

# Pressure Calibration

## Application Note



Fluke 719 Electric Pressure Calibrator

Pressure instrumentation is found in virtually every process plant. Periodic calibration of these pressure, level, and flow instruments is required to keep plants operating efficiently and safely. Fluke provides a broad range of pressure calibration tools to help you quickly and reliably calibrate your pressure instrumentation.

These pressure calibrators accurately measure pressure by using:

- Internal sensors, or
- External Pressure Modules

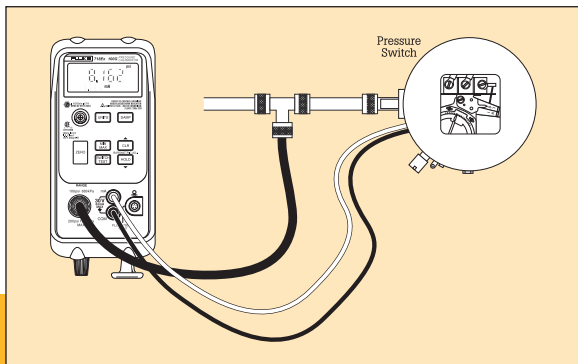
A pressure source may be provided by:

- A self-contained internal pressure pump, or
- An external source such as an accessory pump or a pressure bottle / regulator.

A summary of the pressure calibration capabilities of Fluke Process Tools is shown below.

	717 Pressure Calibrator	718 Pressure Calibrator	719 Electric Pressure Calibrator	725 and 726 Multifunction Process Calibrators	753 Documenting Process Calibrator	754 Documenting Process Calibrator	5520A Calibrator
<b>Pressure Calibration with Fluke Calibrators</b>							
<b>Function</b>							
Measure Pressure to 10,000 psi / 700 bar with internal sensor	•						
Measure Pressure to 300 psi / 20 bar with internal sensor		•					
Measure Pressure to 10,000 psi / 700 bar with Fluke 700Pxx Pressure Modules	•	•	•	•	•	•	•
Pressure switch test	•	•	•	•	•	•	
Source pressure with accessory pumps	•	•	•	•	•	•	•
Source pressure with built-in pump		•	•				
Measure mA	•	•	•	•	•	•	
Source			•	•	•	•	•
Loop power supply	•	•		•	•	•	
Multifunction source and measure				•	•	•	
Electronic data capture					•	•	
Communication to PC				•	•	•	
Integrated HART communication						•	

## How to use the 718 to calibrate a pressure switch



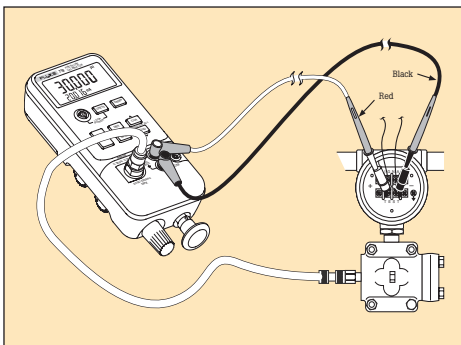
### Pressure switch calibration

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.

## 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:  $\text{Error} = \left[ \frac{(i-4)}{16} \right] - \left[ \frac{(P-3)}{12} \right] * 100$  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.

### Innovative new pump design

- Pumps can be easily contaminated with process fluids
  - Often requires repair
- New design reduces repairs and cost of ownership

Has two clean out ports!

- Remove fluids, clean with a cotton swab
- Easy access, can be serviced in the field



**Intrinsic Safe Version Available**

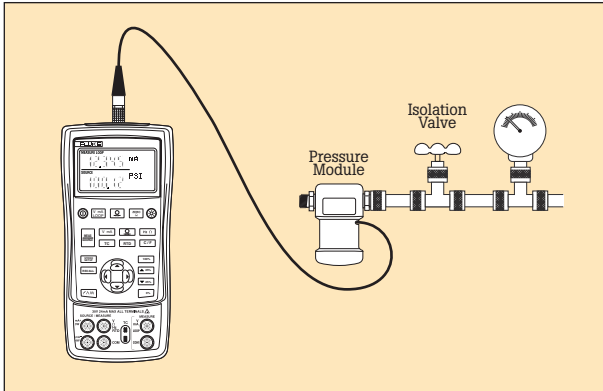
Measuring less than nine inches in length and weighing just over two pounds, the rugged 718 is easy to carry into the field. The 718 is offered in 1 psi, 30 psi, 100 psi and 300 psi models. Media compatibility is dry air and non-corrosive gasses. A built-in pump generates pressure or vacuum. Min, Max, Hold and error % calculator 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. The 718 comes complete with protective holster, test leads, test clips, Users Manual, and two 9-volt batteries (installed).

Functional Pressure Specifications				
Model	Range	Resolution	Over Pressure	Functions
<b>717 1G</b>	-1 PSI to 1 PSI, (-68.9 mbar to 68.9 mbar, -6.89 to 6.89 kPa)	0.001 psi, 0.001 mbar	Over Pressure 5xFS	Zero, Min, Max, Hold, Damp
<b>717 15G</b>	-12 PSI to 15 PSI, (-850 mbar to 1.03 bar, -85 to 103 kPa)	0.001 psi, 0.1 mbar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 30G</b>	-12 PSI to 30 PSI, (-850 mbar to 2 bar, -85 to 206.84 kPa)	0.001 psi, 0.1 mbar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 100G</b>	-12 PSI to 100 PSI, (-850 mbar to 6.895 bar, -85 to 689.48 kPa)	0.01 psi, 1 mbar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 300G</b>	-12 PSI to 300 PSI, (-850 mbar to 20.68 bar, -85 to 2068.4 kPa)	0.01 psi, 1 mbar	Over Pressure 375 PSI, 25 bar	Zero, Min, Max, Hold, Damp
<b>717 500G</b>	0 PSI to 500 PSI, (0 mbar to 34.47 bar, 0 to 3447.4 kPa )	0.01 psi, 1 mbar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 1000G</b>	0 PSI to 1000 PSI, (0 mbar to 68.95 bar, 0 to 6894.8 kPa )	0.1 psi, 1 mbar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 1500G</b>	0 PSI to 1500 PSI, (0 mbar to 103.42 bar, 0 to 10342 kPa)	0.1 psi, 0.01 bar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 3000G</b>	0 PSI to 3000 PSI, (0 mbar to 206.84 bar, 0 to 20684 kPa)	0.1 psi, 0.01 bar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 5000G</b>	0 PSI to 5000 PSI, (0 mbar to 344.74 bar, 0 to 34474 kPa)	0.1 psi, 0.01 bar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp
<b>717 10000G</b>	0 PSI to 10,000 PSI, (0 mbar to 700 bar, 0 to 70,000 kPa)	0.1 psi, 0.01 bar	Over Pressure 2xFS	Zero, Min, Max, Hold, Damp

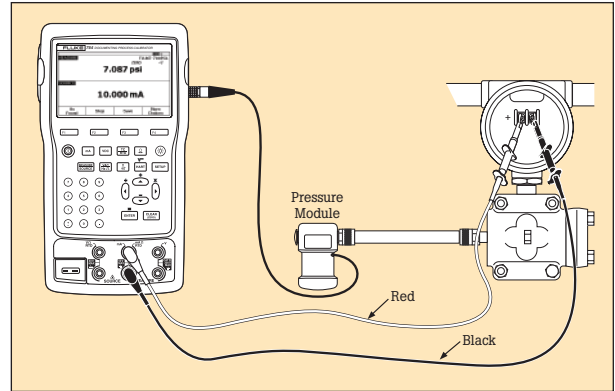
718, 719 Models	Pressure				mA		
	Range	Resolution	Accuracy	Max non-destructive pressure	Range	Resolution	Accuracy
718-1G	-1 psi to 1 psi (-68.9 mbar to 68.8 mbar)	.001 psi (0.001 mbar)	0.05 % FS	5X full scale	0-24 mA Measure	0.001 mA	0.015 % + 2 counts
718-30G	-12 psi to 30 psi (-850 mbar to 2 bar)	0.001 psi (0.01 mbar)	0.05 % FS	2X full scale	0-24 mA Measure	0.001 mA	0.015 % + 2 counts
718-100G	-12 psi to 100 psi (-850 mbar to 7 bar)	0.01 psi (0.01 mbar)	0.05 % FS	2X full scale	0-24 mA Measure	0.001 mA	0.015 % + 2 counts
718-300G	-12 to 300 psi (-850 mbar to 20 bar)	0.01 psi (1 mbar)	0.05 % FS	375 psi or 25 bar	0-24 mA Measure	0.001 mA	0.015 % + 2 counts
719-30G	-12 psi to 30 psi (-850 mbar to 2 bar)	0.001 psi (0.01 mbar)	0.025 % FS	2X full scale	0-24 mA Measure Source	0.001 mA	0.015 % + 2 counts
719-100G	-12 psi to 100 psi (-850 mbar to 7 bar)	0.01 psi (0.01 mbar)	0.025 % FS	2X full scale	0-24 mA Measure Source	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. 719 accuracy specification is for 6 months.



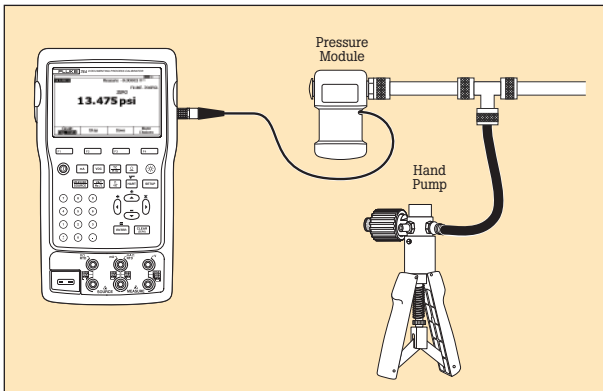
### Measuring pressure

To measure pressure, the appropriate pressure module for the pressure to be tested is attached to the calibrator. The measured pressure can be displayed in a variety of engineering units. A Fluke 725 or 726 multifunction process calibrator could be used here.



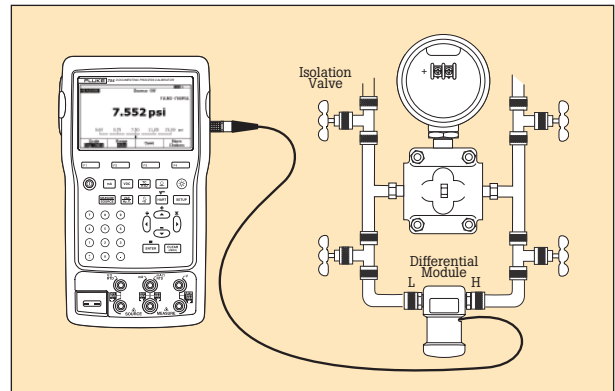
### I to P device calibration

The I to P device is used to convert 4 mA to 20 mA electrical analog loop control to pneumatic analog loop control, generally 3 psi to 15 psi. Here, a typical configuration for using a pressure module with a 750 Series DPC is demonstrated.



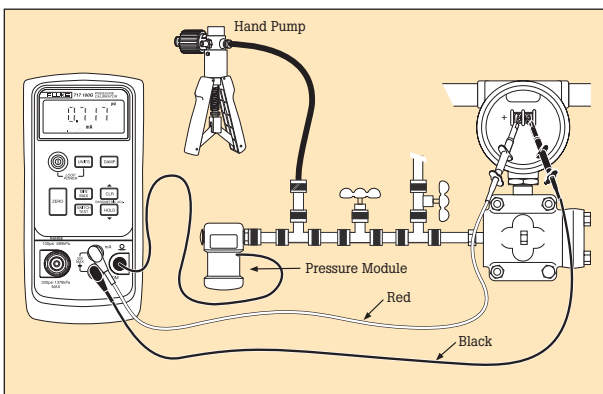
### Sourcing pressure

To calibrate an instrument with pressure input, pressure from an external source (such as a hand-held pump) is applied. Prompts on the 750 Series Calibrator display indicate when to increase or decrease the input pressure, and when the specified test points are achieved. Here, a Fluke 754 Documenting Process Calibrator is shown.



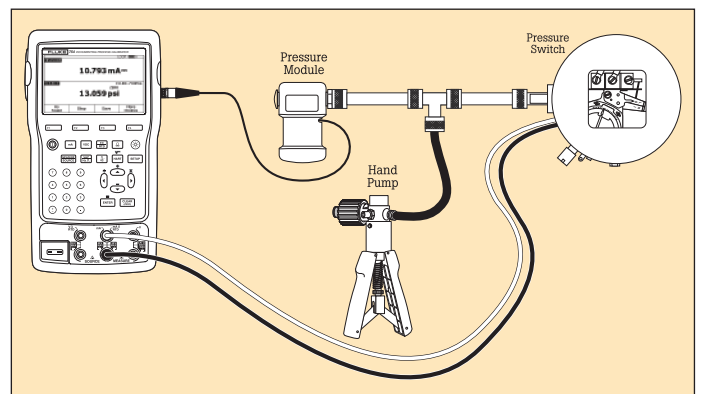
### Differential measurements

Differential pressure modules are useful in a wide variety of applications, e.g., measuring the fluid level in a tank or calibrating a differential pressure transmitter. A Fluke 754 Documenting Process Calibrator is shown.



### P to I device calibration

The P to I device is used to convert pneumatic analog loop control signals of 3 psi to 15 psi to electrical loop control signals of 4 mA to 20 mA. Here, a Fluke 717 Pressure Calibrator is used.



### Pressure switch calibration

Verify and document the setpoint and deadband of pressure switches using the 750 Series Documenting Process Calibrators.

## Pressure Modules



### A complete family of pressure modules

A family of 29 pressure modules covers the most common pressure calibrations from 0–1" H<sub>2</sub>O (0–.25 kPa) to 0–10,000 psi (0–70,000 kPa).

Gage pressure modules have one pressure fitting and measure the process pressure with respect to atmospheric pressure. Differential pressure modules have two pressure fittings and measure the difference between the applied pressure on the high fitting versus the low fitting. Each module is clearly labeled for range, overpressure specification, and media compatibility. A metric adapter is included with all but the P29 through P31 high pressure modules.

### Quick and easy measurements

Fluke 700 Series pressure modules are easy to operate. To measure pressure, the technician plumbs the pressure module to a pressure source, and connects the pressure module cable to the calibrator. Pressure is applied, measured by the pressure module, and displayed digitally on the calibrator. At the touch of a button, the pressure may be displayed in up to 11 different engineering units. When used with the 750 Series Documenting Process Calibrators, pressure readings can be date/time stamped and stored electronically for later retrieval. This saves time, eliminates errors, and supports compliance with quality standards and regulations.

### Pressure module performance

Fluke 700 Series pressure modules are highly accurate, with total specifications that apply from 0 % to 100 % of full span and from 0 °C to 50 °C (32 °F to 122 °F)—a feature that sets them apart from other pressure calibrators. Many ranges have total uncertainties of 0.05 % of full scale and reference uncertainties of 0.025 % of scale (see Table, page 5).

This performance is possible through the innovative application of mathematics and microprocessor power. Fluke pressure modules have silicon piezoresistor sensors which consist of a resistive bridge fabricated in a silicon diaphragm. Pressure applied to the diaphragm causes a change in the balance of the bridge which is proportional to the applied pressure. The bridge balance change is not linear and is very sensitive to temperature. However, since these effects are quite stable with time and through repetitive changes of condition, the sensors can be very accurate in measuring pressure provided they are carefully characterized.

During manufacture, Fluke pressure modules are characterized by reading temperature and pressure at more than 100 points. A least-squares regression is used to calculate the coefficients of a polynomial expression for pressure. The coefficients, unique to that pressure module, are stored in the module's memory.

Each module has its own microprocessor, allowing it to run the measurement circuitry and to communicate digitally with a calibrator. When connected to the calibrator, the modules coefficients are uploaded from the pressure module to the calibrator. Then, as pressure measurements are made, raw sensor values for pressure and temperature are digitally loaded to the calibrator, where the raw sensor values and coefficients are manipulated to derive and display the pressure reading.

This innovative technique provides several benefits:

1. Digital communication eliminates errors due to poor connections and electrical interference.
2. The modules are inherently temperature-compensated from 0 °C to 50 °C (32 °F to 122 °F).
3. The modules are fully interchangeable because all measurements are completed in the pressure module itself and then communicated to the calibrator in digitized form. Modules are calibrated independently of the calibrator, and can be used with any 700 Series calibrator. Each module has its own serial number to facilitate traceability.

### Sensor protection in isolated modules

Many of these modules (see Table) incorporate a stainless steel diaphragm to isolate the sensor. With these modules, any medium that is compatible with stainless steel can be used on the high side of the module.

### Rugged construction

A urethane overmolding protects against shock if a module is accidentally dropped and also seals against dirt, dust, and moisture. Pressure connections are 1/4" NPT. A BSP/ISO adapter is also provided on all but the P29, P30 and P31.

### Convenient setup

A one-meter cable between the pressure module and calibrator reduces the length of connecting tubing to the pressure source. The remote pressure head also provides an extra margin of safety and convenience by removing the calibrator and operator from the pressure source.

# Pressure Performance

## Summary calibrator specifications: (one year, 18 °C to 28 °C)

717	718 / 719	725 / 726	753	754	5520A	Function	Range	Resolution	Accuracy	Notes
●						Measure Pressure <sup>1</sup> (internal sensor)	1 psi to 10000 psi <i>see table</i>	0.0001 psi to 0.01 psi <i>see table</i>	0.05 % full scale	Gasses/liquids <sup>3</sup> (non corrosive) Zero, Min, Max, Hold, Damp
	●					Measure Pressure <sup>1</sup> (internal sensor)	1 psi to 300 psi <i>see table</i> 100 psi (719)	0.0001 psi to 0.01 psi <i>see table</i>	0.05 % full scale (718) 0.025 % full scale (719)	Gasses (non corrosive) Zero, Min, Max, Hold, Damp
●	●	●	●	●	●	Measure Pressure <sup>1</sup> (with Pressure Modules) Over pressure <i>per pressure module specs<sup>2</sup></i>	29 Pressure Modules, 1 in. H <sub>2</sub> O / 0.25 kPa to 10,000 psi / 69 MPa	To 0.0001 psi, per Pressure Module specs <sup>2</sup>	To 0.025 % of full span, per Pressure Module specs <sup>2</sup>	Media compatibility per Pressure Module specs <sup>2</sup> Zero, Min, Max, Hold, Damp
	●					Source pressure built-in pump	-12 psig to full scale	N/A	N/A	Pressure or vacuum, overpressure protected
●	●					Measure mA	0 to 24 mA	0.001 mA	0.05 % reading + 1 count	719 Source mA
		●				Measure mA	0 to 24 mA	0.001 mA	0.020 % reading + 2 count	
			●	●		Measure mA	0 to 24 mA	0.001 mA	0.010 % reading + 0.015 % of full scale	
●	●	●	●	●		Loop power supply	24 V dc	N/A	± 10 %	

<sup>1</sup> Supported Pressure Units on 701 and 702 include: psi, kPa, bar, inches Hg, mm Hg, inches H<sub>2</sub>O (@ 4 °C), and feet H<sub>2</sub>O (@4 °C) Supported Pressure Units on 753, and 754 include all of the above, plus kg/cm<sup>2</sup>, inches H<sub>2</sub>O (@ 60 °F), mm H<sub>2</sub>O (@ 4 °C). Supported Pressure Units on 717, 718, and 725 include psi, kPa, bar, mbar, kg/cm<sup>2</sup>, inches Hg, mm Hg, inches H<sub>2</sub>O (@ 4 °C), inches H<sub>2</sub>O (@ 20 °C), cm H<sub>2</sub>O (@ 4 °C), and cm H<sub>2</sub>O (@ 20 °C).

<sup>2</sup> For Pressure Module specifications, see table below.

<sup>3</sup> Gasses only for 718 and 719.

## Pressure module specifications (all specifications in % of full span. Specifications reflect a confidence interval of 95 %.)

Model	Range/ Resolution	Range (approx)/ Resolution	Reference uncertainty (23 ± 3 °C)	Stability (1 year)	Temperature (0 to 50 °C)	Total <sup>1</sup> uncertainty	High <sup>2</sup> side media	Low <sup>2</sup> side media	Fitting material	Max over- pressure (x nominal)
<b>Differential</b>										
FLUKE-700P00	1 in. H2O/0.001	0.25 kPa/0.0002	0.300	0.025	0.025	0.350	Dry	Dry	316 SS	30x
FLUKE-700P01*	10 in. H2O/0.01	2.5 kPa/0.002	0.200	0.050	0.050	0.300	Dry	Dry	316 SS	3x
FLUKE-700P02	1 psi/0.0001	6900 Pa/0.7	0.150	0.070	0.080	0.300	Dry	Dry	316 SS	3x
FLUKE-700P22	1 psi/0.0001	6900 Pa/0.7	0.100	0.020	0.030	0.150	316 SS	Dry	316 SS	3x
FLUKE-700P03	5 psi/0.0001	34 kPa/0.001	0.050	0.020	0.030	0.100	Dry	Dry	316 SS	3x
FLUKE-700P23	5 psi/0.0001	34 kPa/0.001	0.025	0.010	0.015	0.050	316 SS	Dry	316 SS	3x
FLUKE-700P04	15 psi/0.001	103 kPa/0.01	0.025	0.010	0.015	0.050	Dry	Dry	316 SS	3x
FLUKE-700P24*	15 psi/0.001	103 kPa/0.01	0.025	0.010	0.015	0.050	316 SS	Dry	316 SS	3x
<b>Gage</b>										
FLUKE-700P05*	30 psi/0.001	207 kPa/0.01	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700P06*	100 psi/0.01	690 kPa/0.07	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700P27*	300 psi / 0.01	2070 kPa / 0.1	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700P07	500 psi/0.01	3400 kPa/0.1	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700P08	1000 psi/0.1	6900 kPa/0.7	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700P09*	1500 psi/0.1	10 MPa/0.001	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	2x
<b>Absolute (not compatible with Fluke 701 or 702)</b>										
FLUKE-700PA3	5 psi/0.0001	34 kPa/0.001	0.050	0.010	0.010	0.070	316 SS	N/A	316 SS	3x
FLUKE-700PA4*	15 psi/0.001	103 kPa/0.01	0.050	0.010	0.010	0.070	316 SS	N/A	316 SS	3x
FLUKE-700PA5	30 psi/0.001	207 kPa/0.01	0.050	0.010	0.010	0.070	316 SS	N/A	316 SS	3x
FLUKE-700PA6	100 psi/0.01	690 kPa/0.07	0.050	0.010	0.010	0.070	316 SS	N/A	316 SS	3x
<b>Vacuum (not compatible with Fluke 701 or 702)</b>										
FLUKE-700PV3	-5 psi/0.0001	-34 kPa/0.001	0.040	0.015	0.015	0.070	316 SS	Dry	316 SS	3x
FLUKE-700PV4	-15 psi/0.001	-103 kPa/0.01	0.040	0.015	0.015	0.070	316 SS	Dry	316 SS	3x
<b>Dual</b>										
FLUKE-700PD2	± 1 psi/0.0001	±6900 Pa/0.7	0.150	0.025	0.025	0.200	316 SS	Dry	316 SS	3x
FLUKE-700PD3	±5 psi/0.0001	±34 kPa/0.001	0.040	0.015	0.015	0.070	316 SS	Dry	316 SS	3x
FLUKE-700PD4	± 15 psi/0.001	±103 kPa/0.01	0.025	0.010	0.015	0.050	316 SS	Dry	316 SS	3x
FLUKE-700PD5	-15/30 psi/0.001	-100/207 kPa/0.01	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700PD6	-15/100 psi/0.01	-100/690 kPa/0.07	0.025	0.010	0.015	0.050	316 SS	N/A	316 SS	3x
FLUKE-700PD7	-15/200 psi/0.01	-100/1380 kPa/0.1	0.040	0.015	0.015	0.070	316 SS	N/A	316 SS	3x
<b>High</b>										
FLUKE-700P29*	3000 psi/0.1	20.7 M Pa/0.001	0.050	0.010	0.020	0.080	C276	N/A	C276	2x
FLUKE-700P30	5000 psi/0.1	34 M Pa/0.001	0.050	0.010	0.020	0.080	C276	N/A	C276	2x
FLUKE-700P31	10000 psi/1	69 M Pa/0.007	0.050	0.010	0.020	0.080	C276	N/A	C276	1.5x

<sup>1</sup> Total uncertainty, one year for temperature range 0 °C to +50 °C. Total uncertainty, 1.0 % of full span for temperature range -10 °C to 0 °C. For P00 module only, compensated temperature range is 15 °C to 35 °C.

<sup>2</sup> "Dry" indicates dry air or non-corrosive gas as compatible media. "316 SS" indicates media compatible with Type 316 Stainless Steel. "C276" indicates media compatible with Hastelloy C276.

Use of pressure zero is required prior to measurement or source. Maximum overpressure specification includes common mode pressure. Modules are CE rated. Metric adapter(s): 1/4" NPT female to male BSP/ISO 1/4-19, tapered thread, included with all modules except P29, P30, and P31. Effective October 1996, all modules include a NIST traceable certificate and test data.

\*Intrinsically safe version available for use with the 718Ex and 725Ex.

## Pressure Accessories

### Fluke 700PTP-1 Pneumatic Test Pump



**For use with:** Fluke 700 Series Pressure Modules and the Fluke 710 Series Pressure Calibrators.

**Description:** The Fluke 700PTP-1 is a handheld pressure pump designed to generate either vacuum to -13 psi/-0.9 bar or pressure to 600 psi/40 bar.

The Fluke 700PTP-1 has two pressure ports:

- 3/8-BSP (ISO228) female parallel thread fitting for the reference gauge or pressure module
- 1/8-BSP (ISO228) female parallel thread fitting for the unit under test

**Application:** The Fluke 700PTP-1 features an integral pressure adjustment vernier which varies the pressurized volume by 2.0 cc over approximately eleven turns of the vernier knob. The pressure variation achievable with the vernier will depend on the nominal pressure and total pressurized volume, but with a minimum volume and maximum pressure, the vernier provided 600 ± 20 psi adjustment range. With a minimum volume and no pressure applied, the vernier can also be used to provide a 0 to 70" H<sub>2</sub>O range. Larger volumes will provide a smaller range of adjustment, but greater resolution. The length of the stroke can be adjusted to limit the maximum output pressure. Maximum output pressure is adjustable from 2.5 psi to 600 psi.

### Fluke 700HTP-1 Hydraulic Test Pump



**For use with:** Fluke 700 Series Pressure Modules and the Fluke 710 Series Pressure Calibrators.

**Description:** The Fluke 700HTP-1 is designed to generate pressures up to 10,000 psi/700 bar. The Fluke 700HTP-1 has two pressure ports:

- 3/8-BSP (ISO228) female parallel thread fitting for the reference gauge or pressure module
- 1/8-BSP (ISO228) female parallel thread fitting for the unit under test

**Note:** The user must provide a hose with appropriate end fittings from this port to the unit under test.

**Application:** This pump can provide up to 10,000 psi using distilled water or mineral-based hydraulic oil. The pump is operated by pumping several strokes to prime the system, then switching to high pressure mode when the resistance increases. An integral pressure adjustment vernier knob varies the pressurized volume by 0.6 cc. The pressure variation achievable with the vernier will depend on the nominal pressure and total pressurized volume, but with a minimum volume, the vernier provided 150-3,000 psi (at 150 psi nominal) and 3,000-10,000 psi (at 3,000 psi nominal) adjustment ranges. With a minimum volume and no pressure applied, the vernier can also be used to provide a 0 to 1.7 psi range. Larger volumes will provide a smaller range of adjustment, but greater resolution.

### Fluke 700LTP-1 Low-Pressure Test Pump



**Description:** The Fluke 700LTP-1 is a hand operated pressure pump designed to generate either vacuum to -12 psi/-0.85 bar or pressures to 100 psi/6.9 bar. The Fluke 700LTP-1 has two pressure ports with push fit connectors. These push fit connectors, one for the reference port for connection to a Fluke 700 series pressure module and one to connect to a unit under test, connect to the supplied test hoses. These test hoses are terminated with 1/4-BSP (ISO228) female parallel thread fittings that can be adapted using the fittings included.

**Application:** The Fluke 700LTP-1 is primarily intended for low pressure applications. It features a fine adjust vernier with .00145 / PSI resolution at low pressures. The pressure variation achievable with the vernier will depend on the nominal pressure and total pressurized volume, but with minimum volume and maximum pressure the vernier provides 30 psi ± 6 psi. The adjustable pressure relief valve features a slow-bleed capability that allows the user to slowly release pressure at a controlled rate to achieve a desired pressure.

**Fluke 700HTH-1 Hydraulic Test Hose**



**Description:** The Fluke 700HTH-1 hydraulic test hose is a 10,000 psi, 700 bar working pressure test hose. The hose uses self-sealing fittings with easy finger tight connections.

**Application:** The Fluke 700HTH-1 allows connections to a unit under test from a Fluke 700HTP-1 hydraulic test pump in use with the Fluke 700 series pressure modules. The 700HTH-1 is compatible with water and non-corrosive oil.

**Fluke 700PRV-1 Pressure Relief Valve Kit**

**For use with:** Fluke 700HTP-1 Hydraulic Test Pump.

**Description:** The Fluke 700PRV-1 consists of two relief valves (1360 and 5450 psi) to be used with the 700HTP-1 Hydraulic Test Pump. These relief valves will protect the Fluke pressure modules from damage due to over-pressurization. 1/4 BSP male parallel thread to fit Fluke 700HTP-1.

**Application:** Repeatability ± 10 % of nominal setting. Multi-turn adjustment screw to set preload on internal disc springs.

**Fluke 71X Hose Kit**

**For use with:** Fluke 718 and 719 Pressure Calibrators.

**Description:** The Fluke 71X hose kit includes (2) quick disconnect fittings to connect to the 718 or 719, three 1 meter translucent hoses and one BSP adapter.

**Fluke 700ILF In-line Filter**



**For use with:** Fluke 717, 718, and 719 Pressure Calibrators to help isolate the calibrator from liquid contamination.

**Description:** Use to isolate calibrator from contact with liquids. Input is 1/8" NPT female. Output is 1/8" NPT male.

**Application:** The Fluke 700ILF can be used to isolate the calibrator from incidental contact with fluids present in the gas medium being measured. Particularly useful with the 718/719 calibrator to help keep moisture or oils from contaminating the on-board pump. The 1/8" NPT male threaded output threads directly into the 717, 718, and 719 calibrators. Maximum pressure is 100 psi. Burst pressure is 375 psi. Maximum flow is 10 SCFM and filtration to 1 micron.

**Fluke 700 PCK Calibration Kit**

The Fluke 700PCK Pressure Calibration Kit makes it possible to calibrate your pressure modules at your facility using your own precision pressure standards. The kit consists of a power supply, an interface adapter, appropriate cables, and Fluke 700PC Pressure Module Calibration software. When installed on your PC, the Windows®-based software easily steps you through an as-found verification, a calibration adjustment, and an as-left verification. Calibration data is captured for import to your database. A 386 or better PC, running Windows 3.1, or later is required, along with a precision pressure standard with an uncertainty of less than 1/4 that of the pressure module being verified.

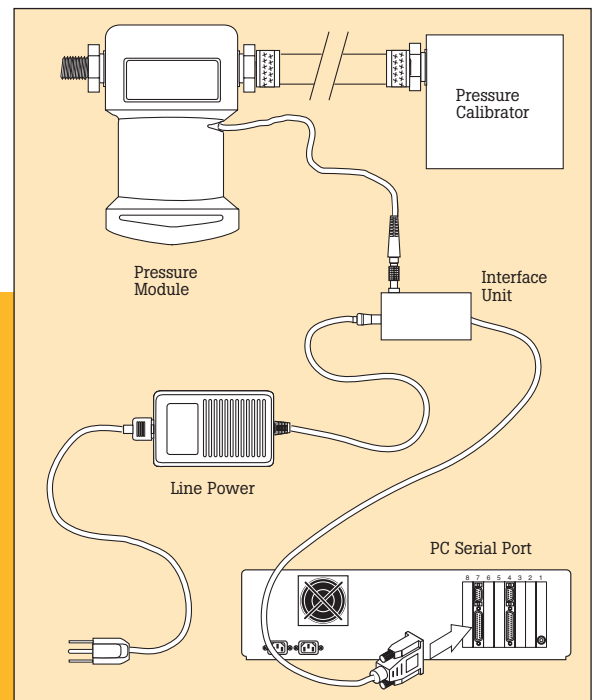
**Fluke 700PMP Pressure Pump**



**For use with:** Fluke 700 Series Pressure Modules and the Fluke 710 Series Pressure Calibrators.

**Description:** The Fluke 700PMP is a hand-operated pressure pump to provide pressures up to 150 psi/1000 kPa. Output fitting is 1/8 FNPT.

**Application:** Linear stroke of 1.6" (4 cm). Multi-turn vernier for fine adjustment of pressure. Includes controlled pressure bleed valve.



**Note:** With a Fluke 700PCK and any Fluke Pressure Module, a Fluke 5520A Calibrator becomes a precision pressure standard.



## Pressure Terminology

**Absolute pressure** — absolute pressure measurements are referenced to zero pressure, (a perfect vacuum.)

**Absolute pressure transducer** — a transducer that has an internal reference chamber sealed at or close to zero pressure (full vacuum) when exposed to atmosphere a reading of approximately 14.7 psi results.

**Boyle's Law** — the volume of a gas is inversely proportional to the pressure of the gas at constant temperature:  $V=1/P$ .

**Charles' Law** — essentially states for a fixed volume of gas, if the temperature is raised, the pressure will increase.  
 $P = \text{Constant} \times T$ .

**Common mode pressure** — the underlying common pressure (or static pressure) within a system from which a differential measurement is being made.

**D/P: Differential pressure, (pronounced DP)** — other names used to mean the same thing are d/p cell, d/p transmitter and  $\Delta P$  transmitter (where  $\Delta$  is delta or differential). This is the most common type of transmitter used in most process industries. It can be used to measure level, flow, pressure, differential pressure, and density or specific gravity. With some modifications, it can measure such things as temperature and oxygen purity. The d/p transmitter can be pneumatic, electromechanical, or solid state. It can also be a smart transmitter. A typical large process plant can have hundreds or thousands of d/p transmitters in service.

**Gage pressure** — the pressure relative to atmospheric pressure. Gage pressure = absolute pressure minus one atmosphere.

**Gage pressure transducer** — a transducer that measures pressure relative to atmospheric pressure.

**Ideal Gas Law** — combining Boyle's Law and Charles' Law, results in the Ideal Gas Law:  $PV=nRT$ , where  $nR$  is constant for a particular gas analogous to the number of molecules and the relative size of the molecule.

**I/P (I to P)** — a current to pressure transmitter. A common instrument in modern industrial plants. A typical large paper mill or refinery could have 5,000 I/Ps in use.

**Line pressure** — the maximum pressure in the pressure vessel or pipe for differential pressure measurement.

**Orifice plate** — a very low cost and common primary sensing element (PSE) for measuring flow. It must be used in conjunction with a d/p cell. It creates a venturi and a resulting P is developed across the plate whose square root is proportional to flow.

**P/I (P to I)** — a pressure to current transducer.

**Pneumatic relay** — refers to a pneumatic instrument that performs a function to its input and provides the result on its output (Example: square root extractor, adder, etc.).

**PSI** — pounds per square inch (same as psig).

**PSIA** — pounds per square inch absolute.

**PSID** — pounds per square inch differential.

**PSIG** — pounds per square inch gage (same as psi).

**Square root extractor** — an instrument or software program that takes the square root of input and puts the result on its output. Square root extraction is needed to linearize many flow signals. Example: orifice plates, venturis, target flow meters, and pitot tubes all require the transmitter's output signal to be linearized. Mag flow meters, turbine flow meters, Doppler flow meters, and vortex shedding flow meters don't require square root extraction.

**Static pressure** — the zero-velocity pressure at any arbitrary point within a system.

**Wet/dry differential** — a differential pressure transducer or transmitter that uses a metal diaphragm at the wet port where fluids can be applied, and no diaphragm at the dry port. The dry port exposes the sensor material to the medium, so only clean dry gas can be applied to this port.

**Wetted parts** — the diaphragm and pressure port material that comes in direct contact with the medium (gas, liquid).



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