

WT Series Digital Pressure Gauge

Operation Manual



CRYSTAL
engineering corporation

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Introduction

The **WT Series** Digital Test Gauge is designed to fit in 8" or 10" panel mount applications commonly found in portable test sets. The **WT Series** is based on the Crystal Engineering Corp. model **XP2i** digital pressure gauge (www.xp2i.com). The **WT Series** pressure gauge has been repackaged so that it may be mounted in a portable enclosure, while retaining easy access to batteries and to the digital (RS-232) interface (both of which would otherwise be on the back of the gauge).

Accuracy is **0.1 percent of reading** - so any **WT Series** gauge can typically replace several gauges you may have been using. The gauge is **fully temperature compensated** - so there is **no change in accuracy throughout the entire operating temperature range!** Three AAA batteries provide up to 500 hours of continuous operation. The batteries are easily replaced by removing the two screws.

Your **WT Series** gauge can be customized, through the use of **ConfigXP** software available from Crystal Engineering. Your personal computer can disable, enable or modify a variety of features of your WT Series.

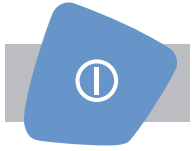
Look for the **CONFIGXP PROGRAMMABLE** logo for programmable features that will:



- provide a user-defined pressure scale, and/or disable unused pressure units
- disable keypad recalibration, enable peak button and/or units button
- expand or decrease allowable Zero range
- enable other pressure units (like inches of mercury, kPa, bar, etc.)
- create and enable a user-defined pressure unit
- store a 12 digit ID or tag number in non-volatile memory
- adjust calibration values

*We hope the **WT Series** gauge meets your expectations, and we're interested in any comments or suggestions you may have. You can send us a note at: feedback@crystalengineering.net. Many features in this and our other products are a direct result of your comments!*

Crystal Engineering is the company that designs, manufactures, markets and services the XP2i, 30 series pressure calibrators, MultiCal multimeter pressure adapters and a variety of industry specific pressure measuring equipment. Crystal Engineering pioneered features like full temperature compensation and "of reading" rated gauges and calibrators. Pressure measuring equipment is the only thing we do and that's why we say: **PRESSURE is Our BUSINESS™**

Operating Instructions




The **WT Series** gauge is shipped with batteries installed, so it's ready to use. Press and hold the  (on/off) button. The gauge will first test all LCD segments. Release the  button when the gauge indicates pressure.

The **WT Series** gauge always resumes operation in the mode and the units of the pressure last used, and it **does not automatically rezero when turned on**.

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.

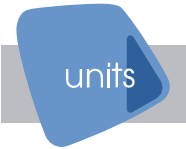
CAUTION: Never insert any object into the pressure connection! The sensor diaphragm is very thin and can be damaged or destroyed by solid or sharp objects. Cleaning of the sensor must be done with appropriate solvents only.

The **WT Series** is intended for gauge pressure measurement. It indicates the difference between applied pressure and ambient barometric pressure. However, the  button can be used to force the **WT Series** to read zero pressure at **any** applied pressure, up to the full scale rating of the gauge. The factory default setting limits the maximum zero value to 200 PSI, but this limit can be changed with **CONFIGXP**.

Some **WT Series** gauges are rated for absolute pressure. Absolute gauges indicate the difference between applied pressure and an internal vacuum reference. Absolute pressure is always positive. For instance barometric pressure at sea level is on average about 14.7 PSI (approximately 100 kPa or 1 Bar), so at sea level this is the lowest expected pressure indication. However, absolute gauges can be "zeroed" (unless prevented by ConfigXP). After zeroing an absolute gauge it is possible to indicate a negative pressure.

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!

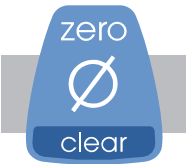
Units button



Pressing this button causes the **WT Series** gauge to select the next available unit of pressure measurement. See “**Pressure Ranges, Display Scales & Resolution**” for the list of pressure units available for your model.

CONFIGXP PROGRAMMABLE Units that you don’t need or never use can be turned off. You can also define a special unit for your **WT Series** gauge with ConfigXP. That way you can use the **WT Series** gauge to display directly in a unit not otherwise available, such as feet of seawater, or foot-pounds of torque. When your custom unit is selected and displayed on the **WT Series** gauge, all pressure unit icons will be off.

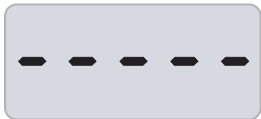
Zero



To zero the WT Series gauge, you must turn off peak indication, then press the zero button for at least ½ second. The display will then briefly flash all dashed lines (- - - -), indicating that it has been re-zeroed. If you attempt to zero the gauge while more than 200 PSI is applied (or the pressure limit set with ConfigXP), the command will be ignored, and “- -HI-” will be displayed.

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!

You can clear the zero value: Turn off peak indication then press and hold the zero button until the display changes from (- - - -) to (- - -). This is especially useful for absolute gauges that have been zeroed while measuring barometric pressure.





Zeroed



Clear Zero (Unzero)

CONFIGXP PROGRAMMABLE You can change the point at which the Zero button will display “- -HI-”. For instance, you could set the maximum zero to 1 PSI. You can also disable the zero button entirely, by setting the Zero value to a large negative number.

The zero button changes its function when the peak high () or the peak low () icon is displayed. While a peak icon is displayed the zero button becomes the clear button.

Peak detection and Average

Pressing the Peak button causes the display to cycle through the following:

 Recorded maximum pressure
 Minimum recorded pressure
 Average pressure*
	<No Icon> Live pressure display

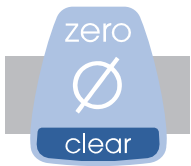
Peak high and low values are not saved when the gauge shuts off; they will reset to the current reading when the **WT Series** gauge is turned on or reset.

* From the factory this Average Pressure is disabled. Use ConfigXP to enable.

CONFIGXP PROGRAMMABLE In some cases the ability to display a peak value may not be needed, or may even be dangerous. ConfigXP allows you to disable this button.

WT Series gauges can average 1 to 10 readings, recalculated every time pressure is measured (3 times per second). Enable and set the number of readings to be averaged with ConfigXP.

Resetting (clearing) recorded peak values



Peak values (if enabled) can only be cleared when displaying either a high or low recorded pressure. Press the **clear** button for at least ½ second. Dashed lines will then briefly appear across the display and both and icons will flash briefly, indicating that both peak values have been cleared. Both peak high and low values will then display the current applied pressure. Pressing the **clear** button while either peak hi or peak lo icon is displayed will not affect the zero value. If you need to rezero the gauge, you must turn off both peak icons by pressing the **peak** button.

Automatic shut-off




The **WT Series** gauge has a shutoff timer and will turn off automatically after 20 minutes of non-operation. Pressing any button or sending any command via the RS-232 connection resets the shutoff timer.


The shutoff feature can be defeated, if desired, when turning the gauge on. Pressing the (on/off) and **zero** buttons simultaneously will prevent the **WT Series** gauge from automatically turning off. The gauge will briefly display the words "**No Auto Off**" to indicate that it will not turn off.

This procedure is required each time the gauge is turned on, if you want to defeat the auto-shutoff.

Backlighting the Display



Pressing the  (backlight) button instantly lights the display at maximum brightness, but to keep it on you need to hold down the button for 2 seconds. The display will flash briefly, indicating that it will stay on for 1 minute. If you press the  button again, the backlight will go into a lower brightness setting to extend battery life, the display will again flash briefly, and remain on for 2 minutes. Press the  button once more and the light will go out.

If you start the **WT Series** gauge in the “No Auto Off” mode, you select the brightness level the same way, but the light will never time out and turn off; you will have to either turn off the gauge or press the backlight  again until the light goes out.

Measuring Vacuum



All versions of the **WT Series** gauge can be used to measure moderate vacuum, though only ranges of 300 PSI (and 20 bar or 2000 kPa) and lower are actually tested and certified for vacuum operation.



When measuring pressure less than ambient barometric conditions, a minus (-) sign will appear. **WT Series** gauges are not recommended for continuous use at high vacuum (pressures lower than -14.5 PSI, at sea level).

Absolute gauges (models with a “B” following the pressure range designation in the part number) **will NOT** indicate a negative sign when vacuum is applied, unless the zero button has been pressed while a pressure greater than full vacuum is applied to the gauge. If your absolute gauge does indicate a negative pressure, you can clear the zero value (“unzero”) by pressing the zero button until the display changes from ----- (5 dashes) to - - - (dash, space, dash, space, dash). See “Zero” for details.

Water Density (Inches of Water)

The following applies *only* to models where inches of water are available. As shipped from the factory, the **WT Series** gauge is set to display inches of water corresponding to the density of water at 4°C (39.2°F). You may require a different water density for your application, so the **WT Series** can be set to use the density of water at 20°C (68°F) or 15.6°C (60°F), instead.

To check and or change the water density setting from the keypad, turn on the **WT Series** gauge by pressing the  (on/off) button and the  button simultaneously. The display will indicate either “4C” or “60F” or “68F”.

Press the  button until the display cycles to the desired water density, then press the  button to store the selection (this will not zero the gauge).

CONFIGXP PROGRAMMABLE Select and set the desired density of water.

Overpressure Conditions

The **WT Series** gauge will read pressure up to approximately 110% of the rated pressure range. Above 110% percent of the range the display will start flashing and the readings will not be reliable. **The zero function does not affect the point at which the display starts flashing to indicate overpressure**, so depending on the zero value it is possible that the display can start flashing without the maximum pressure being displayed.

For instance, if a 100 PSI **WT Series** gauge is zeroed when 30 PSI is being applied, it will indicate that the overpressure condition has been reached at 80 PSI (i.e., $110\% \times 100 \text{ PSI} - 30 \text{ PSI} = 80 \text{ PSI}$).

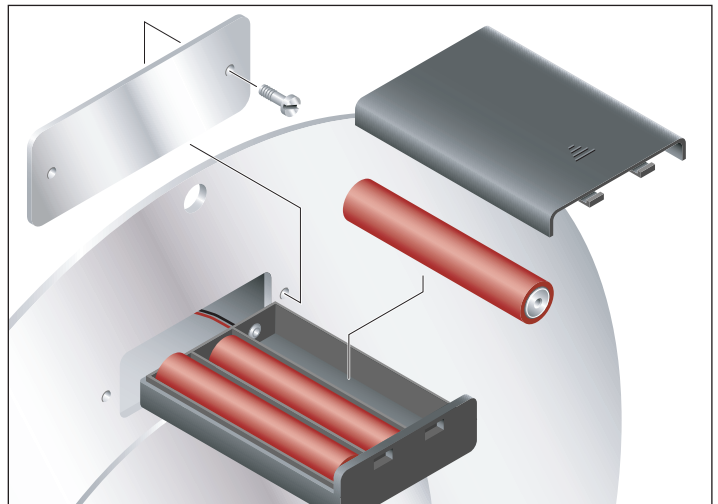
Overpressure can affect accuracy, but the effect is only temporary unless the sensor has been destroyed. See [Specifications](#) for maximum overpressure.

Low battery indication

The battery icon (⚡) is the first indication of a low battery. The **WT Series** gauge will continue to operate accurately while the icon is visible. When the batteries are exhausted, the letters “batt” will appear across the display. After “batt” appears, no pressure measurements will be possible until the batteries are replaced.

Battery replacement

The **WT Series** gauge uses 3 AAA alkaline batteries. **The batteries are located above the gauge behind a metal panel.** With a small flat blade screwdriver, unscrew the two panel screws to gain access to the battery compartment. Remove the battery holder and slide the cover off. After replacing the batteries, the gauge will start operating immediately (without having to press the ⓘ button). This indicates that a complete reset has occurred, and is normal.



Reset

If for some reason the **WT Series** gauge needs to be reset, remove any battery for at least one minute, then reinstall the battery. If the reset is successful, the gauge will start operating without pressing the ⓘ (on/off) button. Reset will clear the zero, peak values will be reset to the current reading, and the gauge will be set to the default unit of pressure (PSI).

Troubleshooting

The **WT Series** gauge is a very high performance gauge. Due to the high resolution of this product, you may observe conditions that appear to be defects in the product, but are in fact a result of being able to resolve and measure pressure to a degree not possible with other instruments.

Noisy or unstable reading

When calibrating or comparing the indicated pressure from a **WT Series** gauge against a hydraulic deadweight tester or piston gauge, the reading on the **WT Series** may appear unstable - the least significant digit jumps up and down several counts.

Reason: Gas (usually air) is trapped in the line between the gauge and the deadweight tester. What is actually happening is the mass is oscillating up and down, and the combination of gas and fluid is acting like a spring. At higher pressures (above 2000 PSI, typically) this may eventually diminish, as the gas dissolves into the fluid.

Solution: Evacuate all tubing with a vacuum pump, before introducing fluid into the system.

Non-repeatability of pressure measurements

When checking the gauge against a hydraulic deadweight, increasing pressure measurements do not match decreasing pressure measurements.

Reason: As in the previous note, gas has dissolved into the hydraulic fluid. When decreasing the pressure, the dissolved gas then leaves the fluid, but at an uneven rate, so small pressure differential (due to fluid head pressure) may exist between the reference deadweight and the gauge being tested.

Solution: Evacuate all tubing with a vacuum pump, before introducing fluid into the system.

Err 1 displayed

Reason: The **WT Series** gauge checks the integrity of internal calibration coefficients every time it's turned on. If any coefficients have been corrupted in any way, "Err 1" is displayed.

Solution: Contact factory for instructions on how to restore the memory to the original factory settings.

Err 2 displayed

Reason: The **WT Series** gauge has tried to display a number too large for the display (i.e., more than 5 digits). May be due to an electrical malfunction or numerical error.

Solution: Contact factory for further instructions.

Err 5 or Err 6 displayed

Reason: The **WT Series** pressure sensor is exhibiting out of normal operating condition behavior.

Solution: Contact factory for sensor replacement.

Display continuously flashes all segments

Reason: After a reset, and after replacing batteries, the **WT Series** gauge checks the integrity of program memory. If for some reason it has been modified or corrupted, it flashes all segments, and prevents normal operation.

Solution: Contact factory for instructions on how to restore the memory to the original factory settings.

Digital Interface

The **WT Series** gauge can be connected to a personal computer via RS-232, using an ordinary DB9 extension cable (male DB9 for the **gauge** connection, female DB9 for the PC side). The interface lets you record displayed readings and recorded peaks. The data string always includes the pressure units. And the **WT Series** gauge can be operated remotely, as if you were pressing the buttons. You can use a simple terminal program to send the commands, or, you can incorporate them into your own software program. Refer to the XP2i Programming Instructions manual for details—available from our website at: www.xp2i.com.

Calibration

If adjustment is required, we recommend returning the unit to the factory. Factory service offers benefits you won't find anywhere else. We have the facilities to test your gauge at a variety of temperatures utilizing NIST traceable standards, resulting in calibration certificates that provide performance data over temperature. Furthermore, 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.

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

Although we prefer that you return the **WT Series** gauge to Crystal Engineering for calibration, ordinary recertification and/or adjustments may be performed by any qualified personnel with appropriate training and equipment. The following instructions are ONLY intended for such qualified personnel with appropriate test equipment. We recommend that the calibration standards used have a minimum rated accuracy of 0.025%. This level of accuracy may require the use of piston (deadweight) gauges or very high performance pressure controllers, such as those manufactured by DH Instruments (www.dhinstruments.com).

There are no internal potentiometers. The **WT Series** gauge 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 or without a computer (see: ConfigXP Configuration Software).

“Zero” the gauge, then record displayed pressure for two or more pressure points. Determine if the **WT Series** gauge would benefit from an overall increase or decrease of the indicated pressures.

To change the userspan factor from the keypad, turn off the gauge, then press the **(on/off)**, **units** and **peak** buttons simultaneously. The firmware version will be briefly displayed, followed by the word “cal”, followed by the actual userspan value. The userspan factor may be adjusted by pressing either the **units** or **peak** button to increase or decrease the value, respectively. The value changes in 0.0001 increments. Press the **zero** button to store the new value in memory, or the **(on/off)** button to cancel the change.

For absolute **WT Series** gauges, it is possible to correct for long term drift using a second calibration factor, zero value off set. ConfigXP and a barometric reference with accuracy of 0.1 PSI or better is required to perform the calibration. To calibrate the zero off set, clear the zero as described earlier in this manual by pressing and holding the zero button until “- - -” appears. Once cleared, subtract the displayed pressure from barometric pressure, add this difference to any existing zero value off set in ConfigXP, and update the gauge (new value = barometric – displayed + existing). For example, if the displayed value is 14.5 PSI, barometric pressure is 14.7 PSI, and the existing zero value off set in ConfigXP is 0.1 PSI, the new zero value off set would be 0.3 PSI (14.7 - 14.5 + 0.1 = 0.3).

CONFIGXP PROGRAMMABLE The userspan level can be viewed, set directly, and disabled by ConfigXP.

WT Series Serial Number

The serial number of your **WT Series** is located on the front panel directly below the zero button. It is also stored digitally within the gauge.



Model Numbering System

WT(prefix)(type)-(options)

Prefix: Pressure range and units - [see table on page 14](#)

Type: (none) ...standard gauge
 B (Barometric) Absolute pressure indication

Note: Absolute version available only on **WT Series** gauges with ranges of 2000 PSI and higher.

Options: -1000 Panel Mount Flange for 8.7” bolt center mounting
 -1500 Panel Mount Flange for 10.125” bolt center mounting

Specifications

Accuracy specifications are for one year, and include all effects of linearity, hysteresis, repeatability, and temperature within the specified operating temperature range.

The gauge must be exercised and re-zeroed whenever exposed to significant changes in environmental conditions to achieve these specifications. To exercise the gauge, cycle the gauge between zero and the pressure of interest. A properly exercised gauge will return to a perfect zero reading.

Exposure to environmental extremes of temperature, shock and/or vibration may warrant a more frequent recertification period.

Accuracy

20 to 100% of Full Scale: $\pm 0.1\%$ of reading

0 to 20% of Full Scale: $\pm 0.02\%$ of Full Scale

Vacuum, 300 PSI and lower pressure gauges:*

0 to -14.5 PSIG : $\pm 0.25\%$ of Full Scale,

where F.S. = -14.5 PSI

***Not specified for 500 PSI models and higher**, although all models can be safely connected to vacuum.

Temperature

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

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

Humidity

Temperature Range	Humidity
-10 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

Media Compatibility

Liquids and gases compatible with PTFE (Polytetrafluoroethylene) penetrated, anodized aluminum sensor manifold, 316 stainless steel (sensor), and PTFE tape.


Pressure Conversions

- 1 PSI = 27.6806 inches of water column (water at 4°C [39.2°F])
- 27.7070 inches of water column (water at 15.6°C [60°F])
- 27.7292 inches of water column (water at 20°C [68°F])
- 2.03602 inches of mercury (mercury at 0°C [32°F])
- 6.8948 kilopascals
- 51.7149 millimeters of mercury (mercury at 0°C [32°F])
- 703.087 millimeters of water column (water at 4°C [39.2°F])
- 0.068948 bar
- 68.948 millibar
- 0.070307 kilograms per square centimeter

Connection

Pressure Fitting: 1/8" female NPT.

Power

- Batteries: 3 x AAA, alkaline recommended
- Battery Life: 500 hours continuous operation
- Low Battery Indicator: Battery Icon ()
- Dead Battery Indication: "batt"

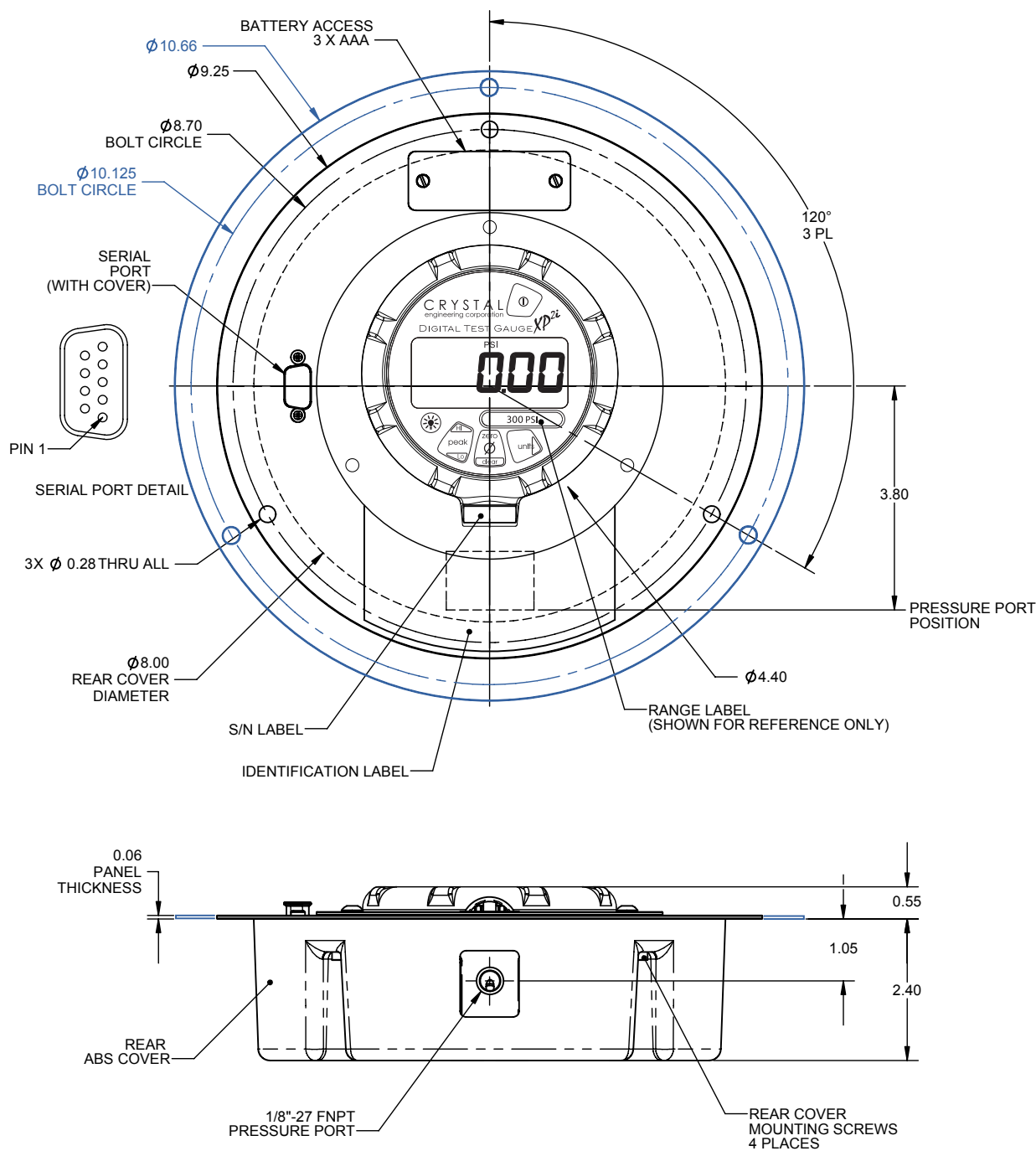
Enclosure

Aluminum and stainless steel.

Weight: 1.25 kg (2.7 lbs), including batteries.

All dimensions in inches.

Dimensions in **blue** are for the 1500 Panel Mount Flange option.



Pressure Ranges, Display Scales & Resolution

PSI	bar	kPa	Over- pressure	Pressure Units and Resolution									
				PSI	kg/cm²	inch Hg	inch H ₂ O	mm Hg	mm H ₂ O	kPa	bar	mbar	
P/N Prefix	P/N Prefix	P/N Prefix											
15PSI	1BAR	100KPA	6.5 x	0.001	0.0001	0.001	0.01	0.01	1	0.01	0.0001	0.1	
30PSI	2BAR	200KPA	3.0 x	0.001	0.0001	0.001	0.01	0.1	1	0.01	0.0001	0.1	
100PSI	7BAR	700KPA	2.0 x	0.01	0.0001	0.01	0.1	0.1	1	0.01	0.0001	0.1	
300PSI	20BAR	2KKPA	2.0 x	0.01	0.001	0.01	0.1	1		0.1	0.001	1	
500PSI	30BAR	3KKPA	2.0 x	0.01	0.001	0.1	1	1		0.1	0.001	1	
1KPSI	70BAR	7KKPA	2.0 x	0.1	0.001	0.1				0.1	0.001		
2KPSI	140BAR	14KKPA	2.0 x	0.1	0.01	0.1				1	0.01		
3KPSI	200BAR	20KKPA	1.5 x	0.1	0.01	0.1				1	0.01		
5KPSI	300BAR	30KKPA	1.5 x	0.1	0.01	1				1	0.01		
10KPSI	700BAR	70KKPA	1.5 x	1	0.01					1	0.01		

- 1 Unneeded pressure units may be disabled via the RS-232 connector using ConfigXP software.
- 2 kPa models can display pressure in kPa and bar (or mbar) only. PSI and bar models can display all available units.
- 3 **WT Series** gauges 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.
- 4 An Absolute pressure version is available only on XP2is and XP2i-DDs with ranges of 2000 PSI and higher.

Software

LabVIEW™ drivers

Control and communicate with the WT Series gauge using National Instrument’s LabVIEW.

ConfigXP Configuration Software

CONFIGXP Disable unwanted pressure units, set default pressure units, change water density, adjust calibration, and more via the RS-232 interface.

Replacement Parts

The only user-replaceable parts are the batteries.

Accessories

AC adapter kit

P/N 2984: Permits operation of a WT Series gauge from an AC supply of 90 - 264 VAC and 47 - 63 Hz. Includes interchangeable international plugs (for USA, Europe, U.K., and Australia). The adapter will not charge batteries, but in the event of AC power loss, the gauge will automatically revert to battery operation.

RS-232 Cable

P/N 2400: DB-9 male to DB-9 female straight pass-through cable.

Trademarks

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

LabVIEW™ National Instruments

“Pressure is Our Business™” is a registered trademark of Crystal Engineering Corp.

Warranty

Crystal Engineering Corporation warrants the **WT Series** gauge Digital Pressure Gauge 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.

How to Contact Us:

- Phone** (805) 595-5477
- Toll-Free** (800) 444-1850
- 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

CRYSTAL

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



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