Time Electronics
Calibration, Test and Measurement

User Manual

7016
Low Pressure Calibrator with Regulator Control

Version 1.3

11-23

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This manual provides operating and safety instructions for the Time Electronics product. To ensure correct operation and safety, please follow the instructions in this manual.

Time Electronics reserves the right to change the contents, specifications and other information contained in this manual without notice.

Contents

1 Introduction

Vacuum Version

Low Pressure Version
(0.2, 2, 5 or 10 bar)

1.1 Description

The 7016 is a fully integrated pressure test and calibration system. It is suitable for field and laboratory calibration work of both regulated low pressure and electrical process loop signals. The instrument is available in pressure or vacuum regulated configuration, with the range specified on ordering. There are five available versions according to required output range, either vacuum, 0.2, 2, 5, or 10 bar.

The 7016 combines high accuracy with simple operation, and is the popular choice for test engineers performing pressure calibration applications under 10 bar. It is an easy to use instrument suitable for calibration and maintenance of pressure gauges, sensors, transmitters, transducers, indicators, switches, and more.

Features include a 4.5 digit LCD display, 4 pressure units plus mA, zeroing switch, and regulator for output control. Basic pressure accuracy is 0.04 % of full scale and line pressure is supplied via an input quick release port fitted on the side of the unit.

For process signal calibration the loop signal is displayed on the LCD display to 0.05 % accuracy. Loop drive supply (24 V or 36 V) is also provided. Both pressure and loop signal can be displayed at the same time to speed up the calibration of pressure transmitters. Additionally a continuity function is available for testing for open circuit loops.

Power is via internal rechargeable cells (24 hours typical use) with a built-in mains charger. The unit can be powered directly from the mains if required. The 7016 is housed in an impact resistant safety case that provides protection and increased durability. All pressure connections are on the side of the case. The instrument is supplied with a pressure hose, electrical test lead, 2 electrical probes and 2 crocodile clips.

1.2 Line Pressure and Regulators

Low pressure regulators are fitted up to 10 bar, or a vacuum regulator if vacuum is specified, (please note that vacuum regulators will not work with pressure, or that pressure regulators will not work with vacuum). For the connection of line pressure a port is fitted to the right side of case.

The line pressure regulator is independent to the pressure sensor/display inside the 7016. Connection is made via a
T-piece assembly supplied. These independent lines allows the unit to be used as both an adjustable calibrator, and a reference pressure gauge.

1.3 Electrical Signals

The Loop Drive Supply is switch selectable to provide 24V, OFF, or 36V. It is rated up to 50mA and is isolated from the other internal circuits. It has a short circuit protection which limits the current to approximately 100mA.

The Loop Current calibration function is suitable for currents up to 200mA. It does not need zeroing and has an accuracy of 0.05% of reading ± 1 digit and a display resolution of 10µA . Its excellent accuracy allows precise calibration of 4 - 20mA pressure transmitters. The input resistance is only 5 ohms which provides minimal load on the loop.

The Continuity Tester function can be used to test many types of cabling, to and from the sensors. Continuity threshold is 100 ohms and values below this is indicated by an internal buzzer and with the word ‘CONTINUITY’ appearing in the mA display.

All electrical connections to the 7016 are via colour coded industry standard 4mm terminal posts. These allow a 4mm plug to be inserted or alternatively conventional bare wire connection by clamping under the terminal posts.

Two RS232 jack sockets are provided, one for pressure and one for mA, these facilitate re-calibration and read-back when used with the correct software.

The backlights can be controlled from front panel switch.

1.4 Options

For the 7016, input pressure for regulation can be provided by a compressor or gas cylinder. When used as a measuring instrument in the field, pressure can be generated by pumps like the 7090 pneumatic hand pump (vacuum to 40 bar). The 7090 is compact with comfortable handles with grips molded into the design make it easy to control the instrument whilst pumping up to pressure. Also available are a range of pumps suitable for workshop use, that feature an ergonomic mode of operation. These models include the 7193 (vacuum to 40 bar pneumatic) and 7192 (vacuum to 25 bar pneumatic).

For process control signal simulation a practical tool like the Time Electronics handheld 7006 Loop-Mate is available as an option. It is a low cost, simple operation unit that provides 4 - 20 mA and 0 - 10 V signals at levels of 0 %, 10 %, 25 %, 50 %, 75 %, 90 %, 100 %.

It can also step through these set points automatically to allow hands-free calibration. It is battery powered and compact, pocket sized and easy to carry in the field.

EasyCal Calibration Software

The 7016 can be controlled with readback via Time Electronics EasyCal software to automate the calibration process. This provides increased speed of calibration and consistency of results. Produce traceable calibration certificates and test reports for quality standards with additional uncertainty information for ISO 17025 conformance.

1.5 Ordering Information

7016 .....Regulated Low Pressure Calibrator (+ pressure range code a shown below).

Range (bar)	Vacuum	0.2	2	5	10
Option Code	7111	7100	7101	7102	7103

Calibration Certificates and Accompanying Products

7090 .....Pneumatic Hand Pump (vacuum to 40 bar). See datasheet for options.

7192 .....Pneumatic Benchtop Pump (vacuum to 25 bar). See datasheet for options.

7198 .....Pressure calibration adaptors/fittings kit. See datasheet for options.

7006 .....Loop-Mate 1: Loop Current Simulator

ECFL..... EasyCal Calibration Software. See datasheet for further information.

C178 .....Traceable calibration certificate (Factory)

C190 .....Accredited calibration certificate (ISO 17025)

1.6 Technical Specifications

1.6.1 Pressure - Regulator on all ranges

Range (bar)	-0.95 to 0	0 to 0.2	0 to 2	0 to 5	0 to 10
Accuracy (% FS)	0.04	0.1	0.04	0.04	0.04
Resolution (bar)	.0001	0.01 mbar	.0001	0.001	0.001

Units ..... 0.2bar version: mbar, PSI, kg/cm2, cmWg and mA.
Vac, 2, 5, and 10 bar versions: bar, PSI, kg/cm2, cmWg & mA.

Maximum pressure ..... 10 bar for 0.2, 2, 5 bar versions / 12 bar for 10 bar version.

Sensor..... Piezo-resistive - stainless steel diaphragm.

Over pressure warning..... 1.2 x range full scale - audio and visual (on LCD) warning.

Fittings ..... Quick Release.

1.6.2 Electrical

Range ..... Loop current measurement 0 to 200 mA.

Resolution ..... 10 µA.

Resistance ..... Loop load 5 Ω.

Accuracy ..... 0.05 % of reading ±1 digit.

Loop drive ..... 24 V or 36 V switch selectable, 50 mA max - isolated and with short circuit protection.

Continuity ..... Threshold: 100 Ω with audio and visual warning.

Terminals ..... 4 mm industry standard terminal posts.

1.6.3 General Specifications

Power source ..... Internal rechargeable NiMH batteries
or mains supply (230 V or 110 V 50/60 Hz).

Battery life ..... 24 hrs of typical usage between charges.

Display ..... 7 segment LCD display with ‘Low Battery’ warning indicator.

Interfaces ..... RS-232 for readback and re-calibration (software not supplied).

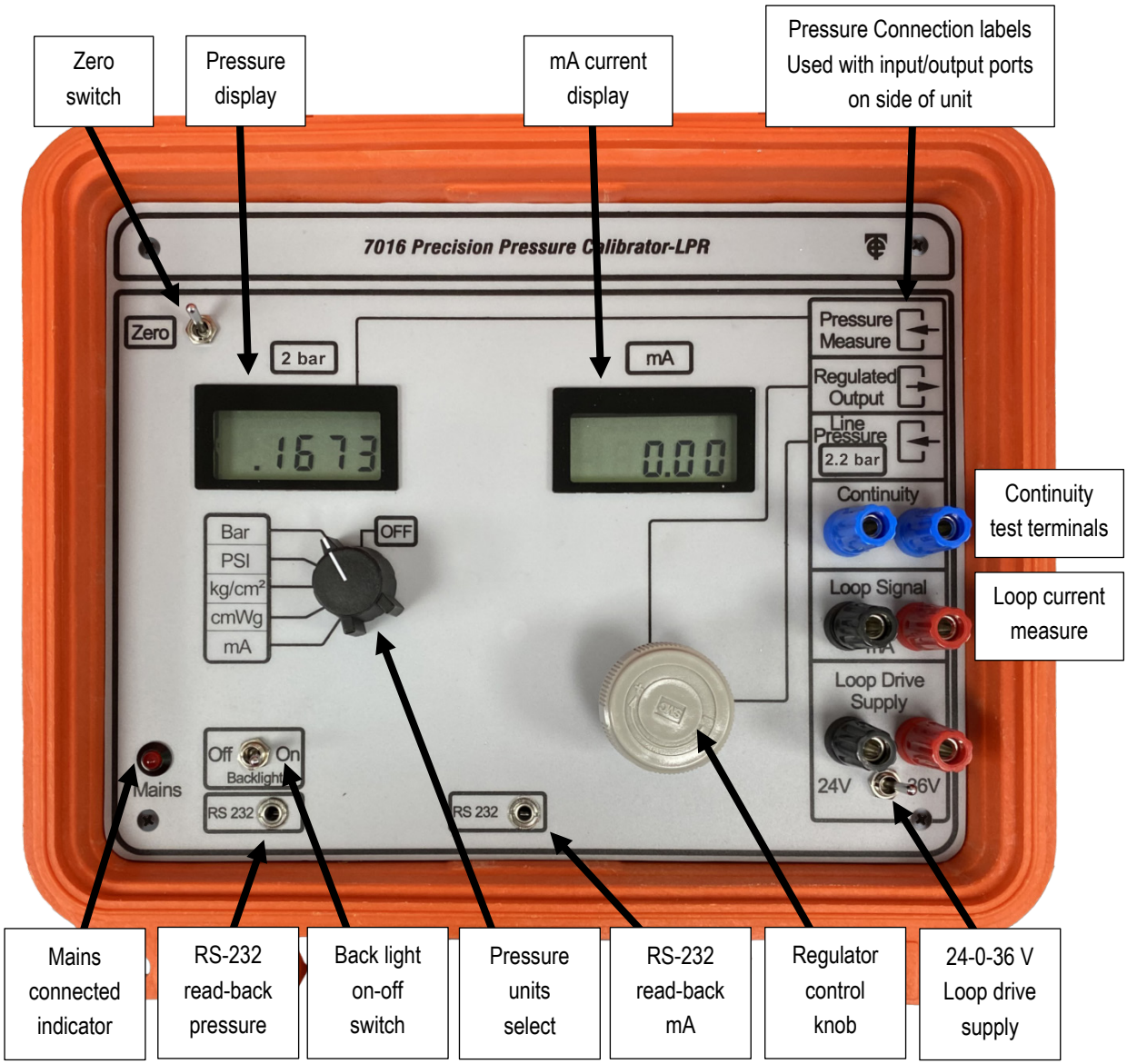
Case..... Structural resin which is weather-proof to IP66 standard.

Dimensions / Weight ..... W 270 x H 175 x D 250 mm / 3 kg

Supplied with..... Pressure hoses and fittings. Electrical Test Lead:
Twin flexible lead, terminated with 4 off 4mm gold plated plugs.
Electrical probes: 2 low voltage probes and 2 crocodile clips.
Mains power lead.

2 Front Panel Controls

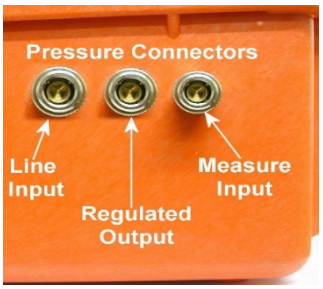
2.1 Main Controls and Display



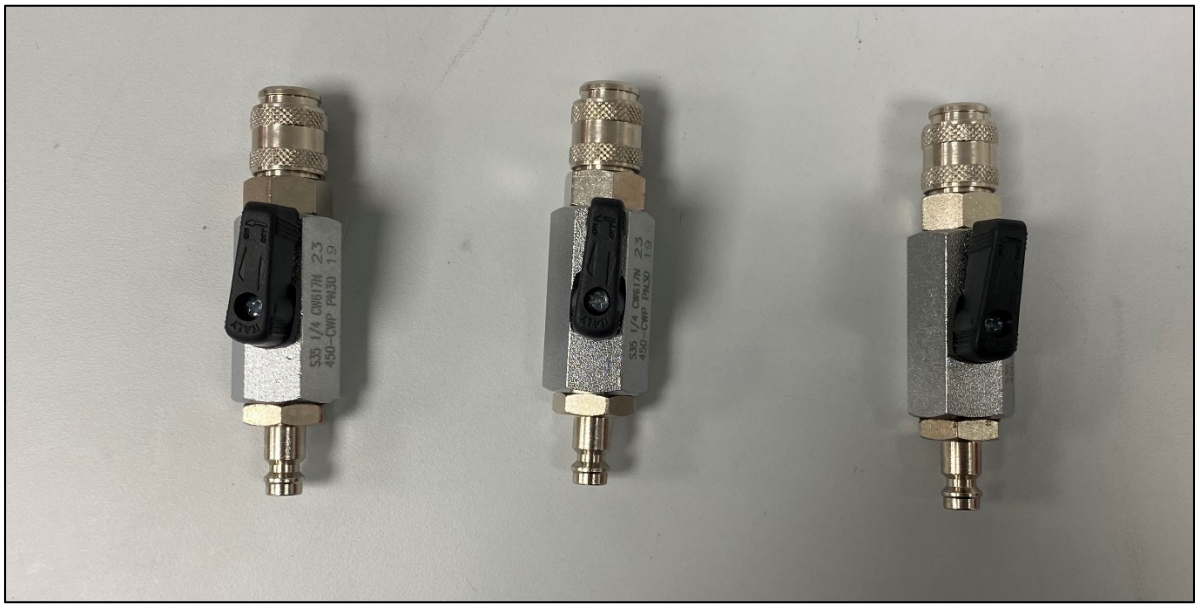
2.2 Pressure Connections

The pressure connections are situated on the side of the case. They are quick release type fittings.

Hoses and fittings are supplied to connect to the line pressure and unit under test.



Three block valve fittings are also supplied to enable closing off pressure lines externally. These may be used depending on the testing application and line pressure setup. For example, if using plant air that is to be permanently connected to the 7016.



These can connect to the pressure ports on the side of the unit as shown:

2.3 Hoses

The hoses supplied are for connection to the line pressure and unit under test.

Line pressure hose

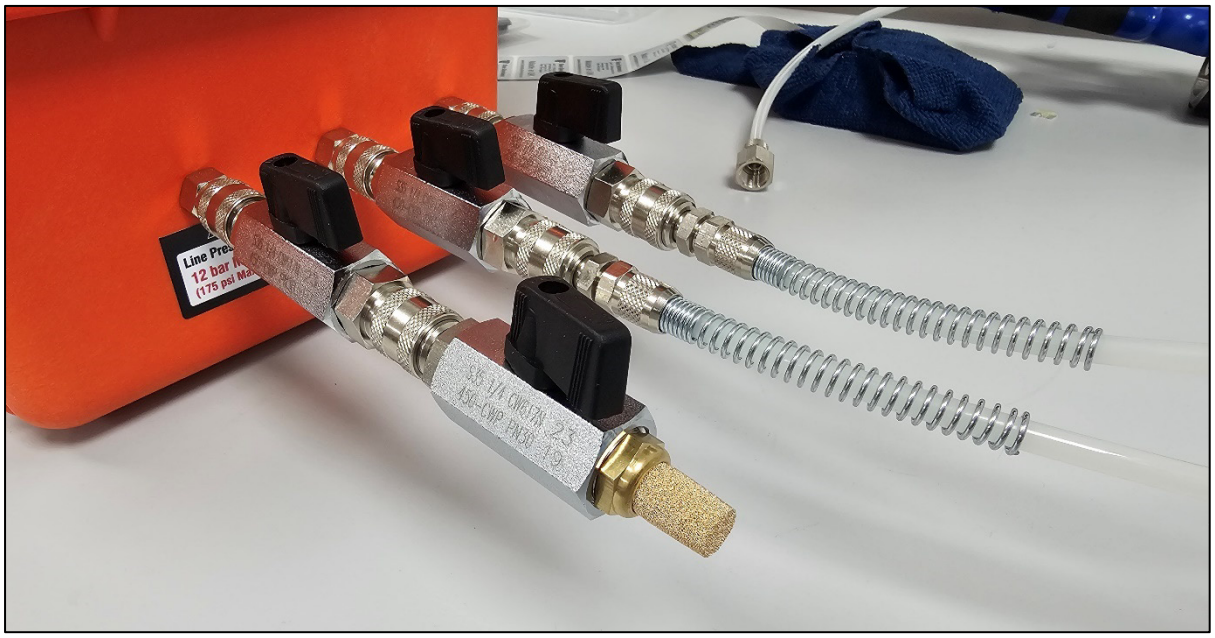
T-piece hose

Connects to regulated output, measure port, and unit under test.

2.4 Suppressor/Vent and Block Valve Fitting

This is an additional fitting that can be used when zeroing the 7016 measurement sensor via the measure port. It opens the sensor to atmosphere.

It is also used to vent the internal pressure inside the 7016, when the line pressure source does not vent the system completely. Or to ensure there is no potential excess pressure in the line.



3 Operation

WARNING: An automatic over pressure relief system is **not** fitted.
Always take care when connecting/disconnecting pressure systems.

3.1 Line Pressure

To connect the line pressure, use the supplied hose and either connect directly to the pressure source, or via the block valve fitting (as shown below).

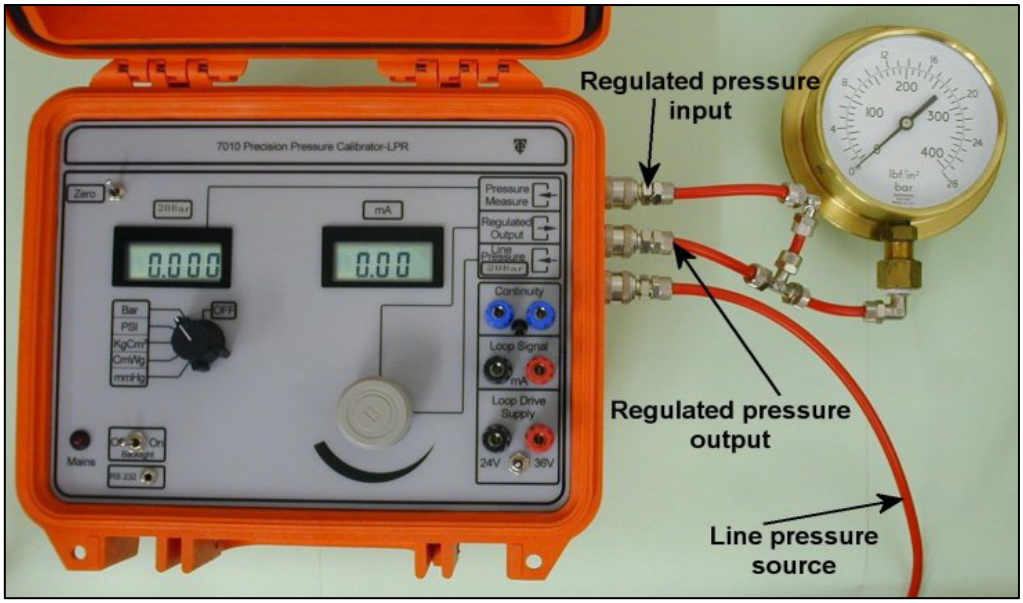
The end of the hose can then be connected to the pressure source. A ¼ BSP female fitting is supplied as standard, adaptors are included also.

NOTE: If your line pressure source has a venting mechanism and will be permanently connected, you can choose to not use the block valve.

Warning: Do not disconnect the quick release fittings when the line pressure is supplying the 7016.
This will cause the pressure to be active in the hose and is potentially hazardous.

3.2 Pressure Calibration using the 7016

1. Switch on the 7016 and select the required pressure units.
2. Ensure that the pressure measure input port is open and at atmospheric pressure. To do this, connect the suppressor/vent fitting to the measure port with the valve open.
3. Press and release the zero switch to zero the display.
   Note: Do not press the zero switch again for more than 2 seconds.
4. Ensure the REGULATOR is fully closed (anti-clockwise).
5. Remove the suppressor/vent fitting and connect the T-piece hose to the regulated output port and the measure input port of the 7016. You can choose to use the additional block valve fittings if you want.
6. Connect the external line pressure/vacuum source to the 7016 line pressure input.
7. Connect the item to be calibrated to the port of the T-piece hose.
8. Slowly apply the external line pressure or vacuum. Do not exceed maximum rated line pressure of the 7016 (see specification and labels on the unit).
9. Open the REGULATOR slowly and adjust for the dial gauge being tested to read the required pressure, note display reading.



10. After completing the calibration points recheck the zero as follows:

    Close REGULATOR fully (anti-clockwise), check for zero pressure on pressure display, The 7016 is now ready to calibrate the next item or for shutting down.

3.3 Shutting Down the 7016

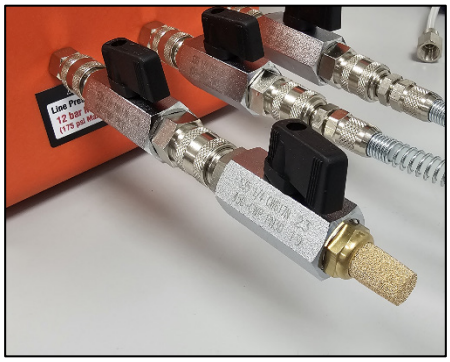
To de-pressurize the system and power down after use, follow these steps.

1. Confirm REGULATOR is fully closed (anti-clockwise). If the T-piece hose is still connected with the UUT, then the 7016 pressure should read zero.
2. Disconnect the unit under test.
3. De-pressurize your line pressure system. If a cylinder or compressor then you would typically vent/decrease the regulator and see that the output gauge reads zero.
4. Remove the line pressure input and output hoses from 7016 ports.
5. Turn the “Unit Select Switch” to off. Also ensure loop drive supply is switched to center off position.
6. Note that the unit will auto power off after 20 minutes if not used.

If you are using the block valve fitting on the line pressure input, you can ensure no excess pressure is between the regulator valve, you can follow these steps:

1. Vent your pressure source (ie compressor or cylinder).
2. Close the block valve.

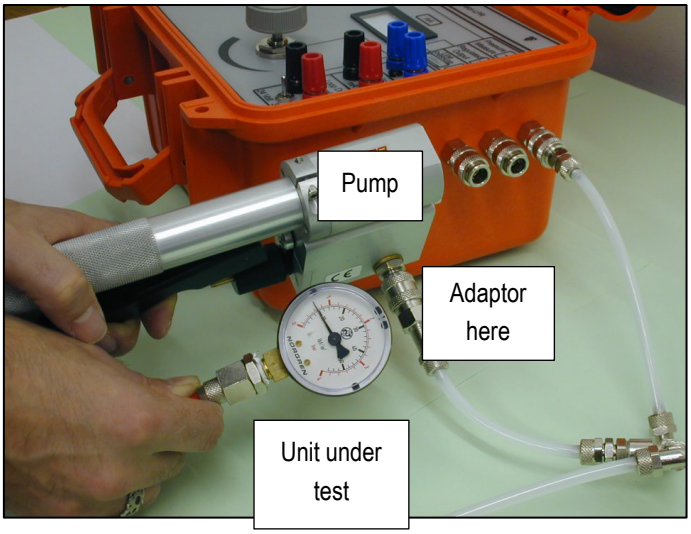
3. Then disconnect the line pressure hose from the block valve input.
4. Attach the suppressor/vent fitting to the block valve input.
5. Open both valves to safely vent and excess internal excess pressure via the suppressor.



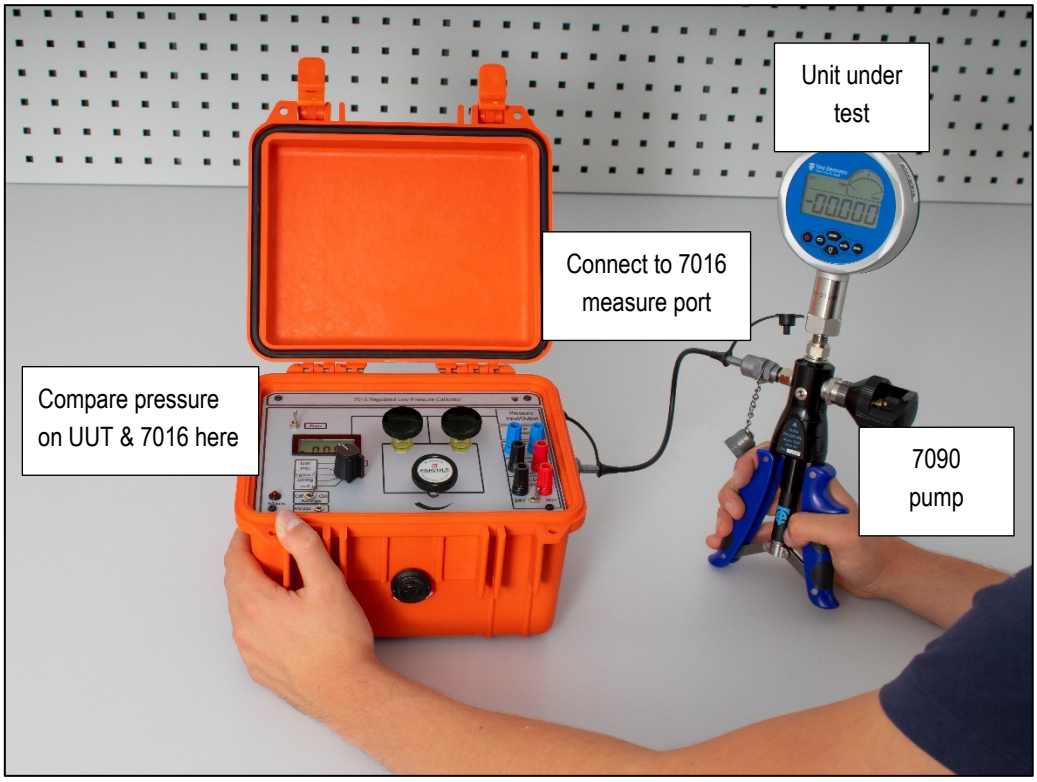
3.4 Using the 7016 with an External Hand Pump

The measure input port can be used with a hand pump up to the maximum pressure/vacuum of the 7016.

If the pump has a single output, it should be connected using a Tee connection adaptor to allow the item to be calibrated and the 7016 to have a common pressure - see below.



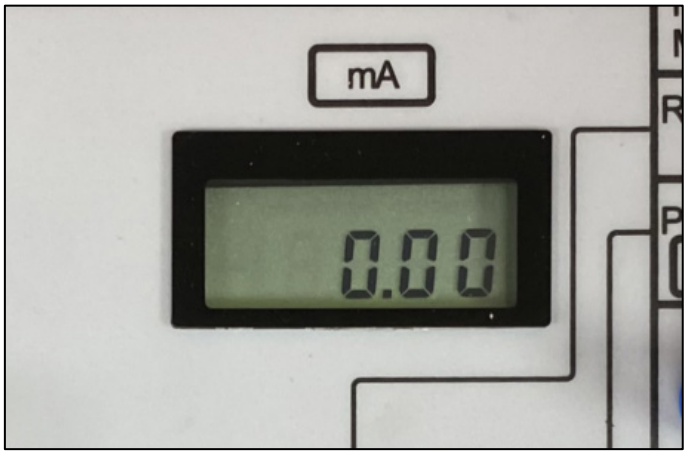
If you are using the Time Electronics 7090 pump, it features 2 output ports. Connect one side to the 7016 measure and the other to the unit under test.



3.5 Current Loop Calibration

Process control loop currents can be measured and calibrated using the ‘Loop Signal’ mA terminals. Connect the loop current drive supply in series if the loop needs power.

The loop signal is always displayed on the second display.



Check that the display is showing zero ± 1 digit before connecting the loop signal.

This can be done without disconnecting the pressure.

3.6 24/36V Loop Drive Supply

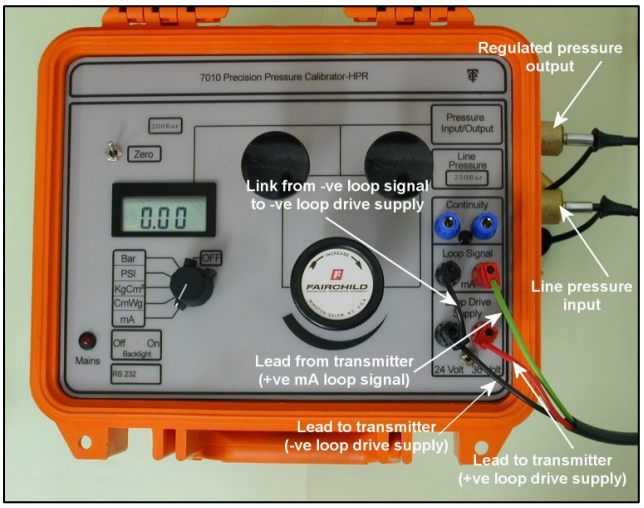
The Loop Drive Supply is switch selectable to provide either 24V or 36V. It is rated for up to 50 mA and is isolated from the other internal supplies. It is short circuit protected and limits the maximum current to about 100mA max.

The loop drive supply can be switched off independently to conserve battery power.

3.7 Pressure Transmitter Calibration

The example opposite shows a typical connection configuration for the HPR version (LPR connections are the same) calibrating a transmitter.

The loop drive supply is being used to power the transmitter. The transmitter signal output is connected to the +ve 'Loop Signal' input. A link connects the –ve loop signal to the –ve loop drive supply.



Calibrating:

With the 7016 LPR the mA function is available at all times.

Using the switch on the 'Loop drive supply', select 24 or 36V as required.

Apply the calibrating pressure required using the regulator. Note the loop mA on the display.

3.7.1 Continuity Tester

The 7016 is fitted with blue coloured continuity terminals. When an electrical connection of less than 100 ohms is made between the two terminals, the display will indicate continuity and the internal buzzer will sound. The continuity tester can be used to check signal/control cabling in process control loops and other general purpose signal wiring.

3.8 Power OFF (auto power down)

To switch the 7016 off, rotate pressure select switch to OFF. Ensure the 'Loop Drive Supply' switch is also set to center OFF. The 7016 should always be switched OFF after use to prevent battery discharge.

3.8.1 Auto power down

This will occur automatically after approximately 20 minutes after the last movement of the 'Units select switch'.

3.8.2 To disable auto power down

Press and hold the zero switch while turning on with unit select switch. With the DP version use the zero switch for the P1 channel.

NOTE: Auto power down disabled mode is cancelled when the 7016 is turned off.

4 Power - Mains and Battery

The 7016 LPR can be operated from the internal battery pack or mains power.
An internal charger re-charges the battery when the mains is connected.

Operation from external mains supply:

When the 7016 is connected to the mains supply, the mains connected indicator will light.

Operation from internal batteries

For field use the instrument can be powered from the internal batteries. Approximately 24hrs of typical use is available from fully charged batteries. When the battery level falls to a level when re-charging is necessary a ‘LOW BATTERY’ indication appears on display. Please note that approx 0.5 hour of use is available after the low battery indication first appears.

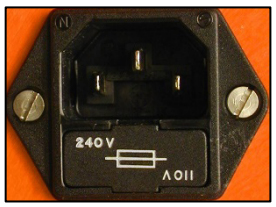
Battery Re-Charging

When the 7016 is connected to a mains supply, the batteries will be charged. (This applies even if the 7016 is switched off). It is important to ensure that the ambient temperature is less than 30 degC for efficient battery charging. The batteries require a charging time of 14 to 16 hours from fully discharged. It is not possible to over-charge the batteries and therefore the 7016 can be left connected permanently to the mains without damage

Mains Supply Voltage Setting

The mains supply voltage is set according to the position of the fuse carrier which is located in the mains inlet socket. To select the mains voltage, remove the fuse carrier and rotate it so that the required mains voltage required is next to the 3 pins of the plug.

A.C Mains Supply	Fuse Carrier
220V, 230V, 240V	240
110V, 115V	110



IMPORTANT: If a mains supply of 230V is connected to the 7016 when it has been set for 110V operation, the fuse in the fuse carrier will blow. If a mains supply of 110V is connected to the 7016 when it has been set for 230V operation, it will not operate correctly. However, no fuses will blow.

Fuses

There are two fuses fitted as protection in the 7016, both are standard 20 x 5mm diameter types. Ensure that the correct type and value are fitted as listed below.

Mains fuse

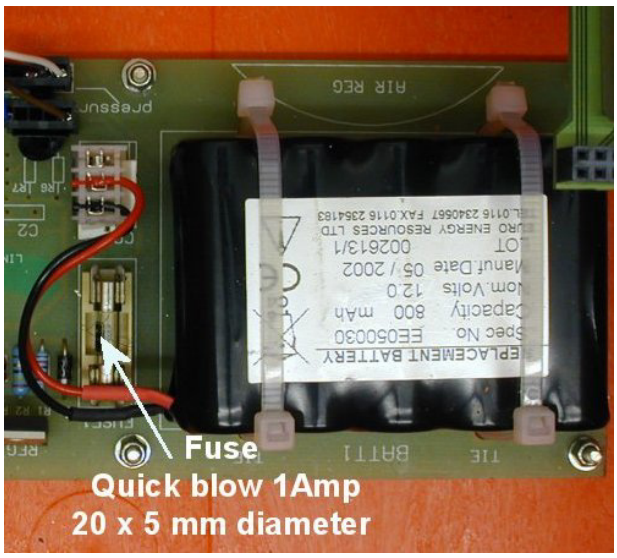
Type: 20 x 5mm diameter, 1A Quick blow.

Located in the fuse carrier/voltage selector section of the mains inlet socket.

Battery fuse

Type: 20 x 5mm diameter, 1A Quick blow.

Located on the power supply PCB, this PCB is mounted at the bottom of the case.



Please note that 4 of this type of fuse are supplied with the accessory items.

5 Operating Precautions and Recommendations

LCD Displays

These should not be exposed to strong sunlight for prolonged periods.

Usage and Storage Temperature/Humidity

Operating:	-10 to +50 °C
Storage:	-30 to +70 °C
Operating/Storage humidity:	10-90%, non-condensing

Pressure Systems:

The 7016 LPR pressure inputs are suitable to work with gas systems. Pressure input(s) are on the right side of the case. To provide quick and flexible test hose connections, Quick release connectors are used. They are self-sealing and do not require special tools to connect. Quick Release is a push on snap fit, and is used for gas below 20 bar and vacuum.

Please note that with the 2 bar pressure version, vacuum measurements may be made on the measurement port, but isolate the regulator output port first.

If you need any additional connections, please contact Time Electronics or their authorized dealer.

WARNING: An automatic pressure relief system is not fitted to the 7016.
Always take care when connecting/disconnecting high pressure systems.

Electrical connections

The electrical functions on the 7016 are via standard 4mm terminals. These must NEVER be connected to mains or other high voltages. The loop current indicator must only be used with current of loops with 36V drive or less. The 24/36V loop supply and continuity tester must never be connected in to any other power source.

6 Warranty and Servicing

Warranty

Time Electronics products carry a one-year manufacturer's warranty as standard.

Time Electronics products are designed and manufactured to the highest standards and specifications to assure the quality and performance required by all sectors of industry. Time Electronics products are fully guaranteed against faulty materials and workmanship.

Should this product be found to be defective, please contact us using the below details. Inform us of the product type, serial number, and details of any fault and/or the service required. Please retain the supplier invoice as proof of purchase.

This warranty does not apply to defects resulting from action of the user such as misuse, operation outside of specification, improper maintenance or repair, or unauthorized modification. Time Electronics' total liability is limited to repair or replacement of the product. Note that if Time Electronics determine that the fault on a returned product has been caused by the user, we will contact the customer before proceeding with any repair.

Calibration and Repair Services

Time Electronics offers repair and calibration services for all the products we make and sell. Routine maintenance by the manufacturer ensures optimal performance and condition of the product. Periodic traceable or accredited calibration is available.

Contacting Time Electronics

Online:
Please visit **www.timeelectronics.com** and select Technical Support from the Contact links. From this page you will be able to send information to the Time Electronics service team who will help and support you.

By phone:
+44 (0) 1732 355993

By email:
mail@timeelectronics.co.uk

Returning Instruments

Prior to returning your product please contact Time Electronics. We will issue a return merchandise authorization (RMA) number that is to accompany the goods returning. Further instructions will also be issued prior to shipment. When returning instruments, please ensure that they have been adequately packed, preferably in the original packing supplied. **Time Electronics Ltd will not accept responsibility for units returned damaged.** Please ensure that all units have details of the service required and all relevant paperwork.

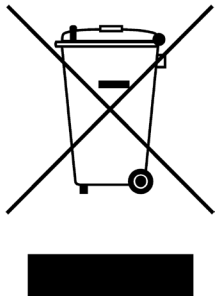
Send the instrument, shipping charges paid to:

Time Electronics Ltd
Unit 5, TON Business Park, 2-8 Morley Road,
Tonbridge, Kent, TN9 1RA.
United Kingdom.

Tel: +44(0)1732 355993
Fax: +44(0)1732 350198

Email: mail@timeelectronics.co.uk
Web Site: www.timeelectronics.com

Disposal of your old equipment



1. When this crossed-out wheeled bin symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC.
2. All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.
3. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.
4. For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or return to Time Electronics.