TESTED
Dive Lab®
Panama City Beach
Florida

Submersible Pressure Indicator

User Guide

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WARNING

Before pressurizing Submersible Pressure indicators always, inspect each SPI for obvious signs of damage /and deterioration. Check the SPI HP hoses for bulges, outer cover cracking. Replace hoses and O-rings that show signs of any damage.

WARNING

Analog SPG gauges normally have a maximum pressure range of 5000 psi. Dive Lab recommends not testing analog gages past 90% of the full range (4500 psig). Testing analog gauges greater than 90% of their full scale can stress the gauge assembly causing a reduction in accuracy during future use.

NOTICE

Testing a single SPI assembly is more difficult than testing multiple Indicators at the same time due to pressurizing and venting control. The yoke/DIN flow restriction works with finer control when measure multiple pressure indicators gauges at one time due to the physical volume.

Note: Dive Lab strongly recommends using good quality batteries and remove them when the unit is stored or not in use for prolonged periods.

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Introduction

The Dive Lab's Submersible Pressure Indicator (SPI) comparator is a simple and accurate way to compare up to six submersible pressure indicators (SPI) assemblies at the same time to pressures up to 4500 psig (310 bar). Dive Lab recommends comparing SPI regularly, at least every 6 months and/or whenever accuracy and or precision is in doubt.

The SPI assembly is primarily intended for comparing 4500 psig air SPI assemblies but could also be used for comparing other high-pressure indicators up to 4500 psig by using appropriate adapters. For further information contact Dive Lab Inc.

The SPI assembly consists of a simple flow restricted high pressure Yoke/DIN SCUBA cylinder interface assembly mated to six port high pressure distribution manifold via a HP SPI whip assembly. The manifold uses a high accuracy 0.25% F.S. (Full Scale) Dwyer® digital pressure gauge that can be set to readout in psig, bar, as well as other pressure values. The digital test gauge has a full-scale accuracy of 0.25% which at the very least, has a 4 times greater accuracy than the typical SPI gauge being compared. Dive Lab recommends re-certification of the digital test gauge annually or IAW with the requirements in place by applicable governing bodies.

For further information on specifics of the Dwyer® "Digital Test Gauge", refer to Dwyer® DPG-100 specifications and operating instructions guide at the end of the user guide. For questions on the SPI comparator assembly please contact Dive Lab Inc, at divelab@divelab.com 850-235-2715.

Understanding SPI Comparator

Calibration is the act or process of determining, checking, or rectifying a measuring instrument or other precision equipment. Accuracy is defined on close the measuring instrument is to an actual value. Precision is defined on how accurate the repeatability is. Calibration can also mean non-random inaccuracies can be identified so they can be compensated for. The SPG comparator allows users to verify accuracy and precision with a relatively minimum degree uncertainty providing the master test in use gauge remains accurate and is checked and re-certified on a scheduled periodicity. Using the comparator can identify gauges that are consistently reading high or low (non-random) and the error remains consistent. SPI assemblies showing significantly high random inaccuracies should be replaced.

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Most good quality analog (mechanical) SPI have a factory stated accuracy of between 1.0-2.0 % of the full-scale (F.S.). These gauges are not capable of being physically adjusted for inaccuracies. Digital SPI's are generally more accurate than analog indicators (often .05-1.0% F.S.). SPI's that have repeatable minor inaccuracies can be compensated for. For this reason, an accurate 0-5000 psig digital pressure gauge like the Dwyer® indicator having a stated accuracy of 0.25% F.S. will provide a reasonably low degree of uncertainty when comparing SPI's. Actual allowable inaccuracy varies with organizations.

As a reference, the EU accuracy requirement for SPI being certified to meet EN-250:2014 is as follows using a 5% allowable error.	
+/- 217 psig for 4350 psig	300 bar
+/- 145 psig for 2900-1450 psig	200 bar 100 bar
+/- 73 psig for 725 - psig	50 bar

SPI Assembly Maintenance - Daily Prior to Use:

STEP 1

Ensure the Dwyer® gauge is within its required re-certification date.
Inspect the hose for obvious signs of damage /and deterioration in the form of bulges, outer cover cracking and fitting damage. Replace the HP hose if any damage is found.

STEP 2

Ensure all ports are plugged.

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STEP 3

Ensure the Yoke/DIN assembly is capped to prevent contamination and the vent valve is shut.

STEP 4

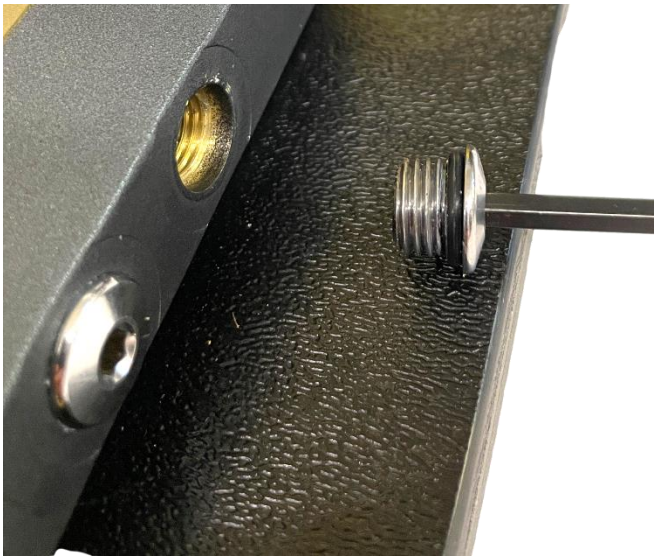
Turn on the digital test gauge to check for proper on off and zero.

SPI Assembly Maintenance - Annually

STEP 1

At least once a year visually inspect the 7/16" port plug O-rings for deterioration and damage. Replace any O-rings that fail visual inspection. All O-rings used are standard 90D Buna-N.

Dive Lab maintains inventory of all required O-rings.



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STEP 2

Inspect the DIN/Yoke O-ring for damage and deterioration.

STEP 3

Remove the digital test gauge from the SPI manifold SS adapter and send off for re-certification.

Dive Lab performs gauge certifications. Contact us at divelab@divelab.com

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Comparator Set Up

One to six SPI assemblies can be compared at the same time. Typically the most common SCUBA cylinders have a rated supply pressure up to 3000 psig (207 bar) with some going as high as 4350 psig (300 bar). Most SPG hoses are rated for a maximum normal working pressure of 4500 psig (300Bar). Comparative testing of SPI units is limited to the SPI maximum working pressure. When testing SPI assemblies, they only require comparison to the maximum pressure of the cylinders in use.

STEP 1

On the Yoke / DIN assembly open the assembly vent by rotating the knob 1/2 to one turns counterclockwise. Attach each SPI gauge assembly to the manifold via the 7/16" port and lightly tighten using the appropriate open-end wrench.

STEP 2

Inspect the cylinder supply valve mating surface for obvious signs of damage contamination. Check shut the Yoke/DIN vent valve.

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STEP 3

Attach the air supply to the Yoke /DIN supply as appropriate. Note: The maximum indicator pressure is achievable by the pressure source. Max pressure is 4500 psi.

STEP 4

After the digital pressure gauge is in the on position, press and hold the zero button until the gauge reads zero. Note: additional information on operation of the digital gauge is available at the end of this document.

STEP 5

Attach the SPI gauges and lightly snug with the appropriate wrench, usually ½” or 9/16”.

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Exercising Gauges

NOTICE

Prior to documenting the actual pressure indicator values comparison, the gauges should be "slowly" exercised (8-10 seconds) by pressurizing and depressurizing the assemblies 2-3 times. This is done by simple "opening slightly the cylinder supply valve 1/8-1/4 turn. The limited flow will allow pressurizing slowly. Use the SPI manifold vent valve to bring the down to the desired pressure. This same procedure will be used when comparing pressure indicators.

Checking Multiple Gauges at a Time

There are several ways to check multiple gauges at once. Because of the readout size and increments of most analog gauges, one of the most accurate way to check multiple SPI is to slowly pressurize the SPI stopping when the first and lowest reading SPG gauge reaches 500 psig or the desired test pressure. Document the test gauge reading on the gauge test sheet. Another way is to bring the test pressure as indicated on the master gauge to an exact pressure and then compare to the unit under test.

Comparing SPG Gauges

STEP 1

Ensure the Yoke/DIN assembly vent valve is open, then document the zero reading on each gauge being compared. The SPI gauges should read zero. Document on the gauge comparison sheets.

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NOTICE

Dive Lab recommends documenting readings at a minimum of 500 psig increments. Users bound by industry or governmental agencies may require other comparison requirements.

STEP 2

After the SPI units under test have been cycled two to three times. Shut the vent and slowly pressurize the SPI gauges to 500 psig (within 5 psi) as read on each SPG gauge. This may require back and forth on the supply and vent valve to obtain each reading. Document the readings on the documentation test sheets.

STEP 3

After testing the first increment, slowly pressurize to 1000 psig as read on the lowest SPI gauge/s.

STEP 4

Continue to each test pressure increment documenting readings on the test sheet. Once the highest required pressure has been documented , slowly reverse the comparison check by rechecking each gauge in ascending (decreasing) pressure in 500 psig increments finally at zero pressure.

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EGS Submersible Pressure Indicator Comparison

Equipment Used to Test				
Manufacturer/Model	Serial Number	Range	Stated Accuracy %	Date Last Calibrated

Equipment Under Test			
Manufacturer/Model	Serial Number	Range	Stated Accuracy

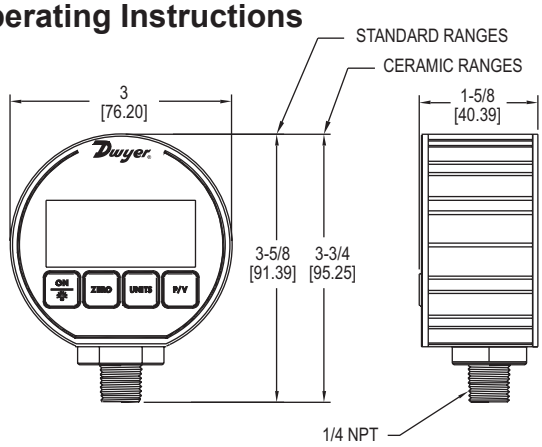
Device Under Test Reding	Master Gauge Reading DOWN ↓	Master Gauge Reading UP ↑
0		
500		
1,000		
1,500		
2,000		
2,500		
3,000		
3,500		
4,000		
4,500		
5,000		

Remarks: if applicable	

Technician's Name:	Date:

Series DPG-100 Digital Pressure Gage

Specifications - Installation and Operating Instructions



The **SERIES DPG-100** Digital Pressure Gage has a precise ±0.25% full scale accuracy. The 4 digit digital display will reduce the potential for errors in readings by eliminating parallax error commonly produced with analog gages.

The DPG-100 is packaged in a durable extruded aluminum case designed to meet NEMA 4/4X. The unit is battery powered and has an auto-shut off to conserve battery life. A four button key pad allows easy access to features without the need to work through complex menus or difficult key combinations. These features include backlight, peak and valley, auto zero and conversion of the pressure units. Readings may be converted to various engineering units. See reverse page for available units.

DPG Quick Start Button Operation
For complete detailed instructions on the four button operation see the Operation Chart provided on back.

ON

On/Backlight: Push to turn on; Press again for backlight. Press and hold for 5 seconds to turn unit off.

ZERO

Zero: Zeros the display - Press the ZERO button until dashes "---" are seen on the LCD, then release the button. If after pressing zero the display does not re-zero, the unit is no longer meeting specified accuracy and should be sent back to the factory for calibration. Do not use the zero button when pressure is applied.

UNIT

Units: Scroll (see next page for Model/Range Chart).

P/V

P/V: Peak recorded reading retrieved by initial push of button; push again retrieves the valley or lowest value recorded.

INSTALLATION
When installing gage always use 1″ hex at the base of the housing to tighten the gage to a mating fitting. **Do not apply wrench to housing.**

MAINTENANCE
A "LOW BAT" descriptor indication will appear on the display when batteries need to be replaced.

Battery Replacement: Remove the three screws on backplate. Lift backplate off by hand. Replace batteries per polarity indicators. To reassemble, ensure O-ring seats into housing evenly and press until seated completely. Replace screws.

⚠ WARNING Substitution of components may impair intrinsic safety. Batteries must be changed in a non-hazardous location only. DO NOT mix batteries from different manufacturers. DO NOT mix old batteries with new batteries. Use 1.5 volt AAA alkaline batteries Duracell® MN2400.

⚠ WARNING Enclosure parts are constructed of plastic. When cleaning the exterior surfaces use a damp cloth to avoid electrostatic sparking.

⚠ WARNING Enclosure parts are constructed of aluminum. Enclosure must be protected from mechanical friction and impact with iron/steel to prevent ignition capable sparks.

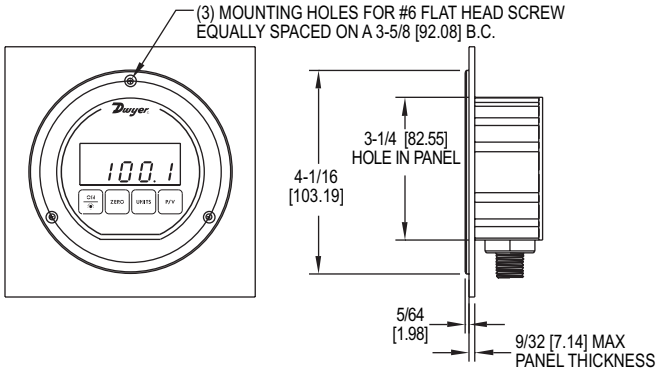
SPECIFICATIONS

Service: Liquids and combustible compatible gases (for FM listings see agency approvals below).
Wetted Materials: Type 316L SS.
Housing Materials: Black polycarbonate front & back cover, anodized aluminum extruded housing with recessed grooves, polycarbonate overlay, Buna-N O-rings, 316L SS sensor construction.
Accuracy: 0.25% full scale; Ceramic Ranges: 0.5% full scale; ±1 least significant digit @ 70°F (21°C). (Includes linearity, hysteresis, repeatability).
Pressure Limit: 2x pressure range for models ≤1000 psi;5000 psi for 3000 psi range;7500 psi for 5000 psi range.
Enclosure Rating: Designed to meet NEMA 4/4X (IP65).
Temperature Limits: 0 to130°F (-18 to 55°C).
Thermal Effect: Between 70 to 130°F is 0.016%/F; Between 32 to 70°F is 0.026%/F; Between 10 to 32°Fis 0.09%/F; Between 0 to 10°Fis 0.50%/F.
Size: 3.00″ OD x 1.90 deep (max).
Process Connection: 1/4″ male NPT.
Weight: 8.84 oz (275 g).
Display: 4 digit (.425 H x .234W digits).
Sample Rate: 2 sec.
Power Requirements: (2) AAA alkaline batteries, included, user replaceable.
Battery Life: 2000 hours typical; low battery indicator (60 hours in continuous use).
Auto Shut-Off: Gage: 60 minute auto shut-off. Auto shut-off may be disengaged; Backlight: 2 minute auto shut-off.
Agency Approvals: FM, CE.

*__Note__: Gages with ceramic sensor are not CE and FM approved.

WARNING: DO NOT pressurize DPG over maximum allowable pressure limits. Extreme damage can occur if limits are exceeded (see Pressure Limit under Specifications). An overflow "OFL" designator will flash to acknowledge that the gage's pressure range has been exceeded.

PANEL MOUNT OPTION
Drill a 3-1/4″ (82.55) diameter hole in a panel, locate three mounting holes for a #6 screw 120° apart on a 3-58″ (92.08) bolt circle.



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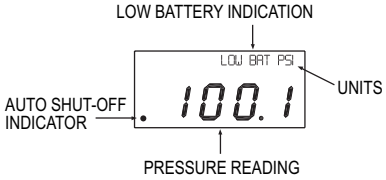
DPG-100 DISPLAY



DPG Button Operation		
Button	**Operation**	**Action**
ON	Turn Unit On Turn Backlight On (Auto Shut-Off: 2 Min) Turn Backlight Off Turn Unit Off	Press and hold ON button While gage is on press ON button While backlight is on press ON button While gage is on, press and hold ON button 5 seconds for unit to turn off.
ZERO	Zero Gage	With no pressure applied to the gage, press the ZERO button until dashes "---" are seen on the LCD, then release If gage will not zero, then gage is no longer meeting specified accuracy and should be sent back to the factory for recalibration **Note:** Gage is not to be zeroed while pressure is applied
UNIT	Unit Selection	Press UNIT button to change units on gage (Not all units are available for each range, please refer to model/range chart located below for available units)
P/V	View Peak View Valley Reset Peak & Valley Exit Peak & Valley	Press P/V button to read peak (highest pressure) measurement Press P/V button again to read valley (lowest pressure) measurement Press and hold P/V button to reset peak and valley Press ON button to exit peak/valley
ON plus P/V	Disengage Auto Shut-Off	Auto shut-off will turn off an idle gage after 60 minutes. To disengage auto shut-off, press and hold ON button, then press and hold P/V button. A decimal will blink in the lower left hand corner of the display to indicate the auto-shut off is turned off. To turn on auto shut-off, repeat above procedure until decimal point stops blinking

Model/Range Chart											
		Pressure Ranges									
Model	**Range psi**	**kg/cm²**	**bar**	**in Hg**	**ft wc**	**kPa**	**oz/in²**	**in wc**	**mbar**	**cm wc**	**mm Hg**
DPG-100*	-14.70-0	-1.033	-1.013	-29.93	-33.94	-101.4	-235.2	-407.3	-1013	-1034	-760.7
DPG-102	15.00	1.055	1.034	30.54	34.61	103.4	240	415.2	1034	1055	775.7
DPG-103	30.00	2.109	2.069	61.08	69.21	206.9	480	830.4	2069	2109	1551
DPG-104	50.00	3.515	3.448	101.8	115.4	344.8	800	1384	3448	3515	2586
DPG-105	100.0	7.03	6.895	203.6	230.7	689.5	1600	2768	6895	7031	5172
DPG-106	200.0	14.06	13.79	407.2	461.4	1379	3200	5536			
DPG-107	300.0	21.09	20.69	610.8	692.1	2069	4800	8304			
DPG-108	500.0	35.15	34.48	1018	1154	3448	8000				
DPG-109	1000	70.3	68.98	2036	2307	6895					
DPG-110	3000	210.9	206.9	6108	6921						
DPG-111*	5000	351.5	344.8								

Compound Ranges available: DPG-120* Range: 30˝ Hg-0-15 psi; DPG-121* Range: 30˝ Hg-0-30 psi; DPG-122* Range: 30˝ Hg-0-45 psi; DPG-123*: Range 30˝ Hg-0-60 psi; DPG-124*: 30˝ Hg-0-100 psi.

*Optional ceramic sensor available. Add "C" to the range (Ex. DPG-100C).

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