Crystal pressure

30 Series Operation Manual

for the 30 Series Pressure Calibrator

AMETEK
SENSORS, TEST & CALIBRATION

Contents

Overview

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.

They weigh less than a pound and 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 30 Series calibrator could replace several conventional calibrators by covering a wide range of pressure with high accuracy.

The Model 30 does not require any manual adjustments or trimming. All calibration is accomplished via an optically isolated communications port using a USB physical interface. The optical isolation protects the Model 30 from electrical transients that may appear on the USB connector or cabling to a PC.

Your 30 Series can be customized through the use of our free ConfigM30™ software. Your personal computer can disable, enable, or modify a variety of features of your 30 Series.

- 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 specializes in making pressure measuring equipment.
It's the only thing we do and that's why we say:

Pressure is our **Business**™

Functions

OPERATING INSTRUCTIONS

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

WARNING: **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.**

WARNING: **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 1/8" 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"H2O or less.

Over-range Indication

Over-range conditions will be indicated regardless of the tare value. If the full scale rating of either the low or high pressure sensor 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.)

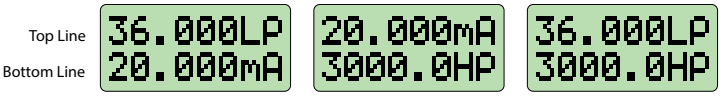
Contrast button

The (contrast) button, left of the display, may never have to be pressed. It is provided to compensate in 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 buttons 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.

The pressure calibrator 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.

Battery Replacement

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.

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/off) 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 a high vacuum.

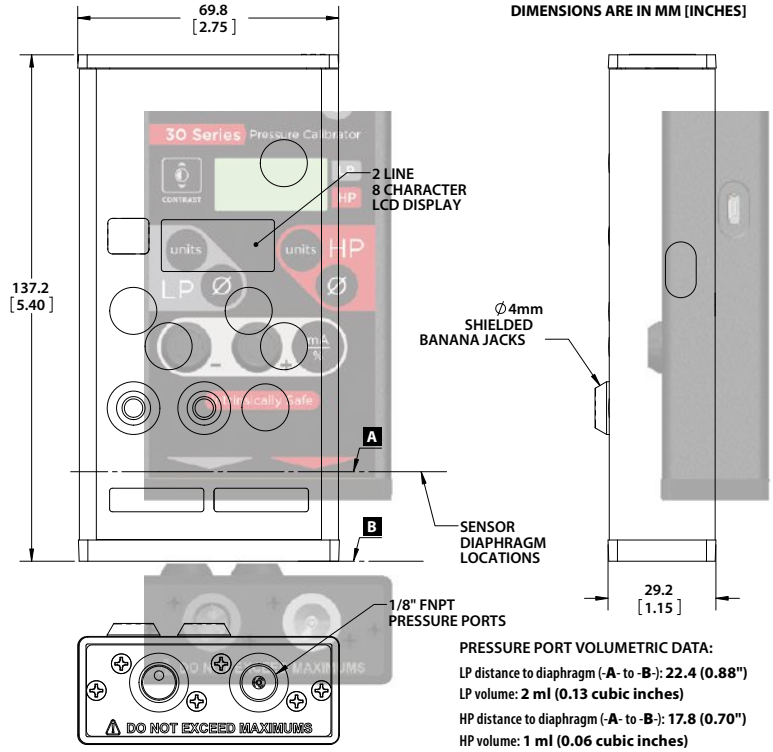
Enclosure

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 w/SS Manifold . . . . . Model 33 - 485g (17.0 oz); Model 31 - 428g (15.0 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 ml (0.13 cubic inches)**
HP distance to diaphragm (-**A**- to -**B**-): **17.8 (0.70")**
HP volume: **1 ml (0.06 cubic inches)**

Specifications

Note: Accuracy includes 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.

Pressure

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

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

See Pressure Ranges, Display Scales, & Resolution on page 8.

Vacuum

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

† *Vacuum Floor Term (VFT):*

For 16 & 36 PSI:	VFT = 0.004 PSI
For 300 PSI:	VFT = 0.01 PSI
For 1 or 2 bar, & 100 or 200 kPa:	VFT = 0.0003 bar or 0.03 kPa
For 20 bar or 2000 kPa:	VFT = 0.001 bar or 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. The 30 Series calibrator is not recommended for continuous use at high vacuum. Refer to the XP2i-DP data sheet for gauges that are intended for continuous high vacuum use.

Temperature

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

Non-condensing. No change in accuracy over operating temperature range. Gauge must be zeroed to achieve rated specification.

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

Battery should be removed if stored for more than one month.

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 . . . 30 VDC

Maximum Current . . . 100 mA

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. mA can be displayed as a percentage, where 0 to 100% corresponds to either 4 to 20 mA or 10 to 50 mA.

Power

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

Approved Batteries

ATEX/IECEx: The 30 Series is Intrinsically Safe only if powered by one of the following battery types:

Approved Battery Type	Ta=	Marking
Duracell Alkaline 9V, MN 1604	0 to 50° C	Ex ia IIC T4 Gb
Energizer Alkaline 9V, 522		
Energizer Lithium 9V, L522		
Varta High Energy Alkaline 9V, 4922	0 to 45° C	

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.

Do not mix battery types or manufacturers.

CSA: Substitution of components may impair intrinsic safety.

CSA: La substitution de composants peut compromettre la sécurité intrinsèque.

CSA: The 30 Series is Intrinsically Safe only if powered by one of the following battery types:

CSA: Le 30 Series est un système à sécurité Intrinsèque seulement s'il est alimenté par un des Piles de type suivant:

Approved Battery Type (Approuvé Type de Batterie)	Marking (Marquage)
Duracell Alkaline 9V, MN 1604	Class I, Division 1, A, B, C, D T4 (Classe I, Division 1, A, B, C, D T4)
Energizer Alkaline 9V, 522	
Energizer Lithium 9V, L522	
Varta High Energy Alkaline 9V, 4922	Class I, Division 1, A, B, C, D T3C (Classe I, Division 1, A, B, C, D T3C)

Battery Life . . . . . 90 hours typical

Low Battery Indicator . . . . . Flashing battery icon

Connections

Pressure Fitting . . . . . ⅛" female NPT

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

Communication . . . . . micro USB

WARNING: Do not use the micro USB serial interface in hazardous locations.

PRESSURE RANGES, DISPLAY SCALES, & RESOLUTION

PSI	bar	kPa	Overpressure	PSI	inch H_2O	inch Hg	mmHg	mmH_2O	cmH_2O	kg/cm^2	bar	mbar	kPa	MPa
16	1	100	6.5 x	0.001	0.01	0.001	0.01	1		0.0001	0.0001	0.1	0.01	
36	2	200	3.0 x	0.001	0.01	0.001	0.01	1		0.0001	0.0001	0.1	0.01	
300	20	2000	2.0 x	0.01	0.1	0.01	0.1		1	0.001	0.001		0.1	
1500	100	10000	2.0 x	0.1						0.01	0.01		1	0.001
3000	200	20000	1.5 x	0.1						0.01	0.01		1	0.001
5000	300	30000	1.5 x	0.1						0.01	0.01		1	0.001

- PSI versions with ranges of 36 PSI and lower include all possible scales except bar.
- bar versions with ranges of 2 bar and lower include all possible scales except inch Hg, cmH2O, and MPa.
- kPa versions are restricted to kPa, MPa, bar and/or millibar, depending on pressure range.

MODEL NUMBERING SYSTEM

Available Units		Intrinsic Safety	Model	Sensors		1st Pressure Range Prefix		2nd Pressure Range Prefix	Pressure Unit		Manifold
_____	-	IS	3	_____	-	_____	/	_____	_____	-	_____
Standard..... omit				Single Sensor ...**1**					PSI.... **PSI**		Standard.....omit
Metric units only ... **SI**				Dual Sensor.....**3**					bar.... **BAR**		Stainless Steel...**SPSS**
									kPa ... **KPA**		

SAMPLE PART NUMBERS

IS31-36PSI ..... Calibrator with one sensor (36 PSI)

IS33-36/3000PSI ..... Calibrator with two sensors (36 PSI and 3000 PSI)

IS33-16/1500PSI-SPSS ... Calibrator with two sensors (16 PSI and 1500 PSI) with two stainless steel manifolds

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 043468 was manufactured in 2010.

Safety & Certifications

HAZARDOUS LOCATIONS

Every **30 Series** pressure calibrator includes the following Intrinsic Safety approvals.

II 2G Ex ia IIC T4 Gb
FTZU 06 ATEX 0010X

Ex ia IIC T4 Gb
IECEx FTZU 10.0018X

Exia Intrinsically Safe and Non-Incendive for Hazardous Locations: Class I, Division 1, Groups A, B, C and D, Temperature Code T4/T3C.

Sécurité intrinsèque et non incendiaire pour dangereux Lieux: Classe I, Division 1, Groupes A, B, C et D, Code de température T4/T3C.

Milliamp Input Entity Parameters:

Ui = 30V	Uo = 9.9V
Ii = 100mA	Io = 2.62mA
Pi = 0.75W	Po = 6.5mW
Ci = 0	Co = 3.2uF
Li = 0	Lo = 100uH

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

Ta = 0 to 50° C

! WARNINGS: The following warnings apply to the 30 Series Pressure Calibrator:

- **Substitution of components may impair intrinsic safety.**
- **Replace batteries with approved type in non-hazardous locations only.**
- **Do not use USB interface in hazardous locations.**

CERTIFICATIONS

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

This 30 Series complies with the Australian Radiocommunications (Electromagnetic Compatibility) Standard 2008.

Crystal Engineering declares that the 30 Series is in accordance with the ATEX Directive, the Electromagnetic Compatibility Directive, and the Pressure Equipment Directive per our declaration(s).

This 30 Series is approved for use as a portable test instrument for Marine use and complies with Det Norsjke Veritas' Rules for Classification of Ships, High Speed & Light Craft and Offshore Standards.

Safety Instructions for Hazardous Locations – **ENGLISH** (English)

- Do not use the USB connector in a hazardous location.
- Replace batteries in non-hazardous locations, with approved batteries, only.
- It is the users responsibility to understand the proper application of this product in potentially explosive atmospheres.

▶ Approved Batteries – **ENGLISH** (English)

The 30 Series is Intrinsically Safe ***only*** if powered by one of the following battery types:

Approved Battery Type	Ta=	Marking
Duracell Alkaline 9V, MN 1604	0 to 50° C	Ex ia IIC T4 Gb
Energizer Alkaline 9V, 522		
Energizer Lithium 9V, L522		
Varta High Energy Alkaline 9V, 4922	0 to 45° C	

Many other battery types and models have been tested but failed to meet the requirements for Intrinsic Safety - do not assume other models are equivalent.

Energizer is manufactured by Energizer Holdings, Inc., and the Eveready Battery Company, Inc.

Instrucciones de seguridad para zonas peligrosas – **ESPAÑOL** (Spanish)

- No use el conector USB en zona clasificada.
- Cambie las pilas en zona no clasificada, solo con pilas aprobadas.
- Es responsabilidad del usario comprender la aplicación de este producto en atmósferas potencialmente explosivas

▶ Pilas aprobadas – **ESPAÑOL** (Spanish)

El 30 Series solo es intrínsecamente seguro si se alimenta con uno de los siguientes tipos de pilas:

Approved Battery Type	Ta=	Marking
Duracell Alkaline 9V, MN 1604	0 to 50° C	Ex ia IIC T4 Gb
Energizer Alkaline 9V, 522		
Energizer Lithium 9V, L522		
Varta High Energy Alkaline 9V, 4922	0 to 45° C	

Se han probado muchos otros tipos de baterías pero han fallado el cumplimiento de los requisitos para la seguridad intrínseca - No asuma que otros modelos son equivalentes.

Energizer está fabricado por Energizer Holdings, Inc., y por Eveready Battery Company, Inc.

Support

CALIBRATION

If adjustment is required, we recommend returning your 30 Series Calibrator to our factory. Factory service offers benefits you won't find anywhere else.

Factory calibration tests the 30 Series at a variety of temperatures utilizing NIST traceable standards, resulting in calibration certificates that provide performance data over temperature. Our calibration facilities are A2LA accredited to ISO 17025:2005 & ANSI/NCSL Z540-1-1994 (A2LA #2601.01). A2LA is internationally recognized as an accreditation body by the International Laboratory Accreditation Cooperation, ILAC.

Under normal operating conditions, we recommend the 30 Series be calibrated on an annual basis. Your quality system may require more or less frequent calibration, or your experience, or operating environment may suggest longer or shorter intervals.

Although we prefer that you return the 30 Series to us for calibration, ordinary recertification and/or adjustments may be performed by any qualified personnel with appropriate training and equipment.

There are no internal potentiometers. The 30 Series contains a "span" factor (userspan), set to approximately 1 (as shipped from the factory).
As components age this may need to be changed to a value slightly higher or lower, to slightly increase or decrease all readings.
This adjustment can be made with a computer through our free ConfigM30 software.

ACCESSORIES AND REPLACEMENT PARTS

CPF: Crystal Pressure Fittings (FITTINGS **FOR LiFE)**

Test Leads

P/N: 1351 Test Lead Kit

Two 4 mm shrouded banana plug, straight to right angle, 122 cm (48 inch) leads with alligator clip and spring loaded hook tip probes.

SOFTWARE

ConfigM30

ConfigM30 is free software to customize your calibrator. Eliminate scales you don't need, calibrate, create custom scales, and password protect the calibrator from future changes! Requires micro USB cable , PN 4431.

CONTACT US

TRADEMARKS

This manual contains the following third-party trademarks, both registered and unregistered. All marks are the property of their respective companies.

Varta® .....VARTA Consumer Batteries GmbH & CO. KGaA

Duracell® .....Duracell Inc. Corporation

Energizer® and Eveready .....Eveready Battery Company, Inc.

"Pressure is Our Business" is a registered trademark of Crystal Engineering Corp.

WARRANTY

Crystal Engineering Corporation warrants the 30 Series Pressure Calibrator 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.

Crystal pressure

AMETEK®
SENSORS, TEST & CALIBRATION

4435.K 2107

ISO 9001:2008 17025:2005