



**SERIES 3000 SGT PHOTOHELIC®  
DIFFERENTIAL PRESSURE SWITCH/GAGE TRANSMITTER**

**Specifications - Installation and Operating Instructions**

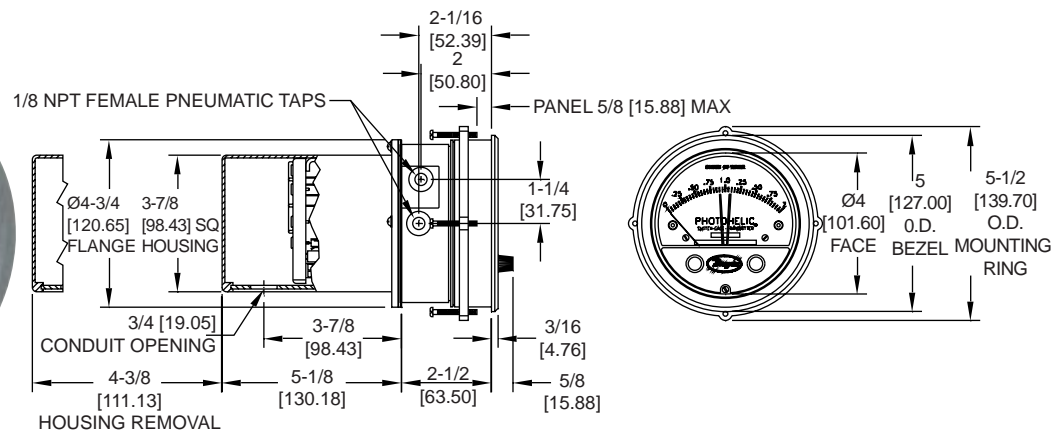


Fig. A

The PHOTOHELIC® Series 3000 SGT is a versatile 3-in-1 instrument combining a time-proven Magnehelic® differential pressure gage, low/high limit pressure switches and a 4-20 mA pressure transmitter. It is designed to measure and control positive, negative or differential pressure of air or other non-combustible, non-corrosive gases. Gage reading is unaffected by switch or transmitter operation. Switch set points are easily adjusted with knobs located on gage face. Applied pressure and switch set points are fully visible at all times. Deadband is one pointer width, less than 1% of full scale. Each set point controls a DPDT relay and both can be interlocked to provide variable deadband control. The 2-wire transmitter operates independently, driven by a separate external 10-35 VDC power supply. Separate zero and span potentiometers are provided inside the rear electronics package for easy field adjustment.

**PHYSICAL DATA**

- Ambient Temperature Range:** 20 to 120°F (-6.7 to 49°C)
- Maximum Pressure:** Model No's. 3020SGT & 3030SGT — 11psi (75 kPa); all other units 5psi (35 kPa).
- Accuracy:** ±2% of full scale at 70°F (21.1°C) (3% on -0).
- Pressure Connections:** 1/8" NPT(F)
- Case Finish:** Baked dark gray epoxy enamel
- Conduit Opening:** 3/4"
- Standard Accessories:** (2) 3/16" tubing to 1/8" NPT brass adapters for rubber or vinyl tubing, (1) mounting ring, (1) snap ring, (4) 6-32 x 2" mounting screws, instructions
- Compatibility:** Use only with air or other non-combustible, non-corrosive gases
- Weight:** 4lbs., 12oz. (2.15 kg)

**ELECTRICAL SPECIFICATIONS (Switches)**

- Power Supply:** 117 VAC
- Current Consumption:** 5 watts average
- Contact Rating:** 10A @ 24 VDC or 120 VAC, 6A @ 240 VAC.

**ELECTRICAL SPECIFICATIONS (Transmitter)**

- Power Supply:** 10.0 to 35 VDC
- Output Signal:** 4-20 mA DC, 2-wire (limited at 38 mA)
- Loop Resistance:** 0-1250 ohms
- Current Consumption:** 38 mA DC, maximum
- Span and Zero Adjustment:** Multi-turn potentiometers, internally accessible
- Thermal Errors:** ±1% per 50°F typical
- Warm-up Time:** 10 minutes

**INSTALLATION**

- 1. Location:** Select a clean, dry, vibration-free location where ambient temperatures will be between 20 and 120°F (-6.7 and 49°C). Tubing supplying pressure to the instrument can be practically any length but long runs will increase response time slightly.
- 2. Position:** The PHOTOHELIC® SGT is factory calibrated for use with scale in a vertical plane. Operation at other angles may affect accuracy and/or require zero adjustment. Most models can be specially calibrated at the factory for other positions if specified at time of ordering. Ranges below 1" w.c. must be used only with scale vertical.
- 3. Mounting:** Normal mounting is flush or through panel as shown in Fig. B. Allow 4-3/8" space behind the unit for electrical enclosure removal. Make 4-3/4" diameter hole in panel. When installing multiple units, it may be preferred to obtain a Model 730E, 120mm chassis punch as manufactured by Greenlee Tool Co. and available from your machine tool distributor.

Insert PHOTOHELIC® unit from front of panel, slip the mounting ring over the case from rear and seat the snap ring in its groove. Thread the (4) 6-32x2" machine screws into mounting ring, back it against snap ring and tighten screws to back of panel. An alternative to flush mounting is the optional A-371 Surface Mounting Bracket. Unit is mounted in this bracket as described above and bracket is then surface mounted. Contact factory for details.

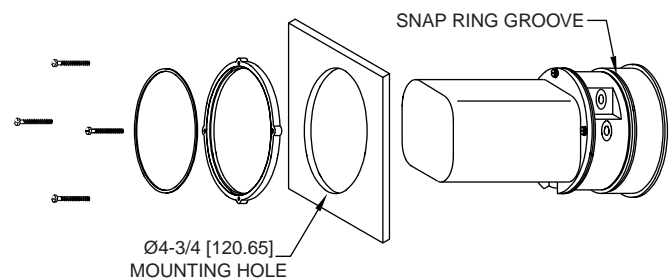


Fig. B

4. **Zeroing & Pneumatic Connections:** After unit is installed in its final mounting position, use the screw at bottom of front cover to adjust pointer for exact zero reading. This must be done with both pressure ports open and vented to atmosphere.

(A) For positive pressure, connect tubing to HIGH PRESSURE port and vent LOW PRESSURE port to atmosphere.

(B) For negative pressure (vacuum), connect tubing to LOW PRESSURE port and vent HIGH PRESSURE port to atmosphere.

When either port will be left open to atmosphere, we suggest installation of optional A-331 Filter Vent Plug to keep gage interior clean.

(C) For differential pressure, connect higher pressure to HIGH PRESSURE port and lower pressure to LOW PRESSURE PORT.

NOTE: If the PHOTOHELIC® SGT is over-pressured beyond its full scale range, pointer could jump from full scale back to zero and remain there until the excess pressure condition is relieved. Users should be aware that this condition would cause a false indication of zero pressure and subsequently affect set-points and transmitter output signal.

### SWITCH/GAGE WIRING CONNECTIONS

To make electrical connections, remove the (3) cover screws and slide cover off. All wiring should be fed through flexible conduit attached to conduit opening at bottom of electrical package. Conduit should be attached to the panel of other suitable support to avoid excess strain on the instrument. See Fig. C.

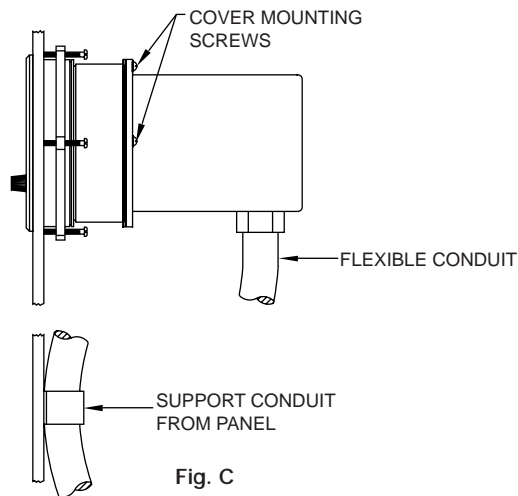


Fig. C

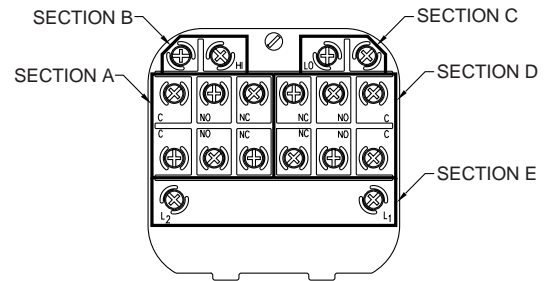
#### 1. Low/High Set-Point Wiring Connections

The rear terminal board contains connections for low and high set-points, holding coil circuits and line power supply. Transmitter connections are located behind this terminal board. See TRANSMITTER WIRING CONNECTIONS for complete information.

Section A contains DPDT connections for the right or high set-point and Section D contains identical connections for the left or low set-point.

Terminals in Section B are for control of the holding coil circuit for the right, high set-point and Section C contains identical connections for the left, low set-point. These holding coil circuits are typically used to allow latching set-points with manual reset or for adjustable deadband operation with one set-point wired to reset the other. See paragraphs 3 and 4 for details. Do Not Connect Line Current to Sections B or C.

Section E (L1 and L2) contains power supply connections for the control unit transformer primary. The transformer in turn supplies reduced voltage power for the LED, phototransistor, amplifier unit, load relay pull-in and holding coils. Connections must always be made to this section for the unit to operate. Standard units require 117 VAC but options are available for other power sources. See label on terminal board for correct voltage and circuit style.



CAUTION: Do not apply electrical current to terminals in Sections B and C.

Fig. D

Separate Ground Wire attachment is provided for by a No. 6-32 screw on the mounting bracket near the conduit opening.

Single Set-Point instruments are furnished with the right or high set-point components and circuitry in place. These are connected to Sections A and B of the terminal board. The left or low set-point components are omitted.

2. **Circuit Style:** The PHOTOHELIC® is available with several factory installed optional internal circuits. They are identified as to style by a label shown in Fig. E. This label is mounted prominently on the terminal board of each instrument. The letter H denotes a circuit in which the relay can be made to latch or remain energized after pressure increase to its set-point.

The letter L denotes a circuit in which the relay can be made to latch or remain de-energized after pressure decreases to its set-point. Two letters are required to fully identify a dual set-point. Two letters are required to fully identify a dual set-point unit. Thus, circuit style HH, which is standard, is a dual set-point circuit which has provisions for latching on pressure increase to either set-point. Single relay units are identified by the letters SR followed by H for the standard unit or L for the special low latch unit. Units for use with other than standard 117 VAC will be so indicated on the label.

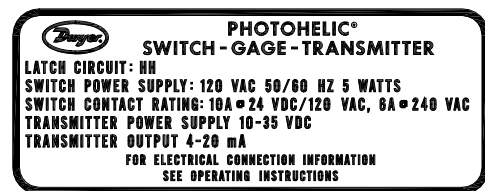
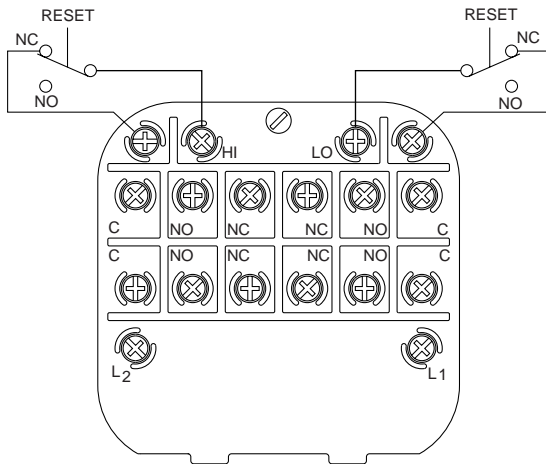


Fig. E

3. **Dual Set Point Automatic Reset:** Circuit Style HH is used for simple on-off switching applications. To place in service, connect load circuits to the appropriate terminals in Section A (Fig. D) for the right set-point and Section D for the left set-point. Note that the N.O. contacts are open when the gage pressure pointer is to the left of the set-pointers. No connections are necessary in Sections B and C. Make external ground connections as required and connect power to Section E for the control unit. To use circuit style LL for automatic reset, a jumper wire must be installed between the upper and lower terminals in Sections B and/or C.

**4. Dual Set Point Manual Reset:** Circuit Style HH may also be used for manual reset applications where it is desired to have maintained contact on either relay following pressure increase above its set-point. Load or signal connections are made to the appropriate terminals in Sections A and D (as in paragraph 3 above). Connect terminals in Sections B and C through normally closed switches or push buttons as shown in Fig. F. Use of "dry-circuit" type switches such as Dwyer Part No. A-601 with paladium, gold, etc. or rotary wiping action type contacts is recommended. Make external ground connections as required and connect power to Section E for the control unit.

Circuit style LL is used for manual reset applications which require that contact be maintained following pressure decrease below the set-point. Load connections are made to the appropriate terminals in Sections A and D. A normally open type manual reset switch such as Dwyer Part No. A-601 is connected to the terminals in Sections B and C. The circuit must be reset or "armed" by momentarily closing the switch while the black pointer is to the right of the set-point. From that point on, the circuit will latch on pressure decrease below the set-point and remain latched on pressure increase until manually reset with the optional switch.

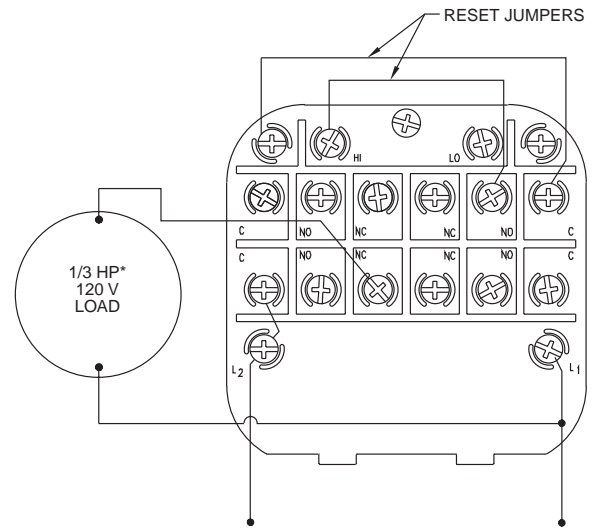


**CAUTION:** Do not apply electrical current to terminals in Sections B and C.  
Manual Reset with Circuit HH

Fig. F

**5. Dual Set Point Automatic and Manual Reset Combinations:** Circuit style HH may be used with either set-point wired and operating with automatic reset as described in paragraph 3 above and other set-point wired and operating with manual reset as described in paragraph 4.

**6. High Low Limit Control – Dual Set-Point:** Circuit Style HH may be used to control fans, dampers, pumps, etc., between the set-points of a PHOTOHELIC®. To accomplish this, use one set-point relay to reset the other as shown in the wiring diagram Fig. G. In this typical application, the load (for instance a fan) would be connected to the N.C. contacts of the right set-point relay, Section A (Fig. D). On pressure rise to the right set-point, its relay would pull in and hold even though pressure might then fall below that set-point. If the pressure continued to fall to the left set-point, its relay would automatically be DE-ENERGIZED, returned to its normal position and in so doing, open the holding coil circuit from Section B (Fig. D). The right set-point relay would thus be reset and the cycle could repeat.



\*Note: For larger motors, use the Photohelic® in a maintained contact, 120 Volt Control or Push Button Circuit of the motor starter.

Fig. G

**7. Dual Set-Point Special Purpose Circuits:** Circuit Style LL may be used where manual reset following maintained contact on pressure decrease to either set-point is desired. Circuit Styles HL and LH are combination units. For special combinations of features, special units, and detailed instructions regarding their use, consult the factory.

**8. Single Set-Point PHOTOHELIC®:** The single set-point PHOTOHELIC® is furnished with the right set-point only. Terminals in Sections A and B (Fig. D) are connected to this relay. Circuit Style SRH is wired for automatic reset as in paragraph 3 above. Manual reset is accomplished by adding a normally closed reset switch or push button to the circuit as described in paragraph 4 above.

**9. Single Set-Point Special:** Manual reset after actuation on falling pressure can be obtained by using Circuit Style SRL. Consult the factory for special units and detailed instructions regarding their use.

**10. Placing in Service:** In normal operation each relay is de-energized when the pressure applied to the instrument is below its set-point. Special low-latching units will ordinarily have to be reset before placing on the line in normal operation.

**11. Failure Mode:** The PHOTOHELIC® circuit design provides certain protection in the event of a loss of pressure or electrical power. In either case, both relays will de-energize, returning to their normal "zero pressure" state. The exceptions to this are models with center zero ranges. Because the relays on all standard models are always energized when the indicating (black) pointer is to the right of their respective set points, the relay action on loss of pressure will depend on set-point position, since either of them could be located to the left of zero. As an example; if the left pointer were set at -2 in. w.c. and negative pressure was -3 in. w.c., a loss of that pressure would allow the black pointer to return to the center and thus cause the low set-point relay to energize.

If the LED should burn out, only the left-low relay will de-energize. The right-high relay will react as if pressure were above its set-point and will remain energized even though pressure might be below that setting. In this situation, only termination of electrical power will allow the right-high relay to de-energize.

## TRANSMITTER WIRING CONNECTIONS

Electrical connections for the two-wire, 4-20 mA transmitter circuit are made to the small terminal block mounted behind the larger switch/gage terminal board. Wiring should enter this area through the 5/8" dia. hole at bottom of electronics chassis. See Fig. H.

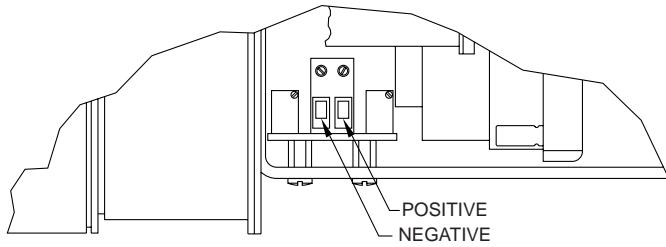


Fig. H

The transmitter function of the PHOTOHELIC® SGT operates independent of the low/high switch set-points and requires a separate external power supply delivering 10.0 to 35 VDC with minimum current capability of 40mA to power its control loop. Refer to Fig. J for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistance ( $R_L$ ) values for various power supply voltages is defined by the formula and graph in Fig. K. Shielded two wire cable is recommended for control loop wiring and the negative side of the loop can be grounded if proffered. The receiver can be connected in either the positive or negative side of the loop. If the polarity of the transmitter or receiver is inadvertently reversed, the loop will not function properly but no damage will be done to the transmitter.

The maximum wire length between the transmitter and receiver is a function of wire size and receiver resistance. Connecting wires should not contribute more than 10% of the receiver resistance to total current loop resistance. Where long runs (over 1,000 feet) are required, select receivers with higher resistances to minimize size and thus cost of wiring. For runs up to 100 feet, wire as small as 24 AWG can be used.

NOTE: RECEIVER MAY BE IN SERIES WITH  
+ OR - LEG OF CONTROL LOOP

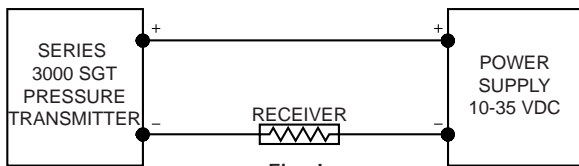


Fig. J

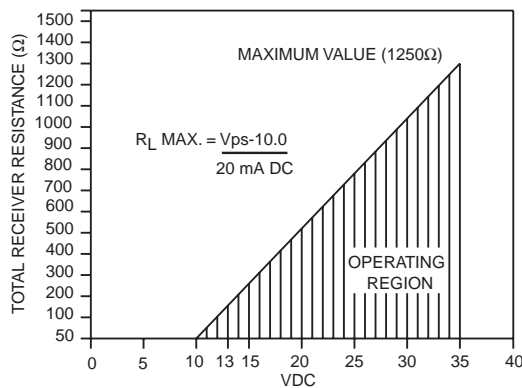


Fig. K

## Voltage Input

The PHOTOHELIC® SGT Transmitter can easily be adapted for receivers requiring 1-5 VDC input. Insert a 250 ohm, 1/2 watt resistor in series with the current loop but parallel to the receiver input. Locate this resistor as close as possible to the receiver input. Because resistor accuracy directly influences output signal accuracy, we recommend use of a precision  $\pm 0.1\%$  tolerance resistor to minimize this effect.

## Transmitter Output Calibration

Each unit is factory calibrated to produce 4mA DC of loop current at zero pressure and 20mA DC at full scale. To check calibration use the following procedure.

1. Connect a controllable source of pressure to the high pressure port and leave the low pressure port vented to atmosphere.
2. With transmitter connected to its companion receiver and power supply, insert an accurate millimeter ranged to approximately 30 mA in series with the current loop.
3. Apply electrical power to the system and check for proper operation. Slowly apply pressure and confirm that loop current increases above the 4 mA zero pressure value.
4. Span and zero controls are located behind the terminal board as shown in Fig. L. Apply pressure until gage reads full scale and adjust span control for 20 mA loop current.

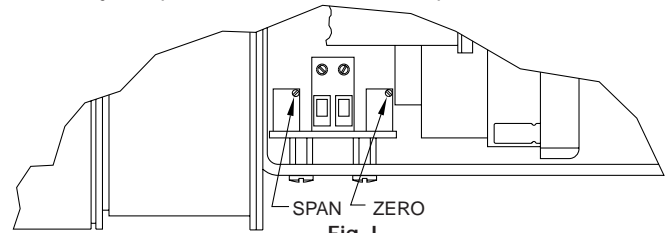


Fig. L

5. Relieve pressure and adjust the zero control for a reading of 4 mA loop current.
6. Zero and span controls are slightly interactive so steps 4 and 5 should be repeated until outputs are consistently 4 and 20mA, respectively.
7. Remove the milliammeter from the current loop, make connections to system pressure sources and place unit in service.

## Multiple Receiver Installation

An advantage of the standard 4-20 mA DC output signal used in Series 3000 SGT switch/gage/transmitters is the compatibility with a wide range of receivers. Devices such as the A-701 Digital Readout, a chart recorder and other process control equipment can all be operated simultaneously. It is only necessary that all devices be designed for a standard 4-20 mA DC input, the proper polarity of input connections be observed and the combined receiver resistances not exceed the maximum for the current loop. If any receiver indicates a negative or down-scale reading, the signal input leads are reversed.

## Maintenance

After final installation of the PHOTOHELIC® Switch/gage/transmitter no routine maintenance is necessary. A periodic check of calibration is recommended following the procedure under TRANSMITTER OUTPUT CALIBRATION. Otherwise, these units are not field repairable and should be returned, freight prepaid, to the following address if service is necessary. Be sure to include a brief description of the problem plus any relative application information available.

Dwyer Instruments, Inc.  
Attn: Repair Department  
102 Highway 212  
Michigan City, IN 46360