A Subsidiary of Haven Holdings Ltd.

Haven Automation Limited

Calibration Solutions for Industry

Measurement House, Kingsway,
Fforestfach, Swansea SA5 4EX, UK.
Tel: General: +44 (0) 1792 588722
Sales: +44 (0) 1792 580255
Service: +44 (0) 1792 579696
Fax: +44 (0) 1792 582624
Email: mail@haven.co.uk
Web: www.haven.co.uk

Introduction

Haven Automation Limited was founded in 1965 and operated as an instrument service and contracting company, until its acquisition by the Wood Group of Scotland in 1978. Haven subsequently concentrated on the design, development, manufacture and service of process calibration equipment and simulator training systems. In 1990 Haven was the subject of a management buyout involving the current management.

The Company's activities are now divided into two divisions:

- Test Instruments (Portable Calibrators & Test Bench Systems)
- Repair and Calibration Services

Haven has successfully maintained a reputation for the technical excellence and reliability of its products. These include calibrators for Pt-100, thermocouple simulation, temperature, pressure and electrical signals and range from hand-held instruments to complete calibration workstations and custom-designed workshops. Haven is supported by a network of agents/distributors world-wide.

Quality is integral to the Company's successful business strategy and ISO9001 accreditation was awarded in 1992. The Company opened its first UKAS accredited laboratory for DC electrical measurement in 1990. This was followed by pressure measurement, AC electrical measurement and in 1997 the first UKAS temperature laboratory in Wales. The laboratories provide essential new product certification and after sales service and support. In addition, Haven provides a repair and re-certification service for other manufacturer's products and is a European Service Centre for Practical Instrument Electronics (PIE), USA, Crystal Engineering, USA and Techne, Cambridge.

0295

Director: K. Jones
London Registration No: 862544 VAT Registration No: 541 0442 88

WEEE Registration No: WEE/EG0103WV

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Haven Services

Haven has provided Calibration and Repair Services to Industry for over 40 years.

Calibration - Haven has UKAS accredited laboratories in the fields of Electrical, Pressure and Temperature Measurement. We offer a fast turnaround, competitive prices and no obligation, FOC quotations. Non UKAS (traceable) calibrations available for many fields of measurement

Repair - A fast turnaround repair service for a wide range of process, control and test instrumentation. All service and repair work is carried out by qualified and experienced staff in our well-appointed repair department. Collection and delivery service available.

Contract Management - We can take the responsibility for co-ordinating your calibration, including instrument recall notification, collection and return, hire of replacement equipment if required, repair and general maintenance.

Hire - The latest in portable electrical, pressure and temperature calibration and test equipment at competitive rates. All equipment supplied fully tested and, where appropriate, with a valid UKAS calibration certificate.

- During plant shut-downs
- Annual calibration routines
- Critical cover when equipment is being repaired or calibrated
- When usage is low or short term
- The latest in portable electrical, pressure and temperature calibration and test equipment at competitive rates
- Low cost next day delivery and collection
- Short and long term hire periods - discounts for long periods
- Credit card payment facilities
- Advance Booking Facility
- Hire to Buy Options - New and Used Equipment

Our hire stock is continuously expanding - so if you cannot see what you want - ASK

Listed below is the range of instruments we have available for hire. Please contact us for further information and a firm quotation.

Multi-Function	
Calibrators	From £30 per week
Electrical	
Current/Voltage Sources	From £20 per week
Decade Boxes	From £25 per week
Digital Clampmeters	From £20 per week
Digital Indicators	From £20 per week
Frequency Generators	From £40 per week
Insulation Testers	From £14 per week
mA Loop Calibrators	From £50 per week
Multimeters	From £14 per week
Oscilloscopes	From £30 per week
Portable Appliance Testers	From £75 per week
Power Supplies	From £15 per week
RCD Testers	From £30 per week
Transmitter Simulators	From £20 per week
V, mV, mA Calibrators	From £35 per week

Pressure	
Dead Weight Testers	From £150 per week
Digital Pressure Gauges	From £45 per week
Digital Pressure Indicators	From £20 per week
Manometers	From £35 per week
Multical Pressure Adaptors (various ranges)	From £15 per week
Pressure Calibrators (various)	From £40 per week
Pressure Pumps (various)	From £15 per week
Standard Test Gauges	From £24 per week
Temperature	
Chart Recorders	From £65 per week
Digital Temperature Indicators	From £20 per week
Oil/Water Baths	From £90 per week
RTD Simulators	From £40 per week
Temperature Block Calibrators (various ranges)	From £50 per week
Thermocouple & Pt100 Calibrators	From £20 per week

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Multimeters	From £14 per week
Oscilloscopes	From £30 per week
Portable Appliance Testers	From £75 per week
Power Supplies	From £15 per week
RCD Testers	From £30 per week
Transmitter Simulators	From £20 per week
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Chart Recorders	From £65 per week
Digital Temperature Indicators	From £20 per week
Oil/Water Baths	From £90 per week
RTD Simulators	From £40 per week
Temperature Block Calibrators (various ranges)	From £50 per week
Thermocouple & Pt100 Calibrators	From £20 per week

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Spec-Cal®

Eclipse II

PROCESS CALIBRATOR

3 modes of cold junction compensation- internal, external and manual

LCD display indicating generated and measured values simultaneously

20 selectable functions

Programme keys for ramp functions and datalogging of calibration results

Switchable backlight

Separate measurement and generation colour-coded terminals

24V integral DC supply

External cold junction probe socket

Features

- Accuracy 0.007% of reading.
- UKAS Certificate at no extra cost - mutually accepted in Europe through EAL*
- Simultaneous measurement and generation of mV, mA ,V and Ω.
- Measures and simulates 12 different thermocouple types and 7 RTD signals to selectable international standards (BS/JIS/DIN/ANSI).
- Unique RTD emulation capability - precision RTD simulation whether used with DC, AC or pulsed waveform excitation currents.
- Automatic remote cold junction compensation.
- Multi-lingual - operates in 5 different selectable languages.
- Pressure Calibrator - plug-in modules available to measure pressures from - 14.7 to 500 psi.
- Integral 24V DC supply.
- Spec-Linkô Windowsô - based calibration software with RS232 interface and data logging facility.
- Portable, bench and panel mounted versions available.

The Haven Spec-Cal® Eclipse II multi-function process calibrator represents a culmination of 30 years experience in calibrator design and manufacture.

The Spec-Cal® Eclipse II measures and simulates 12 thermocouple types to any of four selectable international standards (BS, JIS, DIN and ANSI) as well as simultaneously measuring or generating mV, mA or volts. In addition, the Spec-Cal® Eclipse II measures and generates ohms, and measures and simulates 7 different RTD types.

The hand-held, battery powered Spec-Cal® Eclipse II is protected by a tough, EMC shielded, aluminium case with a durable, splash-proof, polycarbonate keypad which has excellent tactile and audible feedback, a high contrast super twist LCD display and switchable backlight. It is also available as a bench or panel mounted version, mains powered with a permanent backlit display.

Used in conjunction with the Haven Multical Pressure Module, the Spec-Cal® Eclipse II offers the capability of measuring pressures from -14.7 up to 500psi. Spec-Linkô Windowsô- based software provides an automated calibration management facility to assist compliance with ISO9000 quality systems.

Haven Automation Limited

*EAL- European co-operation for Accreditation of Laboratories- International acceptance and mutual recognition agreements of UKAS calibration certificates throughout Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, Australia, Hong Kong and New Zealand.

Simple To Operate Yet Powerful

The Spec-Cal® Eclipse II Calibrator is menu-driven for ease of use, the sequence of options is simple, logical and intuitive. The non-volatile memory will store up to 50 ramp programmes and 500 calibration values even when your Spec-Cal® Eclipse II is switched off or the batteries removed. For each ramp programme you can enter values for units, step time and increment and define high and low limits. The programme can be manually stepped or auto-cycled, it can even be controlled remotely from a PC or stopped by remote contact closure. Three modes of cold junction compensation are available, including Haven's patented external remote CJ measurement system, eliminating the need to use error inducing compensating cable.

The Spec-Cal® Eclipse II is supplied with a set of 6 high capacity NiMH batteries, which will power the instrument for up to ten hours. Alternatively, you can use disposable AA cells or power directly from the mains supply using the battery charger/ eliminator. A low battery indicator will tell you when your Spec-Cal® Eclipse II needs to be charged giving reasonable advance warning of instrument power down. To save power an automatic function is available to power down down your instrument if a key has not been pressed for approximately 10 minutes. An isolated 24 Volt integral supply is provided for loop power.

Multi-Functional Combined with High Performance

Calibrate temperature, voltage, current, resistance and pressure instruments. Use either ITS-90 or IPTS-68 temperature scales, select between ºC and ºF, work in % of range, mA or Volts, display square root values of measured current, detect open-circuit thermocouples or even use your Spec-Cal® Eclipse II as a highly accurate digital thermometer.

The Spec-Cal® Eclipse II is multi-lingual, operating in English, French, German, Italian and Spanish. Other useful functions include password protection, preventing unauthorised use of your instrument, an owner details display and calibration date to remind you when your Spec-Cal® Eclipse II is itself due for recalibration.

The Spec-Cal® Eclipse II offers a basic accuracy of 0.007% of reading and each instrument is supplied with a UKAS calibration certificate as standard. This ensures full traceability through an unbroken chain to National Measurement Standards and so meet the requirements of ISO9000 quality management systems.

The Spec-Cal® Eclipse II is so accurate it is often used as a transfer laboratory standard. Due to increased customer demand, other models are now available; a free standing bench version ideal for laboratory use and a panel mounted bench version for inclusion in our range of custom-designed test benches.

Unique RTD Emulation

The Spec-Cal® Eclipse II uses an innovative circuit design providing precision RTD emulation whether used with DC, AC or pulsed waveform excitation currents. This is unlike other RTD simulators / process calibrators available on the market which are limited to simulating RTDs for instruments with restricted DC or low frequency AC excitation currents.

RTD simulators generate a voltage, the value of which is a function of the excitation current of the instrument under test and the resistance to be simulated. However, excessive variations in the value or rate of change of excitation current can cause the simulation to become unstable and/or inaccurate. This problem is eliminated in the Spec-Cal® Eclipse II by the use of our unique resistance emulation circuitry which uses an array of real, switchable resistors to provide the required resistance value. The Spec-Cal® Eclipse II is in effect an intelligent resistance emulator.

Cold Junction Compensation

Haven Automation invented thermocouple simulation techniques for use in portable calibrators over 20 years ago and the competition is still trying hard to catch up. Our remote cold junction sampling idea was so unique we took out a patent - no need to search around for the correct thermocouple cable to carry out your calibration, no chance of introducing massive errors by using compensation cable (a common mistake) - just copper conductors and no errors.

Haven Automation Limited

Supports ISO9000 Calibration

The Spec-Cal® Eclipse II can be used in the field to store up to 500 measured and generated values along with the identity of the instrument under test. Later, this data can be downloaded to your PC using an RS232 interface and Spec-Link™ software.

Spec-Link™ Windows™ supported software enables straightforward printing of calibration certificates with custom-designed header information and facilities to export your calibration information to other word-processing and spreadsheet applications.

Complete calibration management and analysis features are available when used with the Autocal Management Calibration Software (ask for our Autocal brochure).

Pressure Measurement

Haven Multical plug-in Pressure Modules turn your Spec-Cal® Eclipse II into a highly accurate pressure calibrator enabling direct pressure indication in up to 9 engineering units, and vacuum and pressure generation when used in conjunction with a Haven Hand Pump.
Haven Multicals are Rugged and Reliable - the silicon pressure sensor is protected by a stainless steel diaphragm and the sensor housing is teflon coated. The non-corrosive structure provides excellent resistance against contaminants when used in the field.

Haven Multicals are Universal - they can be used with any instrument that reads millivolts.
Haven Multicals are Pocket-Sized - with an overall length of 12.6cm and weight of 84g and powered by a single 9V battery giving over 400 hours of use.

Multical Specifications

Model	Ranges (Gauge Pressure)	Accuracy	Pressure units
A	0 to 30 psi 30 to 50 psi 0 to -14.7 psi Max Pressure	± (0.05% of reading + 0.01 psi) ± (0.25% of reading) ± (0.5% of reading + 0.02 psi) 100 psi	50 psi module: psi, in H_20, cmH_20, inHg , mmHg, kPa, mbar, bar and kg/cm^2 (9 units)
B	0 to 500 psi 0 to -14.7 psi Max Pressure	± (0.1% of reading + 0.02 psi) ± (0.25% of reading + 0.02 psi) 1000 psi	500 psi module: psi, mH_20, inHg, cmHg, kPa, MPa, bar and kg/cm^2 (8 units)

General Specifications

24 V DC Supply: .....25mA maximum output
Terminal Type: .....4mm binding posts to accept wire or 4mm plug
Isolation: .....The MEASURE, GENERATE and 24V terminals are mutually isolated
Over Voltage Protection: .....30 Volt AC and DC

Cold Junction (int/ext):
Accuracy: .....±0.1°C at 23°C (±0.2°F at 73°F), 0.1 degree resolution
Range: .....-50 to +136°C (-58 to +276°F)
Error: Add 0.01°C per degree difference from 23°C (0.02°F from 73°F)

Environmental:
Temperature: .....-5 to +50°C (23 to 122°F)
Relative Humidity: .....10 to 80% non condensing. <70% recommended.
Storage Temperature: .....-20 to 60°C (-4 to 140°F)
Int Reference Drift: .....<7 ppm per °C from 23°C (73°F)

Dimensions:
Product .....Spec-Cal® Eclipse II
(L,W,H) 246x105x57mm
Weight 1kg
Free Standing Bench Version: 292x530x110mm (6.5kg)

Ramp Specification
Ramp UNITS available: .....V, mV, mV%, mA, mA%, °C, °F
Min Ramp Increment: .....least significant digit of range
Ramp Step Time: .....5 sec to 9999.9 sec
Ramp Delay: .....1 sec to 5 min (before start of cycle)
Modes: .....auto single cycle, auto continuous cycle, manual

Supplied complete with carry case, battery charger, standard accessories, and UKAS Calibration Certificate issued by Haven Automation Ltd.

Laboratory No: 0295

Electrical Signals

Function	Range	Display Resolution	Internal Resolution	Accuracy
Measure	-100 to 100mV	1µV	0.19µV	0.007% Reading + 5µV
	-55 to 55mA	1µA	0.19µA	0.007% Reading + 5µA
	-30 to 30V	1mV	0.06mV	0.007% Reading + 3mV
	0 to 400Ω (lexc = 1mA)	10mΩ	1mΩ	0.007% Reading+ 20mΩ
	400 to 4000Ω (lexc=0.1mA)	100mΩ	10mΩ	0.007% Reading+200mΩ
Generate	-25 to 100mV	1µV	0.19µV	0.007% Reading + 5µV
	0 to 22 mA	1µA	0.04µA	0.007% Reading+5µA
	-2.5 to 10V	1mV	0.02mV	0.007 Reading +3mV
	18 to 400Ω *	10mΩ	1mΩ	0.007%Reading + 20mΩ
	400 to 4000Ω **	100mΩ	10mΩ	0.007% Reading+200mΩ

*Excitation current (DC/AC/pulsed) from -10 to +10mA **Excitation current (DC/AC/pulsed) from -1 to +1mA. All resistance specification are for 4 wire configuration only.

Thermocouple Measurement and Simulation

Simulation

T/C Type	Range C	Worst Case Accuracy* +/-C	Best Case Accuracy** Mid Range +/- C
T	-250 to -200	1.1	0.2
	-200 to -140	0.3	
	-140 to 400	0.2	
E	-250 to -200	0.9	0.2
	-200 to 800	0.2	
	800 to 1000	0.3	
K	-250 to -180	1.7	0.2
	-180 to 550	0.3	
	550 to 1372	0.4	
R	-50 to 100	1.4	0.4
	100 to 1740	0.7	
	1740 to 1767	2.0	
J	-210 to -110	0.3	0.2
	-110 to 700	0.2	
	700 to 1200	0.3	
S	-50 to 0	1.3	0.5
	0 to 120	0.9	
	120 to 1740	0.7	
	1740 to 1767	1.9	
B	300 to 600	1.7	0.5
	600 to 1000	1.1	
	1000 to 1820	0.7	
N	-250 to -220	1.9	0.2
	-220 to -150	0.7	
	-150 to 1300	0.3	
PR (JIS)	0 to 250	1.9	0.6
	250 to 1600	0.8	
	1600 to 1770	0.7	
U (DIN)	-200 to -120	1.0	0.2
	-120 to 180	0.4	
	180 to 600	0.2	
L (DIN)	-200 to -120	0.6	0.2
	-120 to 900	0.3	
NI (ANSI)	-18 to 1310	0.2	0.2

Measurement

T/C Type	Range C	Worst Case Accuracy* +/- C	Best Case Accuracy** Mid Range +/- C
T	-270 to -150	1.1	0.2
	-150 to -400	0.2	
E	-250 to -200	0.8	0.2
	-200 to 800	0.2	
	800 to 1000	0.3	
K	-250 to -180	1.8	0.2
	-180 to 1372	0.4	
R	-50 to 100	1.6	0.4
	100 to 1700	0.7	
	1700 to 1767	1.9	
J	-210 to -100	0.3	0.2
	-100 to 1200	0.2	
S	-50 to 20	1.2	0.5
	20 to 160	0.9	
	160 to 1720	0.7	
	1720 to 1767	2.0	
B	300 to 750	1.5	0.5
	750 to 1020	0.8	
	1020 to 1820	0.6	
N	-250 to -160	1.9	0.2
	-160 to 150	0.5	
	150 to 1300	0.3	
PR (JIS)	0 to 250	1.9	0.6
	250 to 1600	0.8	
	1600 to 1770	0.7	
U (DIN)	-200 to -140	1.2	0.2
	-140 to 100	0.5	
	100 to 600	0.3	
L (DIN)	-200 to -120	0.9	0.2
	-120 to 900	0.5	
NI (ANSI)	-18 to 1310	0.3	0.2

* Worst case accuracy: calculated an 0°C manual CJ using worst case electrical accuracy and worst case linearization errors over specified range.
** Best case, mid range accuracy: calculated at 0°C manual CJ using worst case electrical accuracy and worst case linearization errors.
Resolution for all ranges: 0.1°C.

RTD Measurement and Simulation

Simulation

RTD Type	Range C	Worst Case Accuracy* +/- C	Best Case Accuracy** Mid Range +/- C
Pt50	-155 to 300	0.15	0.15
	300 to 850	0.23	
Pt100	-200 to 360	0.10	0.10
	360 to 850	0.16	
Pt200	-200 to 10	0.04	0.06
	10 to 260	0.07	
	260 to 850	0.43	
Pt500	-200 to -60	0.02	0.15
	-60 to 300	0.15	
	300 to 850	0.23	
Pt1000	-200 to 10	0.02	0.10
	10 to 260	0.09	
	260 to 850	0.16	
Ni100	-60 to 110	0.05	0.04
	110 to 180	0.04	
Ni120	-80 to 150	0.10	0.03
	150 to 260	0.07	

Measurement

RTD Type	Range C	Worst Case Accuracy* +/- C	Best Case Accuracy** Mid Range +/- C
Pt50	-155 to 280	0.15	0.16
	280 to 850	0.26	
Pt100	-200 to 310	0.10	0.10
	310 to 850	0.19	
Pt200	-200 to 60	0.05	0.07
	60 to 260	0.07	
	260 to 850	0.46	
Pt500	-200 to -60	0.03	0.16
	-60 to 330	0.16	
	330 to 850	0.26	
Pt1000	-200 to -150	0.02	0.10
	-150 to 310	0.10	
	310 to 850	0.19	
Ni100	-60 to 150	0.06	0.04
	150 to 180	0.07	
Ni120	-80 to 120	0.12	0.04
	120 to 260	0.09	

* Worst case accuracy: calculated using worst case 4 wire electrical accuracy and worst-case linearization errors across specified range
** Best case, mid-range accuracy: calculated using worst case 4 wire electrical accuracy and worst-case linearization errors .
Resolution for all ranges: 0.01°C
Spec-Cal® Eclipse II has been designed to maintain its specification over a period of 1 year.

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Authorised Representative:

INVESTOR IN PEOPLE

UKAS CALIBRATION 0295

ISO 9001 SGS UKAS QUALITY MANAGEMENT No. Q1160

INSTITUTE OF MEASUREMENT & CONTROL COMPANION COMPANY

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Features

- **High accuracy and reliability**
- **Robust and hard-wearing**
- **Supplied complete with UKAS certificate**

- The Minical® IV is a high accuracy hand-held DC Current and Voltage Calibrator designed for the calibration of process control instrumentation including transmitters, transducers, recorders, controllers and indicators.

- The Minical® IV will calibrate from micro-volt and micro-amp levels to over 100mV/50mA in both read and generate modes, with the added ability to generate up to 12V DC and to read up to 20V DC. The Minical® IV also acts as a 4-20mA Transmitter Simulator, which will operate in powered or unpowered loops.

- Data entry is via a membrane keypad system with fast and slow increment/decrement keys providing rapid and precise output value settings. The membrane keypad is scratch resistant, splashproof and free of potentiometers and switches.

MINICAL™ IV

DC CURRENT AND VOLTAGE CALIBRATOR

Haven Automation Limited

Calibration Solutions for Industry

MINICAL™ IV

DC CURRENT AND VOLTAGE CALIBRATOR

Specifications

Accuracy	+/-0.025% F.S.D.
Resolution	+/- 1 digit
Maximum Ambient Operating Temperature	40°C
Voltage Measurement	
mV range	0-199.99mV
V range	0-19.999V
Current Measurement	0-199.99mA
Voltage Generation	
mV range	0-199.99mV
V range	0-11.999V
Current Generation	0-50mA
Voltage Input Impedance	> 1MΩ
Current Input Impedance	< 11Ω
Maximum Input Voltage	+/- 60V DC
Maximum Input Current	+/- 300mA
Maximum Voltage across Current Generator	+200V
24V DC Supply	50mA max
Estimated battery life	
No load	25 hours
With 50mA load using The internal 24V supply	7.5 hours
LED Display	4½ digit display
Dimensions with Case	140mm x 115mm x 245mm
Weight with Case	1.5Kg

Accessories
Carry case, test leads, charger unit, instruction manual and UKAS Calibration Certificate issued by Haven Automation Ltd.

Laboratory No. 0295

Authorised Representative:

Haven Automation Limited

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INVESTOR IN PEOPLE

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No. Q1160

MODEL 510/511

RTD SIMULATORS

The Practical Instrument Electronicsí Models 510 and 511 RTD Simulators simulate standard RTD curves over the entire industrial temperature range. Choose between seven standard RTD curves. The Model 510 can also be supplied with a custom curve for your specific application such as Pt 200, 500, 1000 with up to 0.1 resolution.

The Model 510/511 will simulate RTD resistances into all types of instruments such as transmitters, recorders, controllers, alarms, data acquisition, and computer systems. Rest easy knowing these calibrators are 100% compatible with pulsed systems and transmitters like the Rosemount 3144 Transmitter.

The Model 510/511 is a superior replacement for decade boxes, so there is no need to lug a decade box around or be prone to error by reading RTD tables incorrectly. The Models 510 and 511 have better accuracy, functions and compatibility than many higher priced RTD calibrators.

The EZ-Checkô function allows the user to store three output temperatures for ease of use. This will save time for repetitive calibrations by instantly recalling the three stored temperature values. Three output settings can be stored, and all settings are saved, even with the power off.

Features

- ***Simulate RTD Temperature Outputs***
  Calibrate directly in temperature for your RTD curve.
  Adjustable output for full temperature range.
- ***Several Manufacturers' RTD Curves Available***
  Platinum, Copper & Nickel.
  Accurate to ±0.25°C (±0.5°F) with up to 0.1° Resolution available on the Model 511.
- ***Works with a wide variety of transmitters including popular Rosemount and Honeywell Models***
  Compatible with devices using pulsed excitation currents including PLCs, DCS, recorders, and all others.
- ***EZ-Dialô Knob***
  Easily adjust output by 0.1° (Model 511) or 1°F (Model 510).
  Pressing down and turning will select a faster dialing speed.
- ***EZ-Checkô Switch***
  User settable EZ-Check™ for 0% and 100% span adjustments.
  Store new EZ-Check™ values by pressing the EZ-Dial Knob.
- ***Uses a standard 9V Alkaline Battery***
  Superior battery life of 45 hours under typical continuous usage.
  Easy access to battery compartment.
- ***Lightweight, Rugged and Reliable***
  Small, tough and protected to 60V.

Models pictured above left:
Model 510: Single curve, 1° resolution, selectable °C or °F
Model 511: Multi type 7 curves, 0.1° resolution with selectable °C or °F and Ω with 0.01Ω resolution
(Pt 100: ∝ = 1.3850, 1.3902, 1.3916, 1.3926 and Cu10, Ni110, Ni120, Ω)

Haven Automation Limited

Exclusive UK and Ireland Distributors to Practical Instruments Electronics (PIE)

General Specifications

(Unless otherwise indicated all specifications are rated from a nominal 23C, 70% rh for 1 year from calibration)

Operating Temperature Range	-25 to 60°C (-10 to 140°F)
Storage Temperature Range	-25 to 60°C (-10 to 140°F)
Relative Humidity Range	10 %≤RH ≤90% (0 to 35°C), Non-condensing 10 % ≤RH ≤70% (35 to 60°C), Non-condensing
Size	4.9 X 3.15 X 1.82 inches (125.5 X 80 X 46.2 mm)
Weight	9.1 oz (258g)
Battery	9V Alkaline provides 45 hours of continuous use
Miscellaneous	Low battery indication with nominal 1 hour of operation left Protection to 60V DC or AC peak up to 30 seconds in duration High contrast graphic liquid crystal display with 0.357" (9.07 mm) high digits

RTD Curve Simulation Specifications (ITS-90 Curves)

Accuracy	±(0.015% of Setting in Ω + 0.05Ω)
Typical accuracies for RTD curves are:	
Pt100	±0.25°C (±0.5°F)
Cu10Ω	±1.5°C (±3°F)
Ni110Ω, Ni 120Ω	±0.25°C (±0.5°F)
Allowable Excitation Current	100 µA to 10.2 mA, steady or pulsed/intermittent/smart
For Accuracies Below 100µA add	±10µV/Excitation Current (units are in Ω)
Pulsed Excitation Current Compatibility	DC to 0.01 second pulse widths
Output Dial Adjustment Resolution	0.1°F or 0.1°C Adjustment Resolution for Model 511 1°C or 1°F Adjustment Resolution for Model 510
Temperature Coefficient	±0.05Ω/°C Ambient

Available Options

Option:	*Part Number:*
Carrying Case	020-0201
UKAS Calibration Certificate	

Authorised Representative:

ORDERING INFORMATION

Model 510 RTD Source (Single Type / 1 resolution)

Order Code:
- Model 510-Pt100-1 (∝ =1.3850)
- Model 510-Pt100-2 (∝ =1.3902)
- Model 510-Pt100-3 (∝ =1.3916)
- Model 510-Pt100-4 (∝=1.3926)
- Model 510-Cu10
- Model 510-Ni110
- Model 510-Ni120

Model 511 Multi type RTD Source (7 Types, Ω / 0.1 resolution)

Order Code: Model 511

Warranty

Practical Instrument Electronics (PIE) equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee can be made by returning the equipment prepaid to Haven Automation Ltd. The equipment will be repaired, replaced or adjusted at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under their guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Practical Instrument Electronics, Inc. or Haven Automation Ltd. be liable for any special, incidental or consequential damage.

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UKAS CALIBRATION 0295

ISO 9001 SGS No. Q1160

INSTITUTE OF MEASUREMENT & CONTROL COMPANION COMPANY

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MODEL 520/521

THERMOCOUPLE SIMULATORS

The Practical Instrument Electronics' Model 520/521 Thermocouple Simulators simulate a standard thermocouple curve over the entire industrial temperature range. Choose between eight standard T/C types or millivolts. The Model 520 can also be supplied with a custom thermocouple curve and range for your specific application.

The Model 520/521 sources precise temperatures for inputs to all types of instruments such as transmitters, recorders, controllers, alarms, data acquisition, and computer systems. The Model 521 provides a miniature T/C connector and the Model 520 provides 18" extension wire. Both are internally cold-junction compensated for changes in ambient temperature. The PIE Model 520/521 offers the highest performance and functions in its class by exceeding the accuracy and functions of many higher priced thermocouple calibrators.

The EZ-Checkô function allows the user to store three output temperatures for ease of use. This will save time for repetitive calibrations by instantly recalling the three stored temperature values. Three output settings can be stored, and all settings are saved, even with the power off.

The low cost PIE Model 520/521 is an "easy as PIE" to use thermocouple source for checkout and calibration of all thermocouple instruments in the field, shop or control room.

Features

- ***Direct Temperature Output***
  Calibrate in temperature for your T/C type.
  Adjust temperature output in 0.1° or 1°.

- ***8 Standard T/C Types Available***
  Types J, K, E, T, R, S, B, N and mV.
  Custom types and ranges are available.
  Ranges from -148°F to F.S. for most types.
  °C & °F Cold Junction Compensated.

- ***High Accuracy***
  ±(0.015% of mV Setting + 0.009mV).
  Typical accuracy of ±0.35°C (0.6°F) for Type K.

- ***EZ-Dialô Knob***
  Easily adjust output by 0.1° (Model 521) or 1° (Model 520).
  Pressing down and turning will select a faster dialing speed

- ***EZ-Checkô Switch***
  User selectable EZ-Check™ for 0% and 100% span adjustments.
  Store new EZ-Check™ values by pressing the EZ-Dial™ knob.

- ***Uses a standard 9V Alkaline Battery***
  Superior battery life of 45 hours under typical continuous usage.
  Easy access to battery compartment.

- ***Lightweight and Rugged with a Solid Feel***
  Small, tough and protected to 60V.

Models pictured above left:

Model 520: 1° resolution, Single Type or Custom Type.
Model 521: Selectable 8 Types, 0.1° resolution with selectable °C or °F and 0.001 mV resolution (J, K, E, T, R, S, B, N and mV).

Haven Automation Limited

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General Specifications

(Unless otherwise indicated all specifications are rated from a nominal 23 C, 70 % rh for 1 year from calibration)

Operating Temperature Range	-25 to 60°C (-10 to 140°F)
Storage Temperature Range	-25 to 60°C (-10 to 140°F)
Relative Humidity Range	10% ≤RH ≤90% (0 to 35°C), Non-condensing 10% ≤RH ≤ 70% (35 to 60°C), Non-condensing
Size	4.9 X 3.15 X 1.82 inches (125.5 X 80 X 46.2 mm)
Weight	7.2 oz (204 g)
Battery	9V Alkaline provides 45 hours of continuous use
Miscellaneous	Low battery indication with nominal 1 hour of operation left Overload Protected to 60V for 30 seconds or less High contrast graphic liquid crystal display with 0.357" (9.07 mm) high digits

Source Thermocouple Specifications (ITS-90 Curves)

Millivolt Uncertainty	±(0.015% of mV Setting + 0.009mV)
Temperature Coefficient of mV Source	±0.005mV/°C Ambient
Output Noise	±5µVpp from 0.1 Hz to 10 Hz
Output Impedance	0.2Ω
Cold Junction Uncertainty	±0.5°C (0.5°F)
Cold Junction Sensor Temperature Coefficient	±0.05°/° in ambient temperature (°C or °F)
General Temperature Accuracy	±(0.015% of mV setting + 0.009mV) ± 0.5°C (0.5°F)
Output Dial Adjustment Resolution	0.1°C or 0.1°F for Model 521 1°C or 1°F for Model 520
Span	-13.000 - 80.000 mV
T/C Type B	594 - 1820°C (1101.2 - 3308.0°F)
T/C Type E	-260 - 1000°C (-436.0 - 1832.0°F)
T/C Type J	-210 - 1200°C (-346.0 - 2192.0 °F)
T/C Type K	-245 - 1372°C (-409.0 - 2501.6°F)
T/C Type N	-229 - 1300°C (-380.2 - 2372.0°F)
T/C Type R	24 - 1768°C (75.2 - 3214.4°F)
T/C Type S	21 - 1768°C (69.8 - 3214.4°F)
T/C Type T	-251 - 400°C (-419.8 - 752.0°F)

Available Options

Option:
UKAS Calibration Certificate

Authorised Representative:

ORDERING INFORMATION

T/C Source (Single Type/1 resolution)	with T/C extension wire: Model 520-* (*add choice of T/C type: B, E, J, K, N, R, S, T or mV) with miniature T/C connector: Model 520-M*
T/C Source (8 Types, mV/0.1 resolution)	Model 521

Warranty

Practical Instrument Electronics (PIE) equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee can be made by returning the equipment prepaid to Haven Automation Ltd. The equipment will be repaired, replaced or adjusted at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under their guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Practical Instrument Electronics, Inc. or Haven Automation Ltd. be liable for any special, incidental or consequential damage.

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UKAS CALIBRATION 0295

ISO 9001 BSI UKAS QUALITY MANAGEMENT No. Q1160

INSTITUTE OF MEASUREMENT AND CONTROL COMPANION COMPANY

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MODEL 522

THERMOCOUPLE CALIBRATOR

The Practical Instrument Electronics' Model 522 is a complete source/read thermocouple calibrator providing direct temperature input to all types of instruments such as transmitters, recorders, controllers, alarms, data acquisition and computer systems. The Model 522 also reads thermocouple outputs and displays temperature, eliminating the need for cumbersome books of conversion tables. The Model 522 is equipped with a miniature T/C connector and slotted screws to connect to common thermocouple equipment or bare extension wire. Select from 8 T/C types to source/read in °C or °F with 0.1 resolution. Or, select mV for direct millivolt source/read capability. The Model 522 is internally cold-junction compensated for accuracy in any operating environment. Use the EZ-Check™ Switch to quickly switch between three stored temperature/mV outputs. It's easy to customise these values to your application. In read mode the EZ-Check™ Switch recalls minimum and maximum readings. Store or clear the memory with a press of the EZ-Check™ Knob. The Practical Instruments Electronics Model 522 offers the highest performance and functions in its class by exceeding the accuracy and functions of many higher priced thermocouple calibrators. It is a low cost solution for the checking and calibration of all thermocouple instruments in the field or laboratory.

Features

- **Direct Temperature Input/Output**
  Read or Source in °C or °F for your T/C type

- **8 Standard T/C Types available**
  Types J, K, E, T, R, S, B, N and mV
  Custom types and ranges are available
  Cold-junction compensated

- **High Accuracy**
  ± (0.008% of mV + 0.006 mV)
  Cold-junction compensated

- **EZ-Dial™ Knob**
  Easily adjust output by 0.1°
  Pressing down and turning will select a faster dialling speed

- **EZ-Check™ Switch**
  User selectable EZ Check™ for 0% and 100% span adjustment
  Store new EZ Check™ values by pressing the EZ Dial™ Knob
  Recall stored minimum and maximum readings

- **Uses a Standard 9V Alkaline Battery**
  Superior battery life of 45 hours under typical continuous usage
  Easy access to battery compartment
  Lightweight and rugged with a solid feel
  Small, tough and protected to 60V

Haven Automation Limited

Exclusive UK and Ireland Distributors to Practical Instruments Electronics (PIE)

General Specifications

(Unless otherwise indicated all specifications are rated from a nominal 23°C, 70% rh for 1 year from calibration)

Temperature Range	-25 to 60°C (-10 to 140°F)
Relative Humidity Range	10% ≤rh ≤90% (0 to 35°C), Non-condensing 10% ≤rh ≤ 70% (35 to 60°C), Non-condensing
Overall Size	125.5 x 80 x 46.2mm (4.9 x 3.15 x 1.82 inches)
Overall Weight	204 grams (7.2oz)
Battery	9V Alkaline provides 45 hours of continuous use
Miscellaneous	Low battery indication with nominal 1 hour of operation left Overload protected to 60 volts for 30 seconds or less High-contrast graphic liquid crystal display with 9.07mm (0.357") high digits
Accuracy:	
Millivolt Accuracy	± (0.008% of mV setting + 0.006 mV)
Temperature Coefficient of mV Source	± (0.008% of mV setting + 0.006 mV)
Cold Junction Calibration Accuracy	± 0.1°C (0.2°F)
Cold Junction Sensor Temperature Coefficient	± 0.025% in ambient temperature (°C or °F)
General Temperature Accuracy	± (0.008% of mV setting + 0.006 mV) ± 0.1°C or 0.1°F

Source Thermocouple Specifications

Output Range	-13.000 to +80.000 mV
Output Noise	± µV pp from 0.1Hz to 10Hz
Output Impedance	0.2 Ω (200 nV/uA)
Source Current	< 8 mA

Read Thermocouple Specifications

Input Noise	< ± 1 LSD from 0.1Hz to 10Hz
Input Impedance	> 1 M Ω
Open T/C Test Pulse	< 1µA for 300ms
Open T/C Response Time	< 3 seconds
Open T/C Threshold	10 k Ω nominal

Available Options

Option:	*Part Number:*
Carrying Case	020-0201
UKAS Calibration Certificate	

Authorised Representative:

Warranty

Practical Instrument Electronics (PIE) equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee can be made by returning the equipment prepaid to Haven Automation Ltd. The equipment will be repaired, replaced or adjusted at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under their guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Practical Instrument Electronics, Inc. or Haven Automation Ltd. be liable for any special, incidental or consequential damage.

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MODEL 530

4-20 MILLIAMP LOOP CALIBRATOR

The Practical Instrument Electronicsí Model 530 is the result of 30+ years of experience manufacturing and designing calibrators for the process control industry.

The Model 530 calibrator incorporates all of this knowledge and experience and combines it into one superior product. It has simple, easy to use controls, featuring a large high contrast display with easy visibility without the need for contrast adjustments.

The Model 530 is designed to be a tool with all the practical functions required to get the job done easily without the confusing extras or reading through a complicated manual.

The Model 530 can source and read current in the process loop, and simulate, power and measure 2-wire transmitters. It can read voltage to 60.00 VDC with over 2X over range ability.

Features

- ***4 to 20 mA Loop Functions***
  Source and Read 0.000-24.000 mA.
  Simulate 2-Wire Transmitters.
  Power 2-Wire Transmitters and Read 0.000-24.000 mA.
  Display current in mA or -25.00-125.00 % of 4-20 mA.

- ***Read Voltage Function***
  Read 0.00 to ± 60.00 VDC with 2X over range ability.

- ***Full 5 Digit Display***
  True ±0.012% of reading accuracy.
  Bar graph for quick reference of input and output levels.
  High contrast graphic display viewable in all lighting conditions and angles.

- ***EZ-Dialô Knob***
  Easily adjust output by 0.001 mA (0.01%) or 0.100 mA (1.00%).

- ***EZ-Checkô Switch with EZ-Stepô Button***
  3 position tactile switch with push button for true one handed calibrations. Push button for stepping through calibration points. 6 different step sizes.
  Hands-free auto step and auto ramp modes.

- ***Uses a standard 9V Alkaline Battery***
  Superior battery life of 40 hours under typical continuous usage. Easy access to battery compartment.

- ***240 VAC Tolerant***
  Fuse-less protection from accidental misuse.

- ***Lightweight and rugged with a solid feel***
  Convenient Velcro® hand strap allows for a firm confident grip or attachment to pipes and ladders.

- ***HARTÆprotocol compatability mode***
  User selectable 250Ω resistor in series with the output for compatability with HART® protocol enabled devices.

Haven Automation Limited

Exclusive UK and Ireland Distributors to Practical Instruments Electronics (PIE)

General Specifications

(Unless otherwise indicated all specifications are rated from a nominal 23C, 70% rh for 1 year from calibration)

Operating Temperature Range	-20 to 60°C (-5 to 140°F)
Storage Temperature Range	-30 to 60°C (-22 to 140°F)
Relative Humidity Range	10% ≤RH ≤90% (0 to 35°C), Non-condensing 10% ≤RH ≤ 70% (35 to 60°C), Non-condensing
Battery	9V Alkaline *Optional 120 VAC 50 Hz AC adaptor available*
Miscellaneous	Low battery indication with nominal 1 hour of operation left Over-voltage protection to 120 Vrms (rated for 30 seconds) or 240 Vrms (rated for 15 seconds) Bar graph display with 1% resolution of 4-20 mA signal scale High contrast graphic liquid crystal display with 0.45" (11.4 mm) high digits

Common Specifications for all Current Modes

Ranges	0.000 to 24.000 mA, -25.00 to 125.00% of 4-20 mA
Accuracy	≤ ± (0.012% of Reading + 0.004 mA)
Temperature Effect	≤ ± 50 ppm/°C of Range
Resolution(s)	0.001 mA and 0.01%

Source/Power and Measure 2-Wire Transmitter Specifications

Loop Compliance Voltage	≥ 24 Volts
Loop Drive Capability	1200 Ω at 20 mA for entire battery life
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display Battery life in: Source mode ≥ 18 hrs at 12mA typical (HART® disabled) Power measure ≥ 10 hrs at 12mA typical. HART® protocol mode is a selectable option at turn on. HART® protocol mode places a 250Ω resistor in series with the output. Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation: In mA mode: 0.001, 0.010, 0.100, 1.000, 4.000(default), 8.000 mA % of 4-20 mA mode: 0.01, 0.10, 1.00, 10.00, 25.00(default), 50.00 %

Authorised Representative:

Read mA Specifications

Voltage Burden	≤ 2V at 20 mA
Overload/Current Limit Protection	nominal ≤ 24 mA
Battery Life	Typical ≥ 40 Hours

2-Wire Transmitter Simulation Specifications

Voltage Burden	≤ 2V at 20 mA
Overload/Current Limit Protection	nominal ≤ 24 mA
Loop Voltage Limits	2-60 VDC
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display Battery life ≥ 40 hour typical Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation: In mA mode: 0.001, 0.010, 0.100, 1.000, 4.000(default), 8.000 mA % of 4-20 mA mode: 0.01, 0.10, 1.00, 10.00, 25.00(default), 50.00 %

Voltage Read Specifications

Range	0.00 to 60.00 VDC (with 2X over range)
Accuracy	≤ ± (0.1% of Reading ±0.1V)
Temperature Effect	≤ ± 200 ppm/°C of Reading
Resolution	0.01V
Input Resistance	≥ 1 MΩ Battery life > 40 hour typical Flashing indicator for over range

Available Options

Option:	*Part Number:*
AC Adaptor	020-0100
Carrying Case	020-0200
UKAS Calibration Certificate	
10-50 Milliamp Loop Calibrator	Model 535

Warranty

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UKAS CALIBRATION 0295

ISO 9001 SGS UKAS QUALITY MANAGEMENT No. Q1160

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The Practical Instrument Electronicsí Model 532 is the best tool for calibration, test, and diagnosing process loops. The Model 532 brings all the features you would expect from a loop calibrator as well as timesaving new ones. Make adjustments with the EZ-Dialô Knob or test limits with the dual action EZ-Checkô Switch. Powerful ramping functions are only a button away on the model 532. Save potentially hours of troubleshooting time on problem loops with the 532ís unique Loop Diagnostic Mode. In Loop Diagnostic Mode, the loop current, voltage, resistances, AC voltage, and mode of operation are all displayed simultaneously; without the need of multiple DMM connections. Loop diagnostic is available in every mode of operation and truly is a diagnostic monitor, as parameters are continuously updated in real time. The smart diagnostic tool even indicates the most likely cause of loop failure!

MODEL 532

4-20 MILLIAMP/VOLTAGE LOOP CALIBRATOR WITH LOOP DIAGNOSTIC

Features

- ***4 to 20 mA Loop Functions***
  Source and Read 0.000-24.000 mA.
  Simulate 2-Wire Transmitters.
  Power 2-Wire Transmitters and Read 0.000-24.000 mA.
  Display current in mA or -25.00-125.00 % of 4-20 mA.
- ***Read & Source Voltage Function***
  Read 0.00 to ± 30.00 VDC with 4X over range ability.
  Source 0.000 to 24.000 VDC with up to 20mA output.
  Direct calibration 1.000V to 5.000V.
- ***Full 5 Digit Display***
  True ±0.012% of reading accuracy.
  Bar graph for quick reference of input and output levels.
  High contrast graphic display viewable in all lighting conditions and angles.
- ***Loop Diagnostic***
  Displays loop current, voltage, resistance, AC voltage and mode of operation simultaneously eliminating multiple DMM connections. Make DYNAMIC loop readings under actual operating conditions. Included in the loop diagnostic features is its ability to measure ground current leakage from faulty wiring, flooded conduit, and corrosion bridges. This leakage subtracts from the signal current sensed by the receiving system (i.e. DCS), causing a measurement error.

DC mA	DC V	DC Ω
00.37	24.0	01423

leakage = 00.16mA
AC V = 00.0

POWER MEASURE DIAG

- ***EZ-Dialô Knob***
  Change the speed of dialing your test point by just pushing down on the knob.
  Easily adjust output by 0.001 mA (0.01 %) or 0.100 mA (1.00 %).
- ***EZ-Checkô Switch with EZ-Stepô Button***
  3 position tactile switch with push button for true one handed calibrations. Push button for stepping through calibration points. 16 different step sizes.
- ***Hands free auto step and auto ramp modes***
  Selectable soak and step time for working with valves.
- ***Uses a standard 9V Alkaline Battery***
  Superior battery life of 40 hours under typical continuous usage. Easy access to battery compartment.
- ***240 VAC Tolerant***
  Fuse-less protection from accidental misuse.
- ***Lightweight and rugged with a solid feel***
  Convenient Velcro® hand strap allows for a firm confident grip or attachment to pipes and ladders.
- ***HARTÆprotocol compatability mode***
  User selectable 250Ω resistor in series with the output for compatability with HART® protocol enabled devices.

Haven Automation Limited

Exclusive UK and Ireland Distributors to Practical Instruments Electronics (PIE)

General Specifications

(Unless otherwise indicated all specifications are rated from a nominal 23C, 70% rh for 1 year from calibration)

Operating Temperature Range	-20 to 60°C (-5 to 140°F)
Storage Temperature Range	-30 to 60°C (-22 to 140°F)
Relative Humidity Range	10% ≤RH ≤90% (0 to 35°C), Non-condensing 10% ≤RH ≤ 70% (35 to 60°C), Non-condensing
Size	7.00 x 3.30 x 2.21 inches (177.8 x 83.8 x 56.1mm)
Weight	12.0 oz (340g)
Battery	9V Alkaline *Optional 120 VAC 50Hz AC adaptor available*
Miscellaneous	Low battery indication with nominal 1 hour of operation left Over-voltage protection to 120 Vrms (rated for 30 seconds) or 240 Vrms (rated for 15 seconds) Bar graph display with 1% resolution of 4-20 mA signal scale High contrast graphic liquid crystal display with 0.45" (11.4 mm) high digits

Common Specifications for all Current Modes

Ranges	0.000 to 24.000 mA, -25.00 to 125.00% of 4-20 mA
Accuracy	≤ ± (0.012 % of Reading + 0.002 mA)
Temperature Effect	≤ ± 50 ppm/°C of Range
Resolution(s)	0.001 mA and 0.01 %

Source/Power and Measure 2-Wire Transmitter Specifications

Loop Compliance Voltage	≥ 24 Volts
Loop Drive Capability	1200 Ω at 20 mA for entire battery life, 950 Ω W/HART® mode enabled
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display Battery life in: Source mode ≥ 18 hrs at 12mA typical (HART® disabled) Power measure ≥ 10 hrs at 12mA typical. HART® protocol mode is a selectable option at turn on. HART® protocol mode places a 250Ω resistor in series with the output. Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation: 2 to 16 selectable step settings ***Step size is determined by the selected high and low ranges*** Selectable time settings for stepping and soak: STEP: 5 to 900 seconds SOAK: 0 to 900 seconds

Read mA Specifications

Voltage Burden	≤ 2V at 20 mA
Overload/Current Limit Protection	nominal ≤ 24 mA
Battery Life	Typical ≥ 40 Hours

Authorised Representative:

2-Wire Transmitter Simulation Specifications

Voltage Burden	≤ 2V at 20 mA
Overload/Current Limit Protection	nominal ≤ 24 mA
Loop Voltage Limits	2-60 VDC
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display Battery life ≥ 40 hour typical Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation: 2 to 16 selectable step settings ***Step size is determined by the selected high and low ranges*** Selectable time settings for stepping and soak: STEP: 5 to 900 seconds SOAK: 0 to 900 seconds

Voltage Specifications (Read Range)

Read Range	0.000 to 24.000 VDC then 24.01 to 30.00 (with 4X over range) Auto Ranging
Resolutions	0.001 V up to 24V, 0.01V up to 30.00V
Temperature Effect	≤ ± 100 ppm/°C of range
Input Resistance	≥ 1 MΩ
Accuracy	0.000 to 24.000 VDC ≤ ± (0.012% RDG + 0.004 V) 24.01 to 30.00 VDC ≤ ± (0.025% of reading ±0.04 V)

Voltage Specifications (Source Range)

Source Range	0.000 to 24.000 VDC
Output Resistance	≤ 0.3 Ω
Source Current	≥ 20.000 mA with flashing indicator for over range
Accuracy	≤ ± (0.012% RDG + 0.004 V) ±50ppm/°C of range
Battery Life	> 40 hour typical

Available Options

Option:	*Part Number:*
AC Adaptor	020-0101 - 50 HZ
Carrying Case	020-0200
UKAS Calibration Certificate	

Warranty

Practical Instrument Electronics (PIE) equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee can be made by returning the equipment prepaid to Haven Automation Ltd. The equipment will be repaired, replaced or adjusted at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under their guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Practical Instrument Electronics, Inc. or Haven Automation Ltd. be liable for any special, incidental or consequential damage.

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Sales: +44 (0) 1792 580255
Service: +44 (0) 1792 579696
Fax: +44 (0) 1792 582624
Email: mail@haven.co.uk
Web: www.haven.co.uk

PC-6 Pneumatic Instrument Calibrator

FEATURES

- Simultaneous pressure measurement & output
- High-accuracy, dual scale splashproof gauges
- Leak-tight rotary selector switch
- Precision pressure regulators
- Rugged waterproof A.B.S. case

The Haven PC-6 pneumatic instrument calibrator is a portable, hard-wearing, instrument designed for on-site calibration of control valves, pressure transmitters and other process loop instrumentation. Calibration is carried out quickly and easily by the PC-6 which features simultaneous pressure measurement and output facilities.

A colour-coded mimic diagram aids connection of test hoses while two dual scale, splashproof Budenberg gauges provide a high accuracy, easy-to-read monitoring facility. Precision pressure regulators and a leak-tight rotary selector switch allows accurate calibration of the most sensitive instrumentation. The PC-6 is housed in a waterproof hardwearing A.B.S. case.

0295

Director: K. Jones
London Registration No: 862544 VAT Registration No: 541 0442 88

WEEE Registration No: WEE/EG0103WV

Feature	Specification
GENERATED OUTPUTS	Range: Two 0-2 Bar (0-30 psi) One 0-10,000mm W.G. (0-400in W.G.)
MEASURED INPUTS	Range: One 0-2 Bar (0-30 psi)
PRESSURE GAUGES	Two dual scale Budenberg standard test gauges, protected to 1P55 BS 5490 (splashproof) Range: 0-2 Bar x 0-30 psi 0-10,000mm W. G. x 0-400in W.G. * Accuracy: ± 0.25% f.s.d.
AIR SUPPLY	3 Bar (45 psi) min. 7 Bar (100 psi) max.
DIMENSIONS	Closed case size: 46 x 38 x 17 cm (18 x 15 x 6½ in)
WEIGHT	8 Kg (18 lbs)
ACCESSORIES	Supplied with four x 2 metre flexible hoses, operating instructions and gauge test certificates. *Alternative ranges available on request

Measurement House, Kingsway,
Fforestfach, Swansea SA5 4EX, UK.
General: +44 (0) 1792 588722
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Fax: +44 (0) 1792 582624

Email: mail@haven.co.uk
Website: www.haven.co.uk

CRYSTAL
engineering corporation

The XP2i Pressure Gauge

It's **not** like **other** pressure gauges.

Transportation Calibration Ma
Oil and Natural Gas Nuclear Power
Petrochemical Aerospace Measu
Manufacturing Laboratory Rese

ritime Production
Offshore Platforms
urement Irrigation
earch Environment

The XP2i is not like other pressure gauges.

The performance, construction, and distinctive design of the XP2i set it apart from any other pressure gauge you've ever seen.

Lighter and easier to use than a deadweight tester, and more rugged than any mechanical pressure gauge, the XP2i is used every day throughout the world; in workshops, calibration laboratories, and on offshore platforms.

And that's just the beginning!

In the following pages you'll learn why the XP2i is different, and what it can do for you!

Crystal Engineering designed and manufactures the XP2i. Based on silicon sensor technology, the XP2i is the culmination of over 20 years devoted to engineering and manufacturing pressure calibrators, pressure gauges, and pressure measuring equipment for many different applications. Crystal Engineering pioneered uncomplicated ***of reading*** specifications, that eliminate the FINE PRINT that degrade and reduce accuracy when equipment is used in outdoor, real world conditions.

Pressure measuring equipment is the only thing we do, and that's why we say

Pressure is Our Business

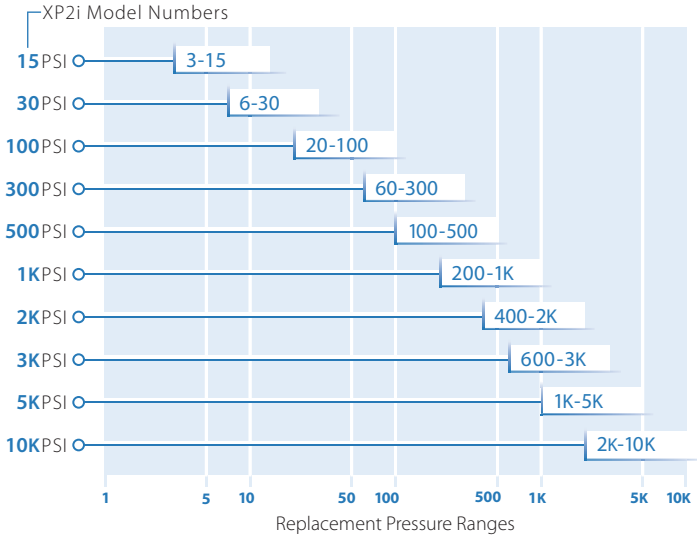
ACCURACY & RELIABILITY

All Welded Stainless Steel Sensor

Unlike many digital pressure gauges, our sensor is all welded stainless steel. It does not use o-rings, thread tape, sealant, or epoxy. As a result, the XP2i can be safely used with any liquid or gas compatible with 316 stainless steel, and it can be cleaned for oxygen service. NPT versions feature a built-in filter.

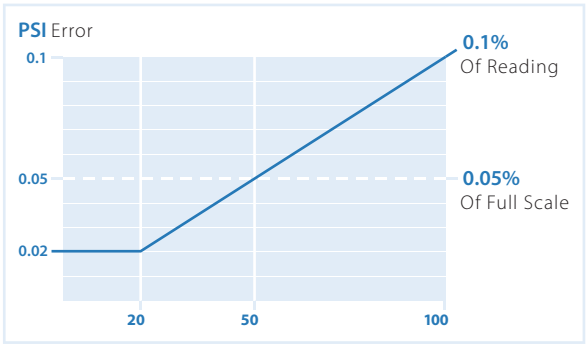
▸ Of Reading Performance

First and foremost, XP2i gauges are rated in percent of reading, like deadweight testers. Accuracy is 0.1% of reading, down to 20% of the range. One *of reading* gauge can replace multiple *of scale* gauges, leaving fewer gauges to maintain and calibrate every year.



A single XP2i pressure gauge can replace multiple 0.1% gauges. As this chart illustrates, our 15 PSI gauge will provide accurate readings down to 3 PSI, while our 10K gauge is accurate over a remarkable range of 8000 PSI.

Other gauges are rated in percent of full scale, just like mechanical pressure gauges. *(How often do you use your gauge at precisely the full scale range?)*



Sample comparison of a 100 PSI *of reading gauge* to a 100 PSI *of scale gauge*.

▸ More than just Temperature Compensated

All digital pressure gauges are "temperature compensated", but study the FINE PRINT and you will find that temperature can still have a ***big effect on accuracy***. The XP2i is ***fully temperature compensated***, and we prove it with every XP2i.

▸ Calibration Certificate Every XP2i includes a factory calibration report that proves it meets specifications at 5 different temperatures, from -10° to 50°C (14° to 122°F), because every XP2i is calibrated in an environmental test chamber using fully automated equipment. ▸ Vacuum Operation All XP2i gauges can be safely used to indicate vacuum. Gauges with a full scale range up to 20 bar/300 PSI have an accuracy to 0.25% of -99.9 kPa or -14.5 PSI on vacuum. Vacuum data is included on each calibration certificate.

▸ Reliability Through Strength

▸ Rugged Housing A stainless steel case helps prevent radio and electrical interference from affecting measurements. The LCD is protected by a hard polycarbonate lens (so dropping a tool on it won't break the display!) and all materials are compatible with common industrial fluids (including Skydrol™). The circuit board is conformally coated, and even the RS232 connection is sealed against leakage. ▸ Designed to be Dropped Since the internal circuitry is mounted to the inside of the gasket, the gauge can be dropped onto hard surfaces without damage. But, if it may be dropped often, we recommend the optional boot for even greater shock resistance.

FEATURES & TECHNOLOGY

Key Features

- Easy to read display—day or night.
- 5 full digits—great for leak testing.
- Available in ranges from 15 PSI to 10,000 PSI.
- Pressure units are easily accessible.
- Capture peak High or Low pressure for relief valve testing.

No Menus. No Manual? No Problem!

The XP2i is very easy to use and you will never get lost in multi-level menu system. In fact, you may never need to open the operation manual.

Features and Capabilities

▶ Backlight The state-of-the-art display is easily viewable under any conditions thanks to the best backlight available for this type of gauge. ▶ Display Options The XP2i can capture maximum or minimum pressure, and can be set to average (dampen) unstable pressure readings. ▶ Optional 2-Line Display Ideal for relief valve testing and leak rate testing. The top line indicates live pressure, while the second line indicates maximum, minimum, average, or leak rate; and can also indicate the difference from a second XP2i, to form a wet/wet differential gauge. ▶ Make it Simple Use ConFigXP software to disable any features you don't need, turn on features you want, and even add password protection. *See page 7 for more information on ConfigXP.*

▶ Intrinsically Safe Every XP2i is intrinsically safe. The basic model is Class 1, Div 1, Groups A,B,C and D. Also available is an ATEX version with ATEX and IECEx approvals. *See ordering information on page 10 for details.*

Free Software

Most software for the XP2i is free, including Labview™ drivers, configuration software, and much more.

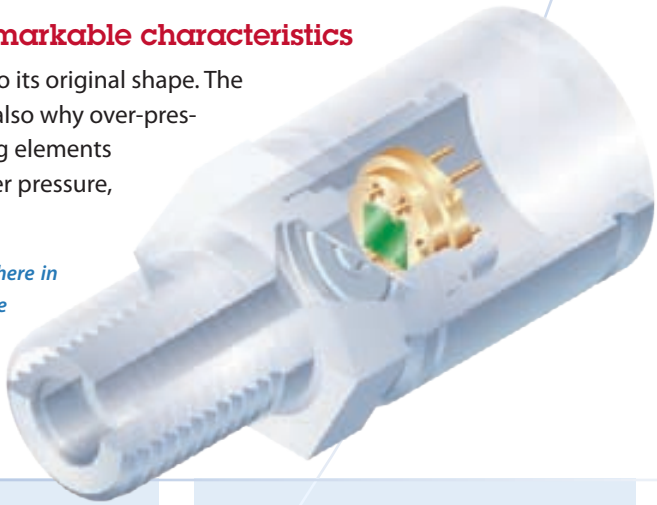
Download from www.xp2i.com.

Technology

The XP2i uses state-of-the-art silicon pressure sensors. These sensors offer better stability and performance than older designs still in use.

Silicon sensors have some remarkable characteristics

Silicon has a crystalline structure: when deformed silicon returns perfectly to its original shape. The crystalline structure is why silicon sensors are so highly repeatable, and it's also why over-pressure has no effect on the accuracy of the gauge.* In contrast, metal sensing elements (including those in mechanical pressure gauges) are easily deformed by over pressure, often without any physical evidence that the accuracy has been affected.



** Under extreme over-pressure conditions it is possible for a sensing element (shown here in green) to break. Our pressure ratings are extremely conservative, and sensor failures are very rare. When it does fail, the failure is instantaneous, like breaking a glass.*

To insure that water vapor or liquids don't degrade the electrical connections to the silicon chip, ***all*** pressure ranges include a permanently filled 316 stainless diaphragm seal.

Compared to Mechanical Test Gauges:

- Accuracy is not affected by over-pressure, temperature, shock (by being dropped) or rapid increases or decreases of pressure (e.g.: Relief valve testing)
- Faster, accurate readings - no parallax errors
- Vibration does not affect the life of the gauge.

Compared to Deadweight Testers

- Much lighter – easily portable
- Not affected by local gravity or temperature
- Easier to use – no special training required
- Significantly less expensive to calibrate and certify

Compared to Other Digital Pressure Gauges

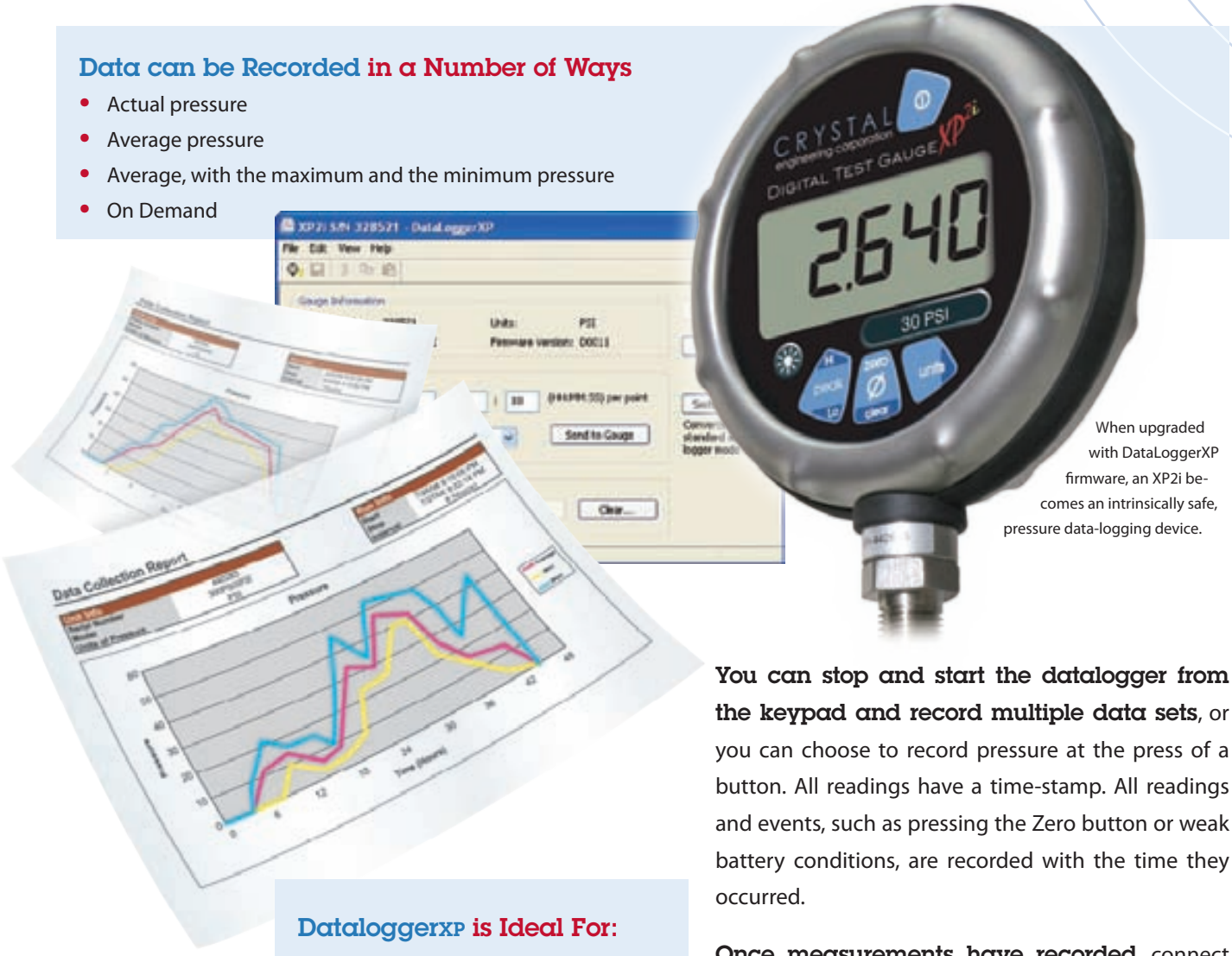
- Stainless steel case—not plastic!
- Easier to use
- Digital interface included

▸ Pressure Datalogging Made Easy When You Add DataLoggerXP™ to an XP2i

By upgrading an XP2i with DataLoggerXP firmware, you can record up to 6000 pressure measurements into non-volatile flash memory in the XP2i. DataloggerXP is a full featured datalogging solution. The recording interval can be set to a minimum of 1 second to a maximum of 18 hours.

Data can be Recorded in a Number of Ways

- Actual pressure
- Average pressure
- Average, with the maximum and the minimum pressure
- On Demand



When upgraded with DataLoggerXP firmware, an XP2i becomes an intrinsically safe, pressure data-logging device.

You can stop and start the datalogger from the keypad and record multiple data sets, or you can choose to record pressure at the press of a button. All readings have a time-stamp. All readings and events, such as pressing the Zero button or weak battery conditions, are recorded with the time they occurred.

Once measurements have recorded, connect the XP2i to any computer running the Windows DataLoggerXP application (available for free: www.XP2i.com). Then download and save the data directly into a Microsoft® Excel spreadsheet (or if you prefer, a comma-separated text file). DataloggerXP can use Excel template files to automatically format your data – an example template file is included.

There is no easier system for accurately recording pressure!

DataloggerXP is Ideal For:

- Pipeline leak testing
- Wellhead monitoring
- Chart recorder verification
- Diagnostics – capture intermittent or transient events*

…and many more

Saves Time Because:

- Easy to use
- Output to spreadsheets
- High resolution saves time in leak testing
- Install on additional computers at no extra cost

**Since all XP2i models can measure vacuum you can even capture pressure to vacuum transitions.*

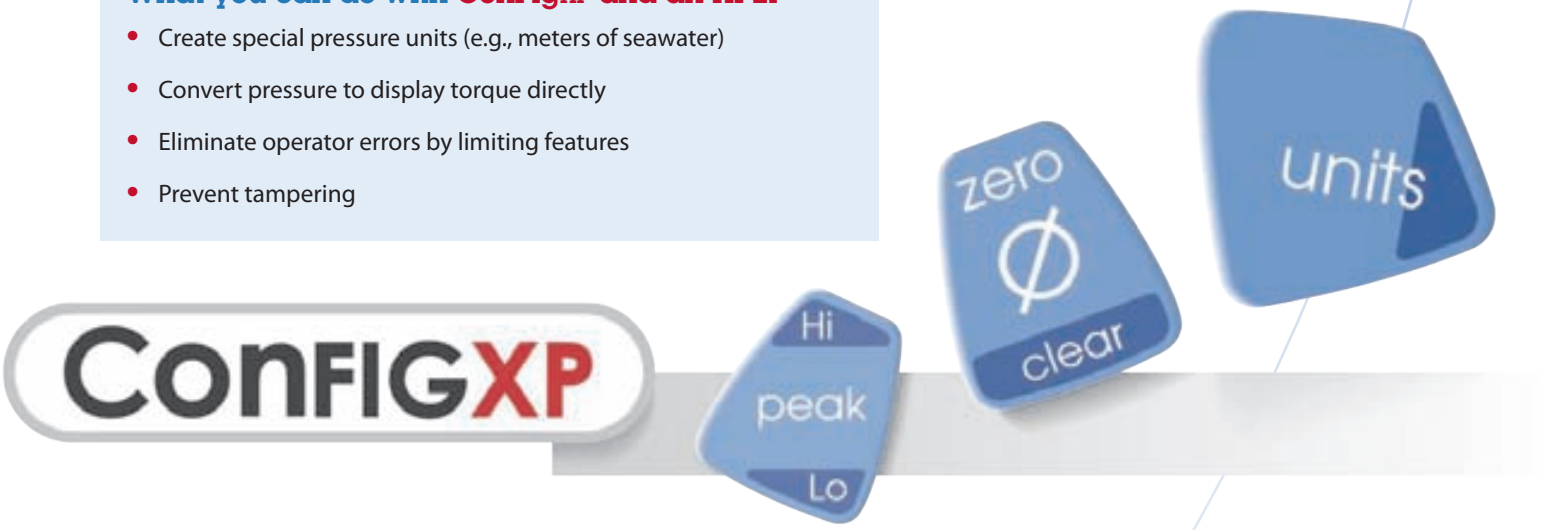
Customize Your XP2i with ConFigXP™ Software

An XP2i includes more features than you may actually need. ConFigXP provides an easy way to disable features you don't want, (or to enable features you do). With an ordinary serial cable, a computer running Windows®, and ConFigXP software, you can easily tailor your XP2i gauge to fit your specific needs. You can:

- Disable pressure units that you never use.
- Disable peak high and low indication.
- Limit the zero range, or even disable the zero button.
- Disable all changes to the gauge with a password.
- Save configuration to a file—use the file to quickly copy the configuration to additional gauges.

What you can do with ConFigXP and an XP2i

- Create special pressure units (e.g., meters of seawater)
- Convert pressure to display torque directly
- Eliminate operator errors by limiting features
- Prevent tampering



You can add features to the XP2i gauge, too:

- Enable averaging
- Enable Tare
- Define new pressure units
- Expand the zero/tare range
- Store an identifier in XP2i memory (Tag ID)

ConFigXP is a free, self-extracting application

- Download from www.XP2i.com.

▸ Get a Custom XP2i

The XP2i is available in several panel mounted configurations. For stationary installations, an XP2i can be ordered with a welded flange for panel mounting. Several flange diameters are available.

A universal AC power supply is available and includes a set of plugs permitting use worldwide. In the event of a power failure, an XP2i powered by the AC power supply will automatically switch to its internal batteries.

▸ ▸ ▸ ▸ ▸ **Flange adapter kits** allow a panel mounted XP2i to fit into different mounting cutouts.

For portable applications we offer the WT version of the XP2i. It has been designed to replicate the dimensions and pressure connections of the most common test gauges mounted in portable cases. The serial interface and batteries have been moved to the front of the gauge for easy access.

XP2i WT Key Features

- Drop-in replacement for most commonly used portable test gauges
- Easy access to the serial port and battery cover from the front of the enclosure
- Batteries supply power for 500 hours of continuous operation

The WT is an excellent replacement for high precision test gauges. The WT is much more rugged and reliable than any mechanical test gauge, and it costs *much* less. Most ranges are available for delivery within one week!

Flush diaphragm and sanitary seals are available for pharmaceutical and food processing industries, and other special applications. Many types are available. Contact the factory with your specific requirements.

For rough service applications, a Skydrol compatible elastomeric boot is available to increase shock resistance.

Any XP2i

- can be cleaned for oxygen service.

ATEX/IECEx Certified Intrinsically Safe

Any XP2i pressure gauge can be ordered in an ATEX Certified configuration. The XP2i ATEX/IECEx pressure gauge meets all the requirements set forth by the EU (European Union) for equipment that may be operated in potentially explosive environments.

EEx ia IIC T4 — IECEx Scheme Compliant
KEMA 04 ATEX1053 — IECEx CSA 05.0001X

CE 0344 Ex II 1G

Specifications and Options

Accuracy

20% to 100% of Full Scale:
±(0.1% of Reading).

0 to 20% of Full Scale:
±(0.02% of Full Scale).

Vacuum, for 2000kPa (300 PSI) and lower pressure gauges:

0 to -99.9 kPa(-14.5 PSIG):
±(0.25% of Full Scale),
where F.S.: -99.9 kPa (-14.5 PSIG).

Pressure Ranges

See Ordering Information, below.

Note:
Density of water conversion can be selected via the keypad: 4°C, 60°F or 20°C/68°F.

Display

Description: 5 Full (seven segment) digits.

Display rate: 3 readings per second.

Numeral Display height: 16.5mm (0.65") single line display • 14 mm (0.55") for main numerals of dual line display.

Temperature

Operating & Compensated:
-10°C to 50°C(14°F to 122°F).

Storage: -40°C to 75°C (-40°F to 167°F)

Connections

Pressure Connection: ¼" male NPT or ⅜" BSP.

Electrical Connection:
DB9, RS-232 (environmentally sealed).

Media Compatibility

Liquids and gases compatible with 316 stainless steel.

Available cleaned for oxygen service.

Power

Battery: Three size AA (RS6) batteries.

Battery Life:
1500 hours typical (alkaline battery).

Enclosure

Description: 300 series SS sealed to NEMA4/IP66.

Weight: 500g (17.6 oz.), including batteries.

Sensor

Description: All welded stainless steel, with a permanent fill diaphragm seal (filled with Dow Corning 200).

Intrinsic Safety

C SP US Exia Intrinsically Safe, Class I, Division 1, Groups A, B, C & D, Temperature code T4

Options

Dual Line Display—Option DD: Adds a second line to the display which can be set to indicate peaks, average, leak rate, or the difference in pressure relative to a second XP2i connected via an ordinary DB-9 null modem cable. (The second XP2i can be any pressure range or model.)

Panel Mounting—Option F4: A panel mount flange allows an XP2i to fit in a 4½" gauge cutout • An XP2i with the F4 option can also be adapted to fit into 6" or 8½" gauge cutouts — see the accessories section on next page.

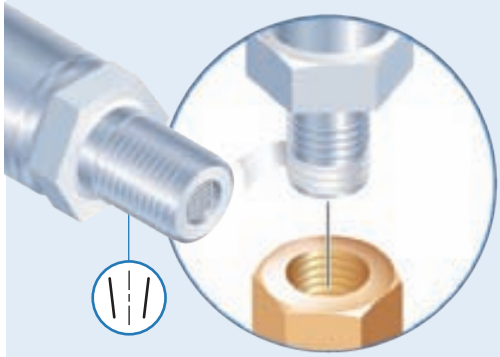
Rear Port Fitting—Option RP: The rear port fitting may be ordered separately, but is included automatically with the panel mount flange option (F4).

Absolute Pressure—Option B: Available for gauges rated at 2000 PSI or higher

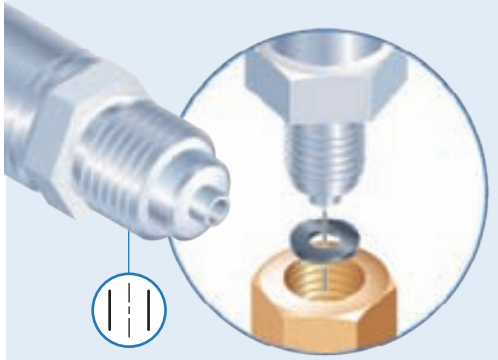
Cleaned for Oxygen Service—Option O

CE Specifications include all effects of linearity, hysteresis, repeatability, temperature, and stability for one year.

NPT & BSP pressure fittings



NPT threads are tapered, and require thread tape or sealant to form a seal.



BSP threads are parallel, and require a washer to form a seal.

Accessories and Software

Accessories

RS232 Cable for XP2i (6' [2m])
P/N: **2400**

USB to RS232 Adapter
P/N: **3313**

Flange Adapter Kit (6" [152mm])
P/N: **2955**

Flange Adapter Kit (8.5" [216mm])
P/N: **2956**

AC Adapter Kit
P/N: **2984**

Hardshell Carrying Case (black)
P/N: **3009**

Protective Boot
P/N: **3193**

Software

DataLoggerXP
P/N: **DATALOGGERXP**

ConFigXP
P/N: **CONFIGXP**

About Resolution

Resolution refers to the smallest unit of pressure that can be measured by a given device. For instance, the smallest increment of *pounds per square inch* of pressure that can be measured on a 15 PSI XP2i is 0.001; while the smallest increment that can be measured on a 10000 PSI XP2i is 1 PSI.

Ordering Information

PSI models		bar models		kPa models			Pressure Units and Resolution								
P/N Prefix	Range PSI	P/N Prefix	Range bar	P/N Prefix	Range kPa	Over-pressure	PSI	kg/cm²	inch Hg	inch H_2O	mm Hg	mm H_2O	kPa	bar	mbar
15PSI	3-15	1bar	0.2-1	100KPA	20-100	6.5 x	0.001	0.0001	0.001	0.01	0.01	1	0.01	0.0001	0.1
30PSI	6-30	2bar	0.4-2	200KPA	40-200	3.0 x	0.001	0.0001	0.001	0.01	0.1	1	0.01	0.0001	0.1
100PSI	20-100	7bar	1.4-7	700KPA	140-700	2.0 x	0.01	0.0001	0.01	0.1	0.1	1	0.01	0.0001	0.1
300PSI	60-300	20bar	4-20	2KKPA	400-2K	2.0 x	0.01	0.001	0.01	0.1	1		0.1	0.001	1
500PSI	100-500	30bar	6-30	3KKPA	600-3K	2.0 x	0.01	0.001	0.1	1	1		0.1	0.001	1
1KPSI	200-1K	70bar	14-70	7KKPA	1.4K-7K	2.0 x	0.1	0.001	0.1				0.1	0.001	MPa
2KPSI	400-2K	140bar	28-140	14KKPA	2.8K-14K	2.0 x	0.1	0.01	0.1				1	0.01	0.001
3KPSI	600-3K	200bar	40-200	20KKPA	4K-20K	1.5 x	0.1	0.01	0.1				1	0.01	0.001
5KPSI	1K-5K	300bar	60-300	30KKPA	6K-30K	1.5 x	0.1	0.01	1				1	0.01	0.001
10KPSI	2K-10K	700bar	140-700	70KKPA	14K-70K	1.5 x	1	0.01					1	0.01	0.001

- Unneeded pressure units may be disabled via the RS-232 connector using ConFigXP software.
- kPa models can display pressure in kPa and bar (or mbar) only. PSI and bar models can display all available units.
- An XP2i will indicate pressure up to 10% above Range Pressure. Above 110%, the XP2i display will flash, indicating that the applied pressure exceeds the calibrated pressure range. If the calibrated pressure range is exceeded, the pressure displayed may not be accurate.
- MPa is available on -DD models only.

The XP2i part numbering system

XP2i part numbers are based on a simple system of numbers and letters that define every attribute of a specific gauge. Part numbers are located behind the battery cover and under a battery on the back of the gauge.

The part number prefix Every part number includes a part number prefix. The prefix identifies the pressure range and units of the gauge. For example, a **2KPSI** prefix identifies a gauge as a PSI model with a pressure range of 2000 PSI.

The gauge type indicator Crystal offers all of its gauges from 2000 PSI/140 bar and up, in an absolute (barometric) version, indicated by a **B** following the part number prefix. For example, the part number for a 2000 PSI, absolute gauge would be 2KPSI**B**XP2I.

The options suffix Many part numbers include a suffix to identify the special options available on a particular gauge. For example, a **-DD** suffix indicates that a gauge is equipped with a dual line display, while an **-O** suffix indicates that a gauge has been cleaned for oxygen service. The dual line display option (**-DD**) may be combined with the rear port (**-RP**) or the 4½" panel mount flange (**-F4**) options. The cleaned for oxygen service option (**-O**) may be combined with any and all options.

The ATEX approved indicator Crystal offers all of its gauges in an ATEX certified configuration, indicated by placing an **AX** immediately before the part number prefix. For example, the part number for an ATEX/IECEx certified 140 bar gauge would be **AX**140BARXP2I.

Pressure fitting options You can order an XP2i with either a ¼" NPT (standard) or a ¼" BSP pressure fitting, indicated by a **-BSP** suffix. The BSP fitting is designed to conform with EN 837-1 and utilizes G ¼ B parallel threads per ISO 228. Refer to the sidebar on page 9 for more information.

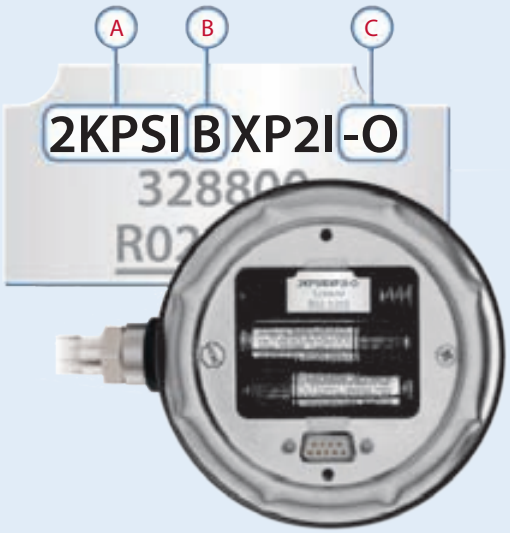
Sample part numbers:

300PSIXP2I ..... 300 PSI standard gauge

10KPSIBXP2I-F4..... 10000 PSI absolute gauge with the 4 ½" panel mount flange option

AX140BARXP2I-BSP.... ATEX approved 140 bar standard gauge, with a ¼" BSP pressure fitting

Anatomy of a Part Number



(A) The part number prefix

(B) The gauge type indicator

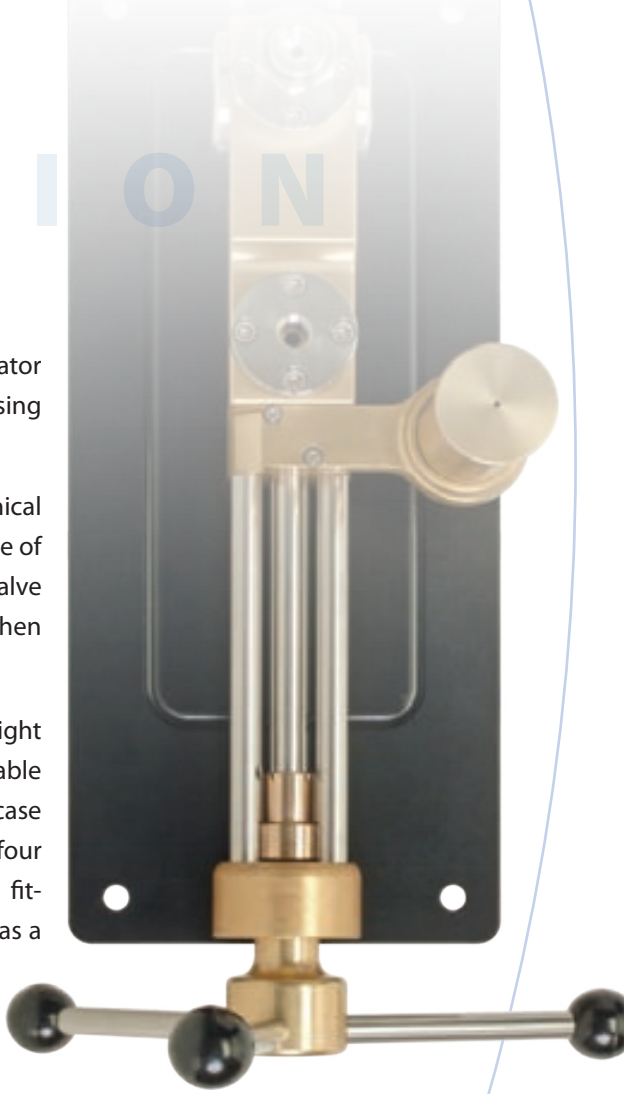
(C) The options suffix

▸ GaugeCalXP™ Pressure Comparator

GaugeCalXP is a self contained, precision hydraulic pressure generator (pressure comparator). It quickly and easily produces up to 10,000 PSI using water or oil as the hydraulic fluid.

The GaugeCalXP has a unique design that eliminates damage to mechanical pressure gauges—there are no external valves that would allow the type of rapid change in pressure that bends gauge needles. Instead, a hidden valve opens when pressure is reduced to almost zero (when the piston is near the minimum position).

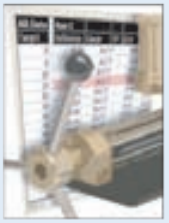
The comparator can be bench mounted, but is light weight and compact enough to use as a portable pressure supply. An ultra-compact rolling carry case is available with room for a comparator, up to four XP2i gauges, a hydraulic fluid bottle, conversion fittings, tools, and more. The case may also be used as a base for the comparator, and straps are included to attach the comparator on top of the case.



FastCalXP™ Gauge Calibration Software

FastCalXP steps you through every phase of gauge calibration. It eliminates errors by recording the applied pressure digitally from Crystal pressure gauges or calibrators. Since FastCalXP was specifically designed to calibrate pressure gauges it takes almost no time to set up and learn to use. 10 point calibrations can be done in 3 minutes or less! Calibration reports use Excel, so you can keep using the forms you already have!
FastCalXP will save time, improve record keeping, and eliminate data-taking errors.
You'll wonder how you ever managed without it!

Set Up the Calibration



Take the As Received and As Left Data

Generate and Print a Certificate

▸ Calibration Kits

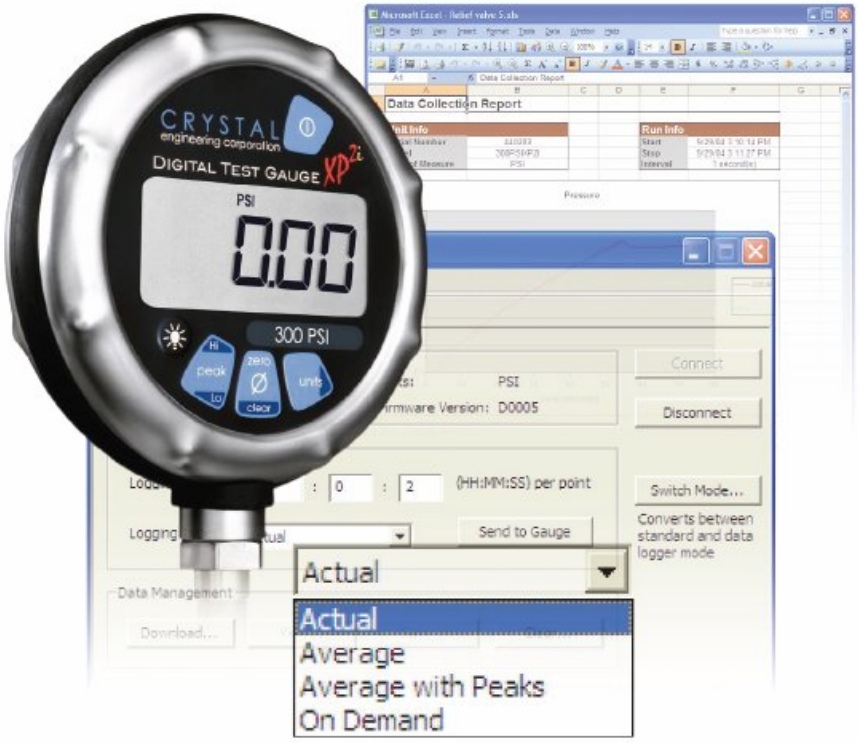
Calibration kits offer the most convenient and compact solutions available for carrying everything you need for field pressure calibration work.

All calibration kits start with an extremely rugged carry case, manufactured from high grade ABS plastic, and designed to withstand a drop of up to 2 meters (6 feet). The case is fully sealed and water tight, with a pressure equalization valve to allow easy opening after changes in altitude or temperature. A rigid, die-cut foam insert is custom designed to fit everything you need into the most compact space possible. Your XP2i pressure gauge, pump, fittings, hoses, leads, pipe thread tape, battery, and bottle of hydraulic fluid fit snugly into precut locations. Refer to the ***Crystal Handpumps and Accessories brochure*** for complete descriptions of all of the pumps, fittings, and calibration solutions we offer.

DataLoggerXP™

The Intrinsically Safe Pressure Data-Logging Solution

CRYSTAL engineering corporation



- Record up to 3,000 Pressure Measurements
- Change Data Collection Parameters, With or Without a Computer
- Start and Stop Multiple Collection Runs from the Keypad of your XP2i
- Record Pressure Readings at Intervals of 1 per Second, up to 1 Every 18 Hours
- Store an Indicated Pressure with the Push of a Button
- View the Data on Any Windows-Equipped Computer
- Save Data Directly into Microsoft® Excel
- Very Easy to Configure and Use!

DataLoggerXP software, working in tandem with Crystal Engineering's XP2i Digital Pressure Gauge, allows you to record up to three thousand measurements, on an intrinsically safe, fully temperature compensated pressure gauge. With the XP2i's long battery life, you can take measurements for up to three months, without the need for external power supplies or battery replacements.

The DataLoggerXP program and XP2i Digital Test Gauge form an integrated data logging solution. The software application handles all of the transfer and saving of data to your computer's hard drive, while the XP2i performs all of the actual data collection. Once measurements have been collected and transferred, DataLoggerXP can save the data files directly into a Microsoft® Excel spreadsheet; or, if you prefer, a comma-separated text file. There's nothing else like it!

Exclusive UK Distributor:

Haven Automation Ltd
Measurement House, Kingsway
Fforestfach, Swansea
SA5 4EX UK
Tel 0044 1792 588722

sales@haven.co.uk

www.haven.co.uk

FastCalXP

Gauge Calibration Made Simple

CRYSTAL
engineering corporation

What FastCalXP Can Do for You

- Eliminate data errors
- Store calibration records in an industry standard database
- Quickly create any style of calibration report using Excel® spreadsheet software
- Remind you when next calibrations are due
- Save time
- Pay for itself!

▶ Introducing FastCalXP

FastCalXP™ software is the cornerstone of an easy to use pressure gauge calibration system consisting of Crystal gauges or calibrators, and the GaugeCalXP™ Pressure Comparator. With **FastCalXP**, ***pressure gauges can be calibrated faster than you ever imagined.***

Its so easy to set up and so simple to learn that you can start to use it right away.

▶ Why FastCalXP is the best way to calibrate pressure gauges

FastCalXP ***frees you from manually recording gauge readings, and eliminates guessing the indicated pressure*** (when the pointer of the gauge is between two dial graduations). You ***don't "read"*** the gauge, you ***set the gauge pointer exactly*** on the pressure that **FastCalXP** tells you to. Once you set the pointer, **FastCalXP** records the actual applied pressure (from the Crystal gauge or calibrator). Automatically. ***No need to write anything down!***

To easily generate and set pressure precisely, use GaugeCalXP, a high pressure hydraulic comparator with a range of up to 10,000 PSI or 700 bar). And though many deadweight testers require you use only oil as the hydraulic fluid, the GaugeCalXP can use distilled water, and even isopropyl alcohol (IPA).

▶ Why FastCalXP is better than other calibration software

Unlike other calibration software that takes a long time to learn to use, and even longer to configure and enter all needed data, **FastCalXP** was specifically designed to calibrate ***pressure gauges*** quickly and easily. After using **FastCalXP** for the first time, you can be printing a calibration report within 30 minutes. The intuitive interface guides you through setup. **FastCalXP** automatically detects and utilizes Crystal Engineering **XP2i** pressure gauges and **30 Series** calibrators.

All data is stored in a standard Microsoft® Access or SQL database, and calibration reports are created in the familiar Microsoft Excel® (*.xls) file format. You can easily change the look of the report to match your company's standards—use Excel® to design the report in the style that you want. If you already use Excel® for your reports, just copy and paste from the included template into your file to use your format right away!

Bottom line? A 10 point up and down calibration can be completed in less than 3 minutes!

▶ Who should be using FastCalXP

Anyone who calibrates pressure Gauges—especially anyone using deadweight testers! Whether you calibrate pressure gauges every day, or only once in a while, **FastCalXP** will save time, improve record keeping, and eliminate data taking errors.

Although deadweight testers can be accurate if used properly (and it's easy to make mistakes), each measurement can take a minute or more – so a 10 point calibration (10 points up and down) takes at least 20 minutes. With FastCalXP calibration system, you can do it in 3 minutes!

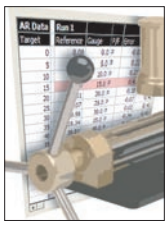
▶ Why YOU need to try FastCalXP

Until you try **FastCalXP**, you won't fully understand why we say it is so good. Once you've tried it, you'll understand.

You'll wonder how you ever managed without it!

Set Up the Calibration

After login, you open an existing database or create a new one. Then, simply select and load the test and reference gauges.



Take the As Received Data

You can either perform a new calibration, or load data that you have collected from a previous calibration.

Take the As Left Data

Make any required adjustments to the gauge and then recalibrate; or accept the calibration data you've collected.

Generate and Print a Certificate

Enter notes relevant to the calibration data you've collected, and then generate a cerificate with the click of a button.

▸ How Does FastCalXP Work?

FastCalXP stores detailed information about all tested or entered gauges, reference gauges, and users, as well as all acquired calibration for each gauge. The workflow proceeds in four simple steps.

FastCalXP automatically detects a Crystal digital reference (gauge) connected to the computer's serial port, and then automatically reads and records pressure measurements from that reference.

All of the information entered into or acquired by **FastCalXP** is stored in a single relational database using Microsoft Access components already on your computer. Using the database, **FastCalXP** generates calibration certificates compatible with Microsoft Excel.

▸ FastCalXP Easy Setup

A typical installation of **FastCalXP** includes a personal computer running Windows® 2000 or later, a GaugeCalXP pressure comparator, and an XP2i or Model 30 digital pressure gauge, used as the reference. The gauge under test is mounted on the comparator along with the reference gauge, and the reference gauge is then connected to the computer's serial port. You can also use an optional foot switch for convenient hands-free recording of your calibration data.

FastCalXP communicates with the reference gauge via an RS-232 cable.

FastCalXP System Requirements

To use FastCalXP you must use a Crystal Engineering XP2i or XP2 Digital Pressure Gauge or 30 Series Pressure Calibrator as the reference gauge, and have a way to generate pressure precisely—we recommend Crystal Engineering's GaugeCalXP Pressure Comparator. You'll also need the appropriate cable to connect your XP2i or 30 Series calibrator to your computer, via either the USB or RS232 port. FastCalXP runs on Windows® XP or Windows 2000. To view calibration reports you must have Microsoft® Excel or Microsoft Office, versions 2000, 2003, or XP. Download size is approximately 11.5 Mbytes, so if purchasing from Crystal Engineering's website, a high-speed internet connection is highly recommended.

Try FastCalXP Now, FOR FREE!
Visit our website at www.fastcalxp.com to download a FREE, FULLY-FUNCTIONAL, 30-day trial version of FastCalXP. We're positive you'll be convinced that it's the fastest, most easy-to-use calibration solution on the market today!

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Ordering Information

FastCalXP

FastCalXP Website Download
Software license included;
plus the complete User's Manual in Acrobat Reader format.
P/N: **FASTCALXPWEB**

FastCalXP on CD
CD and printed User's Manual, only.
Includes RS232 Cable, P/N 2400.
Does not include software license.
P/N: **FASTCALXPDOCS**

FastCalXP CD Plus
Software license, CD, and printed User's Manual.
Includes RS232 Cable, P/N 2400.
P/N: **FASTCALXP**

Options and Accessories

GaugeCalXP Pressure Comparator
Includes complete operation instructions.
P/N: **GAUGECALXP**

Data Entry Foot Switch
USB connection.
P/N: **3327**

RS232 Cable
6 ft cable for use with the XP2i Digital Pressure Gauge.
P/N: **2400**

RS232 Cable
6 ft cable for use with the 30 Series Pressure Calibrator.
P/N: **1928**

USB to RS232 Adapter—DB9
Use this adapter to connect RS232 cables listed above to USB ports.
P/N: **3313**

FastCalXP Additional Features

Test Profile Capability
Specify number of exercise cycles prior to test • No limit to number of test points • Automatic calculation of test points: e.g., for 1000 PSI gauge, ask for 5 points and FastCalXP will fill the profile table with 200, 400, 600, 800, and 1000 PSI. Descending points can be automatically copied from ascending points. Points can also be added or removed manually from the test profile • Number of cycles of testing can be specified (for repeatability studies or data)

Gauge Tolerances
Standard class and ASME ratings can be selected, or custom specifications can be defined for gauge pass/fail tolerance.

Note Area
Note taking area provided to record modifications to the gauge, or any other notes. Notes are stored in the database and can be included in the calibration report.

As Received/As Left
FastCalXP always prompts to repeat a calibration if the gauge fails to meet specifications, and provides a separate record of the "as-left" report. However, FastCalXP allows failed reports to be used as the as-left report.

Login Options
Allows an administrator to control access to FastCalXP, and sets different permissions depending on user type. When enabled, this also records the user name to the calibration record.

Upcoming Calibrations Report
This reports the gauges and/or the reference standards that will need calibration during a time interval that you define (e.g., due for calibration in the next week, next 30 days or 60 days, etc.).

Disable Auto Peak Detect
Use the keyboard or an optional footswitch to enter data instead of automatically detecting the point to record.

Conventional Calibration
FastCalXP also supports and allows calibration where you set the reference gauge precisely, then read the needle on the gauge and then type reading of gauge into the database.

Audible Feedback
FastCalXP can utilize the audio system of a PC to indicate when pressure is recorded, and to prompt the user to apply the next target pressure.

Head Correction Calculator
Built into the program is a head correction calculator, so that you can have FastCalXP correct the measurements when the gauge being tested is at a different elevation than the reference gauge, and a fluid is being used as the pressure media.

708 Fiero Lane, Suite 9,
San Luis Obispo, California 93401-8701

P/N 3336 Rev 0

CRYSTAL
engineering corporation

30 Series

WIDE RANGE
PRESSURE CALIBRATORS

Why carry a **toolbox** full of **gauges** and **modules?**

When a **Crystal Calibrator** can do the **whole job!**

Now available with **ATEX Approval!**

ACCURACY & RELIABILITY

30 Series WIDE RANGE

PRESSURE CALIBRATORS fit easily into your shirt pocket, yet provide unparalleled performance. 30 Series calibrators measure vacuum and pressure from zero to pipeline pressures, and everything in between—and without any external sensors!

There are two models to choose from:
Model 31s have one sensor, while Model 33s combine two sensors into one calibrator. All 30 Series calibrators indicate milliamps.

30 Series Calibrators are built with aluminum and stainless steel. The aluminum housing helps 30 Series calibrators resist interference from two-way radios and cellular phones. Sensors are stainless steel so they're compatible with gases and liquids—and are built in.

every 30 series calibrator is tested in an environmental test chamber

Advanced Design

A 24 bit analog to digital converter provides measurement resolution of 1 part in 16.7 million (equivalent to 7.5 digits), exceeding the displayed resolution (5.5 digits) for all measurements. Temperature compensation is achieved by constantly measuring the temperature of each sensor and the circuit board itself. Therefore, even milliamp readings are fully temperature compensated.

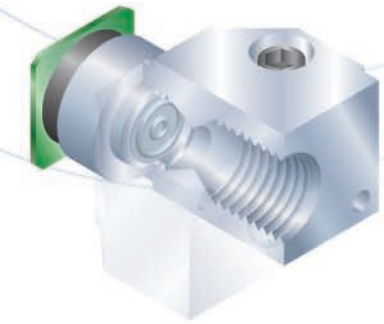
30 Series Calibrators are designed and proven for field use. Accuracy is 0.05% of the indicated pressure, 0.025% of the indicated current (up to 55mA). These specifications are not affected by temperature because each and every 30 Series calibrator is tested in an environmental test chamber over the full operating range of 0°C (32°F) up to 50°C (122°F), duplicating field conditions. Every calibrator is supplied with an NIST traceable certificate of calibration that includes data at 5 temperatures!

Crystal Engineering has been designing and manufacturing pressure measuring equipment for over 25 years, and that's why we say: **Pressure is Our Business.**

FEATURES & TECHNOLOGY

▸ No Menus. No Manual? No Problem!

30 Series calibrators are very easy to use and you will never get lost in a multi-level menu system. In fact, you may never need to open the operation manual. Varying by model, up to 10 different pressure units (PSI, kPa, bar, etc.) are selectable from the keypad. Milliamps can display in percentages of 4-20mA or 10-50mA.



▸ Rugged and Reliable

Advanced technology is employed throughout the 30 Series product line. Pressure is measured using highly repeatable silicon sensors protected by all welded and permanently filled stainless steel diaphragm seals.

hot or cold, your 30 Series calibrator will provide accurate measurements

▸ A Calibration Toolbox in the Palm of Your Hand

30 Series calibrators bring laboratory accuracy to outdoor field conditions. With an overall length of just 137mm (5.4") and weighing less than a pound, 30 Series calibrators are small enough to be taken anywhere safely and easily.

▸ Safe and Accurate Readings

Each and every 30 Series calibrator is fully temperature compensated from controlled testing and exposure to the entire operating temperature range. So when you're working outside, whether in desert heat or arctic cold, your 30 Series calibrator will provide you with measurements that are just as accurate as when you use it indoors!

Special circuitry precisely monitors the 30 Series battery condition to prevent inaccurate measurements due to an over-depleted battery. This circuit helps extend battery life up to 90 hours from an ordinary 9V alkaline battery.

ConfigM30 is a free, self-extracting application

- Download from www.crystalengineering.net

▸ Customize Your 30 Series Calibrator with ConfigM30™ Software

A 30 Series calibrator includes more features than you may actually need. ConfigM30 provides an easy way to disable features you don't want (or to enable features you do). Using a computer running Windows® and ConfigM30 software, and a special serial cable you can easily tailor your 30 Series to fit your specific needs.

You can:

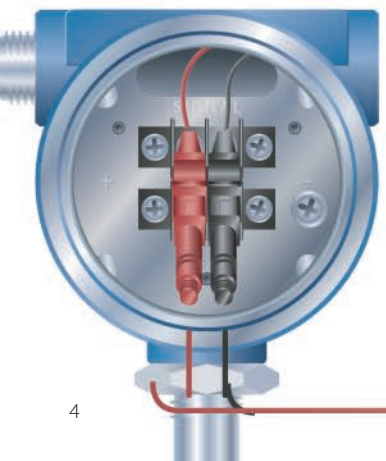
- Disable pressure units that you never use
- Change the inches of water temperature conversion factor. Choose either 60F, 68F, or 4C (39.2F).
- Adjust the calibrator (if required) using the built-in wizard
- Disable all changes to the calibrator with a password
- Save configuration to a file—use the file to quickly copy the configuration to additional calibrators

What you can do with ConfigM30 and a 30 Series Calibrator

- Identify firmware version
- Store a message or identification number
- Create special pressure units (e.g., feet of seawater)
- Eliminate operator errors by removing features
- Prevent tampering

▸ Collect and Control Data from Your 30 Series Calibrator with LabVIEW™ Drivers

Do you use LabVIEW? If so, you can easily take advantage of the performance and capabilities offered by 30 Series calibrators with the Model 30 LabVIEW Driver Library. The driver library is a set of VI's that implement the serial commands of the Model 30. The library also provides parsing of the streaming data output, placing it into a simple cluster for easy access. The library is made up of two basic parts: the command VI's that implement the Model 30 commands like Zero, Units, and Reset; and the data collecting and parsing VI's that handle the reception and parsing of data packets. In addition there is a sample M30 Test Panel.vi file that demonstrates the use of all commands and the data collection components. The Model 30 LabVIEW Driver Library is available as a free download! Visit our website at **www.crystalengineering.net**.



the LabVIEW driver library is a set of vi's that implement the serial commands of the model 30

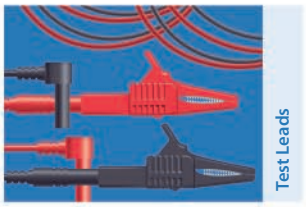
▸ Log Data with SerialDL

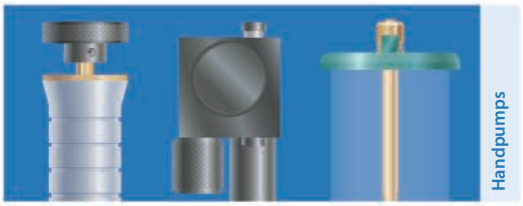
SerialDL is a free command line program that will log data from any 30 Series pressure calibrator, and then create a comma delimited text file that can be easily opened with other applications like Microsoft® Excel spreadsheets or Access databases.

▶ Accessories for Field Testing, Measurement, and Calibration

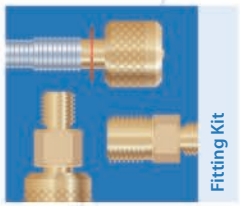
In our Accessories brochure you'll find not only test leads, cables, and a selection of individual fittings and handpumps, but a complete line of Calibration Kits that include everything you need for pressure calibration work—handpumps, fittings, and hoses—packed into our rugged, watertight carrying case. Here are a few of the accessories available.

▶ Test Leads This set features high quality, safety banana plugs, super-flexible silicone-insulated test leads, and rugged, hard plastic insulated alligator clips. P/N: **1351** ▶ Handpumps There are a number of different handpumps available for use with 30 Series calibrators, but we recommend the following pumps for their versatility and compact size. Our Hydraulic Pumps (P/Ns **2819** and **2820**) are capable of generating up to 5000 PSI (35 MPa/350 bar) and includes a variable volume to set pressure exactly. We also recommend our ComboPumps (P/Ns **2907** and **2908**). These pneumatic pumps can be used for both vacuum and pressure, and include a pressure-balanced variable volume. With a ComboPump, it's always easy to set pressure precisely, because the variable volume is easy to turn at any pressure.


Test Leads

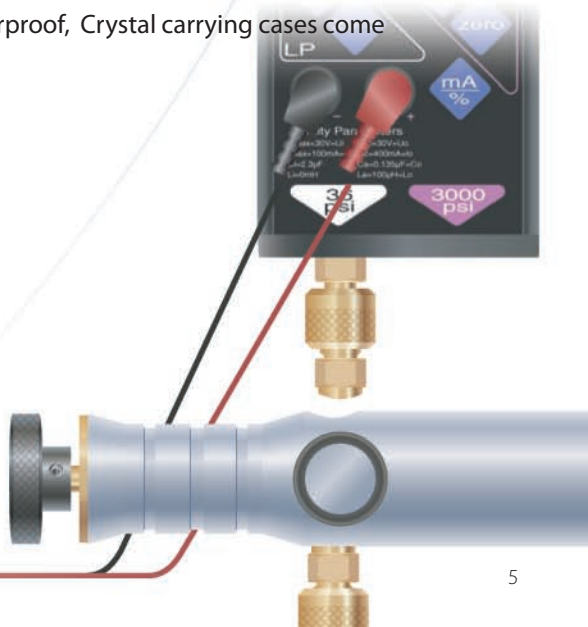

Handpumps

▶ Fitting Kits We offer a full range of fittings and hoses designed specifically for test and calibration. When calibrating or testing, you only need temporary connections. Unfortunately, connecting to a gauge, transmitter, or other device to be tested can take more time than the actual test or calibration—not to mention what happens when there's a leak! To simplify your job, you can eliminate the need for wrenches and pipe-thread tape, and avoid the frustration of finding and fixing leaks. Take a look at our Handpumps and Accessories brochure for our complete line of easy to use quick-connect fittings and fitting kits. ▶ Carrying Cases Rugged, compact, and waterproof, Crystal carrying cases come equipped with custom die-cut foam inserts, and can be ordered as part of a complete calibration kit with all the accessories you need to maximize your productivity on the job. See our Handpumps and Accessories brochure for information on our complete line of carrying cases and calibration kits. Hard Carrying Case with Foam Insert P/N: **2888**


Fitting Kit


Carrying Case

▶ RS232 Cable Required in order to use Crystal software with your 30 series calibrator. P/N: **1928** ▶ RS232 to USB Adapter P/N: **3313**



About Resolution

Resolution refers to the smallest change in pressure that can be indicated for a given model and unit of measure. For instance, the smallest change in *pounds per square inch* of pressure that can be indicated on a 16 PSI 30 Series calibrator (on the PSI scale) is 0.001 PSI, while the smallest change in PSI that can be indicated on a 3000 PSI 30 Series is 0.1 PSI.

▶ Units, Resolution & Pressure Ranges

▶ Pressure Ranges

PSI	bar	kPa*	Over-pressure
16	1	100	6.5 x
36	2	200	3.0 x
300	20	2000	2.0 x
600	40	4000	2.0 x
1500	100	10000	2.0 x
3000	200	20000	1.5 x
5000	300	30000	1.5 x

▶ Pressure Units and Resolution

PSI	kg/cm²	inch Hg	inch H_2O	mm Hg	cm H_2O	mm H_2O	kPa	MPa	mbar	bar
0.001	0.0001	0.001	0.01	0.01		1	0.01		0.1	
0.001	0.0001	0.001	0.01	0.01		1	0.01		0.1	
0.01	0.001	0.01	0.1	0.1	1		0.1			0.001
0.01	0.001						0.1	0.0001		0.001
0.1	0.01						1	0.001		0.01
0.1	0.01						1	0.001		0.01
0.1	0.01						1	0.001		0.01

* kPa versions are restricted to kPa, MPa, bar or millibar, depending on pressure range. PSI versions with ranges of 36 PSI and lower include all possible scales except bar. The 300 PSI version includes all possible scales except mbar. Bar versions with ranges of 2 bar and lower include all possible scales except inch Hg.

Model 33 calibrators, including all ATEX models, have dual pressure sensors. This chart shows all of the sensor combinations.

▶ Second Pressure Range

▶ First Pressure Range

First Pressure Range	Second Pressure Range: 300 PSI / 20 bar / 2K kPa	600 PSI / 40 bar / 4K kPa	1.5K PSI / 100 bar / 10K kPa	3K PSI / 200 bar / 20K kPa	5K PSI / 300 bar / 30K kPa (ATEX ONLY)
16 PSI / 1 bar / 100 kPa	✓	✓	✓	✓	✓
36 PSI / 2 bar / 200 kPa	✓	✓	✓	✓	✓
300 PSI / 20 bar / 2K kPa	n/a	n/a	✓	✓	n/a

▶ The 30 Series Numbering System

30 Series part numbers are based on a simple system of numbers and letters that define every attribute of a specific calibrator. Use this table to define the 30 Series model that best suits your requirements.

Standard or Metric	–	Certification	3	Pressure Sensor	–	1st Pressure Range	/	2nd Pressure Range	Pressure Units	–	Manifold Option
(blank) . . . Standard SI . . . Metric units only		IS . . . CSA approved AX . . . ATEX approved		1 . . . Single sensor 3 . . . Dual sensor		See table above		See table above (blank) . . . Single sensor	PSI . . . PSI BAR . . . bar KPA . . . kPa		(blank) . . . Standard SPSS . . . Stainless steel

▶ Sample Part Numbers

IS33-36/3000PSI . . .

CSA approved, intrinsically safe gauge with two sensors (36 PSI and 3000 PSI pressure ranges).

SI-IS31-200KPA . . .

Metric (kPa, mbar and bar scales only) CSA approved, intrinsically safe gauge with one sensor (200 kPa pressure range).

AX33-2/300BAR-SPSS . . .

ATEX approved, intrinsically safe gauge with two sensors (2 bar and 300 bar pressure ranges) with stainless steel manifolds.

SPECIFICATIONS

Specifications and Options

Pressure (Refer to the table on the facing page)

0 to Full Scale:
±(0.05% of Reading + Floor Term*)

* Floor Term = 0.005% of FS or display resolution, whichever is greater.

Vacuum

±(0.25% of Reading + Vacuum Floor Term†)

† • Vacuum Floor Term (VFT)

- For 16 and 36 PSI, VFT = 0.004 PSI
- For 300 PSI, VFT = 0.01 PSI
- For 1 or 2 bar and 100 or 200 kPa, VFT = 0.03 kPa
- For 20 bar or 2000 kPa, VFT = 0.1 kPa

Note: Vacuum operation is not specified for 600 PSI (40 bar/4000 kPa) models and higher. However, all models can be safely connected to vacuum.

30 Series calibrators are not recommended for continuous use at high vacuum.

Temperature Ranges

Operating & Compensated:
0°C to 50°C (32°F to 122°F).

Storage: -20°C to 70°C (-4°F to 158°F)

Power

Battery:
One (1) 9V battery.

Battery Life:
90 hours typical (alkaline battery).

Low Battery Indicator:
Displayed battery icon

Electrical

Range: 0 to 55 mA

Resolution: 0.001 mA

Accuracy: ±(0.025% of Reading + 0.001 mA)

Percentage Conversion:
4 mA = 0.00%; 20 mA = 100.00% or
10 mA = 0.00%; 50 mA = 100.00%

Connection:
4mm jacks, 19mm (0.75") spacing

Intrinsic Safety

Exia Intrinsically Safe, Class I, Groups A, B, C & D, Temperature code T4

Pressure Fitting(s)

1/8" female NPT

ATEX Certified Intrinsically Safe

33 Series calibrators can be ordered in an internationally accepted, ATEX (European Union) approved version. The ATEX approved versions are certified compliant with the standards listed below. ATEX is available for Model 33 calibrators only. 3.5 MPa, 5000 PSI and 350 Bar ranges are available only in the ATEX approved versions.

EEx ia IIC T4
FTZU 06 ATEX 0010X
CE 0344 Ex II 2G

Media Compatibility

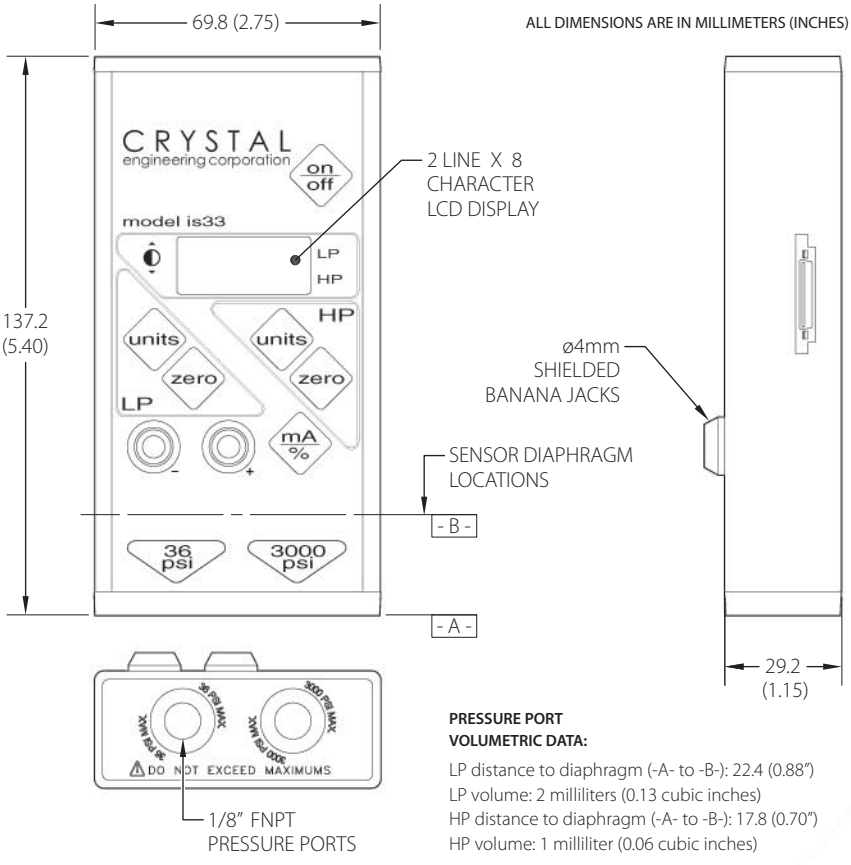
Liquids and gases compatible with PTFE (Polytetrafluoroethylene) penetrated and anodized aluminum sensor manifold, 316 stainless steel (sensor), Viton® (O-ring). (Viton is a registered trademark of Dupont Dow Elastomers.) PTFE can be eliminated, if required, by specifying option SPSS, in which case aluminum manifold(s) will be replaced with stainless steel manifold(s). (Refer to the 30 Series Numbering System chart on the facing page.)

Notes: Over-range occurs at 110% of full scale, causing "HP Over" or "LP Over" to be displayed.

Standard factory setting is 1"H20 = 0.036126 PSI (density of water @ 4°C). Specify at time of order if you require a different density (e.g., for water @ 68°F, 1"H20 = 0.036063 PSI).

CE Specifications include all effects of linearity, hysteresis, repeatability, temperature, and stability for one year.

Enclosure



PRESSURE PORT VOLUMETRIC DATA:

LP distance to diaphragm (-A- to -B-): 22.4 (0.88")
LP volume: 2 milliliters (0.13 cubic inches)
HP distance to diaphragm (-A- to -B-): 17.8 (0.70")
HP volume: 1 milliliter (0.06 cubic inches)

Description

Extruded Aluminum with sealed membrane keypad.

Weight

Model 33: 400g (14.0 oz)
Model 31: 342g (12.0 oz)
Model 31, High Pressure: 360g (13.0 oz)

Weight with SS Manifold

Model 33: 485g (17.0 oz)
Model 31: 428g (15.0 oz)
Model 31, High Pressure: 360g (13.0 oz)

Carry Case & Strap

A handy carry case is included with every 30 Series calibrator. The clear plastic cover protects the keypad while allowing operation of all of the buttons. The included strap provides an easy way to hang the calibrator while in use.

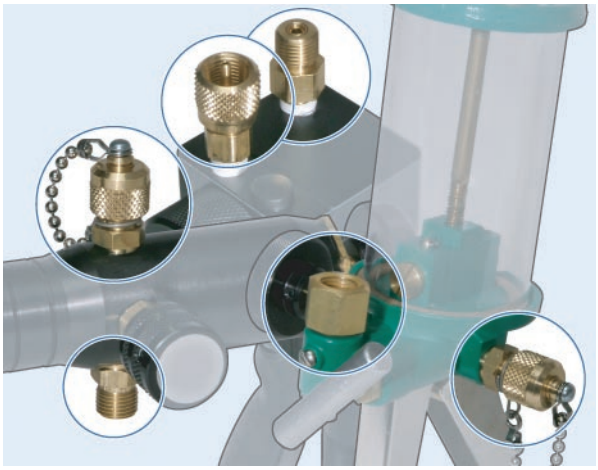
CRYSTAL
engineering corporation

Handpumps and Accessories

Precision**Pressure**
measurement

CRYSTAL Engineering offers a range of accessories for test and calibration of pressure instruments in the field. Included in this brochure are portable pressure sources (handpumps); leak-free fittings and hoses that easily connect to pumps, gauges, and other devices ***without the need for tools***; waterproof carrying cases; and complete carry-case kits that include all of the accessories you need for specific Crystal gauges and calibrators.

All of our handpumps have been designed for field use and incorporate these common features:

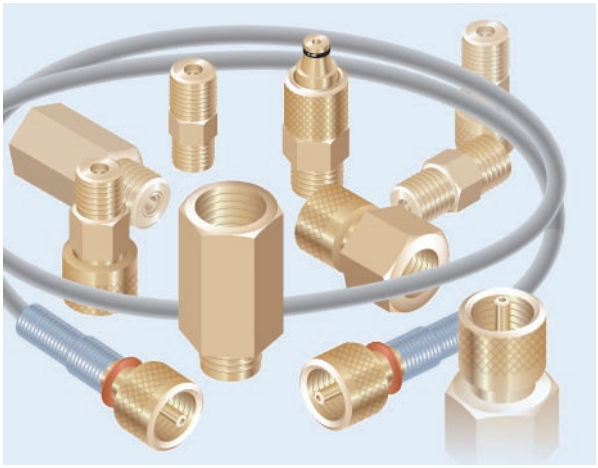


Two pressure ports—one for the gauge or calibrator, the other for the device being tested—eliminate the need for additional fittings.

Simple construction allows for easy replacement of parts, and for complete rebuilds. Rebuild kits are available for every pump in this brochure.

Lightweight but rugged construction assures that your pump will perform even in the harshest field conditions.

Each Crystal handpump is fitted with two pressure ports.



Our Quick-Connect hoses and fittings employ an innovative internal o-ring system designed to insure leak-free connections without the use of tools. While all hoses and fittings may be ordered separately, we also offer them in complete Fitting Kits, designed for use with specific handpumps and test devices. Refer to pages 10 & 11 for complete technical descriptions of all Crystal hoses and fittings.

Waterproof carrying cases have die cut ***rigid*** foam inserts, and have been designed to efficiently fit accessories appropriate to the specific gauge or calibrator, while still being the most compact and lightweight cases available. Our rugged, orange carrying case (shown here and on the following page) is included with every Calibration Kit, or may be ordered separately. We also offer a rolling waterproof case for our popular GaugeCalXP Pressure Comparator, and a low cost non-waterproof case for gauges or calibrators, with room for additional fittings, test leads, or other miscellaneous items.

Lightweight Case
P/N **3009**

Waterproof Case
P/N **2888**

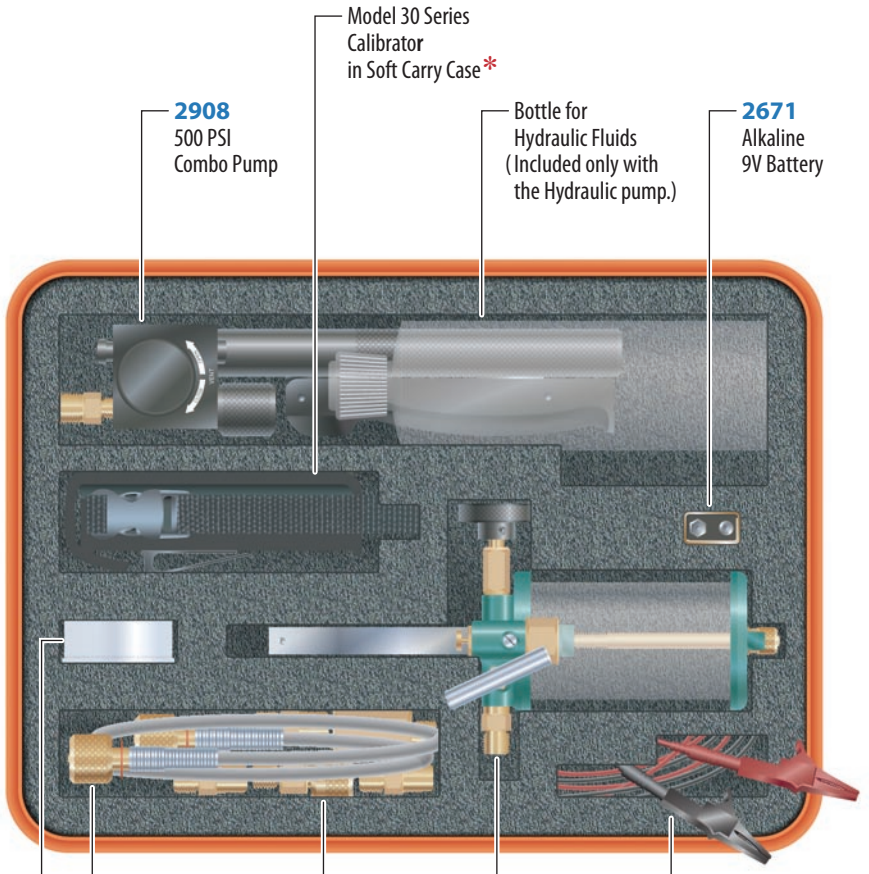
GaugeCalXP Case
P/N **3353**

▸ Calibration Kits

Calibration kits offer the most convenient and compact solutions available for carrying everything you need for field pressure calibration work.

All calibration kits start with an extremely rugged carry case, manufactured from high grade ABS plastic, and designed to withstand a drop of up to 2 meters (6 feet). The case is fully sealed and water tight, with a pressure equalization valve to allow easy opening after changes in altitude or temperature. A rigid, die-cut foam insert is custom designed to fit everything you need into the most compact space possible. Your calibrator, pump, fittings, hoses, leads, pipe thread tape, battery, and bottle of hydraulic fluid (if required) fit snugly into precut locations.

Universal Calibration Kit
*(does not include 30 Series Calibrator)



CylinderPump Calibration Kits (to 80 PSI/5.5bar)

- **for 30 Series Calibrator** . . . . . P/N: **2858**
- **for XP2i Pressure Gauge** . . . . . P/N: **2937**

ComboPump Calibration Kits (to 500 PSI/35bar)

- **for 30 Series Calibrator** . . . . . P/N: **2910**
- **for XP2i Pressure Gauge** . . . . . P/N: **2938**

HydraulicPump Calibration Kits (to 5000 PSI/350bar)

- **for 30 Series Calibrator** . . . . . P/N: **2911**
- **for XP2i Pressure Gauge** . . . . . P/N: **2939**

Universal Calibration Kit (to 5000 PSI/350bar)

- **for 30 Series Calibrator and XP2i Pressure Gauge** . . . . . P/N: **2834**

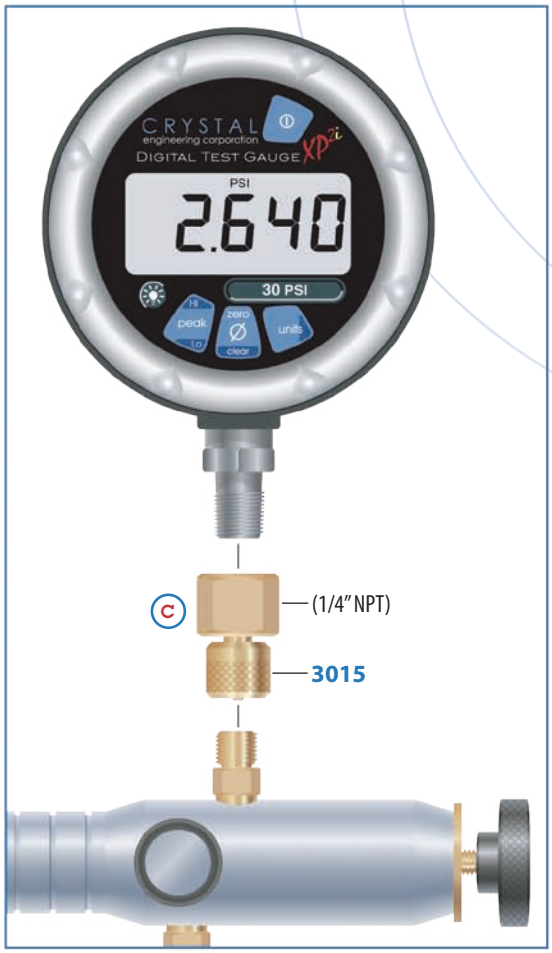
Every Calibration Kit includes a waterproof hardshell case, complete with a handpump—the Universal Kit includes both a 2980 ComboPump *and* a 2820 HydraulicPump—hose, thread tape, and all fittings required to use the gauge or calibrator with the included pump(s). Refer to pages 4-9 for details of required fittings.

Universal and 30 Series kits also include test leads and a spare 9V battery.

▶ CylinderPump fittings for XP2i

▶ CylinderPump fittings for 30 Series

The 1351 Test Leads are shown connected to the device under test.



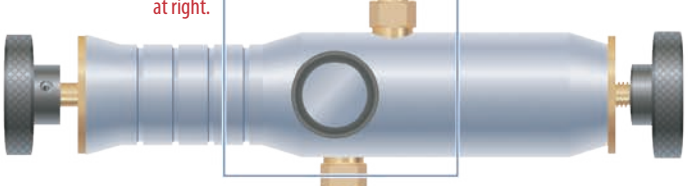
(C) (1/4" NPT)

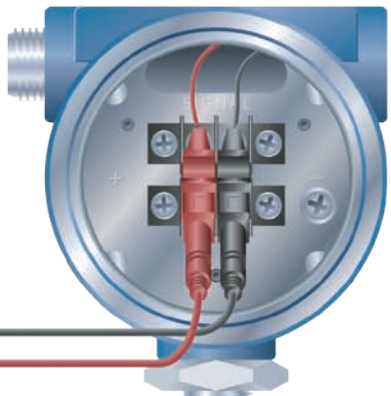
3015

(D) (1/8" NPT)

2991

See XP2i fitting detail at right.





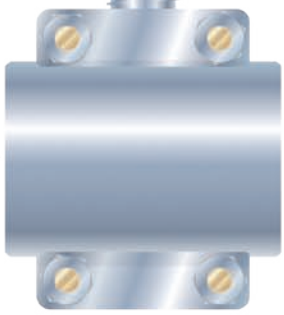
(B)

2821 Hose (36" [0.9m])
or
3017 Hose (60" [1.5m])

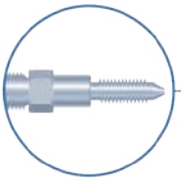
(1/4" NPT)

3011

(A)



Alternately, a Transmitter Calibration Adapter may be used in place of the 3011 Male NPT fitting. See page 11 for more details.



▸ CylinderPump

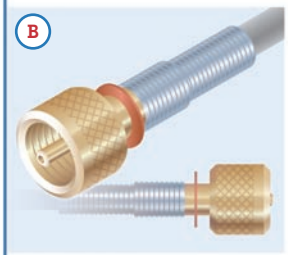
This is the ideal pressure source for calibration of low pressure differential transmitters. It works like a bicycle pump, but with a fine adjustment piston that makes it easy to set the pressure very precisely. On the side of the pump is a vent valve, also designed for precise control, so you can open it very slowly and easily control the rate of change of pressure.

Another valve (not shown) changes the cylinder handpump into a vacuum pump, expanding the usefulness of the pump. This is an all metal pump and is field rebuildable.

Pump shown mounted with an XP2i Pressure Gauge.

Pump Includes...

3011 Male NPT (1/4")
QTY **1**



2821 Hose (36"[0.9m])
QTY **1**

XP2i Requires...

3015 Female NPT (1/4")
QTY **1**

30 Series Requires...

2991 Male NPT (1/8")
QTY **1**

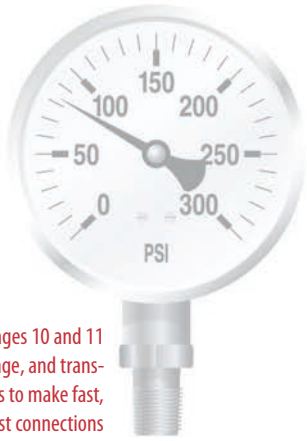
CylinderPump . . . . . P/N: **2936**
- Rated pressure: 80 PSI/ 5.5 bar/ 500 kPa
  Easily produces: 30 PSI/ 2 bar/ 200 kPa
  Vacuum: -25"Hg/-12 PSI/-0.85 bar/-85 kPa

Rebuild Kit . . . . . P/N: **2941**
- for CylinderPump

CylinderPump Calibration Kit . . . . . P/N: **2858**
- for 30 Series Calibrator
  Includes waterproof case, CylinderPump, fittings, test leads, etc. SEE PAGE 3 FOR DETAILS.

CylinderPump Calibration Kit . . . . . P/N: **2937**
- for XP2i Pressure Gauge
  Includes waterproof case, CylinderPump, hose, fittings, etc. SEE PAGE 3 FOR DETAILS.

▶ ComboPump fittings for XP2i



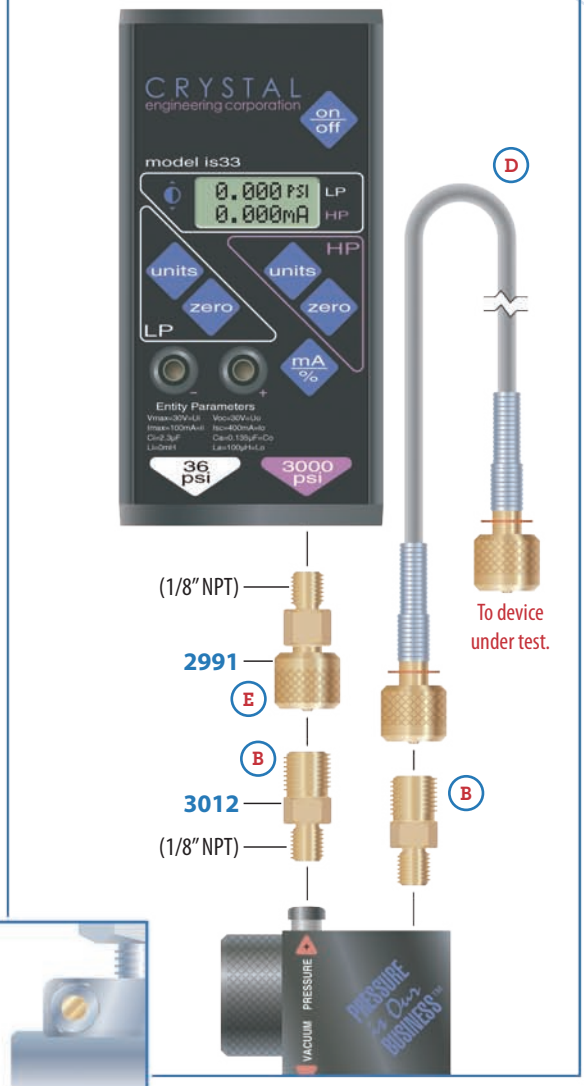
See pages 10 and 11 for NPT, swage, and transmitter fittings to make fast, leak- free test connections ***without*** thread tape or tools.

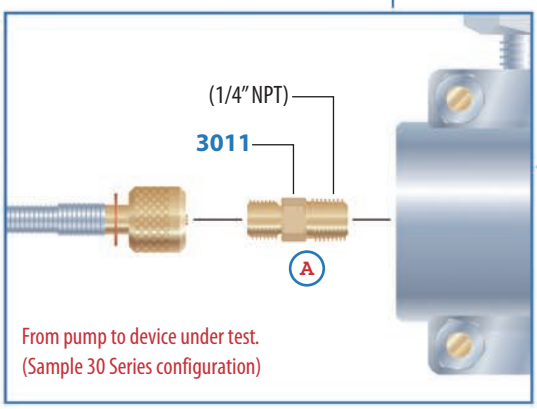
(1/4" NPT)
3015
C
3012
B
(1/8" NPT)
D

See 30 Series fitting detail at right.

2821 Hose (36" [0.9m])
or
3017 Hose (60" [1.5m])

▶ ComboPump fittings for 30 Series





From pump to device under test.
(Sample 30 Series configuration)

▸ ComboPump

The ComboPump is our best selling pump because it's so versatile. You can use it for low differential pressure transmitters but it can generate up to 500 PSI/ 35 bar/ 3.5 MPa, and it's a vacuum pump, too! The unique pressure balanced variable volume lets you set pressure precisely and easily, even at maximum pressure.

Mount a gauge or a calibrator on one of the two pressure ports and use the second port for the device being tested. The result is a complete field pressure calibration system that can be operated with one hand.

Pump shown mounted with 30 Series Calibrator.

Pumps Include...

No fittings

All fittings on this page may be ordered separately, or as complete fitting kits.

XP2i Fitting Kit
P/N: **2797**
Includes the hose and all fittings shown in the second column at right.

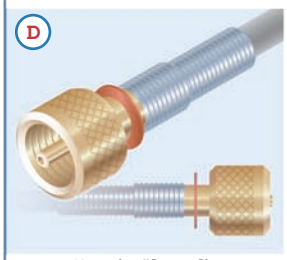
30 Series Fitting Kit
P/N: **2786**
Includes the hose and all fittings shown in the third column at right.

XP2i Requires...

3011 Male NPT (1/4")
QTY **1** (NOT SHOWN IN SCHEMATIC)

3012 Male NPT (1/8")
QTY **2**

3015 Female NPT (1/4")
QTY **1**



2821 Hose (36" [0.9m])
QTY **1**

30 Series Requires...

2991 Male NPT (1/8")
QTY **1**

3012 Male NPT (1/8")
QTY **2**

2821 Hose (36" [0.9m])
QTY **1**

ComboPump . . . . . P/N: **2907**
▸ Rated pressure: 300 PSI/ 20 bar/ 2 MPa
Easily produces: 200 PSI/ 14 bar/ 1.4 MPa
Vacuum: -25"Hg/-12 PSI/-0.85 bar/-85 kPa

ComboPump . . . . . P/N: **2908**
▸ Rated pressure: 500 PSI/ 35 bar/ 3.5 MPa
Easily produces: 300 PSI/ 20 bar/ 2 MPa
Vacuum: -25"Hg/-12 PSI/-0.85 bar/-85 kPa

Rebuild Kit . . . . . P/N: **2802**
▸ for all ComboPumps

ComboPump Calibration Kit . . . . . P/N: **2910**
▸ for 30 Series Calibrator
Includes waterproof case, ComboPump, hose, fittings, etc. SEE PAGE 3 FOR DETAILS.

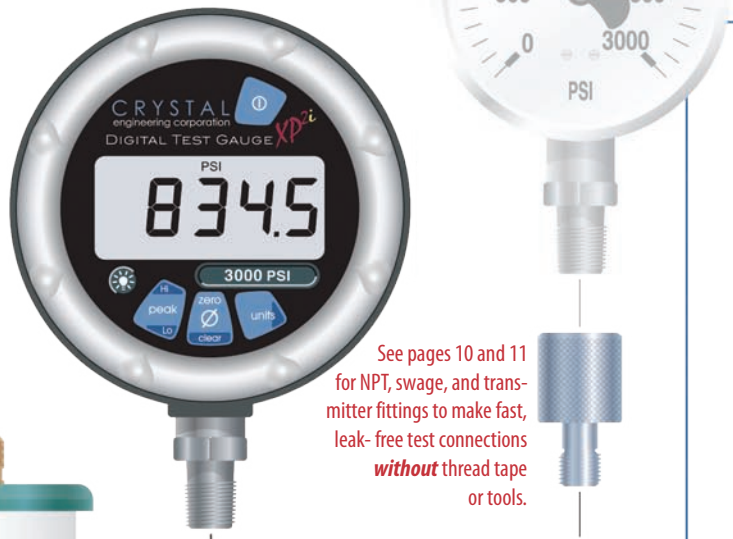
ComboPump Calibration Kit . . . . . P/N: **2938**
▸ for XP2i Pressure Gauge
Includes waterproof case, ComboPump, hose, fittings, etc. SEE PAGE 3 FOR DETAILS.

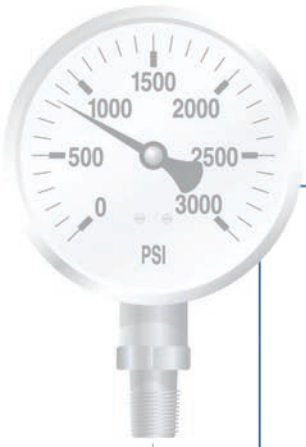
Universal Calibration Kit . . . . . P/N: **2834**
▸ for 30 Series Calibrator and XP2i Pressure Gauge
Includes waterproof case, ComboPump and HydraulicPump, hoses, fittings, etc.
SEE PAGE 3 FOR DETAILS.

Fitting Kit . . . . . P/N: **2786**
▸ for 30 Series Calibrator

Fitting Kit . . . . . P/N: **2797**
▸ for XP2i Pressure Gauge

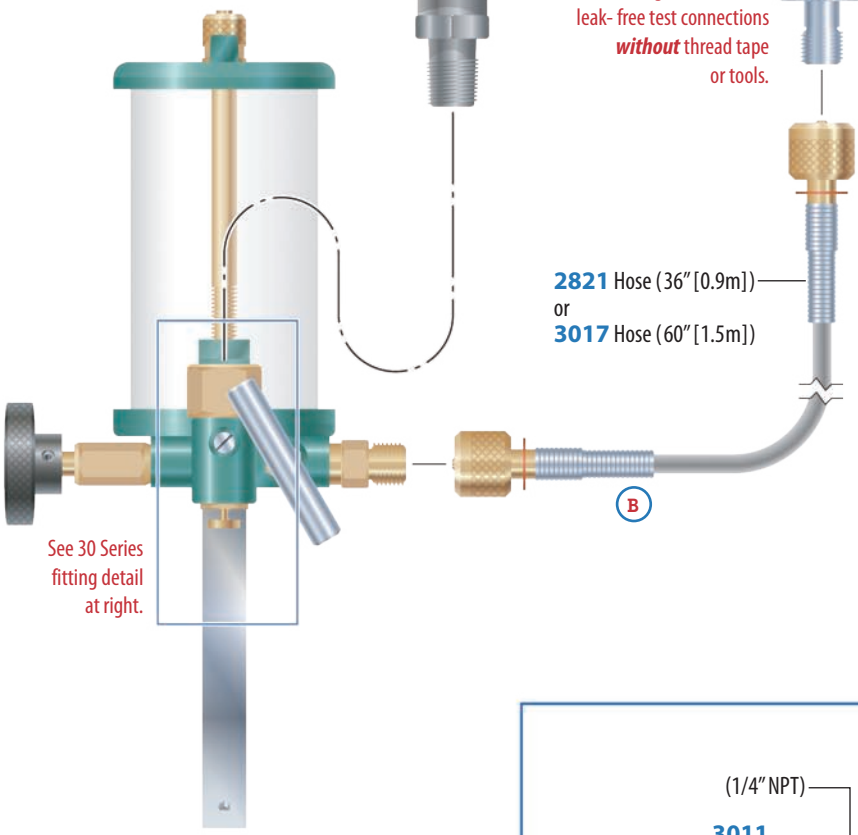
▶ HydraulicPump fittings for XP2i





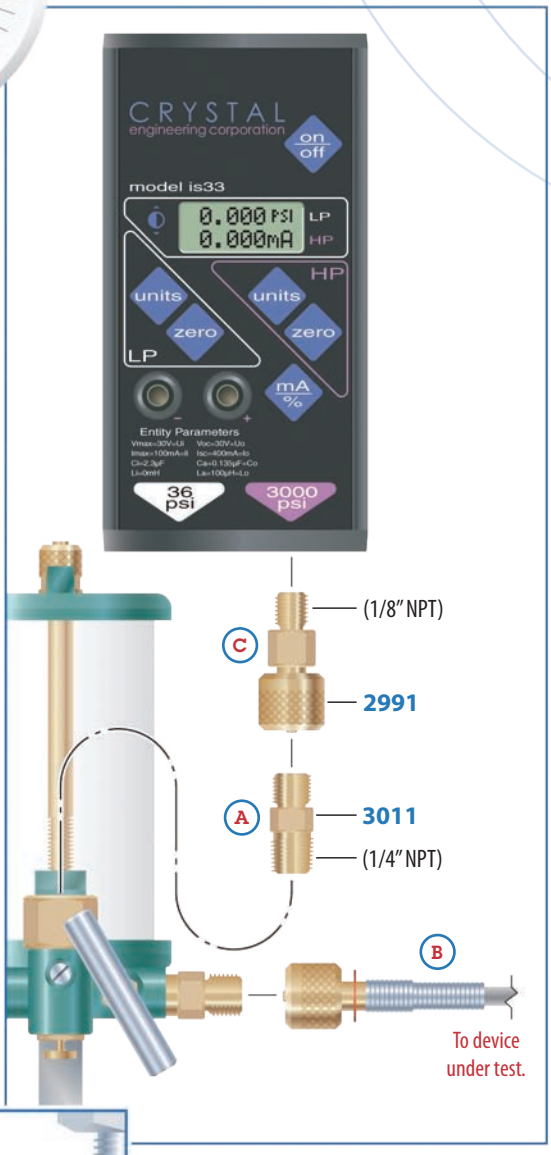
See pages 10 and 11 for NPT, swage, and transmitter fittings to make fast, leak- free test connections ***without*** thread tape or tools.

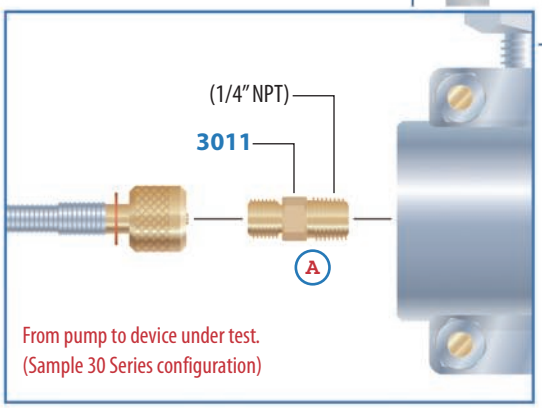
2821 Hose (36" [0.9m])
or
3017 Hose (60" [1.5m])



See 30 Series fitting detail at right.

▶ HydraulicPump fittings for 30 Series





▸ HydraulicPump

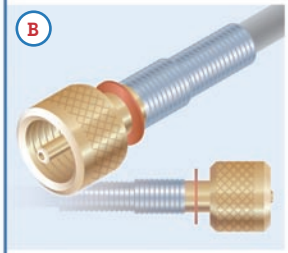
The HydraulicPump is a lightweight, high pressure source that can use oil or water as the test fluid, and produces up to 5000 PSI/ 350 bar/ 35 MPa.

There are two pressure ports on the pump: Mount a gauge or calibrator directly to the front of the pump, connect the spare port directly to the device being tested, and you have a complete field pressure calibration system. A hose, and fittings are included (see below) along with a convenient plastic bottle to hold your hydraulic test fluid. The built-in variable volume provides a way to set the pressure precisely, and the pump is rebuildable. Two versions of the pump are available with maximum pressure ratings of 3000 PSI/ 200 bar/ 20 MPa or 5000 PSI/ 350 bar/ 35 MPa.

Pump shown mounted with XP2i Pressure Gauge.

Pumps Include...

3011 Male NPT (1/4")
QTY **1**



2821 Hose (36" [0.9m])
QTY **1**

XP2i Requires...

No additional fittings

30 Series Requires...

2991 Male NPT (1/8")
QTY **1**

3011 Male NPT (1/4")
QTY **1**

HydraulicPump 3000 PSI . . . . . P/N: **2819**
▸ Rated pressure: 3000 PSI/ 200 bar/ 20 MPa
Easily produces: 3000 PSI/ 200 bar/ 20 MPa

HydraulicPump 5000 PSI . . . . . P/N: **2820**
▸ Rated pressure: 5000 PSI/ 350 bar/ 35 MPa
Easily produces: 5000 PSI/ 350 bar/ 35 MPa

Rebuild Kit . . . . . P/N: **2940**
▸ for all HydraulicPumps

Hydraulic Calibration Kit . . . . . P/N: **2911**
▸ for 30 Series Calibrator
Includes HydraulicPump, hose, fitting, and reservoir, etc. SEE PAGE 3 FOR DETAILS.

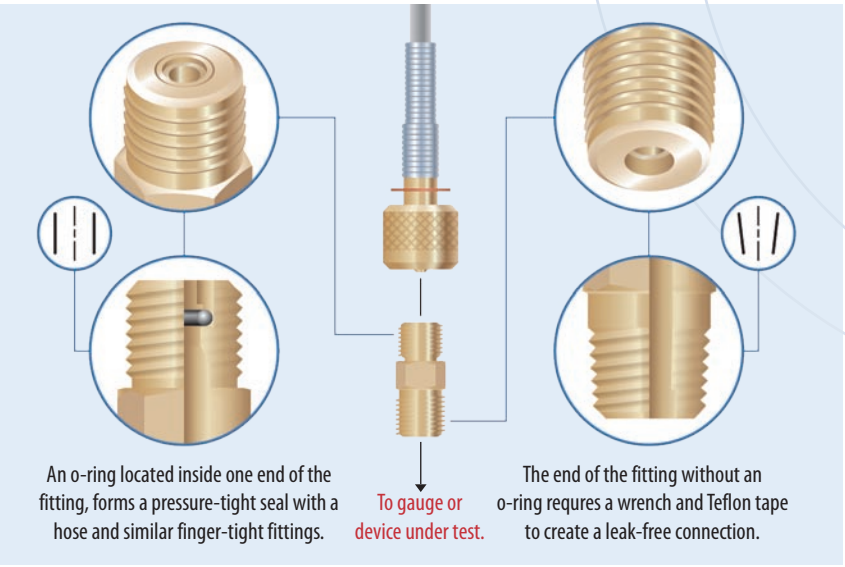
Hydraulic Calibration Kit . . . . . P/N: **2939**
▸ for XP2i Pressure Gauge
Includes HydraulicPump, hose, fitting, and reservoir.

Universal Calibration Kit . . . . . P/N: **2834**
▸ for 30 Series Calibrator and XP2i Pressure Gauge
Includes waterproof case, HydraulicPump and ComboPump, hoses, fittings, etc.
SEE PAGE 3 FOR DETAILS.

▸ Crystal Quick-Connect Fittings save time and eliminate leaks!

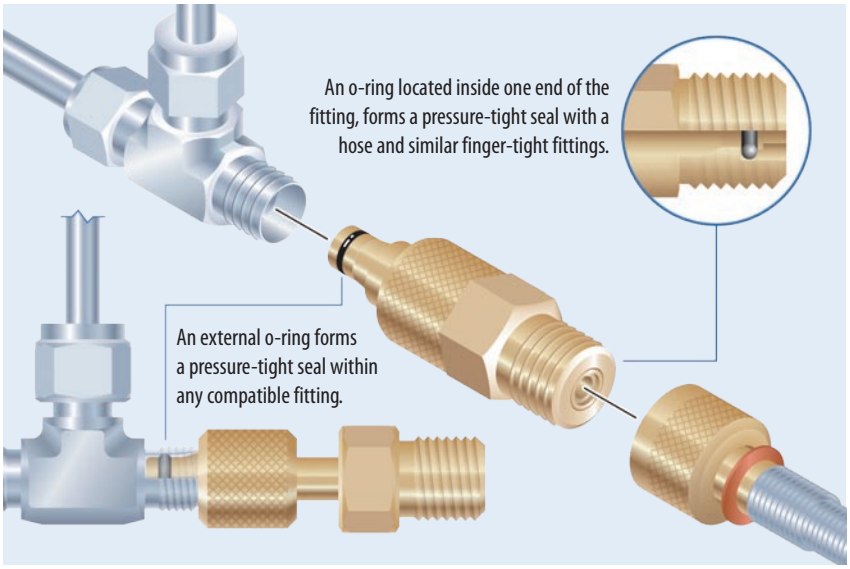
The secret to making leak-tight connections is the o-ring hidden inside each fitting. The o-ring forms a high pressure seal on the external surface of the small tube that protrudes from the (male) mating fitting.

Note: The side of the fitting with the built-in o-ring has parallel threads that are similar in size to 1/4" NPT. **Do not connect this side to any NPT fitting!** It will leak, and you could damage one or both fittings.



The threads on the ***non-NPT*** end of the fitting ***are parallel***.

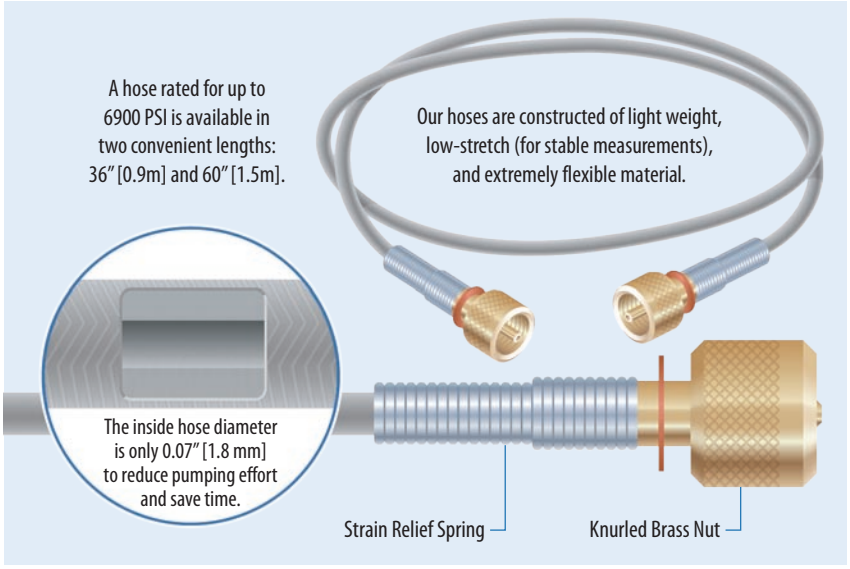
The threads on the ***NPT*** end of the fitting ***are tapered***.



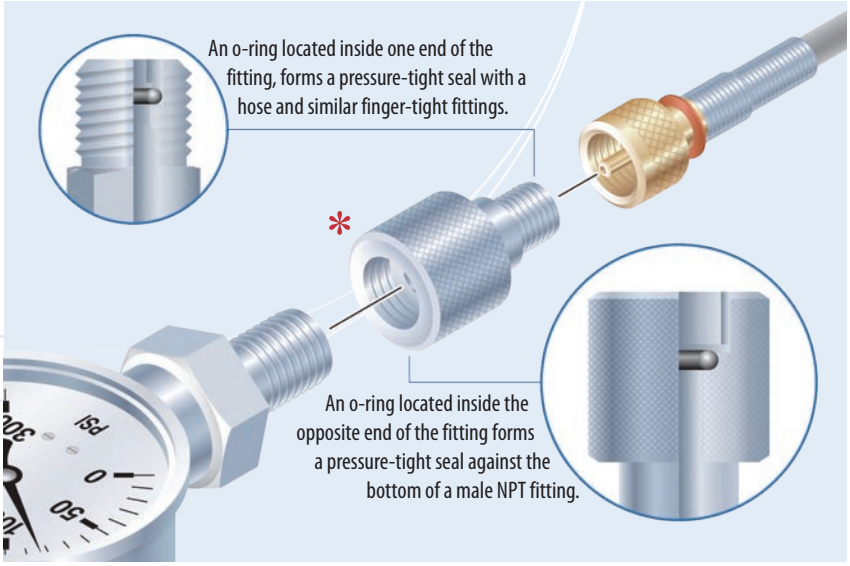
Another time saving fitting lets you connect to any swage style fitting ***without the need for any tools***. An o-ring inside the connection seals to the swage fitting and converts the swage fitting to the Crystal Quick-Connection system.

Additional adapters are available that mate with the proprietary connections found on various brands of pressure transmitters.

Crystal Quick-Test Hose assemblies have a strain relief spring and knurled brass nut. The brass nut features the same innovative hidden o-ring design used in our Quick-Connect fittings. The small diameter hose is both strong *and* flexible, and is rated for up to 6900 PSI (475 bar).

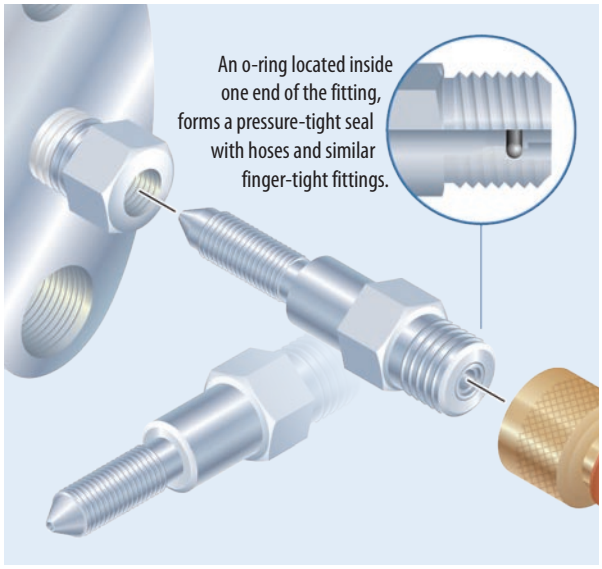


▸ Making NPT connections without the need for thread tape!



Crystal offers Quick-Connect adapters designed specifically for fast and easy gauge and calibrator changes, eliminating the need for tools or thread tape. Simply finger tighten to ensure a leak free connection up to 5000 PSI (350 bar). These fittings are available for both NPT and BSPP and may be ordered separately or as complete Quick-Connect kits.

*P/Ns 3125, 3126, and 3127 for 1/8", 1/4", and 1/2" respectively.



Transmitter calibration adapters are specially designed to mount in the bleed ports of a number of popular models of pressure transmitters. The adapters are installed without the need for thread tape or other sealants, and once installed will accept our Quick-Connect fittings and hoses.

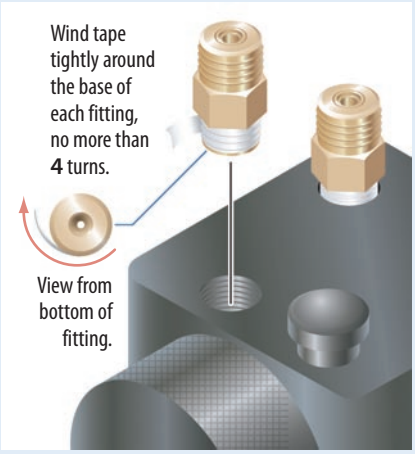
Adapters are available in two configurations: P/N 3400 (5/16"-24 UNF) for Foxboro®, Rosemount®, and Yokogawa transmitters; and P/N 3401 (1/4"-28 UNF) for Honeywell® transmitters.

The secret to making leak-tight connections is the o-ring hidden inside each fitting.

PTFE Thread Tape

Any NPT (or non-parallel thread) pressure connection ***not using a Crystal Quick-Connect adapter*** (as described above) requires the use of PTFE (Teflon®) thread sealing tape. PTFE thread tape not only reduces friction on non-parallel (tapered) threads, it also forms a reliable air- and liquid-tight seal to eliminate leaks.

Apply 3 or 4 turns of thread seal tape in a clockwise direction (as shown below). Take special care to align one edge of the tape on the first (lead-in) thread to avoid having excess tape block the flow of gas or fluid through the connection.



Ordering Information

Handpumps and Rebuild Kits

CylinderPump
P/N: **2936**

Rebuild Kit for CylinderPump
P/N: **2941**

ComboPump 300 PSI/20 bar/2MPa
P/N: **2907**

ComboPump 500 PSI/35 bar/3.5MPa
P/N: **2908**

Rebuild Kit for all ComboPumps
P/N: **2802**

HydraulicPump 3000 PSI/200 bar/20Mpa
P/N: **2819**

HydraulicPump 5000 PSI/350 bar/35Mpa
P/N: **2820**

Rebuild Kit for all HydraulicPumps
P/N: **2940**

Calibration Kits

CylinderPump Calibration Kit
for 30 Series Calibrator
P/N: **2858**

CylinderPump Calibration Kit
for XP2i Pressure Gauge
P/N: **2937**

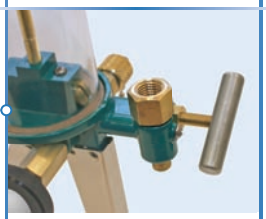
HydraulicPump Calibration Kit
for 30 Series Calibrator
P/N: **2911**

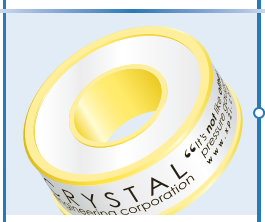
HydraulicPump Calibration Kit
for XP2i Pressure Gauge
P/N: **2939**

ComboPump Calibration Kit
for 30 Series Calibrator
P/N: **2910**

ComboPump Calibration Kit
for XP2i Pressure Gauge
P/N: **2938**

Universal Calibration Kit
for 30 Series Calibrator
P/N: **2834**





Other Accessories

Hose 6900 PSI (36" [0.9m])
P/N: **2821**

Hose 6900 PSI (60" [1.5m])
P/N: **3017**

Red & Black Test Leads
P/N: **1351**

RS232 Cable for 30 Series (6' [2m])
P/N: **1928**

RS232 Cable for XP2i (6' [2m])
P/N: **2400**

USB to RS232 Adapter
P/N: **3313**

Hardshell Carrying Case
For Calibration Kits (orange)
P/N: **2888**

Hardshell Carrying Case
For Individual Calibrators (black)
P/N: **3009**

Hardshell Rolling Case
For GaugeCalXP (black)
P/N: **3353**

Soft Case with Cover for 30 Series
P/N: **2490**

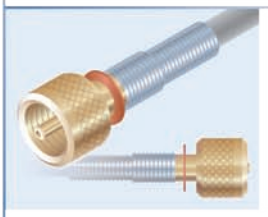
Protective Boot for XP2i
P/N: **3193**

White PTFE Thread Tape
(1/4" [6mm])
P/N: **1810**

Yellow Gas Line PTFE Thread Tape
(1/2" [12mm])
P/N: **3386**

CRYSTAL
engineering corporation

▸ 30 Series Pressure Calibrator Fitting Kit **2786**



2821
Hose
(36″[0.9m])
QTY **1**

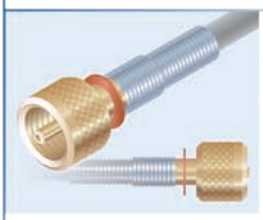
plus...

2991 Male NPT (1/8″)
QTY **2**

3011 Male NPT (1/4″)
QTY **1**

3012 Male NPT (1/8″)
QTY **2**

▸ XP2i Test Gauge Fitting Kit **2797**



2821
Hose
(36″[0.9m])
QTY **1**

plus...

3011 Male NPT (1/4″)
QTY **1**

3012 Male NPT (1/8″)
QTY **2**

3015 Female NPT (1/4″)
QTY **1**

▸ Fitting Kits

All fittings are rated to 5000 PSI (350 bar), and once installed require no tools to connect or disconnect. Internal o-ring seals insure finger-tight, leak-free connections. Hoses are both strong and flexible, and feature nylon linings covered with Kevlar® braiding. Though our fittings and hoses may be ordered individually, to ensure you have everything you might need, consider these convenient, device-specific fitting kits.

▸ Universal Fitting Kit **2832**

2991
Male NPT (1/8″)
QTY **1**

2992
Male NPT (1/4″)
QTY **1**

3011
Male NPT (1/4″)
QTY **3**

3012
Male NPT (1/8″)
QTY **4**

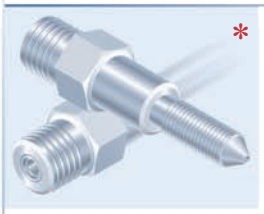
3013
Female NPT (1/4″)
QTY **2**

3014
Female NPT (1/8″)
QTY **1**

3015
Female NPT (1/4″)
QTY **1**

3016
Male Swage
Fitting (1/4″)
QTY **1**

▸ Additional Fittings



* **3400**
5/16″-24 UNF
for:
Foxboro®
Rosemount® &
Yokogawa
transmitters

* **3401**
1/4″-28 UNF
for:
Honeywell®
transmitters

3254
Male NPT (1/4″)

* **3125**
Female NPT (1/8″)
3126
Female NPT (1/4″)
3127
Female NPT (1/2″)

3184
BSPP (1/8″)
3185
BSPP (1/4″)
3186
BSPP (3/8″)
3187
BSPP (1/2″)

* Refer to page 11 for detailed descriptions of these fittings.

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Hand Pumps

Haven hand pumps are rugged, lightweight, compact and easy to use. Ideal as a self contained pressure source for calibration of gauges and switches and compatible with Haven hand-held calibrators. All models feature a precision vernier for fine adjustment and pressure release valve. Additional hose kits and adapters are available.

PP300, PPD25300 & HP3000

H-PV210

SPECIFICATIONS	**PP300**	**PPD25300**	**HP3000**	**H-PV210**
PRESSURE RANGE(S)	0-300 psi (20 Bar)	Pressure 0-300 psi (20 Bar) Vacuum 0-25"Hg (850 mBar)	0-3000 psi (200 Bar)	Pressure 0- 43 psi (3 bar) Vacuum 0-26"Hg (900 mBar)
WEIGHT	0.6 Kg	0.65 Kg	0.8 Kg	0.6 Kg (Pump only)
PHYSICAL DIMENSIONS	230 x 130 x 80 mm	250 x 130 x 80 mm	250 x 130 x 80 mm	170 x 46mm (Dia)
TEST CONNECTIONS	¼" NPT Female	¼" NPT Female	¼" NPT Female	Two push fit connectors to take 4mm flexible hoses with ¼" BSP Female Adapters
MATERIALS OF CONSTRUCTION	Machined Aluminium Body, Stainless Steel Shaft and Needle Valve, ABS Plastic Handles, Brass Tee and Connector			Bright Nickel Plated Brass, Clear Anodised Aluminium
HOSE	Nylon	Nylon	Nylon with Braided Metal Covering	Nylon
SEAL	Viton	Viton	Ethylene Propylene	Nylon

Tempcal®

Dry Block

TEMPERATURE CALIBRATORS

Features

- Choose from three models covering temperatures from -40°C to 650°C.
- Two versions - the basic 'S' and microprocessor based 'H' version.
- High accuracy and stability.
- Large interchangable multiple-drilled insert.
- Unique temperature zone - with improved uniformity and control stability.
- Rapid heat-up and cool-down times.
- Calsoft calibration software supplied as standard with the 'H' versions and as an optional extra with the 'S' versions.
- RS232 interface for data and programme transfer, or real-time control.
- Fast settling time for rapid testing.

'H' versions only

- Software supplied as standard.
- 4 line 20 character LCD, 8 button keypad for entering programmes and viewing data.
- Ability to create/use/store programmes and test results internally.
- Programming of set temperature, ramp rate, hold time, 'pause on switch changeover' operation and hold until pause pressed.
- Switch test input for monitoring temperature thermostats.
- Calibration using the User Probe Interface which allows storage of the block temperature and the reading of the test sensor

Tempcal® Junior

Features

- Low cost option
- Hand-held
- Large block in 6 formats
- Maximum temperature 350°C
- Independent over temperature cut-out
- Temperature sensor burnout protection
- Separate heater on/off switch for fast cool down without changing set temperature
- Indicators for over temperature cut-out and heater power
- Switchable °C/°F

Haven Automation Limited

Tempcal®

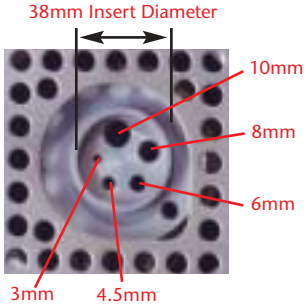
Designed to provide a stable and accurate environment for the calibration of temperature sensors including liquid-in-glass and dial thermometers, thermocouples, RTD's, thermal switches, transmitters and fluid filled bulbs, the Tempcal® range of Block Calibrators comes in two different formats and three temperature ranges.

Model	Min Temp°C	Max Temp°C	°C/°F Display	Programme Storage	Switch Test Input	Software
Tempcal® 140S	amb-45	140	▼	-	-	Optional
Tempcal® 140H	amb-45	140	▼	▼	▼	▼
Tempcal® 425S	amb+20	425	▼	-	-	Optional
Tempcal® 425H	amb+20	425	▼	▼	▼	▼
Tempcal® 650S	amb+25	650	▼	-	-	Optional
Tempcal® 650H	amb+25	650	▼	▼	▼	▼

N.B: Tempcal 140 - using an external 4°chilled water supply connected to the integral cooling coil an actual temperature of - 40°C can be achieved.

One Insert for Multiple Probes

The insert blocks on the Tempcal® units have the advantage of a 38mm diameter to enable multiple probes of varying sizes to be tested at one time, making the units both economical and extremely flexible.
The example shown is insert AB102M with five drilled holes from 3mm to 10mm diameter. Please contact our Sales Office if your requirement is outside our standard range.



Haven Automation Limited

Tempcal® is a registered trademark of Haven Automation

Tempcal Software 'Calsoft'

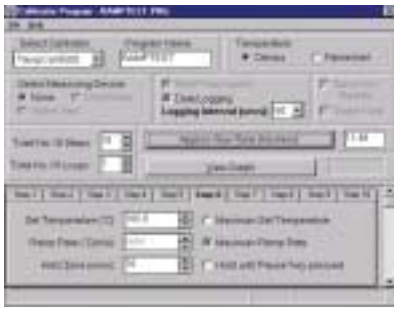
FOR BOTH H AND S MODELS, CALSOFT ENABLES YOU TO:

- Create, open, save and print programmes
- Log data from the calibrator while connected to the computer
- Open, save, view and print logged data
- Run a programme in real time mode

N.B: The 'S' range of Tempcal calibrators must be connected to the computer at all times in order to run the programmes set up by CalSoft.

FOR H MODELS ONLY, CALSOFT ENABLES YOU TO:

- Select 3 possible options to carry out a calibration
- Perform a calibration where you input the temperature of the probe manually
- Perform a calibration using the User Probe Interface - see optional accessories
- Perform a calibration requiring a switch test
- Send programmes to the calibrator
- Retrieve programmes from the calibrator
- Retrieve test results from the calibrator
- Erase test results



Shows step 6 of a 10 step programme for a Tempcal® 650S. Step 6 has a set temperature of 100°C, a maximum ramp rate and a hold time of 10 minutes.

Shows above programme running in real time mode. Programme is currently running step 1 of the 10 step programme, with data being logged and graphed at 60 second intervals.

Shows a visual representation of a 10 step programme for a Tempcal® 650S.

Specifications

	TEMPCAL® 140S/H	TEMPCAL® 425S/H	TEMPCAL® 650S/H	TEMPCAL® JUNIOR
Temperature Range °C	amb-45 to 140*	amb+20 to 425	amb+25 to 650	amb+20 TO 350
Working Ambient °C	10 to 30	10 to 30	10 to 30	10 TO 30
Measuring Zone (M.Z.)	0-50mm from base of well	0-50mm from base of well	0-50mm from base of well	-
Typical Accuracy °C	±0.3 in M.Z.	±0.3 in M.Z.	±0.4 in M.Z.	±1.0 (100-300°C)
Uniformity °C (in M.Z.)	±0.2 at 100	±0.2 at 300	±1 at 400	-
Immersion Depth	114.3mm	114.3mm	152.4mm	-
Stability	±0.05°C after 10 mins	±0.05°C after 10 mins	±0.09°C after 10 mins	±0.10°C @ 100°C ±0.15°C @ 200°C
Display Resolution °C or °F	0.1	0.1	0.1	0.1
Heating Rate	20°C to 100°C - 5 mins	20°C to 400°C - 15 mins	20°C to 600°C - 35 mins	20°C to 300°C - 5.2 mins (230V only)
Cooling Rate	100°C to 0°C - 9 mins	400°C to 100°C - 25mins	600°C to 200°C - 30 mins	300°C to 100°C - 10.8 mins
Fan Cooling	N/A	Automatic	Automatic	Automatic
Programmable Ramp Rate °C/Min	0.1 to 10 on H Version	0.1 to 10 on H Version	0.1 to 10 on H Version	-
Switch Test	on H Version	on H Version	on H Version	-
Weight, Kg	14.0kg (S) 14.4kg (H)	9.2kg (S) 9.6kg (H)	11.8kg (S) 12.2kg (H)	1.5kg
Dimensions H x W x D	285 x 190 x 426mm	285 x 190 x 426mm	285 x 190 x 426mm	72 x 128 x 178mm (excluding handle)
Voltage	230V or 120V	230V or 120V	230V or 120V	230V or 120V
Hz	50/60	50/60	50/60	50/60
Watts	400	700	1100	460

* The minimum temperature achievable can be reduced when used in conjunction with the CH-5 Chiller Unit - see optional accessories

Tempcal® Interchangeable Insert Blocks

Description	Order Code Tempcal 140 and 425 (aluminium)	Order Code Tempcal 650 (aluminium bronze)
5 x 6mm	AB101M	BB101M
1 x 10, 8, 6, 4.5, 3mm	AB102M	BB102M
2 x 6mm and 2 x 10mm	AB103M	BB103M
2 x 6mm and 2 x 12mm	AB104M	BB104M
1 x 6mm	AB105M	BB105M
5 x 1/4"	AB1061	BB1061
3/8", 5/16", 1/4", 3/16", 1/8"	AB1071	BB1071
2 x 3/8" and 2 x 1/4"	AB1081	BB1081
2 x 1/2" and 2 x 1/4"	AB1091	BB1091
1 x 1/4"	AB1101	BB1101
Blank	AB111	BB111
1 x 9/16"	AB1121	BB1121
1 x 5/8"	AB1131	BB1131
1 x 11/16"	AB1141	BB1141
1 x 3/4"	AB1151	BB1151
20mm	AB116M	BB116M
1 x 4, 5, 9, 11mm	AB117M	
1 x 6mm (immersion depth 40mm)	AB118M	
1 x 6mm and 1 x 9mm	AB119M	
9 x 3.18mm	AB120M	
1 x 19.5mm		BB121M
1 x 10, 8, 6, 4, 3mm		BB122M
1 x 12mm		BB123M
1 x 15mm		BB124M

Supplied with a soft carry case with adjustable shoulder strap, removable mains lead, user manual and insert extractor tool.* In addition 'H' units are supplied with Calsoft Software and 1.5 metre RS232 lead.

*Please state when ordering whether you require a 120V or 230V model.

Tempcal Junior

Unit Block Options

Block Type	Description
A	4 x 6mm
B	1 x 10, 8, 6, 4.5, 3mm
C	2 x 6mm, 2 x 10mm
D	4 x 1/4"
E	1 x 3/8", 5/16", 3/16", 1/8"
F	2 x 1/4", 2 x 3/8"

N.B: The block on the Tempcal® Junior is fixed and cannot be removed.

Supplied with removeable mains lead and user manual.*

Optional Accessories

CH-5 Chiller Unit

The CH-5 Chiller Unit is designed for use in conjunction with the Tempcal 140 calibrators to achieve calibration temperature down to -40°C. The minimum temperature achievable on the Tempcal 140 models is 45°C below ambient, but by artificially cooling the heatsink of the units with water from the Chiller an actual temperature of-40°C can be achieved. The unit is designed to run on distilled or deionised water.

Working Temperature Range	4-15°C
Cooling Capacity	400 watts
Temperature Control	Thermostat on/off
Electrical Control	Manual
Dimensions LxWxH (inc. pump)	430 x 235 x 524mm
Bath Capacity	5 litres
Pump Capacity	20 litres/min

Cooling Probe

A cooling probe is available for use with the Tempcal 425 and 650. It can be used to rapidly cool the block and to operate the unit around ambient temperature. The cooling probe must be inserted into a 10mm diameter or larger hole in the insert block.

User Probe Interface

- Enables fully automated and unattended calibration of temperature sensors
- For use on 'H' versions only

The User Probe Interface accepts K, J, N, T and E thermocouple types and 100 and 1000 ohm 3 and 4 wire RTD's. The UPI can also be connected in series with a 0-20 mA loop and the current reading of the transmitter displayed.

Simply install your sensor into the insert block and connect the wiring to the appropriate front panel terminals, switch the UPI on and select your sensor type. Create or run a programme either using the Calsoft Software or the Tempcal Calibrator memory and the Calibrator will save all the data throughout the run.

When finished, data can be output as text, as a graph or a calibration certificate can be created for the sensor under test.

The UPI is powered by a standard 9V battery. Sensor wires are connected to standard 4mm banana jacks.

Probe Type	Resolution	Accuracy	Range
K t/c	0.1°C	0.3°C ±0.15% ±0.2%	-50 to 300°C 301 to 530°C 531 to 650°C
J t/c	0.1°C	0.3°C ±0.15% ±0.2%	-50 to 300°C 301 to 530°C 531 to 650°C
N t/c	0.1°C	0.3°C ±0.15% ±0.2%	-50 to 300°C 301 to 530°C 531 to 650°C
T t/c	0.1°C	0.3°C ±0.15%	-50 to 300°C 301 to 400°C
E t/c	0.1°C	0.3°C ±0.15% ±0.2%	-40 to 300°C 301 to 530°C 531 to 650°C
100Ω RTD	0.1°C	0.2°C ±0.1%	-50 to 200°C 201 to 650°C
1000Ω RTD	0.1°C	0.2°C ±0.1%	-50 to 200°C 201 to 650°C
mA	0.1µA	±0.002mA ±0.2%	0 to10mA 10.1 to 20.0mA

Ordering information

Optional Accessory	For Instrument Type	Order Code
Chiller Unit	Tempcal 140S/H	CH-5
Cooling Probe	Tempcal 425S/H, 650S/H	FG-134
User Probe Interface	Tempcal 140H, 425H, 650H	FG-136
Calsoft Software only	Tempcal 140S, 425S, 650S	FG-132
Calsoft Software and RS232 Cable	Tempcal 140S, 425S, 650S	FG-133
Hard Carry Case	Tempcal 140S/H, 425S/H, 650S/H	FG-137
Soft Carry Case	Tempcal Junior	FG-154
UKAS Calibration Certificate	All Models	On request

Haven Automation Limited

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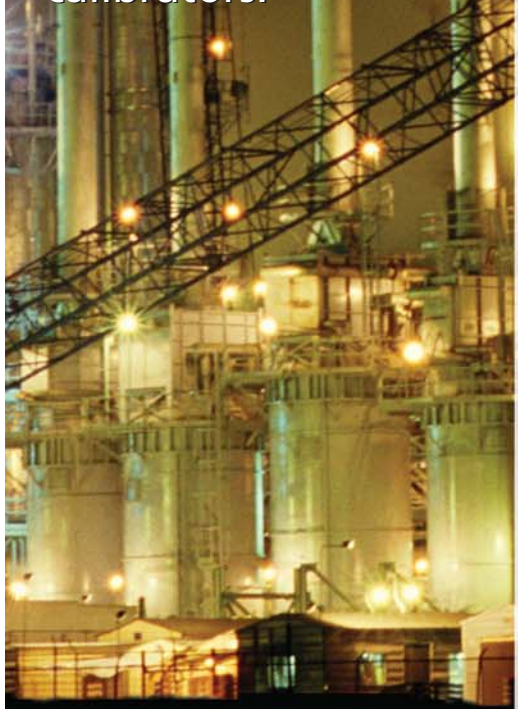
www.haven.co.uk

Authorised Representative:

GB92/1160

Calibrate with confidence using the *NEW* Tempcal "Field" Range of Dri-Block Calibrators

Following on from many years of experience with the high quality ***Tempcal S*** **and** ***H*** models the new ***F*** models have been introduced to offer a compact and lightweight, high performance range of Dri-Block temperature calibrators.



Tempcal 140F

Low temperature Portable Field Temperature Calibrator

Minimum temperature	45°C below ambient (typically -20°C in ambient of 25°C)
Maximum temperature	140°C
Temperature accuracy	±0.3°C
Temperature uniformity	±0.2°C
Temperature stability	±0.05°C (after 10 mins)
Display resolution	0.01°C or 0.1°F
Set point resolution	0.1°C or 0.1°F
Heating rate, 20°C to 100°C	5 minutes
Cooling rate, 100°C to 0°C	9 minutes
Large well	Ø38mm x 114 mm inserts
Fan cooling	Automatic
Dimensions HxWxDmm	273x207x289
Weight	11kg

Options

- Inserts from standard list FINSAL-
- RS-232 interface plus software and cable
- Carry case soft
- Carry case hard
- UKAS calibration certificate

Tempcal 425F

Medium temperature Portable Field Temperature Calibrator

Minimum temperature	20°C above ambient
Maximum temperature	425°C
Temperature accuracy	±0.3°C
Temperature uniformity	±0.2°C
Temperature stability	±0.03°C at 200°C (after 10 mins)
Temperature stability	±0.05°C at 425°C (after 10 mins)
Display resolution	0.01°C or 0.1°F
Set point resolution	0.1°C or 0.1°F
Heating rate, 20°C to 400°C	12 minutes
Cooling rate, 400°C to 100°C	21 minutes
Large well	Ø38mm x 114mm inserts.
Fan cooling	Automatic
Dimensions HxWxDmm	270x170x255
Weight	6.3kg

Options

- Inserts from standard list FINSAL-
- RS-232 interface plus software and cable
- Cooling probe for rapid cooling of block
- Carry case soft
- Carry case hard
- UKAS calibration certificate

www.haven.co.uk

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Tempcal 650F

High temperature Portable Field Temperature Calibrator

Minimum temperature	**25°C above ambient**
Maximum temperature	**650°C**
Temperature accuracy	**±0.4°C**
Temperature uniformity	**±1°C**
Temperature stability	**±0.09°C** (after 10 mins)
Display resolution	**0.01°C or 0.1°F**
Set point resolution	**0.1°C or 0.1°F**
Heating rate, 20°C to 600°C	**35 minutes**
Cooling rate, 600°C to 200°C	**30 minutes**
Large well	**Ø38mm x 152mm inserts.**
Fan cooling	**Automatic**
Dimensions HxWxDmm	**278x170x300**
Weight	**11 kg**

Options

- **Inserts from standard list FINSAB-**
- **RS-232 interface plus software and cable**
- **Cooling probe for rapid cooling of block**
- **Carry case soft**
- **Carry case hard**
- **UKAS calibration certificate**

Ordering information

Tempcal 140F

FDB140FD	Tecal 140F 230v
FDB140FP	Tecal 140F 120v
FDB140FY	Tecal 140F 100v
FDB140FR	Tecal 140F 230v with RS-232
FDB140FS	Tecal 140F 120v with RS-232
FDB140FT	Tecal 140F 100v with RS-232

Tempcal 425F

FDB425FD	Tecal 425F 230v
FDB425FP	Tecal 425F 120v
FDB425FY	Tecal 425F 100v
FDB425FR	Tecal 425F 230v with RS-232
FDB425FS	Tecal 425F 120v with RS-232
FDB425FT	Tecal 425F 100v with RS-232

Tempcal 650F

FDB650FD	Tecal 650F 230v
FDB650FP	Tecal 650F 120v
FDB650FY	Tecal 650F 100v
FDB650FR	Tecal 650F 230v with RS-232
FDB650FS	Tecal 650F 120v with RS-232
FDB650FT	Tecal 650F 100v with RS-232

INSERTS FOR THE TEMPCAL 140 AND TEMPCAL 425 UNITS

Part No	Description	Net weight kg
FINSALA	Insert 5 x 6mm probes aluminium	0.5
FINSALB	Insert 10 + 8 + 6 + 4.5 + 3mm probes aluminium	0.5
FINSALC	Insert 2 x 6mm + 2 x 10mm probes aluminium	0.5
FINSALD	Insert 2 x 6mm + 2 x 12mm probes aluminium	0.5
FINSALE	Insert 1 x 6mm probe aluminium	0.5
FINSALF	Insert 5 x 1/4" probes aluminium	0.5
FINSALG	Insert 3/8" + 5/16" + 1/4" + 3/16" + 1/8" probe aluminium	0.5
FINSALH	Insert 2 x 3/8" + 2 x 1/4" probes aluminium	0.5
FINSALI	Insert 2 x 1/2" + 2 x 1/4" probes aluminium	0.5
FINSALJ	Insert 1 x 1/4" probe aluminium	0.5
FINSALK	Insert blank aluminium	0.5
FINSALL	Insert 9/16" probe aluminium	0.5
FINSALM	Insert 5/8" probe aluminium	0.5
FINSALN	Insert 11/16" probe aluminium	0.5
FINSALO	Insert 3/4" probe aluminium	0.5
FINSALP	Insert 11 + 9 + 5 + 4 mm probes aluminium	0.5
FINSALQ	Insert 6mm probe aluminium (immersion depth 40mm)	0.5
FINSALR	Insert 6mm + 9mm probes aluminium	0.5
FINSALT	Insert 9 x 3.18mm probes aluminium	0.5
FINSALZ	Insert 20mm probe aluminium	0.5

INSERTS FOR THE TEMPCAL 650

FINSABA	Insert 5 x 6mm probes aluminium bronze	1.1
FINSABB	Insert 10 + 8 + 6 + 4.5 + 3mm probes aluminium bronze	1.1
FINSABC	Insert 2 x 6mm + 2 x 10mm probes aluminium bronze	1.1
FINSABD	Insert 2 x 6mm + 2 x 12mm probes aluminium bronze	1.1
FINSABE	Insert 1 x 6mm probe aluminium bronze	1.1
FINSABF	Insert 5 x 1/4" probes aluminium bronze	1.1
FINSABG	Insert 3/8" + 5/16" + 1/4" + 3/16" + 1/8" probes aluminium bronze	1.1
FINSABH	Insert 2 x 3/8" + 2 x 1/4" probes aluminium bronze	1.1
FINSABI	Insert 2 x 1/2" + 2 x 1/4" probes aluminium bronze	1.1
FINSABJ	Insert 1 x 1/4" probe aluminium bronze	1.1
FINSABK	Insert blank aluminium bronze	1.5
FINSABL	Insert 9/16" probe aluminium bronze	1.1
FINSABM	Insert 5/8" probe aluminium bronze	1.1
FINSABN	Insert 11/16" probe aluminium bronze	1.1
FINSABO	Insert 3/4" probe aluminium bronze	1.1
FINSABP	Insert 19.5mm probe aluminium bronze	1.1
FINSABQ	Insert 10/8/6/4/3mm probe aluminium bronze	1.1
FINSABR	Insert 12mm probe aluminium bronze	1.1
FINSABS	Insert 15mm probe aluminium bronze	1.1
FINSABZ	Insert 20mm probe aluminium bronze	1.1

Visit www.haven.co.uk for further information

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Haven Automation Limited

Calibration Solutions for Industry

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OTB-8 Series Digital Oil / Water Baths

Haven OTB-8 Oil/Water Baths are a compact and reliable solution for the calibration of thermal sensors. Available in 2 models depending on range and application required.

All baths are supplied complete with bath cover, drain tap, carry handles and hole to hold a certified sensor. The bath is fully insulated on the sides and the base and has a cooling coil fitted for connection to a cold water supply for use around ambient.

- Temperature stability as good as ±0.005°C
- Ranges covering -35°C* to 250°C
- 7 Litre or optional 12 litre capacity bath.

* A Flow cooler is required to operate the OTB-8S model at below ambient temperatures. A Dip Cooler is required to operate the OTB-8HT model at below ambient temperatures

TempWorks has been designed for use with OTB-8 Oil/Water Baths and the TU-20D controller on the refrigerated baths. It is a Windows® based programme that connects via an RS232 connection to your computer. Programmes can be created, saved and recalled at any time as well as running in real time mode. Time, temperature and ramp rates can all be set up. Temperature can be set to two decimal places. Temperatures within the range of -35°C to 250°C can be programmed.

	OTB-8S	**OTB-8HT**
Temperature Range °C	Ambient +10 to 200	Ambient +10 to 250
Temperature Selection	Digital	Digital
Temperature Stability °C (using water @ 40°C)	±0.005%	±0.005%
Pump Capacity litres/minute	10	N/A Internal Circulation only
Pump Capacity (mbar)	145	N/A
Method of Control	PID	PID
Temperature Sensor	PRT	PRT
Adjustable over-temperature cut-out	YES	YES Plus audible alarm
Low liquid level cut-out	YES	YES
PC Interface	YES RS232	YES RS232
TempWorks Software	Supplied As Standard	Supplied As Standard
Bath Capacity	7 Litre	7 Litre
Bath Opening (mm)	140 x 140	140 x 140
Below Ambient Temperatures	Use Flow Cooler -20°C Model FC-200 -35°C Model FC-500	Use Dip Cooler -20°C Model RU-200 -35°C Model RU-500
Dimensions: (mm) Bath L x W x H Head L x W x H	351 x 260 x 183 237 x 124 x 260	

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Haven Automation Limited

Calibration Solutions for Industry

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Flow Coolers

The Flow Cooler enables the OTB-8S Oil/Water Bath to reach below ambient temperatures down to -35°C**.

They work in conjunction with the thermoregulator (head) to continually extract heat from the bath fluid by means of a heat exchanger which is built into the unit.

	FC-200	FC-500
Minimum Achievable Temperature* (°C)	-20	-35
Cooling Capacity: 20°C (watts)	140	210
Cooling Capacity: 0°C (watts)	140	210
Cooling Capacity: -10°C (watts)	110	200
Internal Capacity (ml)	200	200
Dimensions (Excluding handles) mm Width Length Height	 235 420 300	 370 430 325
Weight (kg)	19	39

* In a well insulated 7 litre bath system at an ambient of 20°C.
** At ambient of 20°C, using a mixture of 40% water, 40% antifreeze, 20% alcohol to achieve -35°C.

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DIP COOLERS

The Dip Cooler enables the OTB-8HT Oil/Water Bath to reach below ambient temperatures down to -35°C.

The cooling head of the Dip Coolers fit neatly and unobtrusively into the corner of the standard circulating bath and can be secured with a specially designed mounting bracket. Even if cooling can be achieved by cold tap water, a dip cooler is recommended as it conserves water and is easier and more convenient to use.

	RU-200	RU-500
Minimum Achievable Temperature* (°C)	-20	-35**
Cooling Capacity @ 0°C (watts)	145	240
Cooling Capacity @ 20°C (watts)	145	240
Cooling Capacity @ -10°C (watts)	110	230
Nominal Dimensions (Excluding handles etc) mm		
Width	235	370
Length	420	430
Height	300	325
Coil Dimensions (mm)		
Length	85	85
Diameter	75	75
Weight (kg)	19	39

* In a well insulated 7 litre bath system, at an ambient of 20°C.
** At ambient of 20°C, using a mixture of 40% water, 40% antifreeze, 20% alcohol to achieve -35°C.

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CH-5 Chiller Unit

The CH-5 Chiller Unit is designed for use in conjunction with the Tempcal 140 calibrators and the OTB-8-H-T Digital Oil / Water Bath to achieve calibration temperature down to -40°C.

The minimum temperature achievable on the Tempcal 140 models is 45°C below ambient, but by artificially cooling the heatsink of the units with water from the Chiller an actual temperature of -40°C can be achieved. The unit is designed to run on distilled or deionised water.

Working temperature range	4 - 15°C
Cooling capacity	400 watts
Temperature control	Thermostat on/off
Electrical control	Manual
Dimensions L x W x H (inc pump)	430 x 235 x 524 mm
Bath capacity	5 litres
Pump capacity	20 litres/min

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Fluidised Baths - SBL Series

- Working temperature span 50°C to 600°C (0-800°C with TC-8D)
- Control stability ±1°C (±0.3° with TC8-D)
- Three models to choose from
- Simple to operate

The SBL range offers a working environment that is dry, easily accessible and totally free from the dangers associated with high temperature oil or salt baths.

The units are designed to be bench standing and only require an electrical and air supply for operation. Air passes through the mass of the (AL203) particles via a porous plate in the base of the unit separating the individual particles and suspending them in free air, giving the properties of a liquid bath. Heaters are placed in the bath which allow temperatures of up to 600°C to be maintained. All the SBL range units have a stainless steel inner container insulated from the outer wall and a safety air pressure switch in the event of loss of air.

All SBL Series fluidised baths are supplied as standard with an overspill flange and an initial charge of fluidising medium.

Other available accessories include air compressor for when a convenient airline is not available, air pressure regulator/filter and stainless steel baskets to keep workpieces from touching the heater elements and to make retrieval easier.

TC-8D
Designed to improve the temperature stability and temperature setting obtainable with the energy regulator supplied as standard with the SBL Series of fluidised baths.

The TC-8D is a self contained unit and is supplied complete with a chromel/alumel Type K thermocouple which fits into the sheath supplied with the SBL baths. The unit has digital set point and readout of bath temperature on an LED display and incorporates PID control.

		SBL-1	SBL-2	SBL-2D	TC-8D
Temperature Range °C		50 to 350	50 to 600	50 to 600	0 to 800
Temperature Stability °C, @ 50°C		±1	±1	±1	±0.3
Heat up Time, minutes 20°C to maximum		60	105	105	N/A
Cooling Time, minutes from maximum to 200°C		150	300	330	N/A
Air Pressure, kPa (psi)		21 (3)	21 (3)	21 (3)	N/A
Air flow, max litres/min		57	57	57	N/A
Weight of Medium (Kg) supplied with unit		13	16	32	N/A
Overall size (mm)	Diameter (excl. tap)	315	385	385	Width 165 Depth 240 Height 140
	Height	470	470	695	
Working volume (mm)	Diameter	228	228	228	N/A
	Height	120	140	350	

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Refrigerated Baths

- Temperature Range -35°C to 100°C
- 7 or 12 litre capacity
- Temperature stability up to ±0.005°C

These baths are a complete refrigerated circulating system for closed circuit applications for temperature ranges from -35 to 100°C.

Two bath capacities are available, 7 litres (RB-5A) or 12 litres (RB-12A). Temperature control is by the thermoregulator giving four different combinations.

COOLING (AT 20°C AMBIENT)	**RB-5A**	**RB-12A**
Minimum Achievable Temperature (°C) *	-20	-35
Maximum Achievable Temperature (°C)	100	100
Cooling Capacity at 20°C (watts)	145	235
Cooling Capacity at 0°C (watts)	145	371
Cooling Capacity at -10°C (watts)	110	154

Dimensions (L x W x H mm)		
Overall Size (with controller)	430 x 250 x 566	430 x 370 x 610
Liquid surface to top of the bath	65	65
Internal Dimensions	192 x 151 x 200	208 x 300 x 150
Working length to thermoregulator	224	224
Working depth – Max/Min (mm)	180 / 135	130 / 85
Working Capacity – Max/Min (litres)	7.0 / 5.5	11.6 / 9.6

THERMOREGULATOR	**TE-10D**	**TU-20D**
Temperature Selection	Digital	Digital
Temperature Stability @ 40°C (°C)	±0.01	±0.005
Nominal Heater Power at 120V (watts)	1000	1500
Nominal Heater Power at 230V (watts)	1000	1800
Pump Capacity (litres/min)	10	10
Pump Capacity (mbar)	145	145
Method of Control	PID	PID
Temperature Sensor	PRT	PRT
PC Interface	NO	YES Via RS-232
Software	NO	OTBSoft ** (Optional Accessory)

* Using a mixture of 40% water, 40% antifreeze, and 20% alcohol to achieve -35°C

**OTBSOFT SOFTWARE
OTBSoft has been designed for use with OTB-8 Oil / Water Baths and the TU-20D controller on the refrigerated baths. It is a Windows® based programme that connects via an RS-232 connection to your computer. Programmes can be created, saved and recalled at any time as well as running in real time mode.

Time, temperature and ramp rates can all be set up. Temperature can be set to two decimal places. Temperatures within the range of -35°C to 250°C can be programmed. Refrigeration units are available for connection to the system and can be controlled via the software.

A Refrigeration Control Pack is needed to turn the refrigeration unit "on/off" when used with the software.

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FB08 Series Fluidised Baths

- Temperature range -100°C to 700°C
- Control stability ±0.2°C to ±0.5°C
- Three models to choose from
- Digital temperature indication/setpoint
- PID temperature control

FB-08 Fluidised Baths are available in three models, the standard FB-08 covering temperatures of 50 to 700°C, the FB-08LT for low temperature operation, -100 to 200°C and the FB-08C designed for minimum supervision, works in conjunction with a supervisory computer via an RS232 (or optional IEEE488) interface.

All FB-08's are attractively finished free standing bench units with controls mounted on a recessed panel on the front of the unit. The inner container is well insulated and the outer case is vented so that it remains safe to touch even when the bath is operating at its maximum temperature.

The inner container is filled from the top with alumina. When fluidised this medium is heated by four immersion heaters close to the container wall; the control thermocouple is close to the heaters. The heater elements are protected (by a pressure switch operated by the fluidising air) from excessive surface temperatures if fluidisation is lost.

Clean dry air from an external source passes through two filters and two regulators, to reduce the pressure for the cyclone extraction system and for fluidisation. The fluidising air passes through a flowmeter and then to a plenum chamber from which it is distributed evenly around the inner container.

The FB-08LT has provision for connection to a liquid nitrogen (LN2) supply and is fitted with an air drying system to avoid condensation of water when the fluidising air at ambient temperature is introduced into the cold fluidised bed. The LN2 supply is regulated by a flow meter on the front of the unit.

Dust extraction is by means of ambient air drawn down past the probe plate and through a peripheral slot round the top of the inner container, then through a cyclone to the exhaust filter. Entrained medium, removed by the cyclone and discharged into a special jar accessible from the front of the unit, can be emptied back into the bath at regular intervals.

Operating temperature is set by depressing and releasing the up/down buttons on the front panel of the control unit. Control of set temperature, incremental temperature steps, dwell times and control of dead bed state on the FB-08C can be programmed by the operator.

All FB-08 precision fluidised baths are supplied with the temperature controller and a probe plate to help keep items being processed away from the heating elements of the bath and to assist in the retrieval of items from the bath. A probe carrier is also available, which holds up to eight probes of varying sizes (customer specified). It is specially designed to allow free flow of the fluidising media assuring constant uniformity, reducing short term temperature fluctuations and improving calibration accuracy.

	FB-08	FB-08LT	FB-08C
Temperature Range °C	50 to 700	-100 to 200	50 to 700
Temperature Stability °C	Short Term @ 50°C ±0.2 Short Term @ 600°C ±0.3 Long Term @ 50°C ±0.5 Long Term @ 600°C ±0.5	@ 200°C ±0.2 @ -100°C ±0.5	Dead bed ±0.01 Short Term @ 50°C ±0.2 Short Term @ 600°C ±0.3 Long Term @ 50°C ±0.5 Long Term @ 600°C ±0.5
Display Resolution °C	1	1	1
Type of Control	3 term (PID)	3 term (PID)	3 term (PID)
Sensor Type	K Chromel/alumel thermocouple	Pt100	K Chromel/alumel thermocouple
Heat up Time, minutes	20 to 700°C, 105	20 to 200°C, 30	20 to 700°C, 105
Cooling Time, minutes	700 to 200°C, 165	200 to -100°C, 90	700 to 200°C, 165
Air Pressure, kPa (psi)	420 (60)	420 (60)	420 (60)
Maximum Flow, litres/minute	127	170	127
Weight of Medium, kg	16	16	16
Overall Size L x W x H, mm	770 x 515 x 600	770 x 615 x 600	870 x 515 x 600
Working Volume : Diameter x Depth, mm	165 x 385	165 x 385	165 x 385
RS232 Interface	NO	NO	YES
Automatic Air Supply	NO	NO	YES
Programmable	NO	NO	YES

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Fluidised Baths - BFS High Temperature Bath

- Temperature range 200°C to 1100°C
- Control stability ±0.5°C to ±3.5°C

Designed for applications requiring a constant high temperature source for calibration. The BFS is supplied with a TC-5 temperature controller, a separate air supply control unit which incorporates two flowmeters for monitoring the air supply, a charge of fluidising medium (aluminium oxide) and air diffuser (zirconium oxide).

The BFS has a hinged lid and a cylindrical bath. Substantial firebrick insulation is incorporated within the outer container and the lid. The inner container holds a layer of zirconium oxide, which acts as a heat insulator and a layer of aluminium oxide, the fluidising medium. The inner container is divided into inner and outer fluidised sections. Each area has a separate air supply which must be oil, water and dust free.

The air supply is adjustable to obtain uniform fluidisation in both sections of the bath. Heaters are mounted in the firebrick insulation between the inner and outer container; heat is radiated inwards to the fluidised bath.

An air extraction tube enables dust created by the bath's operation to be removed if connected to an extraction duct or fan. The dust can also be trapped in a small tank of water.

The TC-5 is used for setting, controlling and indicating the bath temperature. The TC-5 uses a chromel/alumel thermocouple, which mounts onto the back of the BFS and fits into the pocket of the inner container and is also fitted to the air flow control unit.

BFS with TC-5 Temperature Controller	
Temperature Range °C	200 to 1100
Temperature Stability °C (short term)	±0.5 to 3.5
Display Resolution °C	1
Type of Control	3 term (PID) digital set/readout
Sensor Type	K Chromel/alumel thermocouple
Air Pressure, kPa (psi)	47 (7)
Maximum Flow, litres/min	85
For immersed object: Maximum load size Maximum surface area	 2.2 litres 1080mm²
Weight of Medium, kg	16kg (aluminium oxide) 16.8kg (zirconium oxide)
Overall Size L x W x H, mm	686 x 686 x 876 (airflow controller adds 305mm to the width)
Working Volume, Diameter x Depth, mm	203 x 203 Top lid has a central opening 82.5mm square
Overall Size L x W x H, mm (TC-5)	430 x 305 x 140