Dwyer

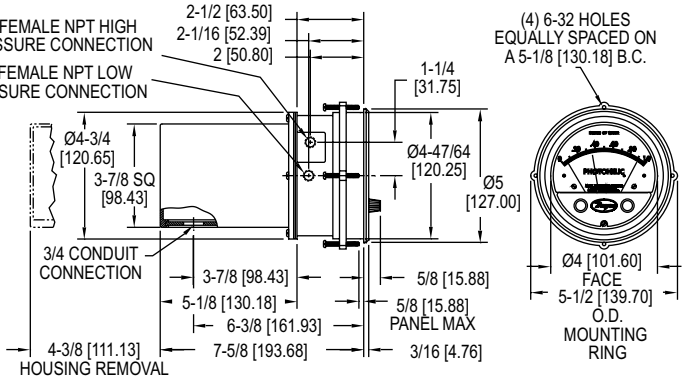
SERIES A3000

PHOTOHELIC® PRESSURE SWITCH/GAGE

3-in-1 Indicating Gage, Lo-Limit and Hi-Limit Control

CALIBRATION SERVICES AVAILABLE

Set points are instantly adjusted with front knobs



The **Series A3000 Photohelic® Pressure Switch/Gage** functions as versatile, highly repeatable pressure switches combined with a precise pressure gage employing the time-proven Magnehelic® gage design. The Photohelic® switch/gage measures and controls positive, negative or differential pressures of air and compatible gases. Standard models are rated to 25 psig (1.7 bar) with options to 35 (2.4) or 80 (5.5 bar) psig. Two phototransistor actuated, DPDT relays are included for low/high limit control. Easy to adjust set point indicators are controlled by knobs located on the gage face. Individual set point deadband is one pointer width - less than 1% of full-scale. Set points can be interlocked to provide variable deadband - ideal for control of fans, dampers, etc. Gage reading is continuous and unaffected by switch operation, even during loss of electrical power. Choose from full-scale pressure ranges from a low 0-.25 in (0-6 mm) w.c. up to 30 psi (21 bar).

BENEFITS/FEATURES

- 3-in-1 instrument allows the reduction of several instruments with one product, saving inventory, installation time and money
- Patented design and 1% full-scale dead band provides quick response to pressure changes means no delay in switching and chatter-free operation
- A wide range of models that can meet pressure measurement specifications from low to very high

APPLICATIONS

- Air conditioning systems
- Clean rooms
- Fume exhaust systems

SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±2% of FS at 70°F (21.1°C). ±3% on -0 and ±4% on -00 models.
Pressure Limits: -20″ Hg to 25 psig (-0.677 to 1.72 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar).
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C). Low temperature option available.
Process Connections: 1/8″ female NPT.
Size: 4″ (101.6 mm) dial face, 5″ (127 mm) OD x 8-1/4″ (209.55 mm).
Weight: 4 lb (1.81 kg).

SWITCH SPECIFICATIONS

Switch Type: Each set point has 2 form C relays (DPDT).
Repeatability: ±1% of FS.
Electrical Rating: 10 A @ 28 VDC, 10 A @ 120, 240 VAC.
Electrical Connections: Screw terminals. Use 167°F (75°C) copper conductors only.
Power Requirements: 120 VAC, 50/60 Hz; 240 VAC and 24 VAC power optional.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Adjustable knobs on face.
Compliance: CE, CSA, UL.

Dwyer

SERIES A3000

PHOTOHELIC® PRESSURE SWITCH/GAGE

3-in-1 Indicating Gage, Lo-Limit and Hi-Limit Control

CALIBRATION SERVICES AVAILABLE

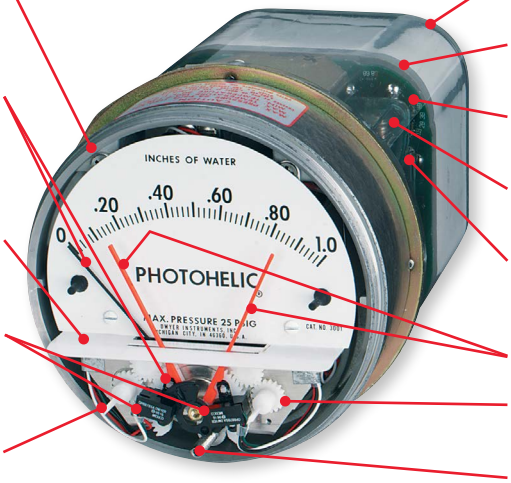
Bezel and front cover (with set point knobs and zero adjustment screw) removed to expose Photohelic® gage set point mechanism. Cover is clear polycarbonate plastic.

Gage pointer and light shutter are mounted on helix and balancing counterweight. Shutter passes through slot in optical limit switch to expose phototransistors to integral infrared light source or mask them depending on applied pressure.

Light shield effectively protects phototransistors from strong outside light sources yet allows free pointer movement. It also gives interior a clean "finished" look.

Optical limit switches are used for reliability and long service life. Attached directly to set pointers, they are individually aligned to assure precise switching accuracy.

Semi-Flexible drive shaft connects to set point knobs.



Plastic enclosure protects electronic components and electrical connections.

Polycarbonate connection or terminal board is self-extinguishing.

Glass-epoxy printed circuit boards for durability and performance.

Load relays are DPDT with latching feature for maximum application versatility.

Electronics are designed to operate on 50/60 Hz, 120 volt current with 10% over or under voltage. Special units for other voltages are available.

Switch set pointers show switch settings at all times.

Spring loaded friction clutch prevents operator damage of set point mechanism.

Zero adjustment screw connects to screw in cover to adjust zero pressure reading.

MODEL CHART

Model	Range, in w.c.
A3000-00	0-.25
A3000-0	0-.50
A3001	0-1.0
A3002	0-2.0
A3003	0-3.0
A3004	0-4.0
A3005	0-5.0
A3006	0-6.0
A3008	0-8.0
A3010	0-10
A3015	0-15
A3020	0-20
A3025	0-25
A3030	0-30
A3040	0-40
A3050	0-50
A3060	0-60
A3080	0-80
A3100	0-100
A3150	0-150
Bi-Directional Range	
A3000-00N	.05-.20

Zero Center Ranges	
Model	Range, in w.c.
A3300-0	.25-0-.25
A3301	.5-0-.5
A3302	1-0-1
A3304	2-0-2
A3310	5-0-5
A3320	10-0-10
A3330	15-0-15

Model	Range, in w.c. /Air Velocity, F.P.M.
A3000-00AV	0-.25/300-2000
A3000-0AV	0-.50/500-2800
A3001AV	0-1.0/500-4000
A3002AV	0-2.0/1000-5600
A3010AV	0-10/2000-12500
Pitot tube required	

Model	Range, mm w.c.
A3000-6MM	0-6
A3000-10MM	0-10
A3000-25MM	0-25
A3000-50MM	0-50
A3000-80MM	0-80
A3000-100MM	0-100
Zero Center	
A3300-20MM	10-0-10
A3300-30MM	15-0-15

Model	Range, Pascals
A3000-60PA	0-60
A3000-125PA	0-125
A3000-250PA	0-250
A3000-500PA	0-500
A3000-750PA	0-750

Zero Center Ranges	
Model	Range, Pa
A3300-250PA	125-0-125
A3300-500PA	250-0-250

Model	Range, kPa
A3000-1KPA	0-1
A3000-1.5KPA	0-1.5
A3000-2KPA	0-2
A3000-3KPA	0-3
A3000-4KPA	0-4
A3000-5KPA	0-5
A3000-8KPA	0-8
A3000-10KPA	0-10
A3000-15KPA	0-15
A3000-20KPA	0-20
A3000-25KPA	0-25
A3000-30KPA	0-30

Zero Center Ranges	
Model	Range, kPa
A3300-1KPA	.5-0- .5
A3300-3KPA	1.5-0-1.5

OPTIONS

To order add suffix:	Description
-HP	High pressure
-LT	Low temperature (-20°F)
-MP	Medium pressure
-NIST	NIST traceable calibration certificate
-OLS	OEM model
-RMR	Remote mounted relay
-SRH	Single relay activates on increase
-SRL	Single relay activates on decrease
-TAMP	Tamper proof knobs

ACCESSORIES

Model	Description
A-298	Flat flush mounting bracket
A-601	Manual reset switch net

Note: Special models can be built to OEM customers' specifications with scales reading in special pressure units like ounces per square inch, inches of mercury, etc. Square Root Scales reading in FPM or SCFM are also available. Custom logos and special graduations can also be included. Contact factory for minimum quantities and pricing.

Process Tubing Options: See page 453 (Gage Tubing Accessories)

Series 3000 Photohelic® Pressure Switch/Gage

Specifications - Installation and Operating Instructions

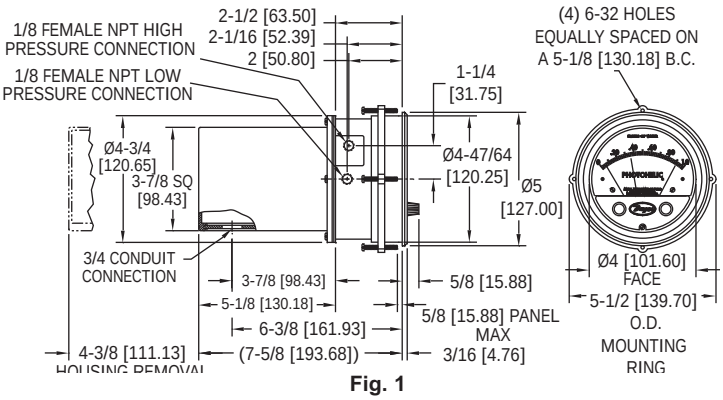


Fig. 1

The Photohelic® Switch/Gage is a very versatile, precise pressure switch combined with the time-proven Magnehelic® pressure gage. Models are available with one or two phototransistor actuated relays. Gage reading is unaffected by switch operation. Easy to adjust set points have knob controls. Applied pressure and switch set points are fully visible at all times. Deadband is one pointer width - less than 1% of full scale. Double-pole double-throw relays can be easily interlocked to provide variable deadband control. For positive, negative or differential pressure only on 3600S models. Full scale ranges available from 0-.25 in w.c. to 0-6000 psig.

PHOTOHELIC® GAGE SENSING - HOW IT WORKS

In a typical control application, the Photohelic® switch/gage controls between high and low pressure set points. When pressure changes, reaching either set point pressure, the beam from an LED to the limiting phototransistor will be cut off by the helix-driven light shield. The resulting signal change is electronically amplified to actuate its DPDT slave relay and switching occurs. Dead band between make and break is 1% of full scale or less - just enough to assure positive, chatter-free operation.

SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±2% of full scale at 70°F (21.1°C). ±3% on -0 and ±4% on -00 models.
Pressure Limits: -20″ Hg. to 25 psig (-0.677 to 1.72 bar). MP option; 35 psig (2.41 bar), HP option; 80 psig (5.52 bar). 36003S – 36010S; 150 psig (10.34 bar). 36020S and higher; 1.2 x full scale pressure.
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C); Low temperature option available.
Process Connections: 1/8″ female NPT.
Size: 4″ (101.6 mm) dial face, 5″ (127 mm) O.D. x 8-1/4″ (209.55 mm).
Weight: 4 lb (1.81 kg).

SWITCH SPECIFICATIONS

Switch Type: Each setpoint has 2 Form C relays (DPDT).
Repeatability: ±1% of full scale.
Electrical Rating: 10A @ 28 VDC, 10A @ 120, 240 VAC.
Electrical Connections: Screw terminals.
Power Requirements: 120 VAC, 50/60 Hz; 240 VAC & 24 VAC; Power optional.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Adjustable knobs on face.

INSTALLATION

1. Location

All parts of the Dwyer® Photohelic® pressure switch/gage are ruggedly constructed and will stand a moderate amount of vibration, physical shock, and handling. Normal care in handling and installation is all that is required. In cases where instrument panel vibration is severe, the panel should be a spring mounted or the amplifier-relay unit mounted remotely on a more stable surface.

Select a location where the ambient temperature will not exceed 120°F. Pneumatic pressure sensing lines may be run any necessary distance. For example, 250 foot sensing lines will not affect accuracy but will damp the reading slightly. Do not restrict lines. If pulsating pressure or vibration causes excessive pointer oscillation or relay chatter, consult factory for additional damping means.

2. Position

The Photohelic® Pressure Switch/Gage may be mounted as an integral package or the amplifier-load relay assembly and housing may be mounted remotely from the indicating gage-phototransistor unit. Extension cords with 7 pin plugs and receptacles are available from Dwyer for interconnection of the two units.

The unit may be mounted in any desired position, scale vertical or horizontal, without affecting its accuracy, but must be rezeroed if position is changed from horizontal to vertical or vice versa. The -0 and -00 models must be mounted with the scale vertical.

3. Mounting

The Photohelic® Switch/Gage is normally mounted before making electrical connections, as the electrical enclosure is independent of the mounting means and may be removed at any time.

Panel Mounting

Normal mounting is flush or through panel is shown in Fig. 2. Be sure to allow 4-3/8″ extra space behind the unit for electrical enclosure removal. Make a single 4-13/16″ diameter hole in the panel. Insert the entire Photohelic® Switch/Gage unit from the front, then slip on the mounting ring and snap ring from the rear. Seat the snap ring in its groove, back up the mounting ring against snap ring and tighten the four (4) 2″ No. 6-32 clamp screws provided. If behind panel space is critical, the amplifier-relay unit can be mounted remotely. See the Remote-Relay Mounting Instructions for details.

Through Panel Mounting

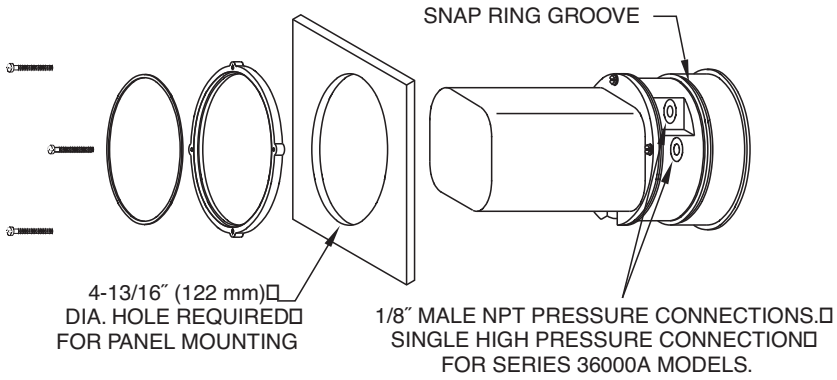


Fig. 2

Gage Mounting with Relays Remote

Where it is desirable to mount the amplifier-relay unit separate from the gage-phototransistor unit, the gage may be mounted either as shown in Fig. 2 (except less amplifier-relay portion) or surface mounted as shown in Fig. 3A. Use the layout shown in Fig. 3B to locate holes. The complete package cannot be surface mounted.

Surface Mounting

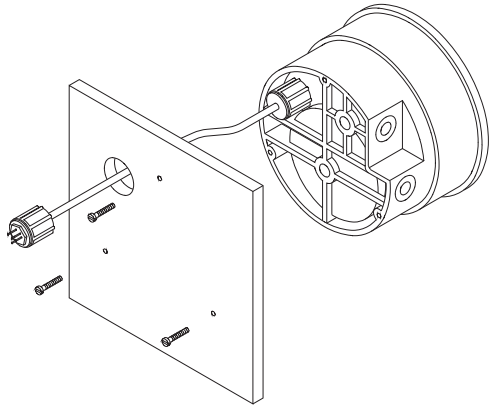


Fig. 3A

Hole Layout (Front)

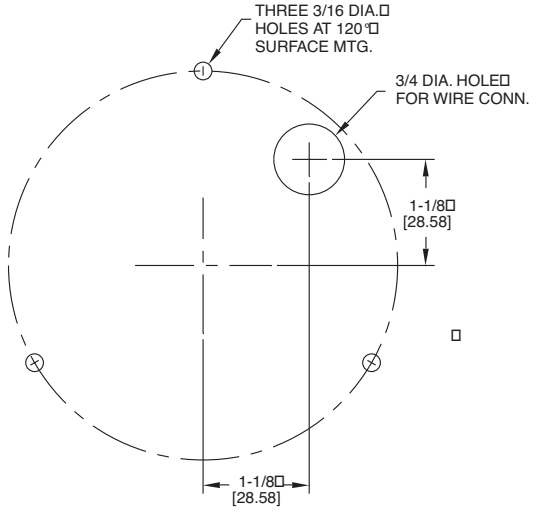


Fig. 3B

Remote Relays Mounting

The amplifier - relay unit may be mounted remotely as shown in Fig. 4A. Use the hole layout as shown in Fig. 4B for this option.

Additional mounting information for special requirements is available from the factory.

Remote Amplifier-Relay Unit

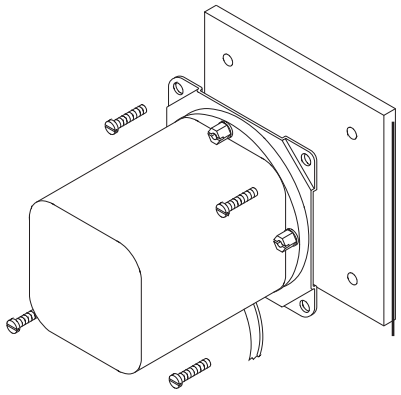


Fig. 4A

Hole Layout

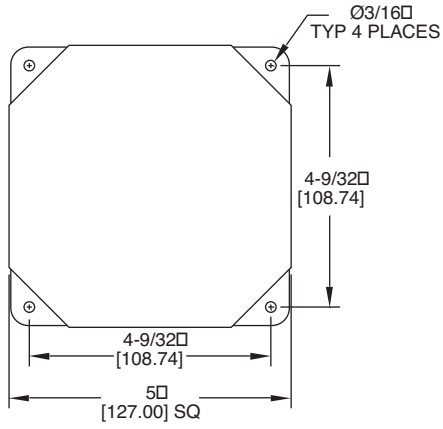


Fig. 4B

4. Pneumatic Connections & Zeroing

After installation but before making pressure connections, set the indicating pointer exactly on the zero mark, using the zero adjust screw located at the bottom of the front cover. Note that this adjustment can only be made with the high and low pressure taps both open to atmosphere.

Connect the high and low pressure taps to positive, negative, or differential pressure sensing points. Use 1/4″ diameter metal or other instrument tubing and 1/8″ NPT adaptors at the Dwyer®. Photohelic® pressure/switch gage. Adaptors for rubber or soft plastic tubing are furnished with the instrument for use where this type of connection is preferred.

If the Photohelic® Switch/Gage is not used to sense differential pressure, one of the pressure taps must be left open to atmosphere. This will allow the reference pressure to enter. In this case, installation of a Dwyer®. No. A-331 Filter Plug or similar fitting in the reference pressure tap is recommended to reduce the possibility of dust entering the instrument.

Note: If the Photohelic® switch/gage is over pressured, pointer may ‘jump” from full scale back to zero and remain there until the excess pressure condition is relieved. Users should be aware of possible false zero pressure indications under this conditions.

ELECTRICAL CONNECTIONS

1. Cover

The amplifier-relay unit has an easy to remove housing. Remove the three (3) screws as shown in Fig. 5 and slide the housing off. Make all the electrical connections before reinstalling and refastening the housing.

2. Conduit

Electrical access to the connection box portion of the relay housing is by bottom opening for 3/4″ conduit. Use of flexible conduit is recommended. It should be supported from the panel or other suitable surface to prevent the wiring system from exerting undue strain on the instrument. See Fig. 5.

Mounting Details

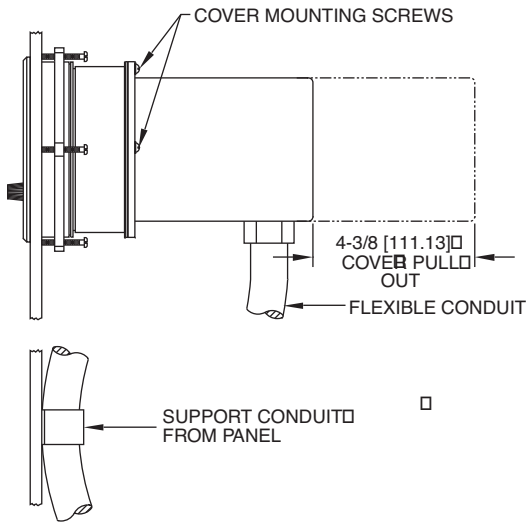


Fig. 5

3. Terminal or Connection Board Layout

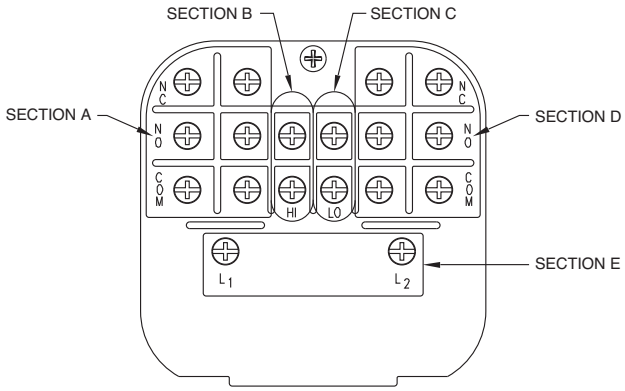
In Fig. 6,"Terminal Board", **Section A** contains the connections for the load or slave relay actuated by the high or right set-point. This relay is a double pole, double throw type. The two top connections are normally closed, the two middle connections are normally open, and the bottom connections are the common pair. The relay is in its normal or De-Energized position when pressure is below the right hand set-point.

Section D is exactly the same as Section A except that its load or slave relay is controlled by the low or left set-point. The De-Energized position is below the left hand pointer set-point.

Section B contains the external connections to the holding coil circuit for the high or right set-point relay and **Section C** contains similar connections for the low or left set-point relay. The function and use of these connections varies somewhat depending on the circuit style of the instrument. See paragraphs 5 and 6 for details.

Section E contains the power connections for the control unit transformer primary. The transformer in turn supplies reduced voltage power for the LED, phototransistor, amplifier unit, and load relay pull in and holding coils. Connections must always be made to this section in order to put the unit in operation. Standard units are designed for 117 VAC input to the transformer. Special units are also available for other voltages.

Terminal Board



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

Fig. 6

Separate Ground Wire attachment is provided for by a No. 6-32 screw on the mounting bracket near the conduit opening. An additional ground wire connection is located on the side of the gage body for use when the amplifier-relay unit is mounted remotely.

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.

4. Circuit Style

The Photohelic® Switch/Gage is available with several factory installed optional internal circuits. They are identified as to style by a label shown in Fig. 7. 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.

Circuit Label

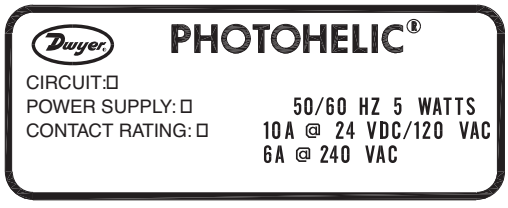


Fig. 7

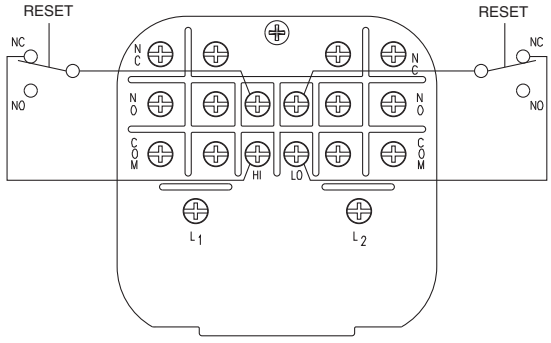
The letter “L” denotes a circuit in which the relay can be made to latch or remain de-energized after pressure decrease to its set-point. Two letters are required to fully identify a dual set-point unit. Thus, circuit style HH, which is standard, is a dual set-point circuit which has provisions for latching 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.

5. 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. 6) for the right set-point and Section D for the left set-point. Note the the N.O. contacts are open when the gage pressure pointer is to the left of the set-point pointers. No connections are necessary in Section 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.

6. 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 above). Connect terminals in Sections B and C through normally closed switches or push buttons as shown in Fig. 8. Use of “dry-circuit” type switches such as Dwyer Part No. A-601 with palladium, 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 “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.

Manual Reset with Circuit HH



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

Fig. 8

7. Dual Set Point Automatic and Manual Reset Combinations
Circuit style HH may be used with either set-point wired and operating as in paragraph 5 and other set-point wired and operating as in paragraph 6.

8. 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® Switch/Gage. To accomplish this, use one set-point relay to reset the other as shown in the wiring diagram Fig. 9. 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. 6)/ 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, its relay would automatically be De-Energized, return to its normal position and in so doing, open the holding coil circuit from Section B (Fig. 6). The right set-point relay would thus be reset and the cycle could repeat.

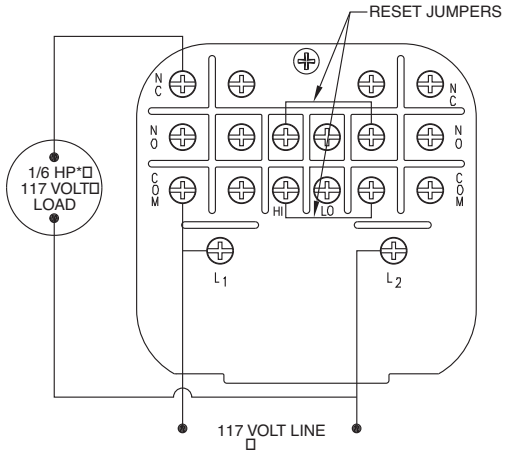
9. Dual Set-Point Special Purpose Circuits
Circuit Style LL may be used where manual reset following maintained contact on pressure decrease to either set-point is desired. Circuit Styles HL and LH are combination units. For special combinations of features, special units, and detailed instructions regarding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

10. Single Set-Point Photohelic® Switch/Gage
The single set-point Photohelic® Switch/Gage is furnished with the right set-point only. Terminals in Section A and B (Fig. 6) are connected to this relay. Circuit Style SRH is wired or automatic reset as in paragraph 5. Manual reset is accomplished by adding a normally closed reset switch or push button to the circuit as described in paragraph 6.

11. 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.

12. 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.

High-Low Limit Control (Circuit HH)



***Note:** For larger motors, use the Photohelic® in a maintained contact, 117 Volt Control or Push Button Circuit of the motor starter.

Fig. 9

13. Failure Mode
The Photohelic® Switch/Gage 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.

MAINTENANCE
Photohelic® Switch/Gages are precision instruments, expertly assembled and calibrated at the factory. They require no lubrication or periodic servicing. If the interior is protected from dust, dirt corrosive gases and fluids, years of trouble-free service may be expected. Zero adjustment should be checked and reset occasionally to maintain accuracy. Any repairs necessary to either the Magnehelic® pressure gage or the electronic components should be performed by a trained instrument mechanic. In most cases, this is best accomplished by returning the complete Photohelic® Switch/Gage to the Dwyer Instruments, Inc. factory.

PHOTOHELIC® PRESSURE SWITCH/GAGE

MODEL AND RANGES

Model	Range, Inches of Water	Minor Div.
3000-00	0-.25	.005
3000-0	0-.50	.01
3001	0-1.0	.02
3002	0-2.0	.05
3003	0-3.0	.10
3004	0-4.0	.10
3005	0-5.0	.10
3006	0-6.0	.20
3008	0-8.0	.20
3010	0-10	.20
3015	0-15	.50
3020	0-20	.50
3025	0-25	.50
3030	0-30	1.0
3040	0-40	1.0
3050	0-50	1.0
3060	0-60	2.0
3080	0-80	2.0
3100	0-100	2.0
3150	0-150	5.0

Model	Range, Zero Center Inches of Water	Minor Div.
3300-0	.25-0-.25	.01
3301	.5-0-.5	.02
3302	1-0-1	.05
3304	2-0-2	.10
3310	5-0-5	.20
3320	10-0-10	.50
3330	15-0-15	1.0

Model	Range PSIG	Minor Div. PSIG
3201	0-1	.02
3202	0-2	.05
3203	0-3	.10
3204	0-4	.10
3205	0-5	.10
3210	0-10	.20
3215	0-15	.50
3220	0-20	.50
3230	0-30	1.0
36003S	0-30	1.0
36006S	0-60	2.0
36010S	0-100	2.0
36020S	0-200	5.0
36030S	0-300	10
36060S	0-600	20
36100S	0-1000	20
36300S	0-3000	100
36600S	0-6000	200

Dual Scale Air Velocity Units (for use with pitot tube)

Model	Ranges, Inches of Water	Range, Air Velocity FPM
3000-00AV	0-.25	300-2000
3000-0AV	0-50	500-2800
3001-AV	0-1.0	500-4000
3002-AV	0-2.0	1000-5600
3010-AV	0-10	2000-12500

Model	Range, MM of Water	Minor Div. MM
3000-6MM	0-6	.20
3000-10MM	0-10	.50
3000-25MM	0-25	.50
3000-50MM	0-50	1.0
3000-80MM	0-80	2.0
3000-100MM	0-100	2.0

Model	Range, Zero Center MM of Water	Minor Div. MM
3300-20MM	10-0-10	.50

Model	Range CM of Water	Minor Div. CM
3000-15CM	0-15	.50
3000-20CM	0-20	.50
3000-25CM	0-25	.50
3000-50CM	0-50	1.0
3000-80CM	0-80	2.0
3000-100CM	0-100	2.0
3000-150CM	0-150	5.0
3000-200CM	0-200	5.0
3000-250CM	0-250	5.0
3000-300CM	0-300	10.0

Model	Range, Zero Center Cm of Water	Minor Div. CM
3300-4CM	2-0-2	.10
3300-10CM	5-0-5	.20
3300-30CM	15-0-15	1.0

Model	Range, Pascals	Minor Div. Pascals
3000-60Pa	0-60	2.0
3000-125Pa	0-125	5.0
3000-250Pa	0-250	5.0
3000-500Pa	0-500	10.0
3000-750Pa	0-750	25.0

Model	Range, Zero Center Pascals	Minor Div. Pascals
3300-250Pa	125-0-125	125-0-125
3300-500Pa	250-0-250	250-0-250

Model	Range Kilo-Pascals	Minor Div. Kilo-Pascals
3000-1kPa	0-1.0	.02
3000-1.5kPa	0-1.5	.05
3000-2kPa	0-2.0	.05
3000-3kPa	0-3.0	.10
3000-4kPa	0-4.0	.10
3000-5kPa	0-5.0	.10
3000-8kPa	0-8.0	.20
3000-10kPa	0-10	.20
3000-15kPa	0-15	.50
3000-20kPa	0-20	.50
3000-25kPa	0-25	.50
3000-30kPa	0-30	1.0

Model	Range, Zero Center Kilo-pascals	Minor Div. Kilo-pascals
3300-1kPa	.5-0-.5	.02
3300-3kPa	1.5-0-1.5	.10

***Note:** The Photohelic® pressure switch/gage may be used in an Under Writers Laboratories approved industrial control panel if the usage conforms to UL specifications for the acceptance of unlisted components.