

2100 Operation Manual

Introduction

Crystal Engineering 2100 Series Pressure Gauges and Calibrators measure almost any type of pneumatic or hydraulic pressures and, depending on the model, up to 500 PSIG. These instruments can also be used to measure vacuum.

2120s are pressure gauges only, 2121s include a high accuracy milliamp indicator for simultaneous display of milliamps and pressure.

A typical application for these instruments is for field calibration of differential pressure transmitters. The transmitter being calibrated is isolated from the pipe, the low side vented to atmosphere and the high transmitter pressure input is connected to a 2121 and a controllable pressure source (like a hand-pump). The milliamp signal from the transmitter is then routed through the 2121 milliamps terminals. The 2121 indicates the actual transmitter milliamp output versus true applied pressure. Zero, span and linearity of the transmitter can be field tested and calibrated with this system.

All 2100 series instruments use a silicon pressure sensor with a permanently filled oil isolator. Only the 316 stainless steel diaphragm is exposed to the applied media, whether it be gas or fluid. This series was designed to survive high humidity so the switches are fully sealed and the circuit boards are conformally coated.

Gauge pressure models (part numbers ending in -G) measure the difference between atmospheric (barometric) pressure, and the pressure (or vacuum) applied to the pressure port. When the pressure applied is less than the barometric pressure (i.e., vacuum) the gauge will indicate negative pressure.

Absolute models (part numbers ending in -A) measure the difference between an absolute reference vacuum and the pressure (or vacuum) applied to the pressure port. Absolute models will not indicate negative pressure when vacuum is applied. The pressure being measured can also be either liquid or gaseous, providing it is compatible with the materials listed in the specification section.



Operating Instructions

To ensure safe and accurate operation, please be familiar with the following operations and functions.

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. 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 1/8" NPT fittings) INTO THE PRESSURE CONNECTIONS! 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.

The pressure being measured can be either liquid or gaseous, providing it is compatible with the materials listed in the specification section. PTFE (polytetrafluoroethylene) tape should be used with any 1/8" male NPT fittings installed into the aluminum manifold.

Operating Instructions

The pressure indication must be set to zero without any pressure being applied to the inlet. The zero adjustment affects all the ranges, but the most precise adjustment is achieved while monitoring the meter on the 200"H₂O range (or the most sensitive range). Turn on the instrument and allow it to warm up for about 1 minute. Using a small screwdriver, adjust the trimming potentiometer marked *ZERO*. Turning the trimming potentiometer counter-clockwise will reduce the reading.

Absolute Only: Do not reset zero unless a full vacuum is applied to the meter. If you are using the gauge for measurements close to barometric pressure, you may use the zero adjustment to trim in the gauge's barometric reading as compared to a precision barometric standard.

The 2100 has two 1/8" female NPT ports. Two ports are provided so that additional tees should not be required. We recommend the following when installing fittings:

1. Make sure the ports are free from debris.
2. Select appropriate fittings. Thread sealant must be used. Tighten the fitting into the pressure port. Use an adjustable wrench on the inlet port manifold to minimize stress on the case. Do not tighten any more than is necessary to insure a leak-free connection.

Maximum pressure on any instrument is 3 times the highest range. The transducer will not be damaged when exposed to an overpressure condition within the limits specified, and will not have to be recalibrated to maintain rated accuracy. Zero may have to be readjusted, however.

Milliamp Meter

To measure milliamperes, connect any standard test leads (with 4mm banana plugs) to the jacks on the right side of the meter. The meter meets accuracy specifications with the leads connected in either polarity. The top jack (red, adjacent to the strap) is the positive input terminal.

The milliamp meter is internally fused with a replaceable glass, 2 amp, 8 AG fuse. Should the fuse require replacement, follow the instructions of step 6 in the calibration procedure for panel removal, then pry out and replace the glass fuse.

Battery Replacement

Replace the battery once a Low Battery indicator becomes visible. The battery warning indicates the battery is exhausted, and the instrument may no longer be accurate. The 2100 operates on one 9V battery, either carbon-zinc (included) or alkaline. To install the battery, open the cover of the instrument. Turn the power switch off. Open the battery compartment by lifting up the tab on the right side of the gauge. Plug the battery into the polarized snap connector.



The power switch must be off when installing the battery, to avoid momentarily connecting the battery in reverse polarity. REVERSE BATTERY POLARITY WILL DESTROY THE GAUGE IMMEDIATELY.

Specifications

Battery: 9V alkaline. Eveready #522 or equivalent.

Battery life: 2120 - 300 hours, 2121 - 100 hours.

Low Battery Indication: LCD displays "LOBAT" and/or "LOW BATTERY"

Size: Approximately 86mm x 52mm x 168mm (2" x 3½" x 6½")

Weight: 340-425g (12-15 ozs.) with battery, depending on model.

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

Operating Temperature Range: 0 to 50°C (32 to 122°F)

Pressure

Pressure Ranges: Refer to the chart on page 5.

Accuracy: ±0.1% F.S.* @ 23°C ±5°C. This includes errors due to linearity, hysteresis and repeatability. The gauge must be adjusted to read zero at barometric pressure (except for absolute pressure versions). *or 1 "least significant digit" on ranges with limited resolution.

Display: 3½ digit Liquid Crystal Display with ½" digit height.

Temperature Stability: ±0.018% F.S. per °C (maximum) from 0 to 18°C and 28 to 50°C.

Compensated Temperature Range: 0 to 50°C (32 to 122°F)

Media Compatibility: Liquids and gases compatible with PTFE (polytetrafluoroethylene) penetrated, hard anodized aluminum transducer housing, 316 stainless steel (sensor), buna-n (O-ring)

Overpressure rating: 3 times highest pressure range.

Pressure fitting: Dual ⅛" female NPT (tapered).

Milliamp Meter

Accuracy: ±0.05% of reading (+2 digits on 20 mA scale) @ 23°C ±5°C.

Ranges: 0 to ±19.999 mA and 0 to ±50.00 mA on 50 mA scale.

Display: 4½ digit Liquid Crystal Display with 0.4" digit height.

Resolution: 0.001 mA on 20 mA scale, 0.01 mA on 50 mA scale.

Temperature Stability: ±0.01% of reading per °C from 0 to 18°C and 28 to 50°C.

Burden Voltage: 0.21V @20mA: 0.51V @ 50mA.

Overload Protection: Internal 2A/8AG/250V user-replaceable fuse.

Options: Super flexible silicone test lead set - individual Red and Black banana to banana test leads with hard plastic insulated banana to alligator clips. Order Part#: AC-1351

Options

1. **High Resolution Pressure Display:** 4½ digit Liquid Crystal Display. Specify option HR. Increases resolution on all ranges by one decimal place.
2. **Pressure fitting kit.** Part#: AC-1391. Includes three ⅛" NPT to ¼" tube adapters and two 24" pieces of ¼" polyurethane flexible tubing. For use up to 90 PSI.
3. **Quick disconnect set.** Part #: AC-1393. One female coupling body with shutoff to male ⅛" NPT and one coupling insert to ¼" plastic tubing adapter.
4. **Low pressure pump.** Part #: P-102. Includes a variable volume pressure control and bleed valve. For up to 60 PSIG.
5. **Low Pressure Plastic Tubing.** Part #: AC-1398. Polyurethane tubing, 0.25" O.D., 0.126" O.D., 90 PSI working pressure.

Standard Models

Model	RANGE 1	RANGE 2	RANGE 3	RANGE 4
212(*)-030PSI-G	199.9"H ₂ O	830"H ₂ O	19.99 PSI	30.0 PSI
212(*)-030PSI-G-HR	199.99"H ₂ O	830.0"H ₂ O	19.999 PSI	30.00 PSI
212(*)-030HG-G-HR	760.0 mmHg	30.00"Hg	830.0"H ₂ O	30.00 PSI
212(*)-200kPa-G	19.99 PSI	50.0 kPa	199.9 kPa	830"H ₂ O
212(*)-200kPa-G-HR	19.999 PSI	50.00 kPa	199.99 kPa	830.0"H ₂ O
212(*)-250PSI-G	830"H ₂ O	30.0 PSI	199.9 PSI	250 PSI
212(*)-250PSI-G-HR	830.0"H ₂ O	30.00 PSI	199.99 PSI	250.0 PSI
212(*)-4"Hg-A	4.00"HgA	1000 mmHgA	15.00 PSIA	30.0"HgA
212(*)-4"Hg-A-HR	4.000"HgA	1000.0 mmHgA	15.000 PSIA	30.00"HgA

(*) insert 1 for millimeter, 0 for gauge, only. Other ranges available, contact factory.

Specifications and Model availability subject to change without notice.

Calibration Procedure

A calibration cycle of 1 year is recommended to maintain the 2100 within specifications. Severe operating conditions (extreme temperature changes, vibration, etc.) may require a more frequent calibration cycle.

These procedures assume that you are familiar with proper calibration techniques especially with regard to high vacuum measurements. (Specifically, a leak free system is required so that pressure differentials do not occur between the instrument being calibrated and the pressure standard.) Recommended equipment is listed in Table 1.

Instrument	Minimum Specification	Recommended Model
Pressure Standard	0.025% of scale	Pressurements deadweight gauge, Model T2300
Precision Current Source	0.005% of reading +1 μ A	EDC Model 521
Absolute Only:		
Vacuum Gauge	\pm 1milliTorr @ 10 milliTorr	Hastings VT6S2
Absolute Gauge	0.01% of Scale	Ruska PPG-30
Vacuum Pump	capable of 1 milliTorr dead-end vacuum	

Table 1: Required Equipment

If you have any questions regarding calibration or repair, please contact us at any of the phone numbers listed on the back of the manual.

Pressure Indicator Calibration Procedure

Use this procedure to calibrate the 2100 Pressure indicator.

1. Verify the condition of the battery. Make sure that the *LOBAT* indicator is not on, or check battery voltage. Battery voltage must be greater than 7V. Replace the battery if necessary.
2. Connect the instrument to the pressure calibration system. Be sure that the pressure calibration system and the connection to the instrument being calibrated is leak free.
3. Allow the instrument to stabilize at room temperature, away from drafts, for at least 30 minutes before proceeding with calibration.
4. Set the scale to 200"H₂O range (or the most sensitive range [selector switch set fully counter-clockwise]).
5. The front panel *ZERO* potentiometer should be centered. To center the front panel *ZERO* rotate the front panel *ZERO* potentiometer fully clockwise until a click is heard, or there is no more increase in output. Then rotate the front panel *ZERO* pot counter-clockwise 15 turns.

Absolute gauges only: Apply full vacuum to the instrument. When the reference vacuum gauge indicates 10 milli Torr adjust the front panel *ZERO* potentiometer for a reading equivalent to 0.01 mm HgA, ± 0.01 mV.

6. If the zero adjustment range of the front panel *ZERO* potentiometer is inadequate, the coarse potentiometer must be readjusted. The *COARSE ZERO* potentiometer is located beneath the front zero pot, on the opposite side of the PCB. To take the unit out of the black case, open the battery case then pull the left side of the black case and gently pull up on the battery case lid, Be sure not to pull too hard, otherwise you may pull the sensor out of the unit. Adjust the *COARSE ZERO* pot until the output is as close to zero as possible. Trim in the final zero reading with the front panel *ZERO* potentiometer.
- 7.1 On the most sensitive range (usually the bottom most range), pressurize to 50% of the range.
- 7.2 Adjust the corresponding front panel span pot so that the indication corresponds exactly with the pressure standard.
- 7.3 Pressurize to 95% of range. The reading should be within 0.1% of true pressure. If not, reset the corresponding front panel span pot until the reading is within 0.1% of true pressure.
- 7.4 Reduce pressure to 50% of range. The reading must be within 0.1% of range. If not, repeat steps 7.1 to 7.4 until both readings are within tolerance.
- 7.5 Reduce pressure to zero. Reading should be within 0.025% of full scale, or ± 1 count, whichever is greater.
- 7.6 Repeat steps 7.1 through 7.5 for each successive range.

2121 Only: Milliamp Meter Calibration

- 8.1 Connect a precision current source to the milliamp input terminals of the 2121.
- 8.2 Set mA meter to 20mA scale.
- 8.3 Apply 19.900 mA to meter.
- 8.4 Adjust the meter with front panel milliamp potentiometer to read exactly 19.900 mA.
- 8.5 Apply 4.000 mA to meter.
- 8.6 Reading must be within ± 0.004 mA of 4.000 mA.
- 8.7 Apply 19.900 mA.
- 8.8 Set mA meter under test to 50mA scale.
- 8.9 Reading must be within ± 0.04 mA of 19.900 mA. (There is no adjustment for this scale).

Warranty

Crystal Engineering Corporation warrants the 2100 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.

For in (or out) of warranty service, we can be reached at:

Phone (805) 473-8416 (Direct line to Repair Department)
Toll-Free (800) 444-1850 (Press 6 for Repair Department)
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.

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.

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