LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is three years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

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Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

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125167, г. Москва,
Ленинградский проспект дом 37,
корпус 9, подъезд 4, 1 этаж
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</table>
**Introduction**

This manual contains information necessary to do performance verification tests and calibration adjustments on your 729 and 729 FC Automatic Pressure Calibrators (the Product).

**Contact Fluke**

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-6714-3114
- China: +86-400-921-0835
- Singapore: +65-6799-5566
- Brazil: +55-11-3530-8901
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at [www.fluke.com](http://www.fluke.com).

To register your product, visit [http://register.fluke.com](http://register.fluke.com).

To view, print, or download the latest manual supplement, visit [http://us.fluke.com/usen/support/manuals](http://us.fluke.com/usen/support/manuals).

The latest software trial version of *DPCTrack2* can be downloaded at [www.fluke.com/productinfo](http://www.fluke.com/productinfo). For more information, see *Update Product Firmware*.
**Safety**

General Safety Information is in the printed Safety Information document that ships with the Product and at www.fluke.com. More specific safety information is listed where applicable.

**Specifications**

**Pressure Specification**

1-year Specification ................................... 0.02 % of full scale

Control Specification .................................. 0.005 % full scale minimum

Temperature Compensation .......................... 15 °C to 35 °C (59 °F to 95 °F) to rated accuracy

Note: For temperatures from -10 °C to +15 °C and 35 °C to 50 °C, add 0.04 % of full scale

**Electrical Specification**

All specifications are valid to 110 % of range, except 24 mA source and simulate which are valid to 100 % of range.

**Ranges**

mA ............................................................. 0 mA to 24 mA

Volts .......................................................... 0 V dc to 30 V dc

**Resolution**

mA Ranges ................................................ 1 μA

Voltage Range ........................................... 1 mV

Accuracy .................................................... 0.01 % ±2 LSD all ranges (at 23 °C ±5 °C)

Temperature Compensation ...................... 20 ppm of full scale /°C from -10 °C to +18 °C and 28 °C to 50 °C

Loop Compliance Voltage ............................ 24 V dc @ 20 mA

mA Simulate External Voltage Requirement ................. 12 V dc to 30 V dc

Temperature Measurement

Only/100 Ω Pt (385) RTD ................................ -50 °C to +150 °C (-58 °F to +302 °F)

Temperature Resolution .............................. 0.01 °C (0.01 °F)

Temperature Accuracy ............................... ±0.1 °C (0.2 °F) (±0.25 °C ±0.45 °F)

combined uncertainty when using 720 RTD probe (optional accessory)

Drive Capability ...................................... 1200 Ω without HART resistor, 950 Ω with internal HART resistor
## Product Models

<table>
<thead>
<tr>
<th>Model</th>
<th>psi Range, Resolution</th>
<th>bar Range, Resolution</th>
<th>kPa Range, Resolution</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>729 30G</td>
<td>-12.0000 psi to +30.000 psi</td>
<td>-0.82737 bar to +2.06842 bar</td>
<td>-82.737 kPa to +206.843 kPa</td>
<td>No wireless communication Dry air and non-corrosive gas only</td>
</tr>
<tr>
<td>729 150G</td>
<td>-12.000 psi to +150.000 psi</td>
<td>-0.8273 bar to +10.3421 bar</td>
<td>-82.73 kPa to +1034.21 kPa</td>
<td>Wireless communication for Fluke Connect Dry air and non-corrosive gas only</td>
</tr>
<tr>
<td>729 300G</td>
<td>-12.000 psi to +300.000 psi</td>
<td>-0.8273 bar to +20.6843 bar</td>
<td>-82.73 kPa to +2068.43 kPa</td>
<td></td>
</tr>
<tr>
<td>729 30G FC</td>
<td>-12.0000 psi to +30.000 psi</td>
<td>-0.82737 bar to +2.06842 bar</td>
<td>-82.737 kPa to +206.843 kPa</td>
<td></td>
</tr>
<tr>
<td>729 150G FC</td>
<td>-12.000 psi to +150.000 psi</td>
<td>-0.8273 bar to +10.3421 bar</td>
<td>-82.73 kPa to +1034.21 kPa</td>
<td></td>
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<tr>
<td>729 300G FC</td>
<td>-12.000 psi to +300.000 psi</td>
<td>-0.8273 bar to +20.6843 bar</td>
<td>-82.73 kPa to +2068.43 kPa</td>
<td></td>
</tr>
<tr>
<td>729CN 200K</td>
<td>-12.0000 psi to +30.000 psi</td>
<td>-0.82737 bar to +2.06842 bar</td>
<td>-82.737 kPa to +206.843 kPa</td>
<td>For China, no wireless communication Dry air and non-corrosive gas only</td>
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<td>-12.000 psi to +150.000 psi</td>
<td>-0.8273 bar to +10.3421 bar</td>
<td>-82.73 kPa to +1034.21 kPa</td>
<td>For Japan, 1 MPa range, no wireless communication Dry air and non-corrosive gas only</td>
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<tr>
<td>729CN 2M</td>
<td>-12.000 psi to +300.000 psi</td>
<td>-0.8273 bar to +20.6843 bar</td>
<td>-82.73 kPa to +2068.43 kPa</td>
<td>For Japan, 2 MPa range, no wireless communication Dry air and non-corrosive gas only</td>
</tr>
<tr>
<td>729CN 200K FC</td>
<td>-12.0000 psi to +30.000 psi</td>
<td>-0.82737 bar to +2.06842 bar</td>
<td>-82.737 kPa to +206.843 kPa</td>
<td>For Japan, wireless communication Dry air and non-corrosive gas only</td>
</tr>
<tr>
<td>729JP 200K</td>
<td>N/A</td>
<td>N/A</td>
<td>-82.737 kPa to +206.843 kPa</td>
<td>For Japan, no wireless communication Dry air and non-corrosive gas only</td>
</tr>
<tr>
<td>729JP 1M</td>
<td>N/A</td>
<td>N/A</td>
<td>-82.73 kPa to +1034.21 kPa</td>
<td>For Japan, 1 MPa range, no wireless communication Dry air and non-corrosive gas only</td>
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<tr>
<td>729JP 2M</td>
<td>N/A</td>
<td>N/A</td>
<td>-82.73 kPa to +2068.43 kPa</td>
<td>For Japan, 2 MPa range, no wireless communication Dry air and non-corrosive gas only</td>
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<tr>
<td>729JP 200K FC</td>
<td>N/A</td>
<td>N/A</td>
<td>-82.737 kPa to +206.843 kPa</td>
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<td>N/A</td>
<td>N/A</td>
<td>-82.73 kPa to +2068.43 kPa</td>
<td></td>
</tr>
</tbody>
</table>
Mechanical Specification

Size (H x W x L) ........................................ 7.0 cm x 27.9 cm x 17.3 cm
(2.75 in x 11.0 in x 6.8 in)

Weight .......................................................... 2.95 kg (6.5 lb)

Environmental Specification

Operating Temperature .................................. -10 °C to +50 °C for measurement,
0 °C to 50 °C for pressure control
Battery will only charge from 0 °C to 40 °C

Operating Temperature with Battery .......... -10 °C to +40 °C

Storage Temperature ................................. -20 °C to +60 °C

Operating Altitude ..................................... 3000 m

Storage Altitude ..................................... 13 000 m

Operating Humidity ................................. Non condensing (<10 °C)
≤90 % RH (at 10 °C to 30 °C)
≤75 % RH (at 30 °C to 40 °C)
≤45 % RH (at 40 °C to 50 °C)

Safety

General ...................................................... IEC 61010-1, Pollution Degree 2, IEC
61010-2-030: 30 V max

Ingress Protection ....................................... IEC 60529: IP54 (with all port seals
properly fitted)

Lithium Battery ........................................ IEC 62133, UN 38.3; 14.4 V, 6.7Ah,
97Wh, 4ICR19/66-2 (4s2p) Charge
input 19.5 V, 1.6 A.

Electromagnetic Compatibility (EMC)

International ........................................... IEC 61326-1: Basic Electromagnetic Environment;
CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated
and/or uses conductively-coupled radio frequency
energy that is necessary for the internal function
of the equipment itself.

Class A: Equipment is suitable for use in all
establishments other than domestic and those
directly connected to a low-voltage power supply
network that supplies buildings used for domestic
purposes. There may be potential difficulties in
ensuring electromagnetic compatibility in other
environments due to conducted and radiated
disturbances.

Caution: This equipment is not intended for use in
residential environments and may not provide
adequate protection to radio reception in such
environments.
Korea (KCC)..........................Class A Equipment (Industrial Broadcasting & Communication Equipment)

   Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC).........................47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103 (non FC versions only)

Radio Certification...............(Contains) FCC ID: T68-FBLE, IC: 6627A-FBLE
Frequency..........................2402 MHz to 2480 MHz
Output Power......................<100 mW

**Performance Verification Tests**

Fluke recommends re-certification each year. To re-certify, do the verification procedure. If test points are out of tolerance, calibrate the Product and then re-verify.

Use the subsequent tests to make sure that the Product is inside its specification limits.

**Verification Equipment**

The equipment necessary for verification of the Product is shown in Table 1. If these instruments are not available, you can replace them with other source and measure instruments that have the same the minimum specification requirements.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Calibrator</td>
<td>DC Voltage: 0 V to 30 V Accuracy: ±0.002 % +0.5 mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC Current 0 mA to 24 mA Accuracy: ±0.002 % +0.5 μA</td>
<td>Fluke 5522A Multi-Product Calibrator</td>
</tr>
<tr>
<td>Digital Multimeter</td>
<td>DC Current: 0 mA to 26 mA Accuracy: ±0.002 % +0.5 μA</td>
<td>Fluke 8508A</td>
</tr>
<tr>
<td>Pressure Controller/Calibrator</td>
<td>-14 psi to 300 psi Accuracy: 0.005 %</td>
<td>Ruska 7252xi</td>
</tr>
<tr>
<td>RTD adapter</td>
<td></td>
<td>Fluke 720URRTDA</td>
</tr>
</tbody>
</table>
**How to Verify**

For each procedure there is a table of test points and permitted readings. If the result of the test is not in the range shown, the Unit Under Test (UUT) is out of tolerance and must be re-calibrated or repaired if necessary. There are columns for 12-month specifications.

Follow these general instructions for all the tests:

- Operate the Unit Under Test (UUT) on battery power. Make sure the battery is fully charged.
- Let each piece of verification equipment have its specified warm-up time.

**Verification Procedures**

Allow the Product a 30-minute warm-up period before doing the verification procedures.

**Pressure Verification**

To verify the pressure function:

1. Carefully attach the pressure fitting of the Pressure Controller/Calibrator to the pressure port of the Product.
2. Put the Product in measure mode.
3. Source full scale pressure (300 psi for the 300 model, 150 psi for the 150 model, and 30 psi for 30 the model) from the calibrator (7252). Hold for at least 1 minute.
4. Source 0 psi from the calibrator.
5. ZERO the Product pressure reading when its reading has stabilized.
6. Test all positive pressure test points in ascending and descending order.
7. Source -12 psi from the calibrator. Hold for at least 1 minute.
8. Source 0 psi from the calibrator.
9. ZERO the Product pressure reading when its reading has stabilized.
10. Test all pressure test points in Table 2 for the 729 pressure range in ascending and descending order.
Table 2. Pressure Verification Points

<table>
<thead>
<tr>
<th>Input Pressure (psi)</th>
<th>12 Month Lower Limit</th>
<th>12 Month Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>729 30G/729FC 30G</td>
<td></td>
<td></td>
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<tr>
<td>-12.0000</td>
<td>-12.0060</td>
<td>-11.9940</td>
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<tr>
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<td>-9.0060</td>
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<td>-6.0000</td>
<td>-6.0060</td>
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<td>-3.0000</td>
<td>-3.0060</td>
<td>-2.9940</td>
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<tr>
<td>0.0000</td>
<td>0.0060</td>
<td>-0.0060</td>
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<td>Input Pressure (psi)</td>
<td>12 Month Lower Limit</td>
<td>12 Month Upper Limit</td>
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</tr>
<tr>
<td></td>
<td>729 150G/729FC 150G</td>
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<tr>
<td>-12.000</td>
<td>-12.030</td>
<td>-11.970</td>
</tr>
<tr>
<td>Input Pressure (psi)</td>
<td>12 Month Upper Limit</td>
<td>12 Month Lower Limit</td>
</tr>
<tr>
<td>---------------------</td>
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<td>----------------------</td>
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<td>729 300G/729 FC 300G</td>
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</tr>
<tr>
<td>-3</td>
<td>-2.94</td>
<td>-3.06</td>
</tr>
<tr>
<td>0</td>
<td>0.06</td>
<td>-0.06</td>
</tr>
<tr>
<td>60</td>
<td>60.06</td>
<td>59.94</td>
</tr>
<tr>
<td>120</td>
<td>120.06</td>
<td>119.94</td>
</tr>
<tr>
<td>180</td>
<td>180.06</td>
<td>179.94</td>
</tr>
<tr>
<td>240</td>
<td>240.06</td>
<td>239.94</td>
</tr>
<tr>
<td>300</td>
<td>300.06</td>
<td>299.94</td>
</tr>
<tr>
<td>240</td>
<td>240.06</td>
<td>239.94</td>
</tr>
<tr>
<td>180</td>
<td>180.06</td>
<td>179.94</td>
</tr>
<tr>
<td>120</td>
<td>120.06</td>
<td>119.94</td>
</tr>
<tr>
<td>60</td>
<td>60.06</td>
<td>59.94</td>
</tr>
<tr>
<td>0</td>
<td>0.06</td>
<td>-0.06</td>
</tr>
<tr>
<td>-3</td>
<td>-2.94</td>
<td>-3.06</td>
</tr>
<tr>
<td>-6</td>
<td>-5.94</td>
<td>-6.06</td>
</tr>
<tr>
<td>-9</td>
<td>-8.94</td>
<td>-9.06</td>
</tr>
<tr>
<td>-12</td>
<td>-11.94</td>
<td>-12.06</td>
</tr>
</tbody>
</table>
**DC Voltage Measure Verification**

To verify the dc voltage measure function, see Figure 1:

1. Push \( V_{DC} \), Measure VDC shows in the second row of the display.
2. Connect the Product red banana jack (V mA) to the 5522A HI VOLTS output.
3. Connect the Product black banana jack (COM) to the 5522A LO VOLTS output.
4. Set the 5522A for the voltage setting in Table 3 and verify the display reading on the Product.

#### Table 3. DC Voltage Measure Verification Points

<table>
<thead>
<tr>
<th>Input Pressure (V)</th>
<th>12 Month Lower Limit</th>
<th>12 Month Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>-0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>11.000</td>
<td>10.997</td>
<td>11.003</td>
</tr>
<tr>
<td>20.000</td>
<td>19.996</td>
<td>20.004</td>
</tr>
<tr>
<td>29.900</td>
<td>29.895</td>
<td>29.905</td>
</tr>
</tbody>
</table>

5. Set the 5522A to Standby.

---

**Figure 1. DC Voltage Measure Verification Connections**
**DC Current Measure Verification**

To verify the dc current measure function:

1. Push \( \text{mA} \), **Measure Current** shows in the second row of the display.
2. Connect the Product as shown in Figure 2.
3. Set the 5522A to the first test point in Table 4 and edit its output so that the correct value shows on the 8508A.
4. Verify the display reading on the Product.
5. Repeat for each applied value in Table 4.

<table>
<thead>
<tr>
<th>Input Current (mA)</th>
<th>12 month Lower Limit</th>
<th>12 month Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.100</td>
<td>0.0980</td>
<td>0.1020</td>
</tr>
<tr>
<td>4.000</td>
<td>3.9976</td>
<td>4.0024</td>
</tr>
<tr>
<td>11.000</td>
<td>10.9969</td>
<td>11.0031</td>
</tr>
<tr>
<td>20.000</td>
<td>19.9960</td>
<td>20.0040</td>
</tr>
<tr>
<td>23.990</td>
<td>23.9856</td>
<td>23.9944</td>
</tr>
</tbody>
</table>

6. Set the 5522A to Standby.
Figure 2. DC Current Measure Verification Connections
**DC Current Source Verification**

To verify the dc current source function, see Figure 3:

1. Connect the Product red banana jack (V mA) to the 8508A HI mA INPUT.
2. Connect the Product black banana jack (COM) to the 8508A LO mA INPUT.
3. Set the 8508A for the Amp setting.
4. Use the arrow keys to move the cursor to second row of the display and highlight **Measure Current**.
5. Push **F3** to switch to the Source Current function.
6. Move the cursor to highlight the mA value.
7. Enter the current setting in Table 5, and push **ENTER**.
8. Verify the display reading on the Product.

**Table 5. DC Current Source Verification Points**

<table>
<thead>
<tr>
<th>Input Current (mA)</th>
<th>12 Month Lower Limit</th>
<th>12 Month Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.100</td>
<td>0.098</td>
<td>0.102</td>
</tr>
<tr>
<td>4.000</td>
<td>3.998</td>
<td>4.002</td>
</tr>
<tr>
<td>11.000</td>
<td>10.997</td>
<td>11.003</td>
</tr>
<tr>
<td>20.000</td>
<td>19.996</td>
<td>20.004</td>
</tr>
<tr>
<td>23.990</td>
<td>23.986</td>
<td>23.994</td>
</tr>
</tbody>
</table>

9. Push **mA** to switch to mA Measure mode to exit the current source function.
**RTD Measure Verification**

To verify the RTD measure function, see Figure 4.

When the Product detects temperature from the RTD connector, it turns on a temperature display.

1. Connect the 720URTDA to the Product.
2. Connect the 720URTDA Current HI to the 5522A HI RTD Output.
3. Connect the 720URTDA Sense HI to the 5522A HI RTD Output.
4. Connect the 720URTDA Current LO to the 5522A LO RTD Output.
5. Connect the 720URTDA Sense LO to 5522A LO RTD Output.
6. Set the 5522A to PT385, RTD, 4-wire Comp temperature settings in Table 6.
7. Verify that the display reading on the Product is within the limits.

### Table 6. RTD Measure Verification Points

<table>
<thead>
<tr>
<th>Applied Temperature from 5522A</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40.00 °C (84.271 Ω)</td>
<td>-40.10 °C</td>
<td>-39.90 °C</td>
</tr>
<tr>
<td>0.00 °C (100.000 Ω)</td>
<td>-0.10 °C</td>
<td>0.10 °C</td>
</tr>
<tr>
<td>150.00 °C (157.325 Ω)</td>
<td>149.90 °C</td>
<td>150.10 °C</td>
</tr>
</tbody>
</table>

---

![Figure 4. RTD Measure Verification Connections](image)
24V Loop Power Performance Check

To verify the 24V loop power function, see Figure 5:

1. Connect the Product red banana jack (V mA) to the 8508A HI VOLTS INPUT.
2. Connect the Product black banana jack (COM) to the 8508A LO VOLTS INPUT.
3. Push mA to get **Measure Current** in the lower display.
4. Move the cursor to second row of the display and highlight **Measure Current**.
5. Push F1 to enable loop power.
6. The reading of 8508A should be between 26 V and 30 V. If it is not, repair may be necessary. See **Contact Fluke**.
7. Push F1 to disable loop power.

![Figure 5. 24V Loop Power Verification Connections](image)
Calibration Adjustment

Calibrate the Product manually or with an electronic calibration process. These processes are explained below.

Calibration Data

The date of the last calibration and verification shows on the sticker on the calibration certificate and on the Instrument Information screen in the Setup menu. The CAL. STATUS number on the sticker should always match the Calibration Status number in the calibration screen. Only qualified personnel should calibrate the Product.

Service Center Calibration or Repair

Only qualified service personnel must do calibration, repairs, or service not included in this manual. If the Product fails, examine the battery pack first, and replace it if necessary.

Make sure to operate the Product in accordance with the instructions in this manual. If the Product is faulty, send a description of the failure with the Product. Pressure modules do not need to accompany the Product unless the module is faulty also. Be sure to pack the Product securely, in the original shipping container if it is available. See Contact Fluke and the Warranty Statement.

Manual Process (Front Panel)

Pressure Adjustment: 2-point adjustment (Zero and Full scale)
1. Push \( \text{SETUP} \) and select 729 information.
2. Push \( \text{F1} \) (Calibrate Pressure).
3. Enter the password 1234 and push \( \text{ENTER} \).
4. Follow the display prompts to finish the adjustment.

Pressure adjustment: 11-point adjustment (Vacuum to Full scale)
1. Push \( \text{SETUP} \) select Maintenance to enter maintenance mode.
2. Select Pressure Sensor Characterize.
3. Enter the password 1234 and push \( \text{ENTER} \).
4. Follow the display prompts to finish the adjustment.

Supply Sensor Self Calibration
1. Push \( \text{SETUP} \) select Maintenance to enter maintenance mode.
3. Follow the display prompts to finish the adjustment.

Electrical Adjustment
1. Push \( \text{SETUP} \) and select 729 information.
2. Push \( \text{F2} \) (Calibrate Electrical).
3. Enter the password 1234 and push \( \text{ENTER} \).
4. Follow the display prompts to finish the adjustment.
**Electronic Calibration Process (Remote)**

The USB port sends calibration process commands and receive readings. Do the calibration with a terminal program or you can write an automated-calibration program with programs like MetCal. This manual describes only the serial terminal mode.

Table 8 lists the required equipment.

**Initiate Communication**

Set up terminal communications with terminal communication software on a PC such as Hyperterminal or Ucon. Connect the Product’s mini USB port to the PC. At first connection, a FTDI virtual serial port is installed on the PC.

The terminal settings are:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: none
- Local echo: on

**Adjust Pressure**

Use the equipment and procedures in this section to adjust pressure. The test equipment required for this adjustment is in Table 7.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
</table>
| Pressure Controller/Calibrator | -14 psi to 300 psi  
  Accuracy: 0.005 % | Ruska 7252xi          |

**Note**

*The Product uses a 1/8" NPT female connection in the pressure input port. Various adapters may be needed to connect to the pressure standard. Make sure the hose, tubing, and fittings have a rated working pressure at or above the pressure of the Product. It is also important that there be no leaks. To achieve accurate calibration, use PTFE tape where appropriate.*
To adjust the pressure function, follow the procedures in Tables 8, 9, and 10.

**Table 8. Ambient Pressure Sensor Characterize Steps for 30 psi Model**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the Product pressure input to the 7252xi output</td>
<td>Message prompts the operator Connect pressure input with the 7252xi test output</td>
</tr>
<tr>
<td>Output -12 psi from 7252xi, input actual value and push [F3] (Go On) to proceed</td>
<td>Output -12 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -9 psi from 7252xi, input actual value and push [F3] (Go On) to proceed</td>
<td>Output -9 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -6 psi from 7252xi, input actual value and push [F3] (Go On) to proceed</td>
<td>Output -6 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -3 psi from 7252xi, input actual value and push [F3] (Go On) to proceed</td>
<td>Output -3 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
</tbody>
</table>
### Table 8. Ambient Pressure Sensor Characterize Steps for 30 psi Model (cont.)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 0 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 0 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 5 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 5 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 10 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 10 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 15 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 15 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 20 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 20 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 25 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 25 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 30 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 30 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Calibration is completed, push F3 (Go On) to exit the calibration</td>
<td>Continue Send command CAL_NEXT until NOT is returned from the Product by CAL_STEPTYPE? query</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Connect the Product pressure input to 7252xi output</td>
</tr>
<tr>
<td>2</td>
<td>Output -12 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>3</td>
<td>Output -9 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>4</td>
<td>Output -6 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>5</td>
<td>Output -3 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>6</td>
<td>Output 0 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>7</td>
<td>Output 25 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>8</td>
<td>Output 50 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Output 75 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
<td>Output 75 psi from 7252xi Wait for 7252xi output ready Send command <strong>CAL_NEXT</strong> <code>&lt;actual_pressure&gt;</code> to proceed</td>
</tr>
<tr>
<td>Output 100 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
<td>Output 100 psi from 7252xi Wait for 7252xi output ready Send command <strong>CAL_NEXT</strong> <code>&lt;actual_pressure&gt;</code> to proceed</td>
</tr>
<tr>
<td>Output 125 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
<td>Output 125 psi from 7252xi Wait for 7252xi output ready Send command <strong>CAL_NEXT</strong> <code>&lt;actual_pressure&gt;</code> to proceed</td>
</tr>
<tr>
<td>Output 150 psi from 7252xi, input actual value and push <strong>F3</strong> (Go On) to proceed</td>
<td>Output 150 psi from 7252xi Wait for 7252xi output ready Send command <strong>CAL_NEXT</strong> <code>&lt;actual_pressure&gt;</code> to proceed</td>
</tr>
<tr>
<td>Calibration is completed, push <strong>F3</strong> (Go On) to exit the calibration</td>
<td>Continue Send command <strong>CAL_NEXT</strong> until NOT is returned from the Product by <strong>CAL_STEPTYPE?</strong> query</td>
</tr>
</tbody>
</table>
### Table 10. Ambient Pressure Sensor Characterize Steps for 300 psi Model

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the Product pressure input to 7252xi's output</td>
<td>Message prompts the operator Connect pressure input with 7252xi's test output</td>
</tr>
<tr>
<td>Output -12 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output -12 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -9 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output -9 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -6 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output -6 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output -3 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output -3 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 0 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 0 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 50 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 50 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 100 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 100 psi from 7252xi Wait for 7252xi output ready Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
</tbody>
</table>
Table 10. Ambient Pressure Sensor Characterize Steps for 300 psi Model (cont.)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 150 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 150 psi from 7252xi</td>
</tr>
<tr>
<td></td>
<td>Wait for 7252xi output ready</td>
</tr>
<tr>
<td></td>
<td>Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 200 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 200 psi from 7252xi</td>
</tr>
<tr>
<td></td>
<td>Wait for 7252xi output ready</td>
</tr>
<tr>
<td></td>
<td>Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 250 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 250 psi from 7252xi</td>
</tr>
<tr>
<td></td>
<td>Wait for 7252xi output ready</td>
</tr>
<tr>
<td></td>
<td>Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Output 300 psi from 7252xi, input actual value and push F3 (Go On) to proceed</td>
<td>Output 300 psi from 7252xi</td>
</tr>
<tr>
<td></td>
<td>Wait for 7252xi output ready</td>
</tr>
<tr>
<td></td>
<td>Send command CAL_NEXT &lt;actual_pressure&gt; to proceed</td>
</tr>
<tr>
<td>Calibration is completed, push F3 (Go On) to exit the calibration</td>
<td>Continue send</td>
</tr>
<tr>
<td></td>
<td>Send command CAL_NEXT until NOT is returned from the Product by CAL_STETYPE? query</td>
</tr>
</tbody>
</table>

**Adjust Voltage Input**

The test equipment to adjust the voltage input is listed in Table 11.

Table 11. Required Test Equipment for Voltage Input Adjustment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Calibrator</td>
<td>DC Voltage: 0 V to 30 V</td>
<td>Fluke 5522A Multi-Product Calibrator</td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±0.002 % +0.5 mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC Current 0 mA to 24 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±0.002 % +0.5 μA</td>
<td></td>
</tr>
</tbody>
</table>
Use the test procedure in Table 12 to adjust the voltage input.

**Table 12. Voltage Input Adjustment Procedure**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the Product VDC input with Fluke 5522A NORMAL output</td>
<td>Message prompts the operator Connect VDC input to 5522A NORMAL output</td>
</tr>
<tr>
<td>Output 0 V from Fluke 5522A, input actual value and push <strong>Go On</strong> to proceed</td>
<td>Output 0 V dc from 5522A Wait for at least 3 seconds for signal stable Send command <strong>CAL_NEXT &lt;actual_volts&gt;</strong> to proceed</td>
</tr>
<tr>
<td>Output 30 V from Fluke 5522A, input actual value and push <strong>Go On</strong> to proceed</td>
<td>Output 30 V dc from 5522A Wait for at least 3 seconds for signal stable Send command <strong>CAL_NEXT &lt;actual_volts&gt;</strong> to proceed</td>
</tr>
</tbody>
</table>

**Adjust mA Input**

The test equipment to adjust the mA input is listed in Table 13.

**Table 13. Required Test Equipment for mA Input Adjustment**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
</table>
| DC Calibrator | DC Voltage: 0 V to 30 V  
Accuracy: ±0.002 % +0.5 mV  
DC Current 0 mA to 24 mA  
Accuracy: ±0.002 % +0.5 μA | Fluke 5522A Multi-Product Calibrator |
| Digital Multimeter | DC Current: 0 mA to 26 mA  
Accuracy: ±0.002 % +0.5 μA | Fluke 8508A |

**Note**

All reference (actual) values that you input during the calibration procedure should be the reading from 8508A.
Use the test procedure in Table 14 to adjust the mA input.

**Table 14. mA Input Adjustment Procedure**

<table>
<thead>
<tr>
<th>Expected Manual Process</th>
<th>Expected Electronic Calibration Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Front Panel)</strong></td>
<td><strong>(Remote)</strong></td>
</tr>
<tr>
<td>Connect the Product mA input with Fluke 5522A AUX output</td>
<td>Message prompts the operator</td>
</tr>
<tr>
<td>Output 0 mA from Fluke 5522A, input actual value and push <strong>F3 (Go On)</strong> to proceed</td>
<td>Connect mA input with 5522A AUX output</td>
</tr>
<tr>
<td>Output 22 mA from Fluke 5522A, input actual value and push <strong>F3 (Go On)</strong> to proceed</td>
<td>Output 22 mA dc from 5522A</td>
</tr>
<tr>
<td></td>
<td>Wait for at least 3 seconds for signal stable</td>
</tr>
<tr>
<td></td>
<td>Send command <strong>CAL_NEXT &lt;actual_mA&gt;</strong> to proceed</td>
</tr>
</tbody>
</table>

**Adjust mA Source**

Table 15 is a list of the test equipment to adjust the mA source.

**Table 15. Required Test Equipment for mA Source Adjustment**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Multimeter</td>
<td>DC Current: 0 mA to 26 mA Accuracy: ±0.002 % +0.5 μA</td>
<td>Fluke 8508A</td>
</tr>
</tbody>
</table>
Use the test procedure in Table 16 to adjust the mA source.

**Table 16. mA Source Adjustment Procedure**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the Product mA output to Fluke 8508A's Amps input, and set Fluke 8508A to DCA function</td>
<td>Message prompts the operator Connect the Product mA output to 8508A's Amps input</td>
</tr>
<tr>
<td>Input measured mA value from Fluke 8508A, and push [\text{F3} \text{(Go On)}] to proceed</td>
<td>Wait for at least 3 seconds for signal stable Send command \text{CAL_NEXT &lt;actual_mA&gt;} to proceed</td>
</tr>
<tr>
<td>Input measured mA value from Fluke 8508A, and push [\text{F3} \text{(Go On)}] to proceed</td>
<td>Wait for at least 3 seconds for signal stable Send command \text{CAL_NEXT &lt;actual_mA&gt;} to proceed</td>
</tr>
<tr>
<td>Input measured mA value from Fluke 8508A, and push [\text{F3} \text{(Go On)}] to proceed</td>
<td>Wait for at least 3 seconds for signal stable Send command \text{CAL_NEXT &lt;actual_mA&gt;} to proceed</td>
</tr>
</tbody>
</table>

**Adjust RTD**

Table 17 is a list of the test equipment to adjust the RTD.

**Table 17. Required Test Equipment for RTD Adjustment**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Calibrator</td>
<td>DC Voltage: 0 V to 30 V Accuracy: ±0.002 % +0.5 mV DC Current 0 mA to 24 mA Accuracy: ±0.002 % +0.5 μA</td>
<td>Fluke 5522A Multi-Product Calibrator</td>
</tr>
<tr>
<td>RTD adapter</td>
<td></td>
<td>Fluke 720URTDA</td>
</tr>
</tbody>
</table>
Use the test procedure in Table 18 for RTD adjustment.

### Table 18. RTD Adjustment Procedure

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect FLUKE 720URTDA to the Product RTD input, and connect it to Fluke 5522A (in 4-wire ohms mode)</td>
<td>Message prompts the operator Connect 720URTDA to the Product RTD Lemo jack, and connect the adapter with 5522A in 4-wire connection</td>
</tr>
<tr>
<td>Output 80 Ω from Fluke 5522A, input actual value and push F3 (Go On) to proceed</td>
<td>Output 80 Ω from 5522A in 4-wire mode Wait for at least 3 seconds for a stable signal Send command CAL_NEXT &lt;actual_ohms&gt; to proceed</td>
</tr>
<tr>
<td>Output 160 Ω from Fluke 5522A, input actual value and push F3 (Go On) to proceed</td>
<td>Output 160 Ω from 5522A in 4-wire mode Wait for at least 3 seconds for a stable signal Send command CAL_NEXT &lt;actual_ohms&gt; to proceed</td>
</tr>
<tr>
<td>Calibration is completed, push F3 (Go On) to exit the calibration</td>
<td>Continue Send command CAL_NEXT until NOT is returned from the Product by CAL_STEPTYPE? query</td>
</tr>
</tbody>
</table>

### Adjust Continuity

Table 29 lists the test equipment to test continuity.

### Table 19. Required Test Equipment for Continuity Adjustment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Minimum Specifications</th>
<th>Recommended Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistor</td>
<td>0 Ω</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±1 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 kΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±1 %</td>
<td></td>
</tr>
<tr>
<td>Digital Multimeter</td>
<td>DC Current: 0 mA to 26 mA</td>
<td>Fluke 8508A</td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±0.002 % +0.5 μA</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

All reference (actual) values the you input during the calibration procedure should be the reading from 8508A.
Use the test procedure in Table 20 for continuity adjustment.

|---------------------------------------|--------------------------------------------------|
| Connect 0 Ω resistor to the Product switch input | Message prompts the operator  
Connect a 0 Ω resistor to the Product switch input |
| Input actual resistance value and push F3 (Go On) to proceed | Wait for at least 3 seconds for signal stable  
Send command CAL_NEXT <actual_ohms> to proceed |
| Connect 1 kΩ resistor to the Product switch input | Message prompts the operator  
Connect a 1 kΩ resistor to the Product switch input |
| Input actual resistance value and push F3 (Go On) to proceed | Wait for at least 3 seconds for signal stable  
Send command CAL_NEXT <actual_ohms> to proceed |
**Calibration Remote Commands**

1. Get last calibrated date
   - Syntax
   
   CAL_DATE? [{EMM|PCM}]

2. Return PCM cal date if no argument provided.
3. CAL_START - Start a calibration
   - Syntax
   
   CAL_START {EMM|PCM|PCHAR},<password>
   
   **EMM**
   Run calibration procedure for electrical functions
   
   **PCM**
   Run 2-point pressure calibration for internal pressure module
   
   **PCHAR**
   Run ambient pressure sensor characterization
   
   `<password>`
   Default value 1234, or super password calculated by Product serial number

4. Get type of current calibration step
   - Syntax
   
   CAL_STEPTYPE?
   
   - Response
   
   **NOT**
   No calibration procedure is running
   
   **INS**
   Displays message for next step
   
   **REF**
   Expects reference value for current step
   
   **RUN**
   Busy

5. Get name of current calibration step
   - Syntax
   
   CAL_STEPNAME?

6. Get nominal calibration reference
   - Syntax
   
   CAL_REF?
   
   - Response
   
   `<ref_value>,<unit>`
7. Proceed to next step with optional reference
   • Syntax
   CAL_NEXT [<ref>][:<unit>]]
   For REF step, a reference value must be sent with this command to proceed.

8. Skip to next step
   • Syntax
   CAL_SKIP

9. Backup a step
   • Syntax
   CAL_BACKUP

10. Skip to next section
    • Syntax
    CAL_SECTION
    Use this command to skip some functions that do not need to be recalibrated.

11. Save CAL constants
    • Syntax
    CAL_SAVE

12. Abort calibration
    • Syntax
    CAL_ABORT
Example:

```bash
=>CAL_START EMM 1234  # Start electrical function calibration
=>CAL_STEPTYPE?
  # Get current step type
  INS
  # Instruction
=>CAL_STEPNAME?
  # Get current step name
  DC20MA_INS
  # Need to connect 729 to 5522A AUX
=>CAL_NEXT
  # Proceed to next step
=>CAL_STEPTYPE?
  # Get current step type
  REF
  # Reference value is expected to proceed
=>CAL_STEPNAME?
  # Get current step name
  DC20MA_1
  # The 1st calibration point of MADC measure function
=>CAL_REF?
  # Get nominal reference value
  0.000000e+00,mA
  # 0.000 mA
=>CAL_NEXT
  # Proceed with default reference value
=>CAL_STEPTYPE?
  # Get current step type
  REF
  # Reference value is expected to proceed
=>CAL_STEPNAME?
  # Get current step name
  DC20MA_2
  # The 2nd calibration point of MADC measure function
=>CAL_REF?
  # Get nominal reference value
  2.200000e+01,mA
  # 22.000 mA
=>CAL_ABORT
  # Abort calibration
=>CAL_STEPTYPE?
  # Get current step name
  NOT
  # No calibration is running
```
Serial Commands

- The Serial Commands provide basic measure/source functions
- The serial port should be configured for 9600, 8 data bits, 1 stop bit, no parity
- The Product will echo letters back by default, user can enable/disable it with ECHO command
- The Product will show prompt which indicates the command execution result of last command, user also can disable it with PROMPT command

=>
Last command is executed successfully
/>
Last command execution contains error, please check the error with command ERROR

- All commands and arguments are case insensitive
- < > indicates a required parameter.
- [ ] indicates optional parameters.
- '|' indicates alternate parameter values.

General

1. Get identity
   - Syntax
     *IDN?*
   - Response
     FLUKE,<ModelName>,<SerialNum>,<Main Rev>+<PCM Rev>+<EMM Rev>

2. Reset the instrument
   - Syntax
     *RST*

3. All settings except instrument settings are reset to the default value.

4. Error queue are cleared as well, and front panel is also reset.

5. Clear error queue
   - Syntax
     *CLS*

6. The error queue is cleared.

7. Get error
   - Syntax
     ERROR?
     \**FAULT?** (to be compatible with existing Martel product)
   - Response
     <error_no>,<error_message>
8. The earliest error is dequeued and its error number and message are returned.

9. Get echo setting
   • Syntax
     ECHO?
   • Response
     0 or 1

10. Enable/disable echo
    • Syntax
      ECHO {0|1|ON|OFF}

11. Get prompt setting
    • Syntax
      PROMPT?
    • Response
      0 or 1

12. Enable/Disable prompt
    • Syntax
      PROMPT {0|1|ON|OFF}

13. Get date format setting
    • Syntax
      DATE_FORMAT?
    • Response
      YMD, MDY or DMY

14. Set date format
    • Syntax
      DATE_FORMAT {YMD|MDY|DMY}

15. Get time format setting
    • Syntax
      TIME_FORMAT?
    • Response
      12H or 24H

16. Set time format
    • Syntax
      TIME_FORMAT? {12H|24H}
17. Get clock value
   • Syntax
   $$\text{CLOCK?}$$
   • Response
   <clock value depends on date format>

18. Set clock value
   • Syntax
   $$\text{CLOCK <year>,<month>,<day>,<hour>,<minute>[,<second>]}$$

19. Get temperature unit setting
   • Syntax
   $$\text{TEMP\_UNIT?}$$
   • Response
   Cel or Far

20. Set temperature unit
   • Syntax
   $$\text{TEMP\_UNIT } \{\text{CEL}\vert\text{FAR}\}$$

21. Get pressure unit setting
   • Syntax
   $$\text{PRES\_UNIT?}$$

22. Set pressure unit
   • Syntax
   $$\text{PRES\_UNIT } <\text{unit}>$$
   • Argument
   <unit>
   INHG, MMHG, MHG, PA, KPA, MPA, BAR, MBAR, PSI, ATM, KG/SQCM, G/SQCM
   CMH2O4C, MMH2O4C, INH2O4C, FTH2O4C, MH2O4C
   CMH2O20C, MMH2O20C, INH2O20C, FTH2O20C, MH2O20C
   CMH2O60F, MMH2O60F, INH2O60F, FTH2O60F, MH2O60F

23. Pressure unit of both internal pressure module and 750P pressure module are changed, use $$\text{PMOD\_UNIT}$$ to change 750P's unit separately.

24. Get auto-off setting
   • Syntax
   $$\text{AUTO\_OFF?}$$
   • Response
   $$\text{OFF, 5, 10, 15, 30, 60 minutes}$$
25. Set auto-off
   • Syntax
     AUTO_OFF {OFF|5|10|15|30|60}

Example:

```plaintext
=>*IDN?
FLUKE,729FC,12345678,0.0.46+0.1.22+0.1.9

=>ERROR?
0,No Error

=>DATE_FORMAT?
YMD

=>PRES_UNIT?
kPa

=>CLOCK?
06/02/2017 17:33:30

=>CLOCK 2017,6,2,18,0,0
```

**Internal Pressure**

1. Get internal pressure module function
   • Syntax
     UPPER_FUNC?
     or FUNC1?
     or FUNC?
   • Response
     VENT, MEASURE or SOURCE

2. Put internal pressure module to measure mode
   • Syntax
     MEASURE
     or MEAS

3. Put internal pressure module to vent mode
   • Syntax
     VENT

4. Get zero offset
   • Syntax
     ZERO_MEAS?
     or ZERO?
   • Response
     <zero_offset>,<unit>

5. Zero internal pressure module
   • Syntax
     ZERO_MEAS
     or ZERO
6. Clear zero offset
   • Syntax
     ZERO_CLEAR

7. Get temperature of pressure sensor (testport)
   • Syntax
     TEMP?
   • Response
     <temperature>,<unit>

8. Get pressure value when switch is detected open
   • Syntax
     OPEN_PRES?
   • Response
     <open_pressure>,<unit>

9. Get pressure value when switch is detected closed
   • Syntax
     CLOSE_PRES?
   • Response
     <close_pressure>,<unit>

10. Get internal pressure module setpoint
    • Syntax
      UPPER_OUT?
      or OUT1?
      or OUT?
    • Response
      <setpoint>,<unit>,<slewrate>

11. Set pressure setpoint
    • Syntax
      UPPER_OUT <setpoint>[,[<unit>[,<slew_rate_per_second>]]]
      or OUT1 <setpoint>[,[<unit>[,<slew_rate_per_second>]]]
      or OUT <setpoint>[,[<unit>[,<slew_rate_per_second>]]]
    • Argument
      <setpoint>
      New setpoint in desired pressure unit.
      <unit>
      Pressure unit, optional, keep original pressure unit if omitted.
      <slew_rate_per_second>
      Slew rate per second, optional, no rate control if omitted.

12. Internal pressure module is put into source function automatically
13. Get internal pressure module reading
   • Syntax
     UPPER_VAL?
     or VAL1?
     or VAL?
   • Response
     <pressure_reading>,<unit>

   Example:

   ```
   =>UPPER_FUNC?
   MEASURE
   =>OUT 0.2MPa       # Set to 200kPa output
   =>OUT?             # Get setpoint and slewrate
   0.20000,MPa,0.00000
   =>UPPER_OUT 25,cmH2O4C,1 # Set to 25cmH2O output
   =>UPPER_OUT?
   25.00,cmH2O4C,1.00
   =>UPPER_VAL?       # Get pressure reading
   25.01,cmH2O4C
   =>MEASURE          # Set to measure mode
   =>UPPER_FUNC?      # Get internal pressure module function
   MEASURE
   =>VENT             # Set to vent mode
   =>ZERO_MEAS        # Zero internal pressure module
   ```

**Electrical Functions**

1. Get electrical function
   • Syntax
     LOWER_FUNC?
     or FUNC2?
   • Response
     MADC, MADCSRC, MADCSIM, VDC, CONT

2. Set electrical function
   • Syntax
     LOWER_FUNC {MADC|MADCSRC|MADCSIM|VDC|CONT}
     or FUNC2 {MADC|MADCSRC|MADCSIM|VDC|CONT}

3. Get setpoint of electrical source function
   • Syntax
     LOWER_OUT?
     or OUT2?
   • Response
     <setpoint>,mA,<slew_rate>
4. Set setpoint of electrical source function
   - Syntax
     \texttt{OUT2 <setpoint>[,<unit>[,<slew_rate_per_second>]]}
     or \texttt{LOWER\_OUT <setpoint>[,<unit>[,<slew_rate_per_second>]]}
   - Argument
     \texttt{<setpoint>}
     New setpoint in desired unit.
     \texttt{<unit>}
     mA or A, optional, mA if omitted.
     \texttt{<slew_rate_per_second>}
     New slew rate per second, optional, no rate control if omitted.
   - Need to set electrical function to either \texttt{MADCSRC} or \texttt{MADCSIM} first, if not, \texttt{MADCSRC} will be set by default.

5. Get electrical reading
   - Syntax
     \texttt{LOWER\_VAL?}
     or \texttt{VAL2?}
   - Response
     \texttt{<reading>,<unit>}

6. Get loop power setting
   - Syntax
     \texttt{LOOP\_PWR?}
     or \texttt{LOOP\_POWER?}
   - Response
     0 or 1

7. Set loop power of MADC function
   - Syntax
     \texttt{LOOP\_PWR \{0|1|ON|OFF\}}
     or \texttt{LOOP\_POWER \{0|1|ON|OFF\}}

8. Valid for MADC function only.

9. Get HART resistor setting
   - Syntax
     \texttt{HART?}
   - Response
     \texttt{ON} or \texttt{OFF}

10. Enable HART resistor
    - Syntax
      \texttt{HART\_ON}
11. Disable HART resistor
   • Syntax
     HART_OFF

12. Get auxiliary function
   • Syntax
     AUX_FUNC?
     FUNC3?
   • Response
     PRESSURE, RTD, HARTPV

13. Set auxiliary function
   • Syntax
     AUX_FUNC {PRESSURE|RTD|HARTPV}
     or FUNC3 {PRESSURE|RTD|HARTPV}

14. If configure PRESSURE, 750P needs to be connected to the instrument first

15. If configure RTD, 720RTD needs to be connected to the instrument first

16. If configure HARTPV, a HART transmitter needs to be connected by polling of HART

17. Get auxiliary reading
   • Syntax
     AUX_VAL?
     or VAL3?
   • Response
     <reading>,<unit>

Example:

```text
=>LOWER_FUNC?
   MADC

=>LOOP_POWER 1
   # Enable loop power

=>LOOP_POWER?
   1

=>LOWER_OUT 0.001A
   # Set output 1mA source mode

=>LOWER_OUT?
   1.000000e+00,mA,0.000000e+00

=>AUX_FUNC?
   PRESSURE

=>AUX_FUNC RTD
   # Set auxiliary function to temperature

=>AUX_VAL?
   81.64,Far,110.733,Ohms
   # Get auxiliary function reading
```
**750P Pressure Module**

1. Get 750P status
   - Syntax
     ```plaintext
     PMOD?
     ```
   - Response
     ```plaintext
     <avail_status>,<model>,<serial>,<last_cal>
     ```
     - `<avail_status>`
       - 0 not available
       - 1 available

2. Get 750P range
   - Syntax
     ```plaintext
     PMOD_RANGE?
     ```
   - Response
     ```plaintext
     <zero>,<fullscale>,<unit>
     ```

3. Get pressure module unit
   - Syntax
     ```plaintext
     PMOD_UNIT?
     ```
   - Response
     ```plaintext
     <name_of_pressure_unit_configured>
     ```

4. Set pressure module unit
   - Syntax
     ```plaintext
     PMOD_UNIT <unit>
     ```
   - Argument
     ```plaintext
     <unit>
     ```
     - INHG, MMHG, MHG, PA, KPA, MPA, BAR, MBAR, PSI, ATM, KG/SQCM, G/SQCM
     - CMH2O4C, MMH2O4C, INH2O4C, FTH2O4C, MH2O4C
     - CMH2O20C, MMH2O20C, INH2O20C, FTH2O20C, MH2O20C
     - CMH2O60F, MMH2O60F, INH2O60F,

5. Reset pressure module
   - Syntax
     ```plaintext
     PMOD_RESET
     ```

6. Pressure module's unit and zero offset are reset as if the module is just connected.

7. Get zero offset of pressure module
   - Syntax
     ```plaintext
     PMOD_ZERO?
     ZERO_EXT?
     ```
   - Response
     ```plaintext
     <zero_offset>,<unit>
     ```
8. Zero pressure module
   • Syntax
     \texttt{PMOD\_ZERO [\textless abs\_offset\>[,.<unit>]]}
     \texttt{ZERO\_EXT [\textless abs\_offset\>[,.<unit>]]}
   • Argument
     \begin{itemize}
     \item \textless abs\_offset\> Actual pressure for absolute pressure module
     \item \textless unit\> Unit of actual pressure value
     \end{itemize}
   \textbf{Example:}

   \begin{verbatim}
   =>PMOD?                   # Get status of 750P module
   1,FLUKE-750PA27,2731072,02/04/2014
   =>PMOD\_RANGE?            # Get 750P module range
   0.0,2068.4,kPa
   =>PMOD\_ZERO?             # Get 750P zero offset
   0.0,kPa
   =>PMOD\_ZERO 101.3,kPa    # Zero absolute 750P module with actual pressure
   \end{verbatim}

\textbf{HART Function}

1. Get HART Status
   • Syntax
     \texttt{HART\_STATUS?}
   • Response
     \begin{itemize}
     \item \textit{IDLE} No transmitter connected
     \item \textit{POLLING} Bus polling in progress
     \item \textit{CONNECTING} A transmitter is found, reading data from transmitter
     \item \textit{CONNECTED} Transmitter is connected
     \end{itemize}

2. Disconnect from a Transmitter
   • Syntax
     \texttt{HART\_DISCONNECT}

3. Connect to a Transmitter
   • Syntax
     \texttt{HART\_CONNECT <address>}
   • Argument
     \begin{itemize}
     \item \texttt{<address>} HART bus address, 0 to 15
     \end{itemize}

4. HART status will be updated automatically when a transmitter is connected
5. Get Interval of Auto Update of All Dynamic Variables
   • Syntax
   \texttt{HART\_AUTO\_UPDATE?}

6. Set Interval of Auto Update of All Dynamic Variables
   • Syntax
   \texttt{HART\_AUTO\_UPDATE <interval>}
   • Argument
   \texttt{<interval>}
   50 to 50000 milliseconds, 0 to disable auto update.

7. Write to some HART variable, like PV\_UNIT, need to disable auto update first, to avoid conflict.

8. Read HART Variable
   • Syntax
   \texttt{HART\_READ? <var\_name>}
   • Argument
   \texttt{<var\_name>}
   \begin{itemize}
   \item \texttt{CMD\_RESPONSE} - Command response code
   \item \texttt{DEV\_STATUS} - Field device status
   \item \texttt{DEV\_TYPE} - Expanded device type
   \item \texttt{MIN\_PREAMBLES} - Minimal preambles for master
   \item \texttt{HART\_MAJORREV} - HART major revision
   \item \texttt{DEV\_REV} - Device revision
   \item \texttt{SW\_REVISION} - Software revision
   \item \texttt{DEV\_ID} - Device ID
   \item \texttt{POLL\_ADDRESS} - Polling address
   \item \texttt{PV} - Primary variable value
   \item \texttt{PV\_UNIT} - Primary variable unit code
   \item \texttt{PV\_LOOP\_CURRENT} - PV loop current
   \item \texttt{PV\_PERCENT} - PV percent
   \item \texttt{SV} - Secondary variable value
   \item \texttt{SV\_UNIT} - Secondary variable unit code
   \item \texttt{TV} - Tertiary variable value
   \item \texttt{TV\_UNIT} - Tertiary variable unit code
   \item \texttt{QV} - Quaternary variable value
   \item \texttt{QV\_UNIT} - Quaternary variable unit code
   \item \texttt{PV\_CLASS} - PV classification code
   \item \texttt{SV\_CLASS} - SV classification code
   \item \texttt{TV\_CLASS} - TV Classification code
   \item \texttt{QV\_CLASS} - QV classification code
   \item \texttt{PV\_RANGE\_UNIT} - PV range unit
   \item \texttt{LRV} - PV lower range value
   \item \texttt{URV} - PV upper range value
   \item \texttt{SENSOR\_SN} - Transducer serial number
   \item \texttt{SENSOR\_UNIT} - Transducer range unit code
   \item \texttt{LTL} - Transducer lower test limit
   \item \texttt{UTL} - Transducer upper test limit
   \end{itemize}
MINSPAN - Transducer minimal span
ALARM - PV alarm selection
DAMPING - PV damping
XFER_FUNC - PV transfer function
TAG - Tag (8 letters)
MESSAGE - Message (32 letters)
SCRIPTOR - Descriptor (16 letters)
DATE - Date
PV_FIXED_CURRENT - PV fixed loop current
MEASURED_PV_CURRENT - Measured PV loop current

• Response
  <value>,<unit> for IEEE754 variables
  <string> for PACKET, LATIN variables
  <date_string> for DATE variable
  <value>,<string> for ENUM and BITENUM variables

9. Write HART Variable
   • Syntax
     HART_WRITE <var_name>,<value>
   • Argument
     <var_name>
     Same variable list as Read HART Variable command
     <value>
     New value in string

10. New values will not be sent to transmitter until corresponding write command is
    not sent.

11. Send HART Command
    • Syntax
      HART_SEND_CMD <command_no>
    • Argument
      <command_no>
      Number of command to be sent
Example:

- Connect to a HART transmitter

```plaintext
=>LOWER_FUNC MADC             # Switch to mADC measure function
=>LOOP_POWER 1                 # Enable loop power
=>HART_CONNECT 0              # Connect to transmitter at bus address 0
                             # Need to wait at about 5 seconds to finish all data fetching operations
=>HART_STATUS?               # Get HART status
  CONNECTED
=>HART_READ? PV_UNIT
  12,kPa
=>HART_READ? PV_VAL
  1.000123E+03,kPa
```

- Set PV unit

```plaintext
=>HART_AUTO_UPDATE 0          # Disable dynamic variable auto updating
=>HART_WRITE PV_UNIT 6        # Write new value 6 (psi) to PV_UNIT
=>HART_SEND_CMD 44            # Send command 44 to write PV_UNIT to transmitter
=>HART_SEND_CMD 15            # Send command 15 to update device information
=>HART_SEND_CMD 14            # Send command 14 to update PV transducer information
                             # Wait at least 3 seconds to complete these 3 commands
=>HART_AUTO_UPDATE 200        # Re-enable dynamic variable updating every 200ms.
```

- PV zero trim

```plaintext
=>HART_SEND_CMD 43            # Set PV zero
```

- D/A trim

```plaintext
=>HART_WRITE PV_FIXED_CURRENT 4
=>HART_WRITE MEASURED_PV_CURRENT 3.999
=>HART_SEND_CMD 45            # Trim 4mA with measured current value (3.999mA)
=>HART_WRITE PV_FIXED_CURRENT 20
=>HART_SEND_CMD 40            # Fix PV analog output at 20mA
=>HART_WRITE MEASURED_PV_CURRENT 19.999
=>HART_SEND_CMD 46            # Trim 20mA with measured current value (19.999mA)
=>HART_WRITE PV_FIXED_CURRENT 0
=>HART_SEND_CMD 40            # Return to normal analog output mode
```
Automatic Pressure Calibrators

The Battery

The Product features a rechargeable battery. Charge the battery while it is inside or outside of the Product. This allows you to have more than one fully-charged battery on hand.

Charge the Battery

Before the Product is used, charge the battery. To charge the battery while in the Product, connect the battery charger to the Product.

The battery fully charges in 8 hours.

To charge the battery outside of the Product, see Figure 6 for battery access:

1. Place the Product face down.
2. Lift the Product stand to expose all screws.
3. Remove the six screws with a Phillips screwdriver.
4. Pull off the back.
5. Remove the battery.
6. Connect the battery charger to the input on the battery.
7. The battery charge indicator (top-right of display) shows while the battery is outside of the Product. Solid green bars show the level of charge on the battery. When all bars are illuminated and solid, the battery is fully charged. The bars progressively illuminate to show that the battery is currently charging.
Battery Life

The battery charge indicator shows on the upper right of the display.

Table 21 shows the typical operation time for a new, fully charged battery. Product performance meets its specification until the battery charge indicator reads empty.

<table>
<thead>
<tr>
<th>Operation Modes</th>
<th>Battery Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure, continuous</td>
<td>20 Hours</td>
</tr>
<tr>
<td>Measure and source, with loop power on, continuous</td>
<td>10 Hours</td>
</tr>
<tr>
<td>Typical intermittent operation</td>
<td>&gt;16 Hours</td>
</tr>
</tbody>
</table>

Battery Replacement

Replace the battery when it no longer holds a charge for the rated interval. The battery normally lasts for up to 300 charge/discharge cycles. To order a replacement battery, see Contact Fluke and User-Replaceable Parts.

Note

Take spent batteries to a qualified recycler or hazardous materials handler for disposal. Contact an authorized Fluke Service Center for recycling information.

To replace the battery, see Figure 6:

1. Push and select Maintenance.
2. Push (Exhaust) to release Product internal pressure.
3. Turn Off the Product.
4. Remove test leads.
5. Make sure the Product is unplugged from its charger.
6. Turn over the Product.
7. Lift the bail and remove the six screws with a Phillips screwdriver.
8. Lift off the battery cover.
9. Replace the battery.
10. Replace the back cover and screws.
Figure 6. Replace the Battery
Maintenance

⚠️ Warning
To prevent possible electrical shock, fire, or personal injury:
- Have an approved technician repair the Product.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.
- Remove the input signals before you clean the Product.
- Use only specified replacement parts.
- Run “Exhaust” before you open the battery door.

Clean the Product
Clean the Product and pressure modules with a soft cloth dampened with water or water and mild detergent.

⚠️ Caution
To prevent possible damage to the Product, do not use solvents or abrasive cleansers.

Clean the Pump Valve
1. Remove the battery door (see Battery Replacement) and locate the pump valve caps, see Figure 7 (1).
2. Use a small screwdriver to remove the two valve retention caps located in the oval shaped opening on the underside of the Product.
3. Gently remove the spring and O-ring assembly.
4. Set aside the valve assemblies and clean out the valve body with a cotton swab soaked in isopropyl alcohol (IPA).
5. Repeat this process several times with a new cotton swab until there is no sign of residue.
6. Run the pump for a few seconds.
7. 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 necessary.
8. Inspect the springs for wear or loss of tension. They should be approximately 3.8 mm (0.15 in) long in the relaxed state. If they are shorter, the O-ring will not seat properly. Replace if necessary.
9. Clean and inspect all parts and then reinstall the O-ring and spring assemblies into the valve body.
10. Reinstall the retention caps and gently tighten the cap.
11. Seal the output of the Product and pump up the unit to at least 50% of its rated pressure.
12. Release the pressure and repeat several times to ensure that the O-rings seat properly.
13. The Product is now ready for use.
Replace the Pump Filters

1. Remove the battery door (see Battery Replacement) and locate the two filter caps, see Figure 7 (1).
2. Use a screwdriver to push the pressure release pin on the screws before removing.
3. Unscrew the two filter caps.
4. Remove the filters and replace if necessary.
5. Clean the O-rings on the filter caps with IPA and inspect the O-rings closely for any cuts, nicks, or wear. Replace if necessary.
6. Reinstall the filter caps.
7. Gently tighten the caps.

Figure 7. Pump Valve
In Case of Difficulty

⚠️⚠️ Warning

To prevent possible electrical shock, fire, or personal injury, do not use the Product if it operates abnormally. Protection may be impaired. When in doubt, have the Product serviced.

If the Product does not turn on, check the battery charge. Disconnect the battery charger. If the Product receives power, the power button is illuminated. If the button is illuminated, but the Product does not turn on, have the Product serviced. See Contact Fluke.

Update Product Firmware

To update the Product firmware version:

1. Turn on the Product.
2. Connect the USB cable (provided) to a PC (see Figure 8).
4. Click on “Find your software”.
5. Search for “729”.
6. On the results page, select the Software Downloads tab.
7. Click on the necessary software link.
8. Read the instructions on this page.
10. Click on the Firmware exe file.

Figure 8. Connect the USB Cable
## User-Replaceable Parts and Accessories

Table 22 is a list of replacement parts and accessories.

### Table 22. User-Replaceable Parts and Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Fluke P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP729, Rechargeable Li-ion Battery</td>
<td>1</td>
<td>4817068</td>
</tr>
<tr>
<td>Power Charger, AC/DC</td>
<td>1</td>
<td>4878453</td>
</tr>
<tr>
<td>Mains Adapters International (Except For China)</td>
<td>1</td>
<td>2441372</td>
</tr>
<tr>
<td>Line Cord, Jumper (Except China)</td>
<td>1</td>
<td>4542113</td>
</tr>
<tr>
<td>Power Cable (China Only)</td>
<td>1</td>
<td>2716592</td>
</tr>
<tr>
<td>USB Cable Assembly</td>
<td>1</td>
<td>4499448</td>
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<tr>
<td>AC280, Suregrip Hook Clips</td>
<td>1</td>
<td>1610115</td>
</tr>
<tr>
<td>Alligator Clip Set</td>
<td>1</td>
<td>3765923</td>
</tr>
<tr>
<td>Cable Assembly, Stackable Test Leads Set</td>
<td>1</td>
<td>3669716</td>
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<tr>
<td>TP220, Test Probes</td>
<td>1</td>
<td>3971276</td>
</tr>
<tr>
<td>Hose, Nylon</td>
<td>3.3 ft</td>
<td>4366602</td>
</tr>
<tr>
<td>Fitting, 1/8&quot; NPT-Female x 1/4&quot; NPT-Female</td>
<td>1</td>
<td>4366616</td>
</tr>
<tr>
<td>Fitting, 1/8&quot; Tube x 1/8&quot; NPT-Male</td>
<td>2</td>
<td>4551693</td>
</tr>
<tr>
<td>Fitting, 1/8&quot; NPT-Female x M20-Female</td>
<td>1</td>
<td>4366633</td>
</tr>
<tr>
<td>Fitting, 1/4&quot; BSP-Female x 1/8&quot; NPT-Female</td>
<td>1</td>
<td>4366640</td>
</tr>
<tr>
<td>PTFE Tape</td>
<td>1</td>
<td>3714052</td>
</tr>
<tr>
<td>Filter</td>
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<td>4883735</td>
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<tr>
<td>Softcase</td>
<td>1</td>
<td>4860790</td>
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<tr>
<td>Softcase Accessory</td>
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<td>4821227</td>
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<tr>
<td>Shoulder Strap</td>
<td>1</td>
<td>4850059</td>
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<tr>
<td>Hanger, Dual Magnet</td>
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<tr>
<td>Magnet Strap</td>
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<td>Strap - 9 in</td>
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<tr>
<td>Liquid Contaminant Trap (optional)</td>
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<td>Calibration Certificate</td>
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<tr>
<td>Printed Multilingual Safety Information</td>
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<tr>
<td>Warranty Card</td>
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