30 Series PRESSURE CALIBRATOR

Operation Manual

CRYSTAL
engineering corporation

Contents

Introduction

Thank you for choosing a Pressure Calibrator from Crystal Engineering Corporation.

The **30 Series** are compact and rugged pressure calibrators designed to bring laboratory accuracy to outdoor field conditions. Every **30 Series** Calibrator is fully temperature compensated through extensive testing of all measured parameters while being exposed to environments of 0°C (32°F) to 50°C (122°F).

All **30 Series** calibrators are intended for gauge pressure measurement. That is, they indicate the difference between applied pressure and ambient barometric pressure. The zero button also can be used as a tare function - extending the functionality of the calibrator for special applications.

Although they weigh less than a pound, advanced technology is employed throughout the product line. Sensors are constructed with stainless steel isolation diaphragms and permanent oil fill. This means **30 Series** products can be used with gases and liquids.

Long battery life is achieved with a low power, RISC (reduced instruction set) type micro-controller for computation of complex algorithms. A 24 bit analog to digital converter provides internal resolution of 1 part in 16.7 million. Internal resolution always exceeds the displayed resolutions for all measurements. Full accuracy is maintained even while the low battery icon is flashing.

The **30 Series** is specified in percent of reading instead of percent of scale. Why? Because one calibrator could replace a series of calibrators by covering a wide range of pressure with high accuracy.

There are no internal potentiometers: All adjustments are accomplished via the optically isolated RS-232 interface. Power for the RS-232 communication is provided by the host PC. Therefore, there are no exposed "live" pins when not connected to a PC.

Your **30 Series** can be customized through the use of ConfigM30™ software available from Crystal Engineering. Your personal computer can disable, enable or modify a variety of features of your **30 Series**. Look for the CONFIGM30PROGRAMMABLE logo for programmable features, like:

- add or create new pressure units and/or disable unused pressure units
- password protection to prevent unauthorized changes
- load and save custom configurations
- view and print an *as received* versus *as left* change report
- select your preferred H2O water density: 4°C, 60°F, or 68°F/20°C
- store a message or identification number
- adjust (calibrate) the gauge

Finally, the **30 Series** is manufactured and serviced by a company that only makes pressure measuring equipment. It's the only thing we do and that's why we say: PRESSURE *is Our* BUSINESS™

Operating Instructions

To ensure safe and accurate operation, please be familiar with the following warnings:

WARNINGS

Severe injury or damage can occur through improper use of pressure instruments! Do not exceed recommended pressure limits of tubing and fittings. Be certain all pressure connections are secured.

This gauge can display zero pressure when connected to a source of pressure! Do not rely on the display indication before disconnecting - it may not be indicating true pressure. Never disconnect pressure instrumentation without first relieving system pressure!

CAUTION: Never insert any object (other than the ⅛" NPT fitting) into the pressure connection! The sensor diaphragm is very thin and can be damaged or destroyed by solid or sharp objects. Cleaning of the sensor must be done with appropriate solvents only.

Zero

To make sure that the calibrator is performing to its rated accuracy, it should be exercised and re-zeroed whenever exposed to changes in temperature (see Specifications). It's also good practice to check zero as your final reading too, as these calibrators should return to a perfect zero reading. The 30 series does not automatically re-zero when first turned on. The zero button can be used as a "tare" button because it will "zero out" any value the selected range is capable of displaying. **The zero reading may also shift when the calibrator is moved from a vertical to a horizontal orientation.** This is due to the oil filling that transmits the pressure signal from the stainless steel diaphragm to the silicon pressure sensor. The magnitude of the shift is typically 0.3"H_2O or less.

Over-range Indication

Over-range conditions will be indicated regardless of the tare value. If the low or high pressure full scale ratings are exceeded by 10% or more, appropriate warning messages will be displayed. Also, if the milliamp input exceeds 55 mA a warning message will appear.

Model 33, only: These messages will only appear if the parameter being measured is selected for display. For example, if the milliamp input is greater than 55 mA, but milliamps is not selected for display, no over-range warning will be indicated. (The milliamp input is protected by a semiconductor type fuse that automatically resets once the fault condition is removed.)

Contrast button

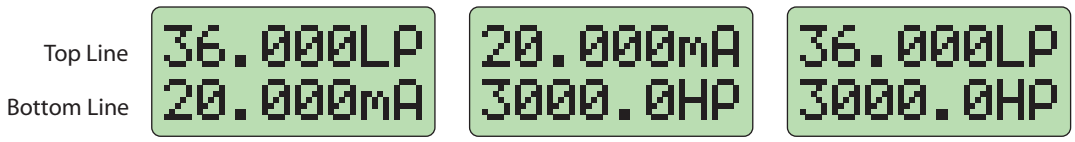
The contrast button, left of the display, may never have to be pressed. It is provided to compensate for slight contrast changes with temperature and component aging. Press the button and the

contrast will increase. If you press the contrast button repeatedly enough times the display will jump to the *least* contrast setting, allowing you to adjust it darker until you get the best contrast and legibility.

Units button and mA / % button

Pressing the units button updates the display to the next unit selection. The mA button scrolls through direct milliamps, %4-20 and %10-50.

Model 33s (only) will display the following combinations of pressure and/or milliamps:



If LP, HP or mA are not being displayed, press the respective button and the parameter will appear. If the parameter is already on screen, pressing the corresponding button will cause it to cycle to the next scale or units for that button.

On/Off button

This function is obvious. What is not obvious is that all the settings are saved when you turn the unit off. When you turn the unit back on it will be set to the same combinations of ranges and scales. Even the zero or tare value stays the same.

Changing the battery

The battery is located on top of the unit, under the sliding cover. **Batteries must only be changed in a non-hazardous area!** The best way to change the battery is to first turn off the unit, then replace the battery. All settings will be retained if battery replacement is done this way. If the unit is stored for a long time, the battery should be removed, to avoid potential damage from battery leakage. If the battery has been removed for storage or the battery was disconnected while the unit was on, the unit will automatically reset 5 to 10 seconds after reconnecting the battery.

WARNING

The 30 Series is approved as intrinsically safe only if powered by one of the following battery types: Duracell® Alkaline 9V, MN 1604 or Eveready® 9V, P/N 216.

Reset

If for some reason the unit needs to be reset, remove the battery. Either wait one minute, or short circuit the battery snap connections with any metal object. If the reset is successful the unit will begin operating when the battery is reconnected without pressing the "ON" button.

Measuring Vacuum

All sensors in 30 series calibrators can be used to measure vacuum, but only ranges rated at 300 PSI (2000 kPa) or less have actually been certified. (Refer to your calibration certificate.) When measuring pressure less than ambient conditions the display will show a minus (-) sign in the left most position. On some scales (like kilograms per square centimeter which has 4 decimal places of resolution), this will cause the display to shift right one digit. Resolution won't be lost, but part of the range icon will disappear until positive pressure is restored.

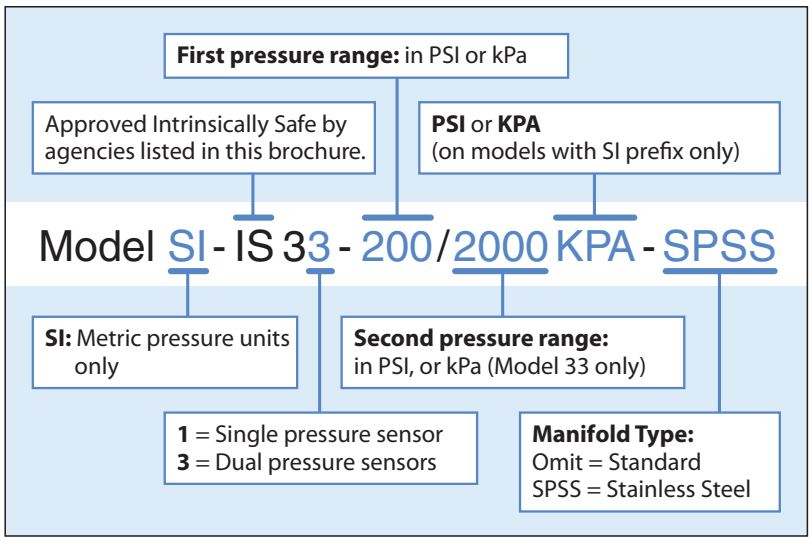
CAUTION: 30 Series calibrators are not recommended for continuous use at high vacuum.

Calibration

There are no potentiometers. The 30 Series contains a "span" factor (Userspan) set to approximately 1 at the factory. As components age, this may need to be changed to a slightly higher or lower value to slightly increase or decrease readings. If adjustment is required, we recommend returning the unit to the factory, though this adjustment can be made with a computer running **ConfigM30** software. Refer to the **Software** descriptions later in this book. Zero the calibrator, then record the displayed pressure for two or more pressure points to determine if the 30 Series would benefit from an overall increase or decrease of the indicated pressure.

Factory service offers benefits you won't find anywhere else. We have the facilities to provide calibration reports that include test data at a variety of temperatures utilizing NIST traceable standards. In addition, upgrades may be available to add or enhance operating features. We designed the product to last, and we support it so that you can get the most from your investment.

30 Series Model Numbering System



This manual applies to all models in the current 30 Series product line. To determine the specifications for your model, use this table to decode the model number.

Serial Numbering System

The serial number of your 30 Series is located on the rear of the product. Serial numbers consist of 10 numbers, with the left-most digit of the second grouping representing the year of manufacturing. For example **3460–630017** was manufactured during 2006.

Specifications

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

Exposure to environmental extremes of temperature, shock or vibration may warrant a more frequent period. To quote from MIL-STD-45662A "<Calibration> Intervals shall be shortened or may be lengthened...when the results of previous calibrations indicate such action is appropriate to maintain acceptable reliability".

Pressure

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

* Floor Term = 0.005% of FS or display resolution, whichever is greater.
See page 9 for resolution table.

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

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

Temperature

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

Storage Range . . . . . -20°C to +70°C (-4°F to +158°F)

Humidity

Temperature Range	Humidity
0 to 10°C	Uncontrolled
10 to 30°C	0 to 95% Relative
30 to 40°C	0 to 75% Relative
40 to 50°C	0 to 45% Relative

SI (metric) Versions

"SI" is the French acronym for the International System of Units. 30 Series products with "KPA" in the part number are intended for markets where ***only*** SI units are permitted. Therefore, these models only have kPa and/or MPa, bar and/or mbar available.

Media Compatibility (LP and HP)

Liquids and gases compatible with PTFE (Polytetrafluoroethylene) penetrated, hard anodized aluminum (transducer housing), 316 stainless steel (sensor), and Viton® (O-ring). (Viton is a registered trademark of Dupont Dow Elastomers.)

Products with the letters "SPSS" in the suffix of the part number (e.g., "IS33-36/3000-SPSS"), have stainless steel manifolds and therefore the only wetted materials are stainless steel and Viton.

Pressure Conversions

1 PSI = 27.6806 inches of water column (water at 4°C [39.2°F])

703.087 millimeters of water column (water at 4°C [39.2°F])

70.3087 centimeters of water column (water at 4°C [39.2°F])

2.03602 inches of mercury (mercury at 0°C [32°F])

51.7149 millimeters of mercury (mercury at 0°C [32°F])

6.8948 kilopascals

0.070307 kilograms per square centimeter

0.068948 bar

68.948 millibar

0.0068948 megapascals

Note: Other conversions may have been specified at time of order. Refer to your certificate of calibration for details.

Electrical

Range . . . . . 0 to 55 mA

Resolution. . . . . 0.001 mA

Accuracy . . . . . ±(0.025% of reading + 0.001 mA)

Maximum Voltage 30VDC

Maximum Current 100mA

Note: When connecting to circuits that included HART transmitters, a 250 ohm resistor must be placed in series with the calibrator to prevent damage to the calibrator and any other equipment connected to the loop.

Power

Battery . . . . . One Alkaline or Lithium 9V battery

Approved Batteries . . . . . The 30 series is approved as intrinsically safe only if powered by one of the following battery types:

Duracell® Alkaline 9V, MN 1604
Eveready® 9V, P/N 216

Battery Life . . . . . 90 hours typical

Low Battery Indicator . . . . . Flashing battery icon

Many other battery types and models have been tested but failed to meet the requirements for potentially explosive atmospheres—do not assume other models are equivalent.

Connections

Pressure Fitting . . . . . ⅛" female NPT

Milliamperes . . . . . 4mm jacks, 19mm (0.75") spacing

Accessories

We offer a full range of accessories, including hand pumps, fitting kits, pressure hoses, silicone test lead sets and the most complete and compact waterproof carrying cases available. The carrying cases (with custom diecut foam inserts) can be ordered complete with all the accessories you need to maximize your productivity on the job. Refer to the **Crystal Handpumps and Accessories brochure** for more information on our complete line of easy to use quick-connect fittings and fitting kits, handpumps, and other accessories. You can also contact your local distributor, or any of the contact numbers or addresses at the back of this manual, for more information.

Fitting Kits

Crystal supplies a full range of fittings (available individually or grouped into kits) for use with both the 30 Series calibrator and our portable handpumps. For a complete list of fittings and fitting kits available, refer to the **Crystal Handpumps and Accessories brochure**. You may also contact your local distributor, or use one of the numbers listed on the inside back page to speak directly to Crystal's knowledgeable, helpful sales staff.

Test Leads

Our test lead kit features high quality banana to banana test leads with rugged, hard plastic insulated alligator clips.
Test Lead Kit P/N: 1351

Handpumps

Crystal offers three different handpump options. All provide a portable pressure source for the calibration of 30 Series calibrators, as well as other high pressure gauges, recorders, switches and transmitters. A built-in variable volume control makes it easy to set precise pressure with the turn of a dial. Additionally, the CylinderPump and ComboPump can serve as both a pressure and vacuum source.
CylinderPump P/N: 80 PSI–**2936**
HydraulicPump P/Ns: 3000 PSI–**2819;** 5000 PSI–**2820**
ComboPump P/Ns: 300PSI–**2907;** 500 PSI–**2908**

Software

ConfigM30: Customize your calibrator! Eliminate scales you don't need, calibrate the gauge, create custom scales and password protect the calibrator from future changes! Available from our website at **www.crystalengineering.net**. (Requires RS232 cable, PN 1928).

LabVIEW™ Drivers: The Model 30 LabVIEW Driver Library is a set of VIs 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.

SerialDL: SerialDL is a free command line program that will log data from any 30 Series pressure calibrator, create a comma delimited text file, and can automatically format the data into a Microsoft® Excel spreadsheet.

Units, Resolution and Maximum Pressure Ratings

Your unit will have one or two of these pressure ranges and corresponding display resolution:

Pressure Range				Available Pressure Units and Resolution										
Range PSI	Range bar	Range kPa*	Over-pressure	PSI	kg/cm^2	inch Hg	inch H_2O	mmHg	cmH_2O	mmH_2O	kPa	MPa	mbar	bar
16	1	100	6.5 x	0.001	0.0001	0.001	0.01	0.01		1	0.01		0.1	
36	2	200	3.0 x	0.001	0.0001	0.001	0.01	0.01		1	0.01		0.1	
300	20	2000	2.0 x	0.01	0.001	0.01	0.1	0.1	1		0.1			0.001
600	40	4000	2.0 x	0.01	0.001						0.1	0.0001		0.001
1500	100	10000	2.0 x	0.1	0.01						1	0.001		0.01
3000	200	20000	1.5 x	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 include all possible scales except bar for 36 PSI ranges and lower and mbar for the 300 PSI version.

Bar versions include all possible scales except inch Hg for the 2 bar ranges and lower.

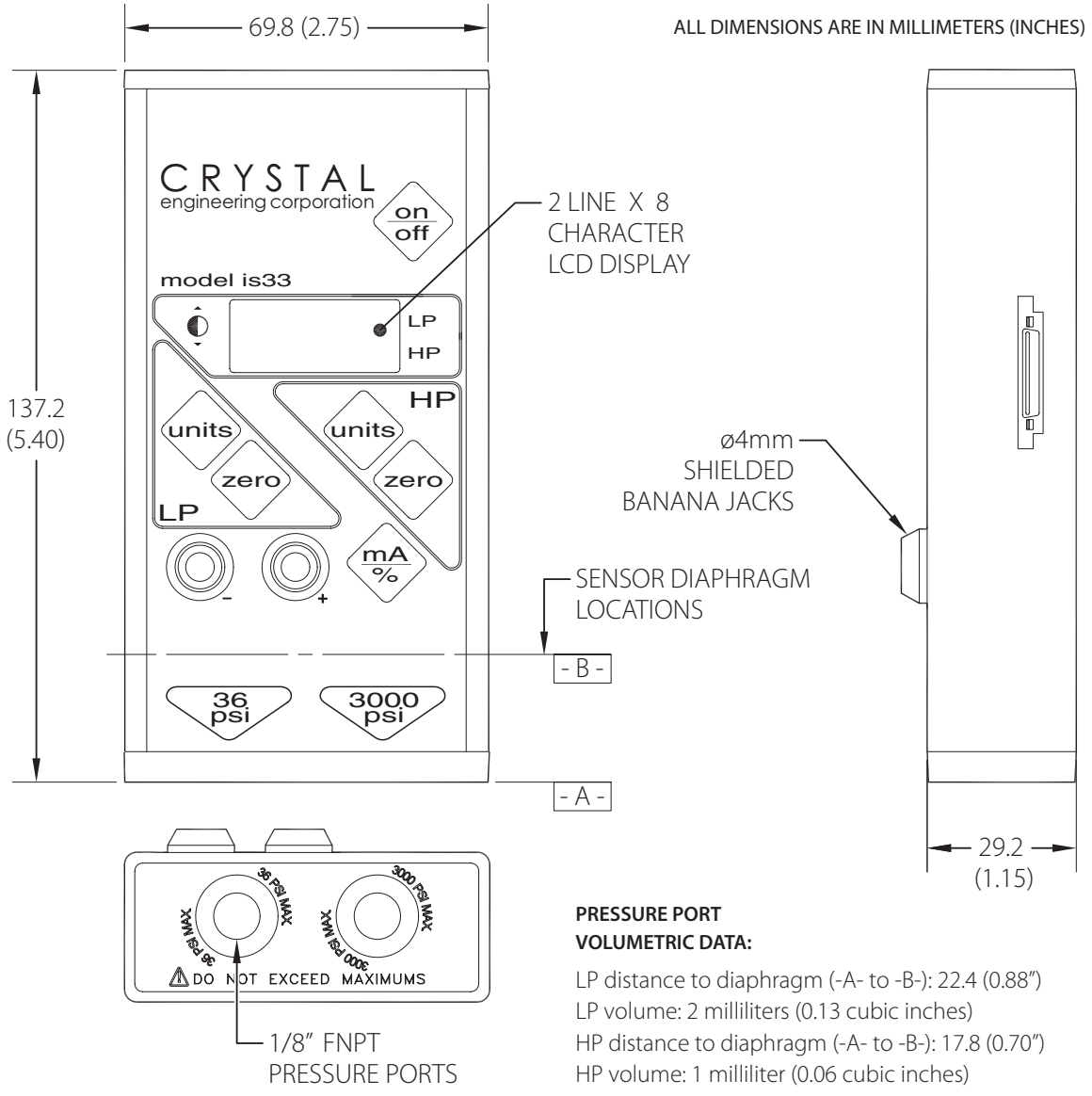
Enclosure

Description..... Extruded Aluminum with sealed membrane keypad.

Weight:..... Model 33 - 400.3g (14.1 oz.); Model 31 - 342g (12.1 oz.); Model 31, High Pressure - 360g (12.7 oz.)

Weight w/SS Manifold:..... Model 33 - 484.6g (17.0 oz); Model 31 - 428g (15.1 oz.); Model 31, High Pressure - 360g (12.7 oz.)

Carry Case w/strap: ..... PN 2490 (included). Clear cover protects keypad - calibrator can be operated while in case. Also provides a way to hang the calibrator while in use.



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)

Intrinsically Safe Certifications

Crystal Engineering pressure calibrators starting with "IS" in the part number have been certified intrinsically safe by the following agencies per the listed standards:

CSA

Intrinsically Safe, Entity Parameters - for Hazardous Locations: Class I, Groups A, B, C and D; Temperature Code T4

LCIE \ CENELEC

EEx ia IIC, T4

LCIE 98.E6046 X

Milliamp Input Entity Parameters:

Vmax=30V=Ui	Voc=5V=Uo
Imax=100mA=Ii	Isc=400mA=Io
Ci=2.3µF	Ca=0.135µF=Co
Li=0mH	La=100µH=Lo

Entity parameters specify the safe voltage, current, capacitance and inductance that can either be connected to the device, or is internal to the device.

WARNINGS

Substitution of battery components may impair intrinsic safety. Use only:

Duracell® Alkaline 9V, MN 1604

Eveready® 9V, P/N 216

Do not use the RS232 connector in a potentially explosive atmosphere.

Replace batteries in non-hazardous locations with approved types only.

Certifications

The 30 Series calibrator has been tested and certified to comply with a variety of international standards.

C-tick

This 30 Series calibrator complies with the Australian requirements for the C-tick mark. The instrument was tested against AS/NZS 3584, C-tick EMC/EMI requirements.

European Community Declaration of Conformity

EC Declaration of Conformity

CE

I/We

Crystal Engineering Corporation

of

720 Aerovista Place, Suite B
San Luis Obispo, CA, 93401
USA

declare that

Pressure Calibrator
IS31 and IS33

In accordance with the following directives

89/336/EEC	**The Electromagnetic Compatibility Directive** and its amending directives

has been designed and manufactured to the following specifications

EN 50081-1	**1992**	**Electromagnetic compatibility - Generic emission standard -- Part 1: Residential, commercial and light industry**
EN 50081-2	**1993**	**Electromagnetic compatibility - Generic emission standard -- Part 2: Industrial environment**
IEC 1000-4-2	**2001 Ed. 1.2**	**Electromagnetic compatibility (EMC): Testing and measurement techniques - Electrostatic discharge immunity test**
IEC 1000-4-3	**2001 Ed. 1.2**	**Electromagnetic compatibility (EMC)- Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test**
EN 55011 & A1	**1998 1999**	**Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement**

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives

David K. Porter, P.E.
(NAME OF AUTHORIZED PERSON)

Director of Engineering
(TITLE OF AUTHORIZED PERSON)

(SIGNATURE OF THE AUTHORIZED PERSON)

16 April 2003
(DATE OF ISSUE)

How to Contact Us:

Phone (805) 595-5477

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Fax (805) 595-5466

Email service@crystalengineering.net

Web www.crystalengineering.net

If calling, have ready the model number, serial number, date of purchase and reason for return. You will receive instructions for returning the device to Crystal Engineering.

Send your comments to: feedback@crystalengineering.net

Warranty

Crystal Engineering Corporation warrants the **30 Series** Pressure Calibrators to be free from defects in material and workmanship under normal use and service for one (1) year from date of purchase to the original purchaser. It does not apply to batteries or when the product has been misused, altered or damaged by accident or abnormal conditions of operation.

Crystal Engineering will, at our option, repair or replace the defective device free of charge and the device will be returned, transportation prepaid. However, if we determine the failure was caused by misuse, alteration, accident or abnormal condition of operation, you will be billed for the repair.

CRYSTAL ENGINEERING CORPORATION MAKES NO WARRANTY OTHER THAN THE LIMITED WARRANTY STATED ABOVE. ALL WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, ARE LIMITED TO A PERIOD OF ONE (1) YEAR FROM THE DATE OF PURCHASE. CRYSTAL ENGINEERING SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT OR OTHERWISE.

Note (USA only): Some states do not allow limitations of implied warranties or the exclusion of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

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ISO 9001
BUREAU VERITAS
Certification
Nº 191559

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