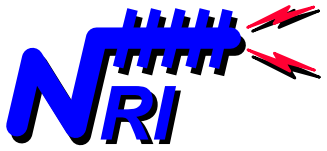
The Hybrid Pressure Switch Pump Station Controller Installation, Operations, And Maintenance Procedures

Telemetry And Control System Engineering Series

Version 1.02

15 March 2004



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wireless-telemetry.com

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1 INTRODUCTION

In 1995, Navionics Research introduced the **WiSTAR** Network, an acronym derived from **Wi**reless **S**ystem **T**elemetry **A**nd **R**emote-Control. This product was designed to solve the problems posed by the complex distributed control and monitoring requirements of the rural water and wastewater industries. Early in the development stages, it became apparent that the WiSTAR RTU should support a control language which offered the flexibility of field programming and interactive debugging. This meant that, in addition to its wireless communication and telemetry functions, the WiSTAR RTU should offer the full industrial control power of a PLC (Programmable Logic Controller), yet without the limitations of the master-slave architecture. Furthermore, because the control decisions of rural water systems are optimally made across the wireless link, the control language would be most effective if it contained a library of functions which specifically address inter-site control, data-sharing, and radio-link status evaluation. As a result of these demanding requirements, **NCL**, an acronym derived from **N**etwork **C**ontrol **L**anguage, was developed. It is offered as Navionics' open control language with a focus on solving difficult distributed wireless control problems.

Inherent in the WiSTAR RTU's intelligence is the ability to detect and alarm fault conditions. For example, if a WiSTAR RTU in a Pump Station should lose communications with its controlling water tower, then it will detect this condition and provide an alarm to the operator. Furthermore, the WiSTAR RTU will fail over into an alternate control mode until the fault condition (loss of communications) is corrected. The possible failover options are virtually unlimited, and, in general, any NCL-programmable or External-Hardware method can be easily implemented.

This manual describes the operational and maintenance procedures for a unique External-Hardware failover method, which will be described hereafter as a "Hybrid Pressure Switch". This device was designed according to the guidelines put forth by Mr. Wally Cox (Heneghan & Associates Engineers). It operates using the best features of a Pressure Switch combined with the best features of a Timer.

A conventional Pressure Switch operates a pump with a "Low-Pressure Turn-ON" level and a "High-Pressure Turn-OFF" level. However, several problems occur when using a Pressure Switch by itself. First, water hammers often occur upon pump turn-on or shut-off, often causing false stops or false starts. Second, an accurate tuning of the "High-Pressure Turn-OFF" level is difficult to achieve with the Pressure Switch due to a high degree of head loss and turbulence when the pump is running.

A conventional Timer operates a pump during fixed periods on a daily basis. However, because water usage often varies dramatically from one day to the next, Timer-based operation can cause water shortages or tower overflows if not constantly supervised.

The “Hybrid Pressure Switch” described in this manual operates using the Pressure Switch to determine when the pump should turn ON, and a Time-Delay Relay to determine the runtime. Additionally, a second Time-Delay Relay is placed in the Turn-ON circuit to prevent false starts due to water hammers. By eliminating the requirement of a “High-Pressure Turn-OFF” level in the Pressure Switch and by eliminating the false starts and stops due to water hammers, the provided device is a substantial improvement over either a Timer or a Pressure Switch.

2 CIRCUIT DIAGRAM

Figure 1. Wiring Diagram

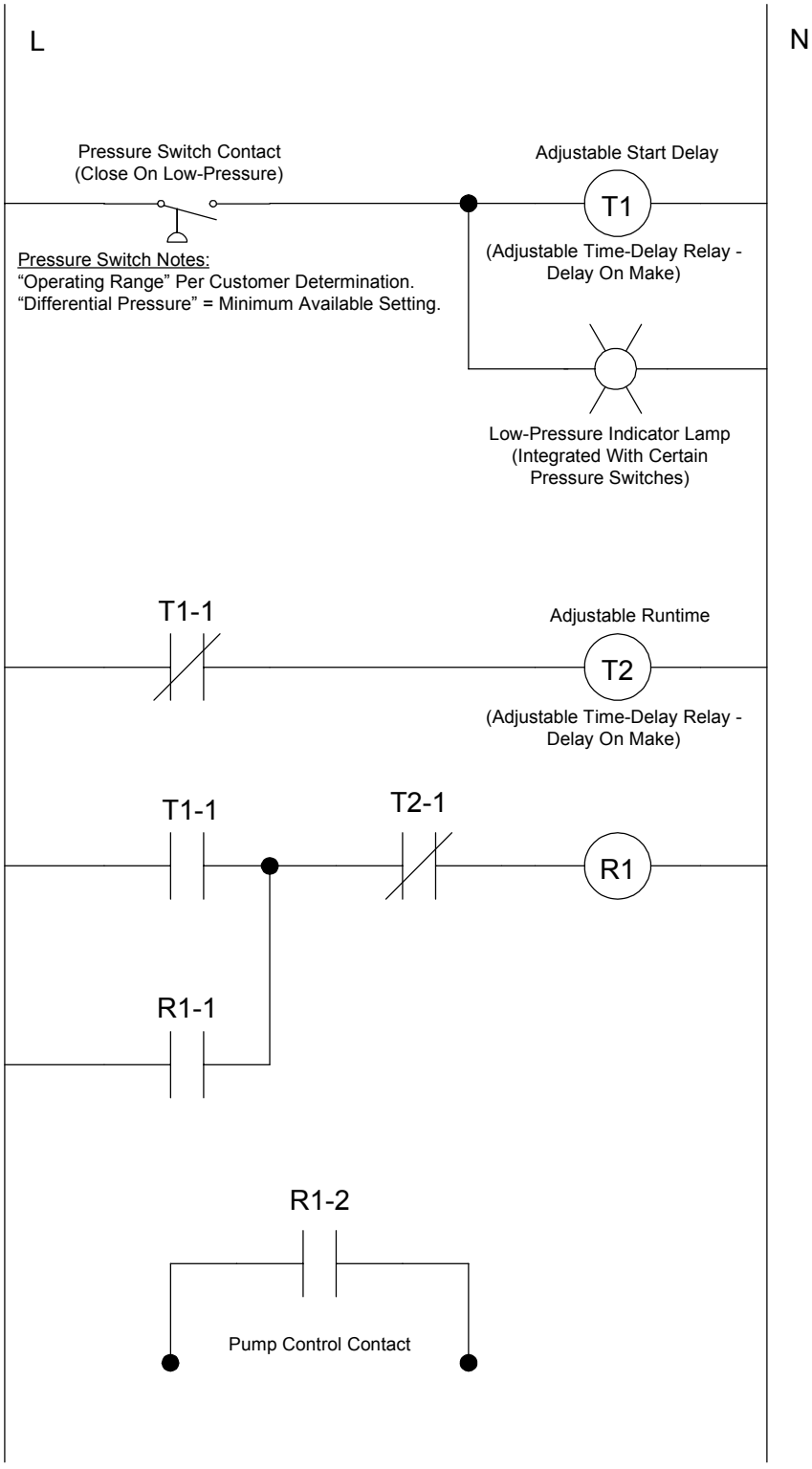
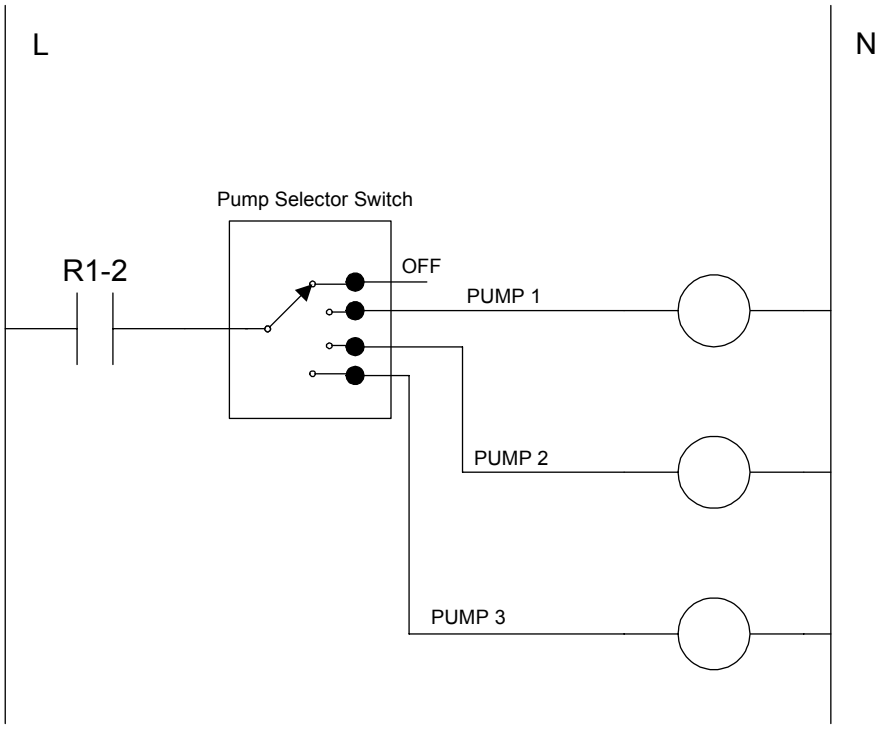
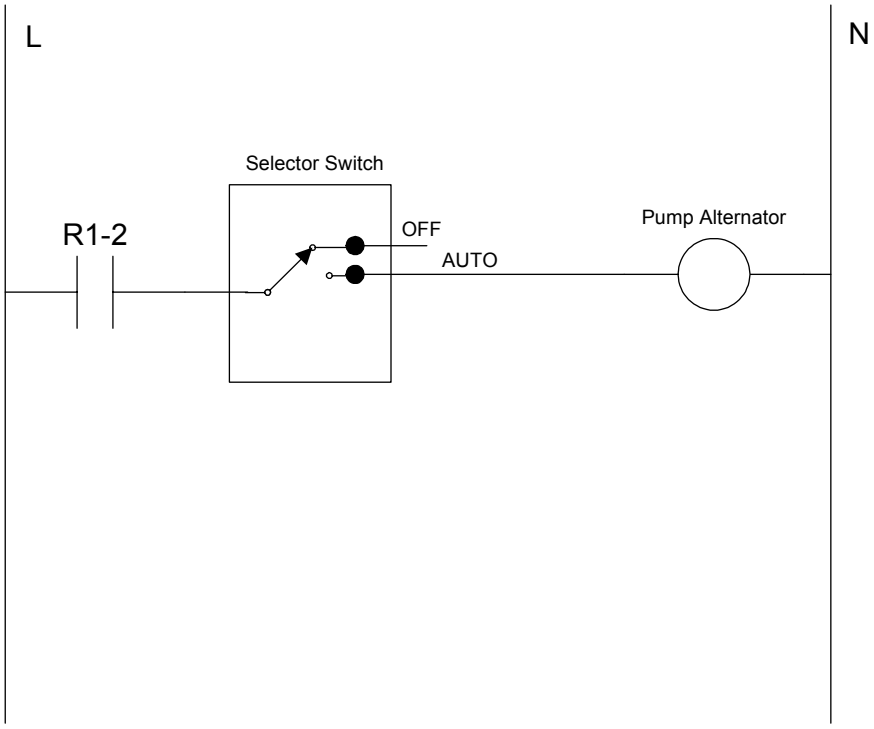


Figure 2. Example Applications

EXAMPLE
APPLICATION 1



EXAMPLE
APPLICATION 2



3 INSTALLATION

1. The enclosure should be attached to the wall or alternate mounting surface using the four (4) mounting flanges. The enclosure should then be connected to the main control panel using appropriate conduit and fittings.

2. The circuit requires 120VAC, Neutral, and GND. The 120VAC should be connected to the Black terminal block marked “L”. The Neutral should be connected to the White (or Gray) terminal block marked “N”. The GND should be connected to the grounding bar marked “Equipment GND”.

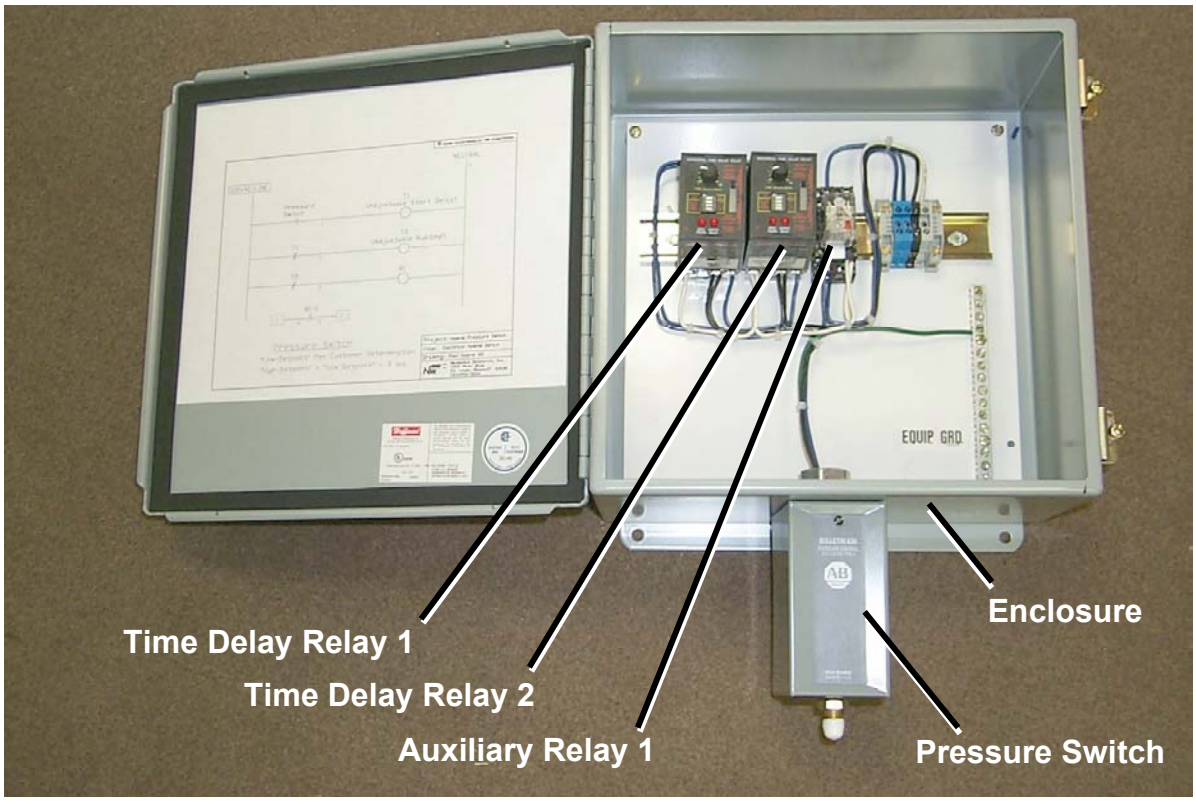
3. A hydraulic sensing line should be connected from the discharge line of the Pump Station to the Pressure Connection of the Pressure Switch. The Pressure Switch contains an integral snubber to filter out transient pressures.

4. A normally-open contact on R1 provides the dry contact which is to control the pump. Note that these contacts should be rated for sufficient voltage and current to drive the desired control circuit.

4 TIMER CALIBRATION

In order to complete the Timer Calibrations described herein, refer to Figure 2: Device Layout.

Figure 2. Device Layout



1. Calibrate Time-Delay Relay #1. This relay controls the delay before turning the pump ON. This delay is designed to eliminate false starts due to water hammers on the line. The delay should be set to the operator's preference, and usually within the 15-45 minute range. This time-delay relay should be set for the operating mode: "DELAY ON MAKE".

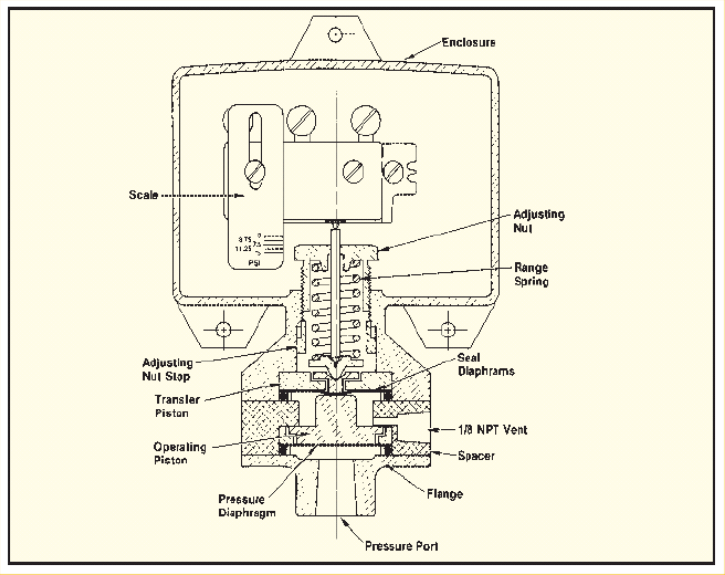
2. Calibrate Time-Delay Relay #2. This relay controls the pump runtime. In other words, once the pump turns ON, it will run for the amount of time set on this relay. This time setting should not exceed the length of time that it would take to fill the tower from the "Pump Turn-ON" threshold during a "Low-Usage" period. This time-delay relay should be set for the operating mode: "DELAY ON MAKE".

5 PRESSURE CALIBRATION

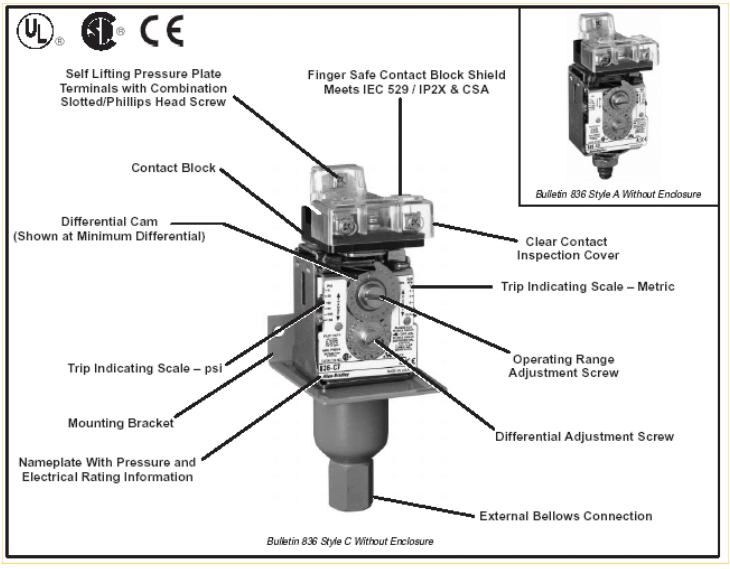
In order to complete the Pressure Calibration described herein, refer to Figure 3: Pressure Switch Internal Details.

Figure 3. Pressure Switch Internal Details

Ashcroft B – Series Pressure Switch
(Note: Product has non-adjustable, narrow deadband. Deadband does not require adjustment.)



Allen Bradley Bulletin 836 Pressure Switch
(Note: Product has adjustable deadband. Deadband requires adjustment.)



1. This procedure must be performed when the Water Tower is at the desired “Call-For-Pump” level.

2. **Deadband Adjust.** Set the Deadband Pressure to the Minimum Setting by turning the adjustment all the way clockwise. Note: For certain pressure switches, a deadband adjustment is not required.

3. **Range Adjust.** With the Pressure Switch “Range” set to the Maximum Setting, decrease the range by turning the Range Adjustment counterclockwise. When the Pressure Switch switches into the ON position (Time-Delay Relay #1 will show “Input Power ON”), the correct Pump Turn-ON pressure will be achieved.

6 OPERATIONS AND TROUBLESHOOTING

This section describes the correct operation of the "Hybrid Pressure Switch". Troubleshooting is simplified by matching the below-documented situations with the actual field operations using the integral LED's on the front faces of the two Time-Delay Relays.

Situation 1. Pressure Switch Is Open (And Has Been Open For A Long Time).
(The following conditions will persist until the Pressure Switch closes.)

a. Time-Delay Relay #1:
   Input Power: OFF
   Output Relay: OFF

b. Time-Delay Relay #2:
   Input Power: ON
   Output Relay: ON

c. Pump: OFF

Situation 2. Pressure Switch Has Just Closed.
(The following conditions will persist for the amount of time set on Time-Delay Relay #1.)

a. Time-Delay Relay #1:
   Input Power: ON
   Output Relay: OFF

b. Time-Delay Relay #2:
   Input Power: ON
   Output Relay: ON

c. Pump: OFF

Situation 3. Time-Delay Relay #1 Has Just Timed Out.
(The following conditions will persist for only a few seconds, until the Pressure Switch opens up.)

a. Time-Delay Relay #1:
   Input Power: ON
   Output Relay: ON

b. Time-Delay Relay #2:
   Input Power: OFF
   Output Relay: OFF

c. Pump: ON

Situation 4. The Pressure Switch Has Just Opened Up.
(The following conditions will persist until Time-Delay Relay #2 times out.)

a. Time-Delay Relay #1:
   Input Power: OFF
   Output Relay: OFF

b. Time-Delay Relay #2:
   Input Power: ON
   Output Relay: OFF

c. Pump: ON

Situation 5. Time-Delay Relay #2 Has Just Timed Out.
(Note: This situation is identical To Situation 1. And the following conditions will persist until the Pressure Switch closes again.)

a. Time-Delay Relay #1:
   Input Power: OFF
   Output Relay: OFF

b. Time-Delay Relay #2:
   Input Power: ON
   Output Relay: ON

c. Pump: OFF

Troubleshooting Tips:

In order for the Hybrid Pressure Switch to operate correctly, the pump must elevate the discharge pressure in the line above the deadband (usually at least 3 psi higher than the pressure before the pump turned ON). In the unlikely circumstance that this does not occur, then the control circuit will stay "locked" in "Situation 3".

7 CONCLUDING REMARKS

With the installation complete, it is good practice to observe the "Hybrid Pressure Switch" in action in order to verify correct operation. Also, the "Pressure Calibration" procedure should be repeated once every 12 months in order to correct for any "setpoint drift" which may occur within the Pressure Switch.

8 COMPONENT LIST

Component List:

Note: The equipment listed in this section constitutes the components tested and recommended by Navionics Research. However, equivalent components may substituted.

A. *Hoffman* A-1212CH Piano Hinge JIC Box, or equal.
B. *Hoffman* A-12P12 Back Panel, or equal.

C. *Ashcroft* Series B Pressure Switch in NEMA-4X Enclosure
(Cat.# B4–20–B–XNHPK–### PSI)
or
Allen Bradley Bulletin 836 Pressure Switch In NEMA-1 Enclosure
(Cat.# 836-C#A, # = 3 (30 psi), 4 (45 psi), 5 (80 psi), 6 (100 psi), 7 (150 psi)),
or equal.

D. *Allen Bradley* Bulletin 700 General Purpose Timing Relay (Quantity=2)
(Cat.# 700-FEA3TU23),
or
SSAC TRU-2 Timer SPDT 8-Pin (Quantity=2)
IDEC SR2P-06 8-Pin Relay Socket (Quantity=2),
or equal.

E. *Siemens* GB-14 14 Point LD-CTR Groundbar Kit

F. *Allen Bradley* Bulletin700 Type H 4PDT Relay (Cat.# 700-HC24A1-3-4),
or equal.
G. *Allen Bradley* Bulletin 700 Type H Relay Socket (Cat.# 700-HN103),
or equal.

H. *Allen Bradley* Bulletin 199 Din-Rail (Cat.# 199-DR1).
or equal.

Data Sheets:

The data sheets for the Ashcroft Pressure Switch, Allen-Bradley Pressure Switches, and SSAC Time-Delay Relay are available in the "Members-Only" Area of the Navionics Web Site: http://wireless-telemetry.com

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DRESSER Instruments

BULLETIN SW-10

B-SERIES PRODUCT INFORMATION

The Dresser Control Instrument Operation supplies highly reliable Ashcroft® switches and controls for industrial and process applications. We begin with rock-solid designs, matching the most appropriate technology with the safety and reliability requirements of the applications. The materials of construction are specified to Dresser's exacting standards, and product is built to last in the toughest applications. Our modern, responsive manufacturing facility in Connecticut is supported by an extensive network of stocking distributors and factory sales offices located in virtually every part of the world. Special application assistance is always just a telephone call away.

The Ashcroft B-Series switch line is designed to satisfy most switch requirements. Materials of construction have been selected for long life. A wide variety of precision switch elements are available to meet every application requirement, including hermetically sealed contacts for added reliability and safety. The actuators we use have been proven in more than 20 years of service in the world's plants and mills. Special designs are available for fire safety, NACE, limit control and other more stringent requirements. Simplicity and ease of use are stressed to improve reliability of the installation.

B-Series switches have proven reliable in such harsh environments as:

- Offshore oil rigs
- Chemical and petrochemical plants
- Pulp and paper mills
- Steel mills
- Power plants
- Water and sewage-treatment plants
- Other corrosive environments

Type 400 Enclosure

UL and CSA listed instrument quality snap-action switch for reliable operation. Ratings up to 10A dc or 20A ac. Hermetically sealed switch also available.

Epoxy-coated aluminum enclosure for corrosion resistance. Meets NEMA 3, 4, 4X, 13 and IP66 requirements.

Accessible adjustment for convenient switch setting, includes vibration-resistant feature.

¾ NPT electrical connection for easy wiring.

Neoprene gasket for sealing enclosure.

High proof pressure.

Deadband limits for each switch.

Standard pressure connection materials:
Pressure psi ranges – 316 SS
Differential psid ranges – Nickel-plated brass
Pressure and differential I.W. ranges –
Epoxy-coated carbon steel

Applications include: pumps, compressors, washers, filters, degreasers, evaporators, recovery systems, food processing, ground support equip-ment, reverse osmosis systems, heat exchangers, hydraulic systems, lubrication systems, marine equipment, textile machinery, heating and air conditioning equipment.

Hermetically Sealed Switch

We recommend hermetically sealed switch elements for improved reliability. The hermetically sealed switch provides uncompromising contact protection in harsh or corrosive environments. The Ashcroft 400 Series is also approved for installation in Division II hazardous areas when supplied with hermetically sealed contacts.

Features:
- UL-recognized component, guide WSQ2, File E85076
- All-stainless steel welded construction

RECOMMENDED PRACTICE:
All controls should be selected considering the media and ambient operating conditions. Improper application can be detrimental to the switch, cause failure and possibly personal injury or property damage.

The information in this catalog is offered as a guide to assist in making the proper selection of Ashcroft controls.

Additional information is available from Dresser Control Instrument Operations Sales. Offices are listed on the back cover.

Type 700 Enclosure

UL and CSA listed instrument quality snap-action switch for reliable operation. Ratings up to 10A dc or 20A ac. Hermetically sealed switch also available. Dual (2 SPDT) shown.

Epoxy-coated aluminum enclosure and cover for corrosion resistance. Class 1, Division 1 & 2, Groups B, C, D, Class 2, Division 1 & 2, Groups E, F, G, NEMA 7 & 9 and IP66.

Buna-N 0-ring for sealing enclosure.

Terminal block wiring standard on dual switches. Optional (XK3) on single switches.

Deadband limits for each switch.

High proof pressure.

Two ¾ NPT electrical conduit connections.

Standard 316 SS pressure connection. Optional ½ NPT shown.

Accessible adlustment is stainless steel for corrosion resistance, includes vibration-resistant feature.

PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

B-Series pressure, differential pressure and vacuum switches use two different actuators depending on setpoint requirements. For setpoints between 2 and 3000 psi, the simple, rugged diaphragm-sealed piston actuator is used. This design features high reliability and choice of actuator seal materials for virtually every application. An optional welded design is also available for setpoints up to 1000 psi for maximum reliability. This design is available in 316 SS or Monel. Differential pressure models use a unique, dual diaphragm-sealed piston design that features very high static operating pressures and small size.

For setpoints between 4.5 and 150 inches of H_2O, a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice of materials of construction.

All standard models feature ±1 percent of range setpoint repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used in conjunction with Ashcroft diaphragm seals in extreme services such as slurries or abrasive process fluids.

PRESSURE/VACUUM SWITCHES

Nominal Range[1]			Overpressure Ratings		Approximate Deadband[2] Switch Element				
			Proof psi	Burst psi	20, 26, 27	21, 24, 31	50	22	32
Vacuum									
–30˝ Hg	–760mm Hg	-100 kPa	500	1000	0.3-0.7	1.5-3.0	0.5-2.2	0.4-1.5	2.1-4.2
Compound									
–15˝ H_2O/ 15˝ H_2O	–375mm H_2O/ 375mm H_2O	–3.7 kPa/ 3.7 kPa	20	35	0.15-.75/ 0.15-.75	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.2/ 0.5-1.2	2.1-3.5/ 2.1-3.5
–30˝ H_2O/ 30˝ H_2O	–760mm H_2O/ 760mm H_2O	–7.5 kPa/ 7.5 kPa	20	35	0.30-.60/ 0.30-.60	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.5/ 0.5-1.5	2.1-3.5/ 2.1-3.5
–30˝ Hg/ 15 psi	–760mm Hg/ 1.0 kg/cm²	–100 kPa/ 100 kPa	500	1000	0.5-1.0/ 0.3-0.7	2.0-3.0/ 0.5-1.5	0.75-2.5/ 0 .5-1.0	0.7-1.8/ 0.7-1.4	2.8-4.2/ 0.7-2.1
–30˝ Hg/ 30 psi	–760mm Hg/ 2.0 kg/cm²	–100 kPa/ 200 kPa	500	1000	1.0-1.5/ 0.3-0.8	3.0-6.0/ 1.0-2.0	1.2-4.5/ 0.7-1.5	1.4-2.4 0.4-1.3	4.2-8.4/ 1.4-2.8
–30˝ Hg/ 60 psi	–760mm Hg/ 4.0 kg/cm²	–100 kPa/ 400 kPa	500	1000	2.0-3.0/ 0.7-1.5	5.0-9.0/ 3.0-5.0	2.5-7.0/ 1.1-4.0	2.8-4.5 1.0-2.3	7.0-12.0/ 4.2-7.0
Pressure									
10˝ H_2O	250mm H_2O	2.5 kPa	20	35	0.2-0.5	1.0-2.0	0.35-1.5	0.4-1.0	1.4-2.8
30˝ H_2O	750mm H_2O	7.5 kPa	20	35	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60˝ H_2O	1500mm H_2O	15 kPa	20	35	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100˝ H_2O	2500mm H_2O	25 kPa	20	35	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150˝ H_2O	3750mm H_2O	37 kPa	20	35	1.0-2.5	4.5-8.5	1.7-6.5	2.0-6.0	6.0-12.0
15 psi	1.0 kg/cm²	100 kPa	2400	3000	0.1-0.35	0.5-1.5	0.2-1.0	0.4-1.0	0.7-2.1
30 psi	2.0 kg/cm²	200 kPa	2400	3000	0.1-0.50	0.5-1.5	0.3-1.0	0.4-1.0	0.7-2.1
60 psi	4.0 kg/cm²	400 kPa	2400	3000	0.3-1.0	1.0-3.5	0.7-2.5	0.6-2.0	1.4-5.0
100 psi	7.0 kg/cm²	700 kPa	2400	3000	0.5-1.7	1.5-5.0	1.1-3.5	1.0-4.5	2.1-7.0
200 psi	14 kg/cm²	1400 kPa	2400	3000	1-3	5-13	2-9	3.0-7.5	7.0-18.2
400 psi	28 kg/cm²	2800 kPa	2400	3000	4-7.5	5-24	5.5-15	4.0-11.0	7.0-33.6
600 psi	42 kg/cm²	4200 kPa	2400	3000	4-11	9-30	7-20	5.0-23.0	12.6-42
1000 psi	70 kg/cm²	7000 kPa	12000	18000	7-30	30-110	18-70	15-80	42-154
3000 psi	210 kg/cm²	2100 kPa	12000	18000	15-60	80-235	37-160	30.0-230	112-329

DIFFERENTIAL PRESSURE SWITCHES

Nominal Range[1]			Pressure Ratings		Approximate Deadband[2] Switch Element				
			Static Working Pressure	Proof psi	20, 26, 27	21, 24, 31	50	22	32
30˝ H_2O	750mm H_2O	7.5 kPa	5.4	21.6	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60˝ H_2O	1500mm H_2O	15 kPa	5.4	21.6	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100˝ H_2O	2500mm H_2O	25 kPa	5.4	21.6	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150˝ H_2O	3750mm H_2O	37 kPa	5.4	21.6	1.0-2.5	4.5-8.5	1.8-6.5	2.0-6.0	6.3-12.0
15 psid	1.0 kg/cm²	100 kPa	500	2000	0.5-1.0	2.0-5.0	0.7-3.5	0.7-1.4	2.8-7.0
30 psid	2.0 kg/cm²	200 kPa	500	2000	1.0-2.0	2.0-5.0	1.5-3.5	1.4-2.8	2.8-7.0
60 psid	4.0 kg/cm²	400 kPa	500	2000	2.0-4.0	3.0-6.0	3.0-4.5	2.8-5.6	4.2-8.5
100 psid	7.0 kg/cm²	700 kPa	1000	4000	4.0-10.0	11.0-20.0	7.0-15.0	6.0-14.0	16.0-28.0
200 psid	14.0 kg/cm²	1400 kPa	1000	4000	5.0-15.0	12.0-40.0	10.0-26.0	7.0-21.0	17.0-56.0
400 psid	28.0 kg/cm²	2800 kPa	1000	8000	10.0-20.0	20.0-60.0	15.0-40.0	14.0-28.0	28.0-84.0
600 psid	42 0 kg/cm²	4200 kPa	1000	8000	20.0-40.0	80.0-150.0	30.0-115.0	30.0-56.0	112.0-210.0

Values shown are for zero static working pressure.

NOTES:

1 Switches may generally be set between 15% and 100% of nominal range on increasing pressure. Consult factory for applications where setpoints must be lower.

2 All deadbands are given in English units as shown in the nominal range column. Deadbands shown are for switches with Buna N diaphragm. Approximate deadbands for optional diaphragms:

Viton: Multiply Buna N value by 1.4
Teflon: Multiply Buna N value by 1.2
Stainless Steel: Multiply Buna N value by 1.7
Monel: Multiply Buna N value by 1.7
Dual Switch Element: Multiply single switch element value by 1.6 for approximate deadband.

ORDER INFORMATION

B-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1		2		3	4			5
B	4	2	0	B	X	P	K	600 PSI

D4 psid model shown

1 – ENCLOSURE	
B4	Pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
B7	Pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.
D4	Differential pressure switch, Type 400, water-tight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
D7	Differential pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

3 – ACTUATOR SEAL					
Code and Material	**Process Temperature Limits °F[9]**	**Range**			
		Vac. ″ H_2O	**0-600 psi**	**1000 psi**	**3000 psi**
B – Buna-N	0 to 150	•	•	•	•
V – Viton	20 to 300	•	•	•	
T – Teflon	0 to 150	•	•	•	•
S – 316L[8]	0 to 300		•	•	
P – Monel[8]	0 to 300		•	•	

4 – OPTIONS
Use table from page 10

5 – RANGE
Select from table on page 4

2 – SWITCH ELEMENT SELECTION		
Order Code	**Switch Elements UL/CSA Listed SPDT**	
20[7]	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22[6]	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24[1]	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25[2]	Heavy duty dc	10A, 125 Vac or dc, ⅛ HP, 125 Vac or dc
26[7]	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28[5]	Manual reset trip on increasing	15A, 125/250 Vac
29[5]	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed switch, gold contacts	1A, 125 Vac
50	Variable deadband	15A, 125/250 Vac
UL/CSA Listed Dual (2 SPDT)		
61[7]	Dual narrow deadband	15A, 125/250 Vac
62[7]	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67[4,6]	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68[4]	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
71[4]	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

NOTES:

1 Standard switch.
2 Not available with psid ranges.
3 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
4 Wires cannot be terminated inside B400 switch enclosure.
5 Not available with type 700 enclosure.
6 Estimated dc. rating, 2.5A, 28 Vdc (not UL listed).
7 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
8 Available on pressure only.
9 Ambient operating temperature limits –20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70°F reference.

TEMPERATURE SWITCHES

B-Series temperature switches feature a SAMA Class II vapor pressure thermal system. This system provides quick, accurate response to process temperature changes with negligible ambient temperature effects. This is inherent in the design due to the precise relationship that exists between temperature and pressure according to the vapor pressure laws. A wide selection of sensing bulb and armored capillary lengths is available. The vapor pressure system design features small bulb sizes, making installation easy and cost-effective.

All models feature ±1.0% percent of span setpoint repeatability with very high overtemperature ratings.

These standard designs perform well in applications where shock and vibration could be a problem and should be used with Ashcroft thermowells for bulb protection and ease of installation and maintenance.

STANDARD TEMPERATURE RANGE SELECTION

Nominal Range[1]		Maximum Temperature	Approximate Deadband[1] Switch Element				
°F	°C	°F	20, 26, 27	21, 24, 31	50	22	32
–40 to 60	–40 to 16	400	1.0-2.0	3.0-8.0	1.5-5.5	1.4-6.0	8.0-16.0
0 to 100	–20 to 40	400	1.5-3.0	5.0-12.0	2.2-8.5	1.5-7.5	9.0-20.0
75 to 205	20 to 95	400	1.5-3.5	8.0-16.0	2.5-12.0	2.0-9.0	10.0-24.0
150 to 260	65 to 125	400	1.5-3.0	5.0-12.0	2.2-8.5	2.0-9.0	10.0-24.0
235 to 375	110 to 190	500	1.5-3.5	5.0-12.0	2.5-8.5	2.0-9.0	10.0-24.0
350 to 525[3]	175 to 275	700	2.0-4.5	8.0-16.0	3.2-12.0	2.5-10.0	15.0-34.0
500 to 750[2]	260 to 400	900	4.0-8.0	16.0-30.0	7.2-24.0	5.0-23.0	30.0-50.0

NOTES:

1 All deadbands given in °F.
2 Available with remote mount thermal systems only.
3 Not available with 2¾″ stem.
4 Dual switch element multiply single switch element value by 1.6 for approximate deadband.
5 Set and reset points must fall within the adjustable range.

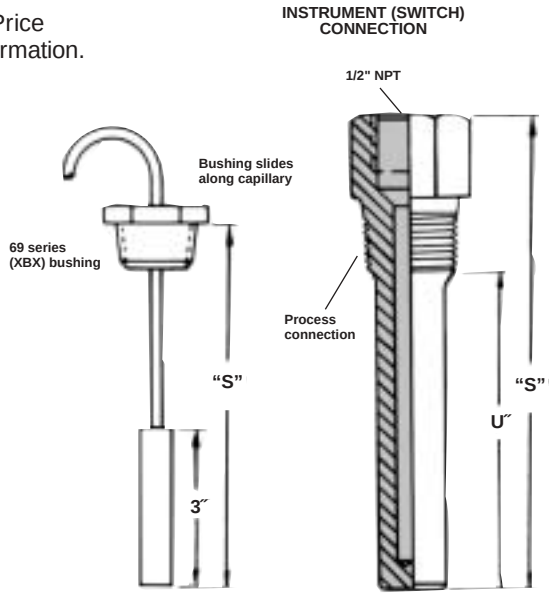
THERMOWELLS

Thermowells must be used on any application where the bulb of the temperature switch may be exposed to pressure, corrosive fluids or high velocity. Additionally, the use of a thermowell permits instrument interchange or calibration check without disturbing or closing down the process.

Ashcroft temperature switches have bulb diameters to match ⅜″ nominal bore thermowells Is. The bulbs have a sensitive portion length of 2″ which can be used with 2½″ "U" dimensioned thermowells or longer. For maximum accuracy a thermowells "U" dimension should be selected to permit complete immersion of the sensitive portion plus 1″ when measuring the temperature of liquids; an extra 3″ should be allowed when measuring the temperature of gases.

Thermowell bushings should be used with remote mount temperature switches. We recommend the standard 3″ bulb and code 69 Series bushings for use with any thermowell "U" dimension. A split rubber grommet allows easy installation and "S" dimension adjustment.

To order a thermowell, refer to Price Sheet TH/PS-1 for complete information.



ORDER INFORMATION

T4 direct mount model shown

B-SERIES TEMPERATURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1	2	3	4	5	6
T4	20	T05	030	XNH	150° to 260°F

1 – ENCLOSURE

T4	Temperature switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
T7	Temperature switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

2 – SWITCH ELEMENT SELECTION

Order Code	Switch Elements UL/CSA Listed SPDT	
20(7)	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22(6)	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24(1)	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25	Heavy duty dc	10A, 125 Vac or dc, ⅛ HP, 125 Vac or dc
26(7)	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28(5)	Manual reset trip on increasing	15A, 125/250 Vac
29(5)	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
50	Variable deadband	15A, 125/250 Vac
UL/CSA Listed Dual (2 SPDT)		
61(7)	Dual narrow deadband	15A, 125/250 Vac
62(7)	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67(4,6)	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68(4)	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
71(4)	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

3 – THERMAL SYSTEM SELECTION

Direct Mount			
Order Code	**System Material**		**Style**
TS	3l6 SS		Rigid
Remote Mount			
Order Code	**System Material**	**Line Length**	**Style**(9)
T05	316 SS	5′	Capillary with 302 SS Spring Armor
T10	316 SS	10′	
T15	316 SS	15′	
T20	316 SS	20′	
T25	316 SS	25′	

4 – BULB LENGTH SELECTION

Direct Mount		
Order Code	**"S" Dimension**	**Minimum Thermowell "U" Dimension**
027(8)	2¾″	–
040	4″	2½″
060	6″	4½″
090	9″	7½″
120	12″	10½″
Remote Mount		
030(9)	3″	2½″

5 – OPTIONS

Use table on page 10

6 – STANDARD TEMPERATURE RANGE SELECTION

Adjustable Range	
°F	**°C**
–40 to 60	–40 to 16
0 to 100	–40 to 40
75 to 205	20 to 95
150 to 260	65 to 125
235 to 375	110 to 190
350 to 525	175 to 275
500 to 750(2)	260 to 400

NOTES:

1 Standard switch.
2 Available with remote mount thermal systems only.
3 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
4 Wires cannot be terminated inside T400 switch enclosure.
5 Not available with Type 700 enclosure.
6 Estimated dc rating, 2.5A, 28 Vdc (not UL listed).
7 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
8 Not available on 350 to 525°F.
9 Consult factory on remote mount for bulb lengths other than 3″.

ORDER INFORMATION

B-SERIES HYDRAULIC PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1		2		3	4			5
H	4	2	4	V	X	F	S	3000 PSI

1 – ENCLOSURE	
H4	Hydraulic pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.

3 – ACTUATOR SEAL		
Code and Material	**Process Temperature Limits °F(4)**	
V – Viton	20 to 300	Viton O-Ring, Stainless Steel Pressure Connection

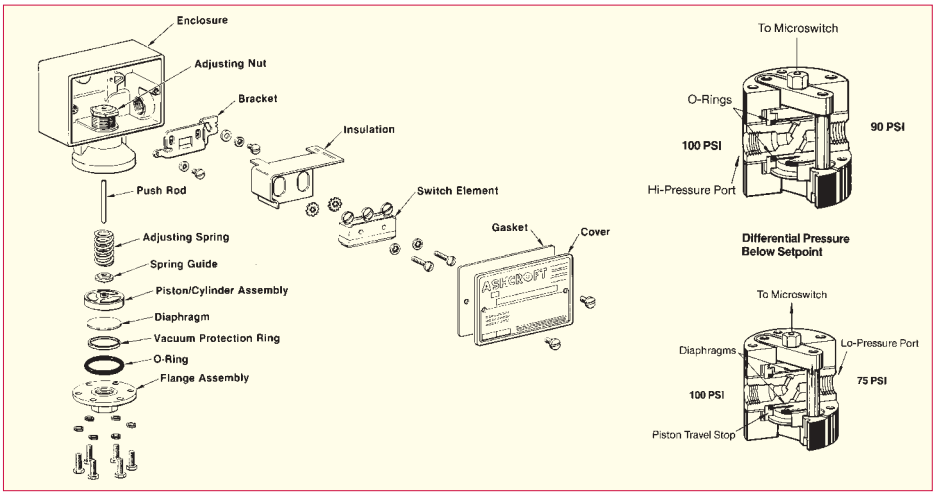
4 – OPTIONS
Use table from page 10

5 – STANDARD PRESSURE RANGE		
Range psi	**Adjustable Setpoint Limits psi**	**Proof Pressure psi**
1000	75-1000	12,000
2000	100-2000	12,000
3000	150-3000	12,000
5000	200-5000	12,000
7500	500-7500	12,000

2 – SWITCH ELEMENT SELECTION		
Order Code	**Switch Elements UL/CSA Listed SPDT**	
20(3)	Narrow deadband ac	15A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24(1)	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25	Heavy duty dc	10A, 125 Vac or dc, ⅛ HP, 125 Vac or dc
26(3)	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28	Manual reset trip on increasing	15A, 125/250 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
UL/CSA Listed Dual (2 SPDT)		
61(3)	Dual narrow deadband	15A, 125/250 Vac
62(3)	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc

NOTES:

1 Standard switch.
2 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
3 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
4 Ambient operating temperature limits –20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70° F reference.



SELECTION

Before making your selection, consider the following:

1. Actuator
The actuator responds to changes in pressure, temperature or differential pressure and operates the switch element in response to these changes.

The actuator is normally exposed to process fluid and must therefore be chemically compatible with it. The following may be used to help select actuator type:

For nominal pressure ranges 0-15 psi through 0-3000 psi, Dresser's standard actuator is a diaphragm-sealed piston. In this actuator, process pressure acting on the piston area causes it to overcome the adjustment spring force and actuate a snap-action switch. A diaphragm and O-ring seal the process media from this mechanism. These are available in various materials, i.e.: Buna N, Teflon and Viton. The standard process connection is stainless steel. Optional Monel pressure connection is available.

For H_2O Pressure and Differential Pressure Ranges, a diaphragm actuator is used. In this design, the standard pressure connections are carbon steel. Diaphragms are available in Viton, Buna N and Teflon. Always review process temperature limits before making seal selections. Optional stainless steel pressure connections are available (option XTA).

For High Differential Pressure Actuator Ranges, 3-15 to 60-600 psid, a Dual Diaphragm-Sealed Piston Actuator is used. This actuator is designed to for high static-pressure applications. The standard pressure connections are nickel-plated brass. Diaphragms are available in Viton, Buna N and Teflon. Always review process temperature limits before making seal selections. Optional stainless steel pressure connections are available (option XUD).

For all temperature ranges the standard Ashcroft® temperature actuator operates on the vapor pressure principle: the vapor pressure in a sealed thermal system is applied to a sensing element, which in turn actuates a switch. This is known as a SAMA Class II system. Various filling materials are used, including Propane, Butane, Methyl Alcohol, N Propyl Alcohol and Xylene. High overtemperature capability is possible with this type of system. The interface between liquid and vapor is the point at which sensing occurs. This is the "sensitive" portion of the bulb. Bulb extensions and capillary are normally filled with vapor, and have little effect on the setpoint, regardless of ambient temperature variations; therefore, no ambient compensation is required. For best results, the bulb should be mounted within 60 degrees of vertical to assure the liquid remains in the bulb.

2. Enclosure
The enclosure protects the switch element and mechanism from the environment and has provisions for mounting and wiring. All Ashcroft switch enclosures are epoxy-coated aluminum or stainless steel for maximum corrosion resistance. Choose between watertight NEMA 4, 4X for most industrial applications and explosion-proof NEMA 7/9 for most process applications.

Ashcroft enclosures include watertight cover gaskets, external mounting holes and one or two ¾ NPT electrical conduit holes for ease of installation. Pressure switches may also be mounted directly to the process by means of the standard ¼ NPTF or optional ½ NPT pressure connection.

Note: When installing Ashcroft switches, refer to instruction sheets included with each switch, the National Electrical Code, and any other local codes or requirements to assure safety.

3. The Switching Function
Next, consider the switching function. Most applications for alarm and shutdown are satisfied by single setpoint, fixed deadband models. For high/low or alarm and shutdown, the dual setpoint models may be selected. For pump, compressor, level and other control applications, an adjustable deadband model is often the best choice. Consult your Ashcroft representative for dual setpoint or adjustable-deadband pressure and temperature switches.

4. The Switch Element
Finally, the electrical switching element must be compatible with the electrical load being switched. For ease of selection, all electrical switching elements are snap acting, SPDT (single pole-double throw), or 2 (SPDT). Refer to catalog pages for switch element choices. Select a switch element with electrical rating that exceeds the electrical rating of the device being controlled by the switch. For better reliability and safety, optional Hermetically Sealed switching elements may be specified.

ADDITIONAL SWITCH TERMINOLOGY

Accuracy – (see repeatability) Accuracy normally refers to conformity of an indicated value to an accepted standard value. There is no indication in switch products; thus, instead, the term repeatability is used as the key performance measure. Ashcroft® pressure and temperature switch accuracy is 1% of nominal range.

Automatic Reset Switch – Switch which returns to normal state when actuating variable (pressure or temperature) is reduced.

Adjustable or Operating Range – That part of the nominal range over which the switch setpoint may be adjusted. Normally about 15% to 100% of the nominal range for pressure and differential pressure switches and the full span for temperature switches.

Burst Pressure – The maximum pressure that may be applied to a pressure switch without causing leakage or rupture. This is normally at least 400% of nominal range for Ashcroft switches. Switches subjected to pressures above the nominal range can be permanently damaged. Consult factory for switches that must operate at pressure above nominal range or reference calibration temperature (70°F).

Deadband – The difference between the setpoint and the reset point, normally expressed in units of the actuating variable. Sometimes referred to as differential.

Division 1 – A National Electrical Code Classification of hazardous locations. In Division 1 locations, hazardous concentrations of flammable gases or vapors exist continuously, intermittently or periodically under normal conditions; frequently because of repair or maintenance operation/leakage or due to breakdown or faulty operation of equipment or processes which might also cause simultaneous failure of electrical equipment. Explosion-proof NEMA 7/9 enclosures are required in Division 1 locations.

Division 2 – A National Electrical Code Classification of Hazardous locations. In Division 2 hazardous locations, flammable or volatile liquid or flammable gases are handled, processed or used, but will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown or in case of abnormal operation of equipment. Either Nema 7/9 explosion-proof enclosures or any enclosure with hermetically sealed switch contacts may be used in Division 2 locations.

Explosion Proof – A term commonly used in industry referring to enclosures capable of withstanding an internal explosion of a specified gas without igniting surrounding gases. Strict installation practices in accordance with the national electrical code are also required for safety.

Fixed Deadband – The difference between the setpoint and the reset point of a pressure or temperature switch. It further signifies that this deadband is a fixed function of the pressure switch and not adjustable.

Hermetically Sealed Switch – A switch element whose contacts are completely sealed from the environment to provide additional safety and reliability. Contact arc cannot cause an explosion, and atmospheric corrosive elements cannot affect the contacts.

Manual Reset Switch – Pressure or Temp-erature switch in which contacts remain actuated even after the actuating variable returns to normal. On Ashcroft manual reset switches, a button must be pushed to reset the contacts.

National Electrical Manufacturers Association (NEMA) – This group has defined several categories of enclosures, usually referred to as "types." Further, they designate certain features and capabilities each type must include. For example, among other features, a NEMA 4 enclosure must include a threaded conduit connector, external mounting provision and cover gaskets. When selecting a NEMA 4 enclosure from any manufacturer, a buyer is assured of receiving these features.

NEMA 4 – Watertight and dusttight enclosures intended for use indoors or outdoors to protect the equipment against splashing, falling or hose-directed water, external condensation and water seepage. They are also sleet-resistant.

NEMA 4X – Watertight, dusttight and corrosion-resistant enclosures with same qualifications as NEMA 4, but with added corrosion resistance.

NEMA 7 – Enclosures for indoor Class I, Division 1 Hazardous locations with gas or vapor atmospheres.

NEMA 9 – Enclosures for indoor Class II, Division 1 Hazardous locations with combustible dust atmospheres.

Normal Switch Position – Contact position before actuating pressure (or variable) is applied. Normally closed contacts open when the switch is actuated. Normally open contacts close when the switch is actuated.

Normally Closed – Refers to switch contacts that are closed in the normal switch state or position (unactuated). A pressure change opens the contacts.

Normally Open Switch – Refers to the contacts that are open in the normal switch state or position (unactuated). A pressure change closes the contacts.

Overpressure Rating(s) – A nonspecific term that could refer to either burst or proof pressure, or both.

Proof Pressure – The maximum pressure which may be applied without causing damage. This is determined under strict laboratory conditions including controlled rate of change and temperature: This value is for reference only. Consult factory for applications where switch must operate at pressures above nominal range, or reference calibration temperature (70°F).

Repeatability (Accuracy) – The closeness of agreement among a number of consecutive measurements of the output setpoint for the same value of the input under the same operating conditions, approaching from the same direction, for full-range traverses. Ashcroft® pressure and temperature switch repeatability is 1% of nominal range.

Note: It is usually measured as nonrepeatability and expressed as repeatability in percent of span or nominal range. It does not include hysteresis or deadband.

Reset Point – The reset point is the Pressure, Temperature or Differential Pressure Value where the electrical switch contacts will return to their original or normal position after the switch has activated.

Setpoint – The setpoint is the Pressure, Temperature or Differential Pressure value at which the electrical circuit of a switch will change state or actuate. It should be specified either on increase or decrease of that variable. (See also reset point.)

Single-Pole Double Throw (SPDT) Switching Element – A SPDT switching element has one normally open, one normally closed, and one common terminal. The switch can be wired with the circuit either normally open (N/O) or normally closed (N/C). SPDT is standard with most Ashcroft pressure and temperature switches.

Snap Action – In switch terminology, snap action generally refers to the action of contacts in the switch element. These contacts open and close quickly and snap closed with sufficient pressure to firmly establish an electrical circuit. The term distinguishes products from mercury bottle types that were subject to vibration problems.

Static Pressure – For differential pressure switches, static pressure refers to the lower of the two pressures applied to the actuator.

B-SERIES SWITCH OPTIONS

		Appicable Switch Series						
		Pressure		Differential Pressure		Temp-erature	H	
Code	Description	(psi)	(in. H_2O)	(psi)	(in. H_2O)	All Ranges		Notes
XBP	Wall Mounting Bracket in. H_2O		•		•			
XBX	½″ Male NPT Bushing					•		
XCH	Chained Cover	•	•	•	•	•	•	
XC8	CSA Approval	•	•	•	•	•		11
XCN	ATEX Directive 94/9/EC EEx d IIC T6	•	•	•	•	•		
XFM	FM Approval – Single Element	•	•	•	•			17
	FM Approval – Dual Element	•	•	•	•			17
XFP	Fungus Proofing	•	•	•	•	•	•	
XFS	Factory Adjusted Setpoint	•	•	•	•	•	•	2
XG3	Belleville Actuator	•						16,17
XG4	Teflon Actuator and Pressure Conn.	•						8
XG5	UL Limit Control to 150″ H_2O				•			1, 17
XG6	UL Limit Control to 600 psi	•						1, 17
XG7	Secondary Chamber with Vent	•						13
XG8	Steam Limit Control to 300 psi	•						7
XG9	Fire Safe Welded Actuator	•						7
XHS	High Static Diflerential Pressure			•				15
XHX	High Pressure, 40 psi, (static) DIP 160 psi (proof) DIP 100 psi proof pressure		•		•			
XJK	Left Conduit Connection	•	•	•	•	•	•	9
XJL	¾″ to ½″ Reducing Bushing	•	•	•	•	•	•	
XK3	Terminal Block (700 Series only)	•	•	•	•	•		6
XLE	Long Leads on the Micro Switch	•	•	•	•	•	•	
XL9	Low Hardness SS Press. Conn.	•						12
XNH	Tagging Stainless Steel	•	•	•	•	•	•	
XNN	Paper Tag	•	•	•	•	•	•	
XPK	Pilot Light(s) Top Mounted	•	•	•	•	•	•	4
XPM	¾″ Sealed Conduit Connection with 16″ Lead Wires	•	•	•	•	•	•	
XTA	316 Stainless Steel Pressure Connection for in. H_2O Range		•		•			
XTM	2″ Pipe Mounting Bracket	•	•	•	•	•		
XUD	316 Stainless Steel Pressure Conn.			•				
X06	Pressure Connection: ½ NPT Male, ¼ NPT Female 316 Stainless Steel (Combination)	•	•	•	•			5
X07	½ NPTF Press. Conn., 316 SS	•	•	•	•			10
X2B	Breather Drain	•	•	•	•	•		
X6B	Cleaned for Oxygen Service	•	•	•				3
	Diaphragm Seal	•	•	•	•			

ATEX Directive 94/9/EC APPROVAL FOR HAZARDOUS LOCATIONS

ATEX is a European designation that deals with standards for equipment and protective systems intended for use in potentially explosive atmospheres. This approval is required for switches intended for use in hazardous locations, especially important to OEMs who export to Europe and contractors specifying or purchasing products for European applications.
XCN option adds special features to Ashcroft 700-Series switch enclosures that meet the requirements for the highest levels of security and danger, such as:

- Special locking device requiring an Allen wrench to remove cover
- Special vents that blow out should the diaphragm rupture, thus preventing pressure build-up in the enclosure
- Special conduit plug requiring an Allen wrench for removal
- Available on pressure, temperature and differential pressure models
- Meets Explosion Class EEx d IIC T6

Order option XCN

NOTES:

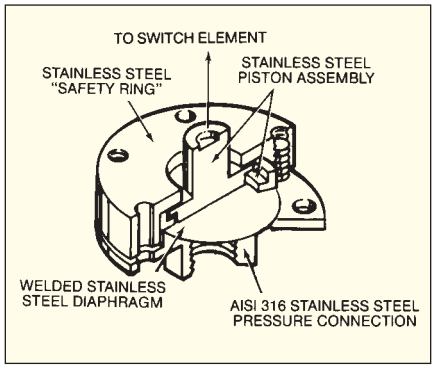
1 Buna N and Viton diaphragm.
2 Advise static or working pressure for differential pressure switches.
3 Buna N cannot be cleaned for oxygen service.
4 N/A on 700 Series.
5 Standard with 1000 and 3000 psi ranges. Bottom connection only on DP in H_2O ranges.
6 Terminal Blocks standard with 700 dual switches.
7 Stainless steel diaphragm only.
8 Pressure connection ¼ NPTF.
9 Standard on 700 Series. N/A with DPDT element on 400 Series.
10 N/A with Monel diaphragm.
11 Standard on 400 Series.
12 N/A on 3000 psi range. Available with Teflon diaphragm only.
13 SS diaphragm required. Teflon diaphragm is the backup. NEMA 7 only.
14 Available in ranges vacuum to 600 psi. Not available with stainless steel or Monel diaphragm.
15 Buna N and Viton diaphragm – 15#D & 30#D only.
16 24, 32, 64 or 68 element only.
17 N/A on all combinations

OPTIONAL FEATURES AND ACCESSORIES

XG9 – FIRE-SAFE WELDED ACTUATOR

Standard features:

- **3000 psi burst pressure unrestrained at room temperature**
- **long service life**
- **all welded – no O-rings**
- **built-in over range protection**
- **superior corrosion resistant materials**
- **interchangeable with current Ashcroft pressure switch actuators**
- **15 psi to 600 psi ranges available**

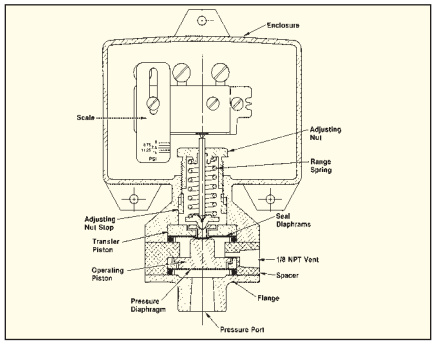


The Ashcroft pressure switch actuator is designed to satisfy most medium range pressure switch applications. It has only two wetted parts; pressure port and diaphragm. No O-rings are required because all joints are welded.

XG6 – U.L. LISTED LIMIT CONROL SWITCH

Standard features:

- **setpoint indicating scale**
- **adjusting nut stop**
- **secondary chamber with vent**
- **optional pilot light for FM requirements**

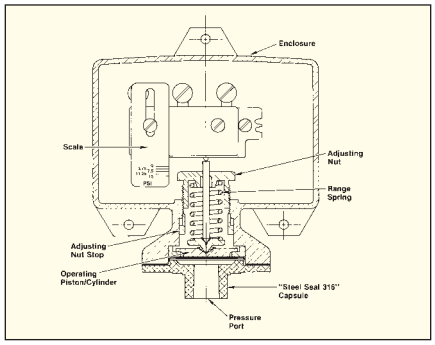


The Ashcroft medium pressure gas and oil limit control switch is designed for use with air, LP gas, natural gas, #1 and #2 fuel oil and #6 oil preheated to 240°F. This limit control is an adjustable pressure operated switch with a secondary chamber to prevent fuel from entering the switch enclosure in the unlikely event that the diaphragm develops a leak. The control shuts down a fuel pump in high or low pressure conditions.

XG8 – U.L. LISTED STEAM LIMIT CONTROL SWITCH

Standard features:

- **316 stainless steel welded diaphragm**
- **setpoint indicating scale**
- **adjusting nut stop**



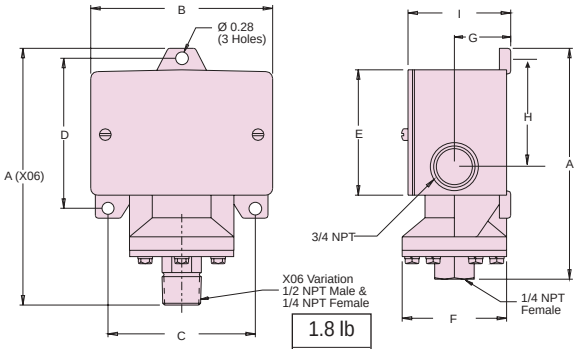
The Ashcroft steam limit control switch is designed for use on boilers equipped with electrically operated burners. The limit control is an adjustable pressure operated switch set to stop burner operation when the recommended safe boiler working pressure is exceeded.

DIAPHRAGM SEALS

Any of the complete line of Ashcroft diaphragm seals may be used with most Ashcroft switches. See Bulletin DS-1.

TYPE 400 DIMENSIONS

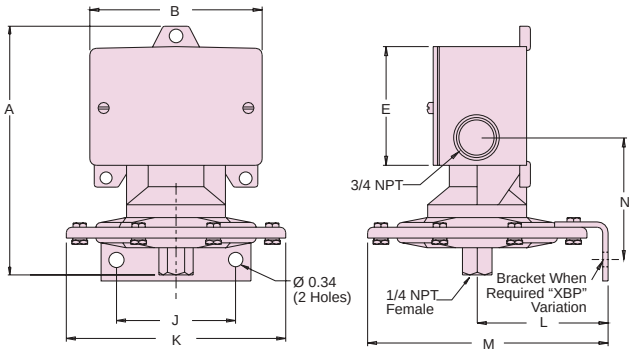
Pressure switch – psi ranges



1.8 lb (.81 kg)

A (X06)	A	B	C	D	E	F	G	H	I
5 7/8	5 1/8	4	3 1/4	3 5/16	2 3/4	2 5/16	1 1/4	2 13/32	2 5/16
(149)	(130)	(102)	(83)	(84)	(70)	(59)	(32)	(61)	(59)

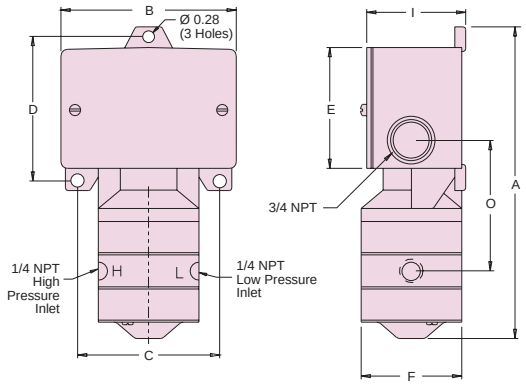
Pressure switch – inches of water ranges



A	B	E	J	K	L	M	N
5 25/32	4	2 3/4	2 25/32	5 1/8	3 1/16	5 11/16	2 27/32
(147)	(102)	(70)	(71)	(130)	(78)	(145)	(72)

2.7 lb (1.2 kg)

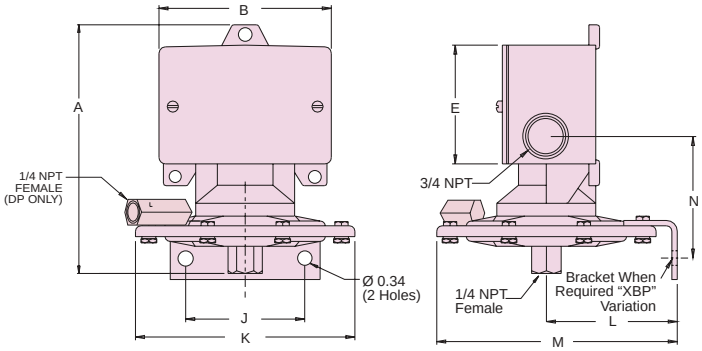
Differential pressure switch – psi differential ranges



A	B	C	D	E	F	I	O
7 5/32	4	3 1/4	3 5/16	2 3/4	2 5/16	2 5/16	3
(182)	(102)	(83)	(84)	(70)	(59)	(59)	(56)

3.6 lb (1.6 kg)

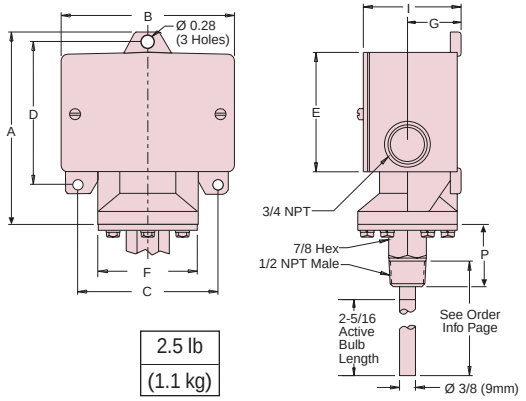
Differential pressure switch – inches of water ranges



A	B	E	J	K	L	M	N
5 25/32	4	2 3/4	2 25/32	5 1/8	3 1/16	5 11/16	2 27/32
(147)	(102)	(70)	(71)	(130)	(78)	(145)	(72)

2.7 lb (1.2 kg)

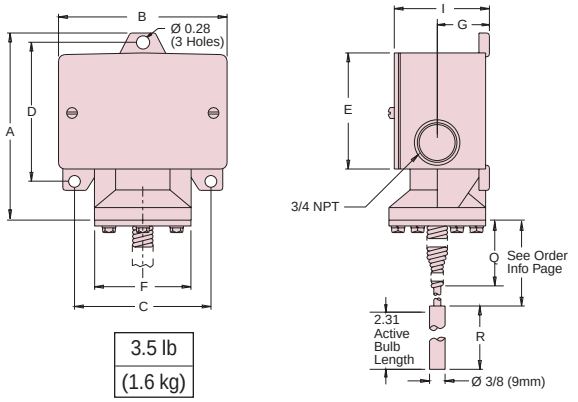
Temperature switch – direct mount



2.5 lb (1.1 kg)

A	B	C	D	E	F	G	I	P
4 11/16	4	3 1/4	3 5/16	2 3/4	2 5/16	1 1/4	2 5/16	1 5/16
(119)	(102)	(83)	(84)	(70)	(59)	(32)	(59)	(33)

Temperature switch – remote mount

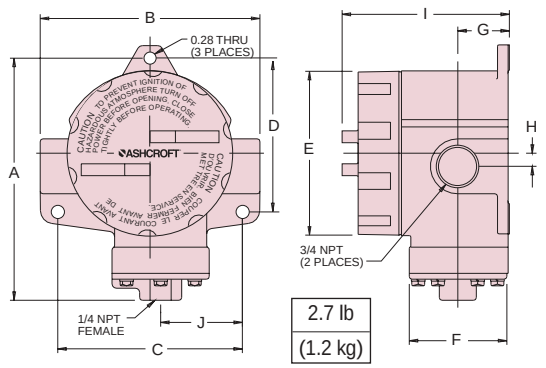


3.5 lb (1.6 kg)

A	B	C	D	E	F	G	I	Q	R
4 11/16	4	3 1/4	3 5/16	2 3/4	2 5/16	1 1/4	2 5/16	3	3
(119)	(102)	(83)	(84)	(70)	(59)	(32)	(59)	(76)	(76)

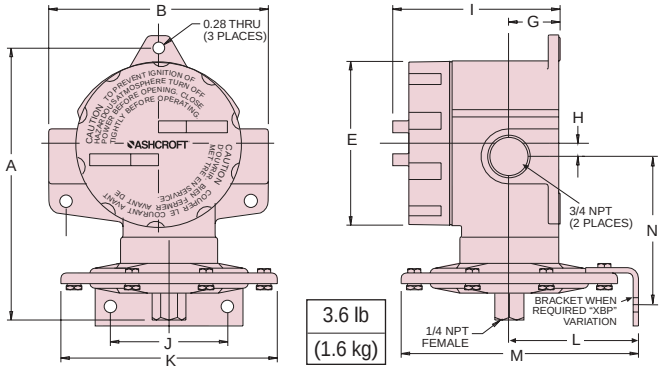
TYPE 700 DIMENSIONS

Pressure switch – psi ranges



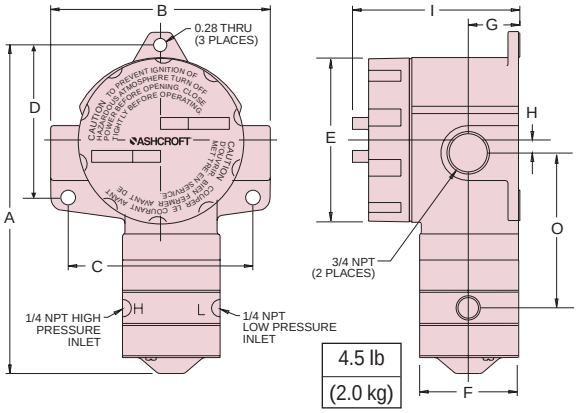
A	B	C	D	E	F	G	H	I	J
5¾	5⁷⁄₃₂	4⅜	3⅝	3⅞	2⁵⁄₁₆	1⁷⁄₃₂	⁵⁄₁₆	3³¹⁄₃₂	1¹⁵⁄₁₆
(146)	(133)	(111)	(92)	(98)	(59)	(31)	(8)	(101)	(49)

Pressure switch – inches of water ranges



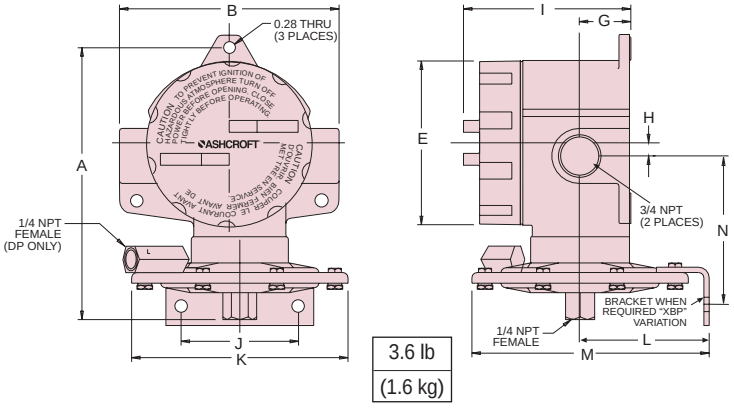
A	B	E	G	H	I	J	K	L	M	N
6⁷⁄₁₆	5⁷⁄₃₂	3⅞	1⅞	⁵⁄₁₆	3³¹⁄₃₂	2²⁵⁄₃₂	5⅛	3¹⁄₁₆	5¹¹⁄₁₆	3½
(164)	(133)	(98)	(31)	(8)	(101)	(71)	(130)	(78)	(145)	(89)

Differential pressure switch – psi differential ranges



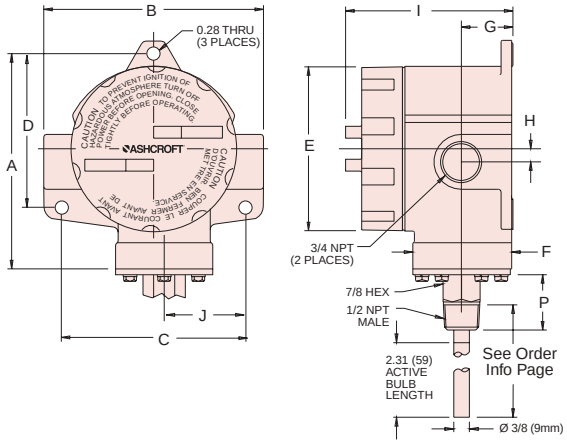
A	B	C	D	E	F	G	H	I	O
7²⁵⁄₃₂	5⁷⁄₃₂	4⅜	3⅝	3⅞	2⁵⁄₁₆	1⁷⁄₃₂	⁵⁄₁₆	3³¹⁄₃₂	3¹¹⁄₁₆
(198)	(133)	(111)	(92)	(98)	(59)	(31)	(8)	(101)	(94)

Differential pressure switch – inches of water ranges



A	B	E	G	H	I	J	K	L	M	N
6⁷⁄₁₆	5⁷⁄₃₂	3⅞	1⅞	⁵⁄₁₆	3³¹⁄₃₂	2²⁵⁄₃₂	5⅛	3¹⁄₁₆	5¹¹⁄₁₆	3½
(164)	(133)	(98)	(31)	(8)	(101)	(71)	(130)	(78)	(145)	(89)

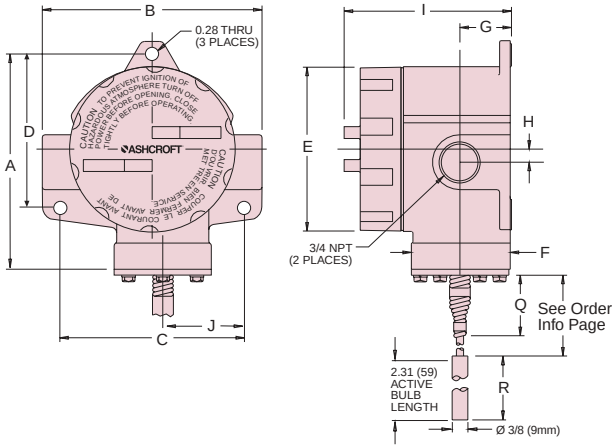
Temperature switch – direct mount



A	B	C	D	E	F	G	H	I	J	P
5³⁄₃₂	5⁷⁄₃₂	4⅜	3⅝	3⅞	2⁵⁄₁₆	1⁷⁄₃₂	⁵⁄₁₆	3³¹⁄₃₂	1¹⁵⁄₁₆	1⁵⁄₁₆
(129)	(133)	(111)	(92)	(98)	(59)	(31)	(8)	(101)	(49)	(33)

3.7 lb
(1.7 kg)

Temperature switch – remote mount



A	B	C	D	E	F	G	H	I	J	Q	R
5³⁄₃₂	5⁷⁄₃₂	4⅜	3⅝	3⅞	2⁵⁄₁₆	1⁷⁄₃₂	⁵⁄₁₆	3³¹⁄₃₂	1¹⁵⁄₁₆	3	3
(129)	(133)	(111)	(92)	(98)	(59)	(31)	(8)	(101)	(49)	(76)	(76)

4.5 lb
(2.0 kg)

ADDITIONAL PRESSURE AND TEMPERATURE SWITCH APPLICATION INFORMATION

DIFFICULT PROCESS MEDIA

When specifying pressure or temperature switches, the material in contact with media must be compatible with it. Otherwise, failure could occur, resulting in leakage, injury, and loss of life, property or production. The user should review prior experience with materials of construction in the process for guidance in material selection. If this is not appropriate, contact Dresser's Control Instrument Operation for assistance. Relevant information such as process media, concentration of each constituent, temperature, pressure, the presence of contaminants, particulate, vibration or pulsation is necessary to make the best recommendation. Refer also to Product Information Page ASH-PI-14B "Corrosion Data Guide."

Some applications are best handled by adding an Ashcroft diaphragm seal to isolate the fluid media from the pressure or differential pressure switch.

Diaphragm seals are recommended where:

- The process media being sensed could clog the pressure element.
- The process media temperature is above or below the ratings of the actuator seal materials.
- The application calls for a sanitary process connection.

Note: The addition of a diaphragm seal may increase the deadband and response time of the pressure switch to process pressure changes. Please consult the Control Instrument Operation for details.

Refer also to Ashcroft Product Bulletin DS-1 and Product Information Page SW/PI-30B, "Switch, Diaphragm Seal Combination."

OXIDIZING MEDIA

When specifying a pressure switch for use in oxidizing media, such as chlorine, oxygen and several other chemical compounds, the wetted materials must be compatible with the media, and the switch should be cleaned for oxygen service. This is necessary to remove any residue that might react violently with the oxidizing media. Specify option X6B (clean for oxygen service). Refer also to Product Information Page SW/PI-6B, "Oxygen Cleaning for Ashcroft Switches."

STEAM SERVICE

In order to prevent live steam from coming into contact with the switch actuator, a siphon filled with water should be installed between the switch and the process line. We recommend the optional stainless steel welded process connection and diaphragm even though viton is rated for use with steam. Experience has shown that in many steam applications, the 300°F high temperature limit of Viton is exceeded by steam under pressure.

In some boiler applications, a special U.L. listing, "MBPR," which requires unique features, is needed. Dresser offers these features with option XG8. Refer also to Product Information Page SW/PI-27A, "Steam Limit Control Switch."

NACE

The National Associations of Corrosion Engineers (NACE) publishes a standard covering the requirements of metallic materials in contact with process media containing Hydrogen Sulfide. We recommend the use of Monel (code P) wetted materials for most applications. Other alternatives include adding applicable diaphragm seals or low hardness stainless steel pressure connection (XL9) and teflon diaphragm. Refer also to Product Information Page SW-22A, "Pressure Switches Meeting NACE Standard MR-01-75."

HIGH TEMPERATURE PROCESS

Refer to the actuator seal table for process temperature limits for pressure switch actuators. Pressure switches mounted directly to the process can withstand up to 300°F when equipped with optional Viton, stainless steel or Monel wetted parts. If process temperature exceeds 300°F, four feet of ½″ tubing between the process and the switch will generally protect the switch from damage.

Alternatively, an Ashcroft diaphragm seal selected from bulletin DS-1 can be used to isolate the switch from the hot process.

VIBRATION

Generally, vibration will not harm Ashcroft pressure switches. However, premature tripping may occur under severe conditions. This tends to be annoying, but repeatable for a given situation and might be in the order of 5% to 10% of switch range from the setpoint, i.e. a 100 psi switch set at 50 psi on increasing pressure might trip somewhere between 40 and 45 psi on increasing pressure. This would not reduce the life of the pressure switch.

The best approach in this type of application is to mount the switch remotely, connecting the switch to the process or equipment with flexible tubing. If this is not possible, consider the use of the Belleville actuator, option XG3. Refer also to Product Information Page SW/PI-58, "Belleville Actuator."

PULSATION

Pressure pulsation below the range of the pressure switch will not harm it. However, because the switch can react to pressure pulses less than one-second duration, it might be desirable to include a dampening device. Several Ashcroft accessories such as snubbers address this situation. Refer to the accessory section of Ashcroft Ordering Handbook (OH-1), or consult your Ashcroft representative for more information.

MOUNTING

All Ashcroft pressure, temperature and differential pressure switches with snap acting contacts may be mounted in any position. This includes the sensing bulbs of temperature switches. This is an important advantage of snap acting switch designs.

ADDITIONAL PRESSURE AND TEMPERATURE SWITCH APPLICATION INFORMATION

SWITCH ELEMENT SELECTION

B-Series switches are available with a wide variety of snap acting switch elements to meet most electrical requirements. The standard contact arrangement is single pole, double throw (S.P.D.T.). This includes both normally open and normally closed contacts. Standard contact material is fine silver which generally is suitable for switching 8 volts or more, up to the rating in the Switch Element Selection Table. When switching less than 8 volts, optional Gold Alloy contacts are recommended.

Optional dual, or 2 S.P.D.T. contacts may be supplied in B-Series enclosures for applications requiring two switch functions at the same setpoint. These contacts are technically not double pole, double throw (D.P.D.T.). They are synchronized at the factory to actuate within 1% of nominal range of each other. For simultaneous actuation of 2 S.P.D.T. contacts, option XG3 should be ordered. Refer also to SW/PI-58 "Belleville Actuator."

HAZARDOUS LOCATIONS

a. Division I.
Ashcroft 700 series or other explosion proof enclosures are required to meet the requirements of Division I Hazardous Locations as defined by the National Electrical Code.

ATEX option shown

b. Division II.
These enclosures also meet the less stringent requirements for Division II Hazardous Locations. Alternatively, Ashcroft 400 series or other watertight enclosures with hermetically sealed switch elements are approved for use in Division II hazardous locations.

c. Intrinsic Safety.
Ashcroft 400 and 700 series pressure and temperature switches may be used with approved barriers in most intrinsically safe systems. These switches do not create or store energy and are therefore designated "simple devices" in these systems.

d. ATEX Approval. (optional)
Ashcroft 700 series pressure and temperature switches are approved for ATEX directive 94/9/EC. This European directive is for equipment intended for use in potentially explosive atmospheres. See option XCN on page 10.

INFORMATION & GUIDELINES FOR SETTING ASHCROFT PRESSURE, TEMPERATURE AND DIFFERENTIAL PRESSURE SWITCHES

All Ashcroft pressure, temperature and differential pressure switches can be set at any point between about 15% and 100% of the range as designated on the label or the nominal range table.

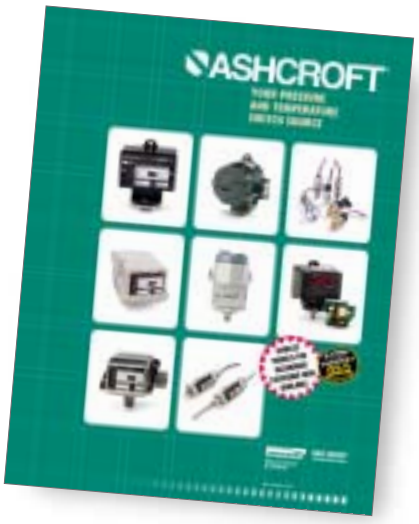
Ashcroft pressure and temperature switches can be either set in the field or ordered from the factory preset to your requirements. When set at the factory, the specification is ±1% of the nominal range.
Factory setting, or XFS, is a very popular option, and as a result, we often receive orders that do not have enough information or have incorrect information.

HOW TO ORDER

When "XFS" is desired:

1. Setpoint must be indicated.
2. Increasing or decreasing pressure must be indicated.

   Ex: B424B XFS 100#
   Set: 60# decreasing
3. For differential pressure switches, static operating pressure must also be specified.



For other Ashcroft switch models request Ashcroft Bulletin, Switch Quick Guide QG-3.
All product information pages mentioned in this bulletin can be downloaded from our web site.

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DRESSER
Instruments

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Economy Timing Relays

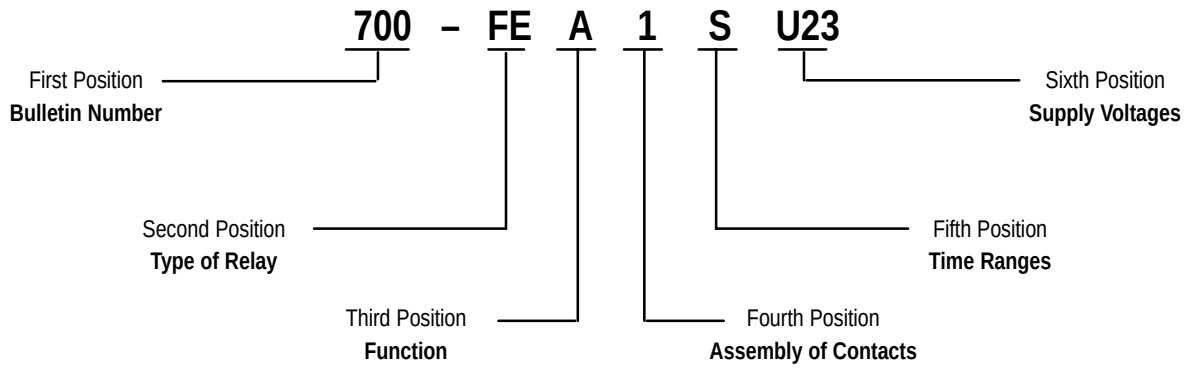
(Catalog Number 700–FE)

Product Data

The Bulletin 700–FE Economy Timing Relays consist of Multi–Function, Single Function, and Special Function designs. These products are offered in a compact, DIN rail mountable package to meet the customers timing needs at an economical price.

- 17.5mm (11/16 inch) Wide
  - 24V AC/DC (1 NO only)
    110–240V AC
  - 24–48V DC (SPDT only)
    24–240V AC
- DIN Rail Mounting
- Finger Safe Terminals
- 1 Normally Open Output Contact
  - Multi–Function (On–Delay, Off–Delay, One Shot, Flasher, with 4 Timing Ranges)
  - Single Function (On–Delay, Off–Delay, One Shot, Flasher, with 4 Timing Ranges)
- Single Pull Double Throw (SPDT) Contact Configuration
  - Multi–Function (On–Delay, Off–Delay, One Shot, Flasher, with 6 Timing Ranges)
  - Single Function (On–Delay, Off– Delay, One Shot, Flasher, Fleeting Off–Delay, Pulse Converter, with 6 Timing Ranges)
  - Special Function (Star–Delta with 4 Timing Ranges)

Catalog Number Explanation



Multi–Function Economy Relays

700-FE	M	1	R	U23
	Function	**Assembly of contacts**	**Time ranges**	**Supply voltages**
	M Multi-function timing relays with a Single-function: A, B, D and F	**1** 1 normally open contact 1 N.O.	**R** 0.5 s... 1 h (4 settings)	**U22** 24V AC/DC❶ 110...240 V 50/60 Hz
		3 1 Changeover contact 1 C/O (SPDT)	**T** 0.05 s...10 h (6 settings)	**U23** 24...48 VDC 24...240 V 50/60 Hz

Single Function Economy Relays

700-FE	A	1	S	U23
	Function	**Assembly of contacts**	**Time ranges**	**Supply voltages**
	A On-delay **B** Off-delay **D** One shot **E** Fleeting off-delay **F** Flasher (repeat cycle starting with pulse) **L** Pulse converter	**Functions A, B, D, F:** **1** normally open contact 1 N.O.	**S** 0.75 s...1 h (4 settings)	**U22** 24V AC/DC❶ 110...240 V 50/60 Hz
		All functions: **3** 1 Changeover contact 1 C/O (SPDT)	**T** 0.05 s...10 h (6 settings)	**U23** 24...48 VDC 24...240 V 50/60 Hz

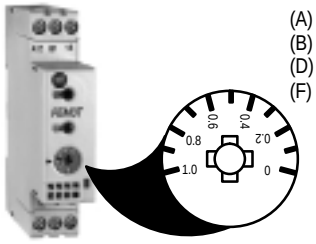
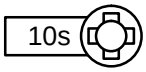
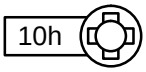
Special Function Economy Relays

700-FE	Y	2	Q	U23
	Function	**Assembly of contacts**	**Time ranges**	**Supply voltages**
	Y Star-delta timing relays	**2** 2 normally open contacts 2 N.O. 1 side common	**Q** 0.15 s...10 min (4 settings)	**U23** 24...48 VDC 24...240 V 50/60 Hz

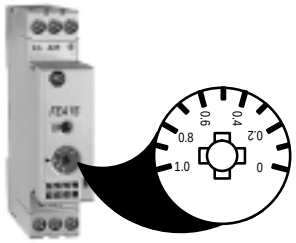
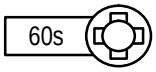
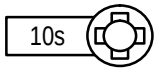
❶ **Voltage is either 24V DC or 24V AC 50/60 Hz.**

Technical Data

700–FEM Multi–Function Economy Relays

Description	1 NO	SPDT
Multi-function timing relays 700-FEM includes 4 selectable functions: (A) - On-delay (B) - Off-delay (D) - One shot / watch dog (F) - Flasher (Repeat Cycle) starting with pulse 	**Multi-time setting ranges 0.5 s...60 m** (10s) 0.5...10 s (60s) 3...60 s (10m) 0.5...10 min (60m) 3...60 m 	**Multi-time setting ranges 0.05 s...10 h** (1s) 0.05...1 s (10s) 0.5...10 s (1m) 0.05...1 min (10m) 0.5...10 min (1h) 0.05...1 h (10h) 0.5...10 h 
Supply voltage	**Cat. No.**	**Cat. No.**
U22 110...240 VAC, 50/60 Hz (A1/A2) 24V AC/DC❶ (A3/A2)	700-FEM1RU22	—
U23 24...48 VDC (A1/A2) 24...240 VAC,50/60 Hz (A1/A2)	—	700-FEM3TU23

700–FE Single Function Economy Relays

Description	1 NO	SPDT
	**Multi-time setting ranges 0.75 s...60 m** (15s) 0.75...15 s (60s) 3...60 s (8m) 0.4...8 m (60m) 3...60 m  **Supply voltage** U22 24V AC/DC❶ (A3/A2) 110...240 VAC, 50/60 Hz (A1/A2)	**Multi-time setting ranges 0.05 s...10 h** (1s) 0.05...1 s (10s) 0.5...10 s (1m) 0.05...1 m (10m) 0.5...10 m (1h) 0.05...1 h (10h) 0.5...10 h  **Supply voltage** U23 24...48 VDC (A1/A2) 24...240 VAC, 50/60 Hz (A1/A2)
Also See 700–FE Timing Charts	**Cat. No.**	**Cat. No.**
(A) On-delay The output contact changes state after the time delay is completed.	700-FEA1SU22	—
	—	700-FEA3TU23
(B) Off-delay Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state when switch "S" is closed. When switch "S" is opened, the time delay begins. After the time delay is completed, the contact returns to shelf state.	700-FEB1SU22	—
	—	700-FEB3TU23
(D) One shot The output contact changes state when the relay is energized. The output contact returns to shelf state when the time delay is completed.	700-FED1SU22	—
	—	700-FED3TU23
(F) Flasher (repeat cycle starting with pulse) The output contact changes state when the power is applied. At the end of the time delay, the output contact returns to shelf state. This cycle continues until the power is removed.	700-FEF1SU22	—
	—	700-FEF3TU23
(E) Fleeting off-delay Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state after closing and opening switch "S". After the time delay is completed, the contact returns to shelf state.	—	700-FEE3TU23
(L) Pulse converter Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the output contact changes state. When the time delay is complete, the output contact returns to shelf state. The time "t" is not influenced by the duration of the control pulse.	—	700-FEL3TU23

❶ Voltage is either 24V DC or 24V AC 50/60 Hz.

Technical Data, Continued

700–FEY Special Function Economy Relays

Description	2 NO w/common
	**Multi-time setting ranges 0.15 s...10 m** (3s) 0.15...3 s (10s) 0.5...10 s (1m) 0.05...1 min (10m) 0.5...10 min **Supply voltage** U23 24...48 VDC (A1/A2) 24...240 VAC, 50/60 Hz (A1/A2)
Also See 700–FE Timing Charts	**Cat. No.**
(Y) Star-delta timing relay When power is applied, the output contact 17/18(Y) changes state. After the time setting, the output contact 17/18(Y) returns to shelf state. After the fixed time (50 to 65 ms), the output contact 17/28Δ changes state. The output contact returns to shelf state after the power is removed.	700-FEY2QU23

Specifications

Time characteristics (according to VDE 0435, part 2021)

	1 NO	SPDT
Setting accuracy	± 5% of full scale	
Repeatability	± 1% of setting (typical)	
Tolerance	by voltage: ± 0.01%/%ΔU by temperature: ± 0.25%/°C	by voltage: ± 0.001%/%ΔU by temperature: ± 0.025%/°C
Supply		
Supply voltage	24V AC/DC❶ and 110...240VAC, 50/60 Hz	24...48 VDC and 24...240VAC, 50/60 Hz
Voltage tolerance	–15%/+20% (DC), –15%/+10% (AC)	
Power consumption	0.5 W at 24 VDC, 9 VA at 240 VAC	0.5 W at 24 VDC, 5 VA at 240 VAC
Time energized	100%	
Reset time	250 ms	100 ms
Cable length (supply voltage control)	max. 100 m (30 feet)	max. 250 m (75 feet)
Pulse control (B1)		
Impulse duration	≥ 250 ms	≥ 50 ms (AC), ≥ 30 ms (DC)
Input voltage	supply voltage range	
Input current	1 mA	
Cable length	max. 250 m without parallel load between B1 and A2 max. 50 m with load (< 3 kΩ) between B1 and A2	
Outputs		
Contact type	1 NO contact	1 Form C – SPDT contact
Switching capacity	Power: 1250 VA According to IEC 947-5-1: AC1 – 5A/250 VAC (resistive load) AC14 – 1 A/250 VAC (inductive load) DC13 – 1 A/24 VDC (inductive load)	
	According to UL 508: NEMA D300 – 1A/300VAC	
Short-circuit protection	6 A gL (Fast Blow Fuse)	
Life	mechanical: 20 Mil. of operations electrical operations: 0.4 Mil. at 1 A/250 VAC, resistive 0.4 Mil. at 0.5 A/250 VAC, cos φ = 0.4 0.4 Mil. at 1 A/24 VDC, resistive	
State indicator	1 LED	1 Bi-Color LED (Supply; Relay)

Specifications, Continued

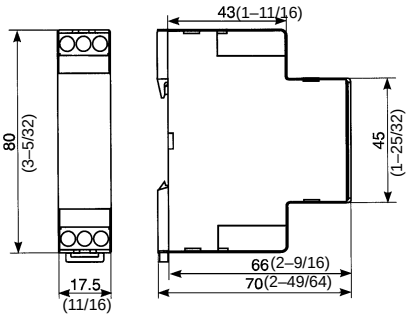
General Specifications

	1 NO	SPDT
Insulation characteristics	2 kVAC/50 Hz test voltage according to VDE 0435 and 4 kV 1.2/50 µs surge voltage according to IEC 947-1 between all inputs and outputs	
EMC/Interference immunity	The following requirements are fulfilled: Surge capacity of the supply voltage according to IEC 1000-4-5: Level 3 (A1–A2) 110...240 VAC according to IEC 1000-4-5: Level 2 (A3–A2) 24 V AC/DC❶ Burst according to IEC 1000-4-4: Level 3 ESD discharge according to IEC 1000-4-2: Level 3	The following requirements are fulfilled: Surge capacity of the supply voltage according to IEC 1000-4-5: Level 3 Burst according to IEC 1000-4-4: Level 3 ESD discharge according to IEC 1000-4-2: Level 3
EMC/Emmission	electromagnetical fields according to EN 55 022: Class B	
Safe isolation	according to VDE 106, Part 101	
Climatic withstand	56 cycles (24 h) at 25...40°C and 95% rel. humidity according to IEC 68-2-30 and IEC 68-2-3	
Vibration resistance	4 g in 3 axis at 10...500 Hz, test FC according to IEC 68-2-6	
Shock resistance	50 g according to IEC 68-2-27	
Protection class IEC 947–1	Enclosure: IP 40 Terminal: IP 20	
Weight	60 g	60 g
Approvals	UL, C-UL, CE Certified	UL, C-UL, Germanischer Lloyd, CE Certified
Ambient temperature	Open: –25°C ... +60°C Enclosed: –25°C ... +45°C Storage: –40°C ... +85°C	
Connections	Screw terminal M3 for Pozidriv No.1, Philips and slotted screws No.2. suitable for power screw-driver. Rated tightening torque 8.8 LB–IN (max. 1.0 Nm) For terminal cross-sections of 1 x 0.5 mm^2 ... 2 x 1.5 mm^2 (solid) or 2 x 1.5 mm^2 (stranded with sleeve), AWG 20...14. Finger protection according to VDE 0106	
Mounting	For surface mounting in any position; snap-on mounting on 35 mm DIN rail or by adapter and 2 screws M4 type	
Disposal	Synthetic materials without dioxin according to EC/EFTA-Notification No. 93/0141/D electrical contacts are AgCdO	

❶ **Voltage is either 24V DC or 24V AC 50/60 Hz.**

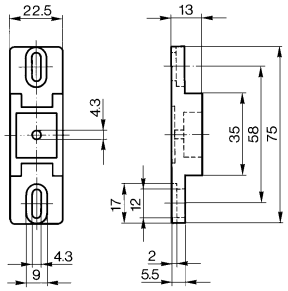
Approximate Dimensions

Dimensions are shown in millimeters (inches).
Dimensions are not intended to be used for manufacturing purposes.



700-FE

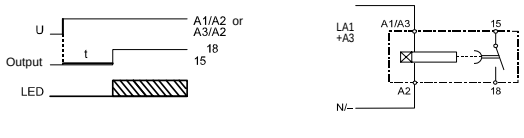
For panel mounting, Use the 199–FSA Panel Mounting Adapter.



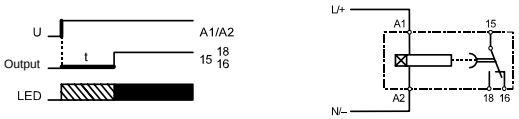
199-FSA

Timing Charts

(A) On-delay

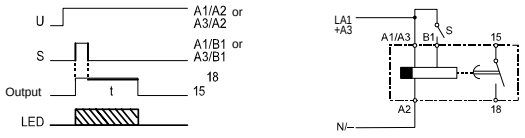


1 N.O. (SPST)

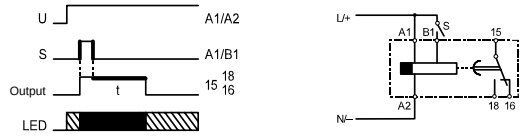


1 C/O (SPDT)

(B) Off-delay

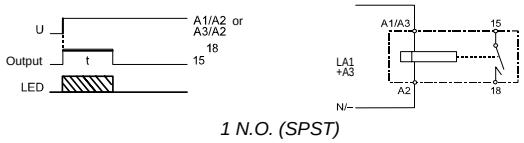


1 N.O. (SPST)

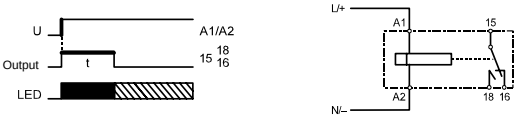


1 C/O (SPDT)

(D) One shot

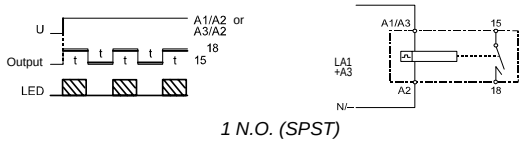


1 N.O. (SPST)

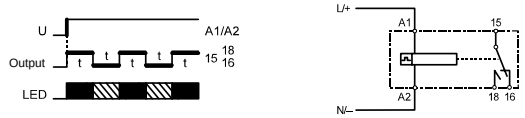


1 C/O (SPDT)

(F) Flasher (repeat cycle starting with pulse)

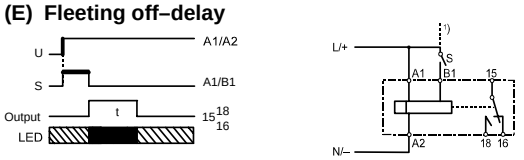


1 N.O. (SPST)



1 C/O (SPDT)

(E) Fleeting off–delay



1 C/O (SPDT)

(L) Pulse converter

1 C/O (SPDT)

Bi-Color LED: 1 C/O (SPDT) Contact Timers

LED U = green: Supply voltage available

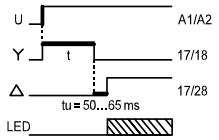
LED Relay = red: Output is energized

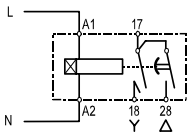
Single Color LED: 1 NO Contact Timers

ON = green:

OFF = no color

(Y) Star–Delta





Wiring Connections

17 Common
18 Y
28 Δ

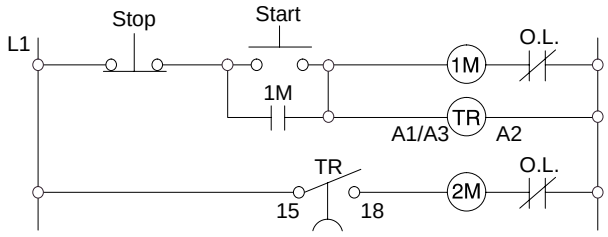
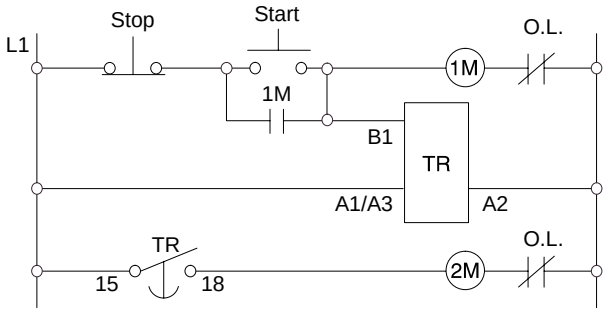
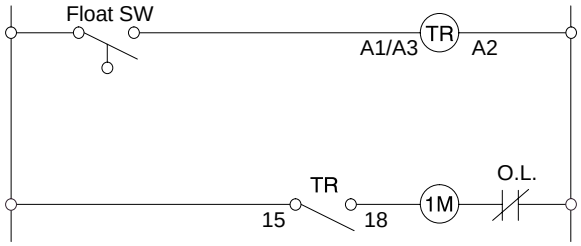
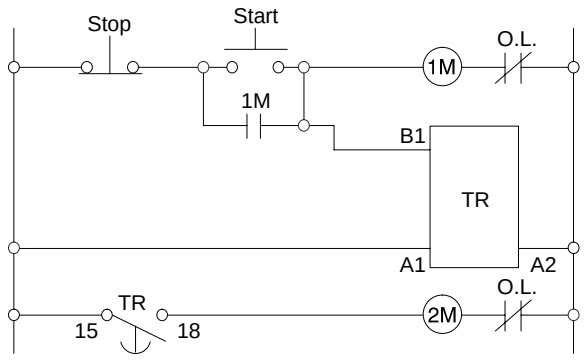
2 NO with Common

Single Color LED: 2 N.O. with Common

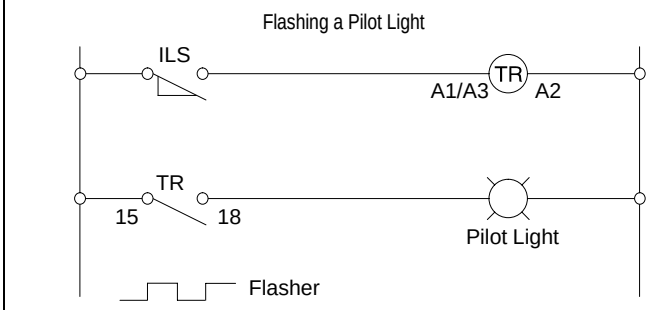
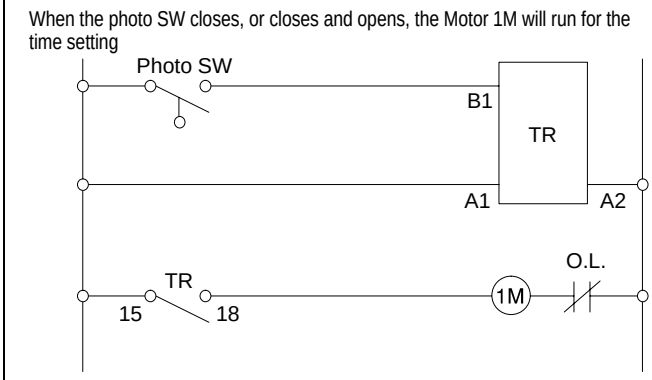
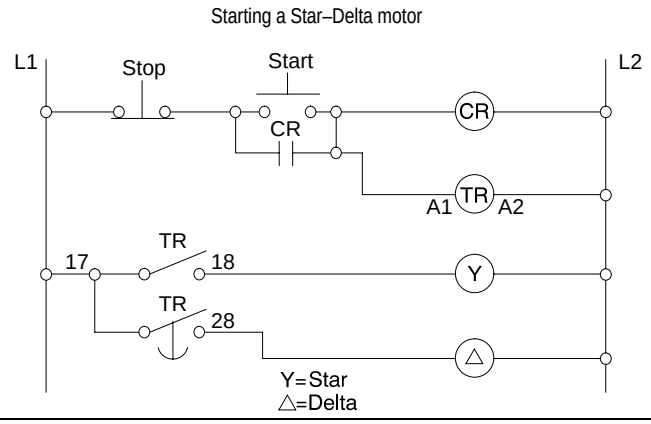
ON = green OFF = no color

NOTE: For the initiate control contact B1, any external power within the supply voltage range can be used. For B1, a different voltage compared to the supply voltage A1/A3–A2 can also be used.
For example: A1–A2 = 230 VAC 50/60 Hz, B1–A2 = 24 VDC, where A2 is the common connection.

Applications

Sequence	Description	Wiring Diagram
On–Delay (A) Motor Starting	Pushing the Start Button energizes both the Starter Coil (1M) and the Timer Coil (TR). The Hold–In Contact (1M) closes to maintain the circuit after the Start Button is released. When the time delay is complete, the contact (TR) closes which energizes coil 2M. Therefor Motor 2M is always started after Motor 1M.	Motor 2M starts after Motor 1M 
Off–Delay (B) Motor Stopping	Pushing the Start Button energizes both 1M and 2M. Pushing the Stop Button de–energizes 1M and the Timer (TR) de–energizes 2M after the time delay. This allows Motor 2M to remain energized for a predetermined time after 1M is stopped	Motor 2M runs for a predetermined time after 1M is stopped 
One Shot (D) Motor On for a Predetermined Time	Each time the Float Switch is closed, Motor 1M will run for the predetermined time that is set on the one shot timer.	Motor 1M always runs for a predetermined time 
Fleeting Off–Delay (E) Motor On for a Predetermined Time After a Stop	Pushing the Start Button and then the Stop Button to energize and de–energize Motor 1M, will cause Motor 2M to be energized for a set time delay.	Turning 1M and Timer TR on and off will cause 2M to run for at least the predetermined time setting on TR 

Applications, Continued

Sequence	Description	Wiring Diagram
Flasher (Repeat Cycle Starting with Pulse) (F) Flashing a Pilot Light	When Limit Switch (1LS) closes, the Timer (TR) will be energized to close and open the contact for the time delay setting, causing the Pilot Light to flash.	
Pulse Converter (L) Pulses Are Turned Into a Set or Predetermined Output	When the Photo Switch closes, the contact TR closes to energize Motor 1M for the predetermined time setting. Time setting is 0.05s to 10h. The timer will not be reset by the opening or pulsing of the photo switch until the time delay is completed.	
Star–Delta (Y) Starting a Star–Delta Motor	Pushing the Start Button energizes the relay CR and the timer TR. Both will hold in through CR. Contact 17–18 will close energizing the Star Contactor (Y), and starting the motor for the predetermined time. Then contact 17–18 will open and 50ms to 65ms later contact 17–28 will close to energize the Delta Contactor (△).	

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Publication 700–2.16 April 1998

Allen-Bradley

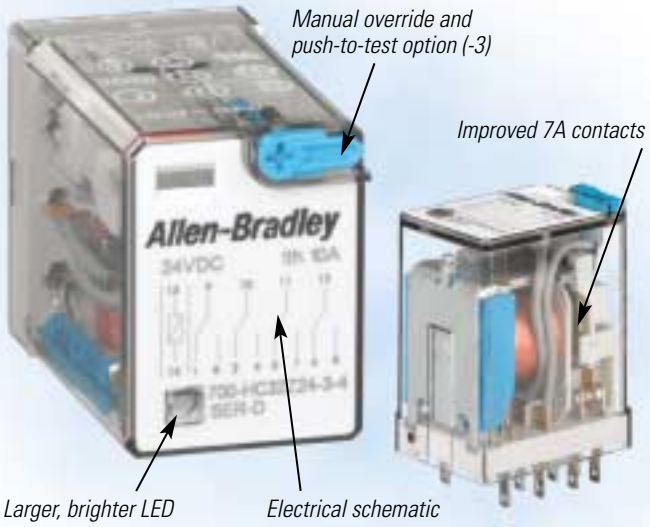
Product Profile

Interposing Relays

New Cost-Saving Relay Design

Bulletin 700-HC, 700-HP, 700-A

Rockwell Automation is introducing a new and improved Allen-Bradley 700-HC "Ice Cube" General Purpose Relay. This 4-pole plug-in relay has been redesigned to meet your low energy switching application needs. Along with the 700-HC, Allen-Bradley is offering a new, space-saving 700-HP printed circuit board (PCB) "Pin" style relay.



700-HC Series D

700-HC Series D

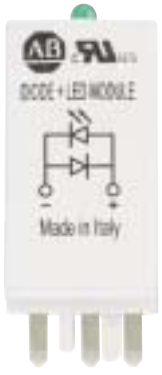
- Cost-reduced design
- Improved low-energy switching capability
- Increased the I_{th} switching capability from 5 A … 7 A
- Designed the same Allen-Bradley relay family appearance on faceplate
- Incorporated manual override lever (-3 option) with the existing push-to-test button
- New 700-HC Series A, 2-pole, 10 A version is now available with silver contacts

New!

700-HP PCB "Pin" Style

- PCB or socket mountable
- 5 mm Pin spacing available in a 2-pole, 8 A design

700-HP PCB "Pin" Style



700-A Plug and Play Module

700-A Plug and Play Modules

- Module mounted within sockets
- Available as surge suppression, timing and LED modules
- Modules compatible with 700-HN104 socket (for 700-HC relay)
- Modules compatible with 700-HN123 socket (for 700-HP relay)
- Modules compatible with 700-HN153 socket (for 700-HB relay)

Coil and Contact Suppression Sockets

- 700-HN104 (for 700-HC relay), 700-HN123 (for 700-HP relay)
- 12 A, 300V AC rating
- Able to insert optional plug and play 700-A modules

Allen-Bradley · Reliance Electric · Dodge · Rockwell Software

Rockwell Automation

Specification Overview								
Catalog Number		**700-HC**				**700-HP**		
Electrical								
Pilot Duty Rating		NEMA C300, R300						
Rated Thermal Current I_{th}		4-pole 7 A		2-pole 10 A		2-pole 8 A		
Contacts	Inductive 120V AC 240V AC	▸] [◂ 15 A 7.5 A	◂] [▸ 1.5 A 0.75 A	▸] [◂ 15 A 7.5 A	◂] [▸ 1.5 A 0.75 A	▸] [◂ 15 A 7.5 A	◂] [▸ 1.5 A 0.75 A	
	DC	24V DC, 7 A		24V DC, 10 A		30V, 8 A		
Permissible Coil Voltage Variation		80 ... 110% of Nominal Voltage at 50 Hz 80 ... 110% of Nominal Voltage at 60 Hz 80 ... 110% of Nominal Voltage at DC				80 ... 110% of Nominal Voltage at 50 Hz 80 ... 110% of Nominal Voltage at 60 Hz 73 ... 150% of Nominal Voltage at DC		
Min. Permissible Contact Ratings		700-HC14 = 10V, 1 mA 700-HC22 and 700-HC24 = 10V, 10 mA				700-HP32 = 300 mW (5V, 5 mA) 700-HPX = 50 mW (5V, 5 mA)		
Coil Consumption ‡ 10%		50 Hz		60 Hz		50 Hz	60 Hz	
AC Coils	Inrush Sealed	2.2 VA 1.3 VA		1.6 VA 1.1 VA		1.8 VA 1.2 VA	1.5 VA 1.0 VA	
DC Coils		1.0 W				0.5 W		
Design Specification/Test Requirements								
Electrical								
Dielectric Withstand Voltage **Pole-to-Pole** **Contact to Coil** **Contact to Frame**		1600V AC 1600V AC 1600V AC				2000V AC 5000V AC —		
Electrical Life		100,000 min.						
Mechanical								
Degree of Protection (Open Type) IEC 529		IP 20 (Guarded Terminal Sockets)						
Mechanical Life Operations		20 x 10^6 (AC) 50 x 10^6 (DC)				10 x 10^6 (AC) 20 x 10^6 (DC)		
Switching Frequency Operations		1800/hr.						
Coil Voltages		See Overview/Product Selection						
Operating Time (ms)	Max Pickup Max. Dropout	10 15				15 12		
Maximum Operating Rate		16 OPS/Seconds						
Environmental								
Temperature	Operating	-30 ... +55° C (-22 ... +131° F)				-40 ... +85° C		
	Storage	-55 ... +85° C (-67 ... +185° F)				-45 ... +100° C		
Altitude		2000 m (6560 ft)						
Construction								
Insulating Material		Molded High Dielectric Material						
Enclosure		Transparent Dust Cover						
Contact Material		Silver Nickel, (AgNi) Silver Nickel + Gold Plating (AgNi + Au)						
Terminal Markings on Socket		In accordance with ENSO 0005						
Sockets		700-HN103, -HN128, -HN104				700-HN123		
Certifications and Approvals		cULus Listed, cURus certified, IMQ, ABS, RINA, CE Marked						
Conformity to Standards		EN 60947 -4-1, EN 60947 -5-1, IEC 947, CSA 22.2, UL 508						

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