Max non-destructive pressure	Range	Resolution	Accuracy
1G	-1 to 1 psi	0.0001 psi	0.05 % FS	5 psi	0-24 mA	0.001 mA	0.015 % + 2 counts
30G	-12 to 30 psi	0.001 psi	0.05 % FS	60 psi	0-24 mA	0.001 mA	0.015 % + 2 counts
100G	-12 to 100 psi	0.01 psi	0.05 % FS	200 psi	0-24 mA	0.001 mA	0.015 % + 2 counts
300G	-12 to 300 psi	0.01 psi	0.05 % FS	375 psi	0-24 mA	0.001 mA	0.015 % + 2 counts

Specifications are based on a one year calibration cycle and apply for ambient temperature from +18 °C to +28 °C. "Counts" are the number of increments or decrements of the least significant digit.



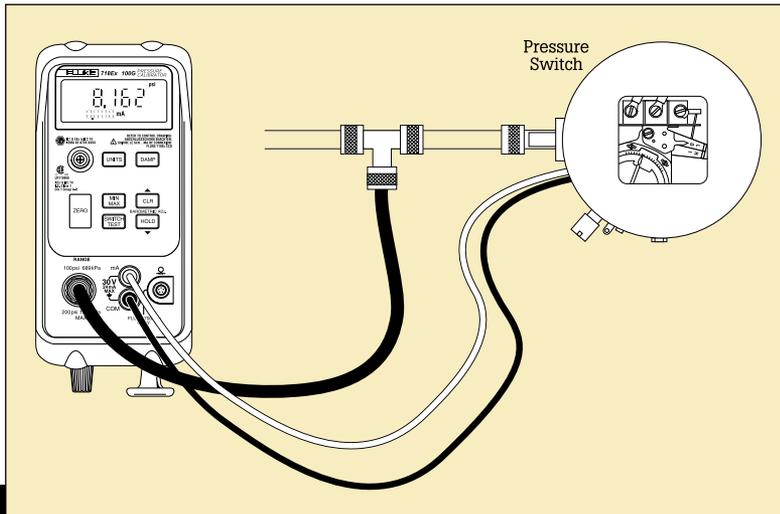
Cleaning the fluid trap in the Fluke-718 Calibrator is quick, easy and only requires a slotted screwdriver and cotton swab.

Pump valve assembly cleaning instructions

1. Using a small screwdriver, remove the two valve retention caps located in the oval shaped opening on the underside of the Calibrator.
2. After the caps have been removed, gently remove the spring and o-ring assembly.
3. Set aside the valve assemblies in a safe area and clean out the valve body using a cotton swab soaked in IPA (isopropyl alcohol).
4. Repeat this process several times using a new cotton swab each time until there is no remaining sign of residue.
5. Pump the unit several times and check again for residue.
6. Clean the o-ring assembly and o-ring on the retention caps with IPA and inspect the o-rings closely for any cuts, nicks, or wear. Replace if needed.
7. Inspect the springs for wear or loss of tension. They should be approximately 8.6 mm long in the relaxed state. If they are shorter than this, they may not allow the o-ring to seat properly. Replace if needed.
8. Once all parts have been cleaned and inspected, reinstall the o-ring and spring assemblies into the valve body.
9. Reinstall the retention caps and gently tighten the cap.
10. Seal the output of the Calibrator and pump up the unit to at least 50 % its rated pressure.
11. Release the pressure and repeat several times to ensure that the o-rings seat properly.

The Calibrator is now ready for use.

How to use the 718 to calibrate a pressure switch



Pressure switch calibration

Verify the setpoint and deadband of pressure switches using the 718 Pressure Calibrators.

1. Depressurize and isolate the pressure switch from the process.
2. Plumb the 718 and make connections as per the illustration.
3. Turn on the 718 and open the vent valve. Press the Zero button to clear the zero offset. Close the vent.
4. Press the Switch Test button to enter the switch test mode.
5. Apply pressure slowly with the hand pump until you approach the setpoint. Using the fine adjust vernier adjust the pressure until the switch opens and OPEN is displayed on the 718.
6. Release the pressure slowly using the fine adjust vernier until RCL is displayed.
7. Press the Switch Test button once to read the pressure values for switch opening and again to see the pressure at switch closing.
8. Press and hold the Switch Test button for 3 seconds to clear the test results and start over.
9. Adjust the pressure switch setpoint until the switch contacts open and close at the desired pressure.

Precautions for safety, procedures and safety equipment

It's important to follow specific isolation procedures before isolating a device from a process. In a live process, it may be necessary to set the process control system to manual override. In the case of processes that contains hazardous elements, the fluid or process material drained from the system may need to be carefully handled or captured to avoid a dangerous incident. Once drained, the area from which the fluid was drained may need to be flushed.

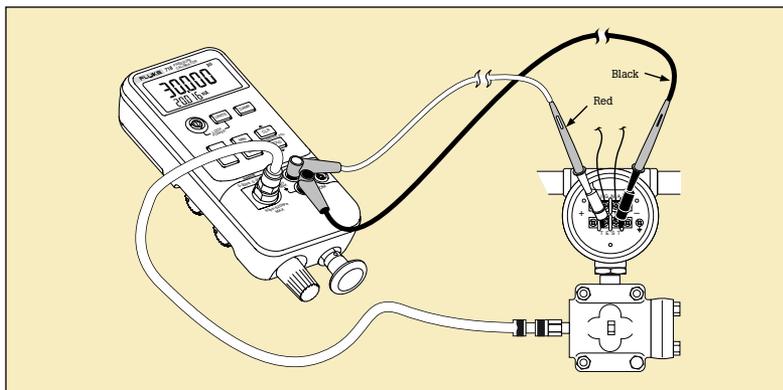
Isolation valves—do you have them installed?

In Figure 1, valves V1 and V2 serve to isolate the DUT from a process for routine maintenance. Ideally, these valves are installed when the instrument is originally commissioned. They may also be installed after the fact, during device maintenance (at a much higher cost).

Not all instruments are commissioned with maintenance in mind. Contractors may decide to cut the cost of the adding isolation valves if not included in the design specification. In Figure 1, closing valve V2 and opening valve V1, the process fluids can be drained, isolating the device under test from the process. Once the fluids have drained completely, the device is ready to have the calibration pump connected.

Typical pressure applications

How to calibrate a P/I transmitter



With a built-in hand pump, precision measurement of both pressure and current, and a 24 volt loop supply, the Fluke 718 Pressure Calibrator is a complete, self-contained tool for the calibration of P/I transmitters. To calibrate a 3-15 psi / 4-20 mA transmitter using a Fluke 718 30G Pressure Calibrator:

1. Depressurize the transmitter, and then plumb the transmitter to the 1/8 inch NPT pressure port of the 718. Connect the test leads per the figure above.
2. Turn the calibrator on. (If you need to power the transmitter, hold down the UNITS key while turning on the calibrator.)
3. Press the UNITS key until PSI shows in the display.
4. With the 718's bleed valve open to atmosphere, press the ZERO key. Close the bleed valve. Set the pressure / vacuum valve to +, for positive pressure.
5. Use the hand pump to apply roughly 3 psi to the transmitter. Partial pump strokes will apply small increments of pressure. Use the fine-adjust knob to get reasonably close to 3.00 psi.
6. Press the HOLD key, and record the psi and mA readings. Press the HOLD key to resume reading.
7. Calculate and record the error, using: $\text{Error} = \left(\left[\frac{i-4}{16} \right] - \left[\frac{P-3}{12} \right] \right) * 100$ where Error is in % of span, i is your measured current in mA and P is your measured pressure in psi.
8. Repeat steps 5 through 7 at mid-range, around 9 psi, to check linearity at mid-span.
9. Repeat steps 5 through 7, now at 15 psi, for a check at 100 % of span.

If your calculated errors are within tolerance, the transmitter has passed your As-found test, and you are done. If necessary, perform your zero and span adjustments, then repeat steps 5 through 9 for an As-left test. Depressurize the line, and disconnect the 718.

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