



EXPERIENCE *the* EXCELLENCE

# Damage Control Engine Protective Devices

Exline Protective Devices Keep Minor Damage From Becoming A Major Problem



**EXPERIENCE *the* EXCELLENCE**

# **Damage Control Engine Protective Devices**

## **Table of Contents**

### **Pneumatic**

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Stationary Sensor .....	2
Striker Sensor .....	4
Stationary Striker Sensor Assembly .....	6
Exhaust Gas Temperature Sensor .....	8
Thermowell .....	10
Compressor Rod Drop Indicator .....	12
Trip Valve .....	14
Over-Travel Indicator .....	16
Dual Sensor Assembly .....	18
Roller Type Wear Detector .....	20
Vented Roller Type Wear Detector .....	22
Positive Flow Indicator .....	24

### **Electrical**

---

Electronic Compressor Rod Drop Indicator .....	26
Electrical Temperature Sensor Assembly .....	28
Electronic Devices Stationary/Thermowell .....	30
Electronic Trip Switch .....	32

### **In-Head Air Start Distributor**

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Pneumatic Air Start Distributor .....	34
SaveAir™ .....	36-39

Product and Service Warranty .....	40
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## Stationary Sensor

This is one of the most versatile of all Exline Temperature Sensors. It is designed to detect excessive temperature where protection is necessary or desired on stationary parts or areas.

A fuse metal plug in the brass sensor is compounded of specific quantities of special metal alloys which melt at a predetermined temperature. When the fuse plug melts a pressure drop in the pneumatic or hydraulic control system results. This pressure drop can be used to shut down the equipment or sound an alarm.

- Total Reliability
- No Maintenance
- No Calibration
- No Deterioration
- Wide Range of Temperatures
- Reusable
- Device can be reloaded quickly and easily at our factory.

### How to Order

Determine length of sensor and temperature desired. Show part number and temperature.

Example: #300208 – 205°

### Standard Sizes in Stock

Length (L)	Part No.	Length (L)	Part No.
1.0"	300202	5.0"	300210
1.5"	300203	5.5"	300211
2.0"	300204	6.0"	300212
2.5"	300205	6.5"	300213
3.0"	300206	7.0"	300214
3.5"	300207	7.5"	300215
4.0"	300208	8.0"	300216
4.5"	300209	9.0"	300218

*Special sizes available on request. Allow for additional delivery time.*

### Available Fuse-Metal Plug

#### Melting Temps

117° F 162° F 217° F 281° F 361° F  
 136° F 178° F 228° F 291° F 374° F  
 142° F 198° F 243° F 310° F 390° F  
 150° F 205° F 255° F 349° F

*Information concerning special temperatures available on request.*

## Typical Areas Protected by the Stationary Sensor

- Bearings – Main, Pedestal; etc.
- Slides – (Compressor & Power)
- Packing Cases
- Fuel Injection Headers
- Jacketwater\*
- Discharge Gas\*
- Oil Sump\*

\* In conjunction with Thermowell.

## Details of Installation

### Bearing: See Fig. B.

Usually requires drilling and tapping a hole through the cap. This is done with a step drill so dimensions can be held as shown in Fig. B. Insert sensor and tighten to maximum of 8-10 foot-pounds. Check cap to ensure approximately 1/8" clearance between bottom of sensor and back of insert.

### Packing Case, Slides, Cylinder Liner

Drill 7/16" hole 1" deep. Tap 1/4" n.p.t.. Insert sensor and tighten to maximum of 8-10 foot-pounds.

Caution: Machine slots must be kept free of any foreign material that would keep sensor from venting. Use no sealants on the external pipe threads.

All units then can be piped to control air header using tubing and various fittings. Heavy wall brass or stainless steel tubing is recommended.

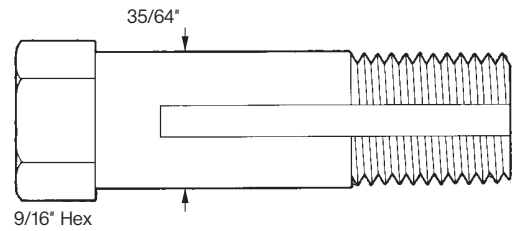
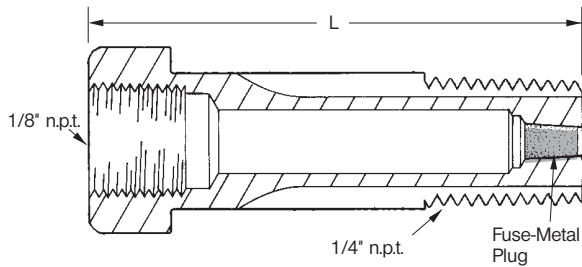
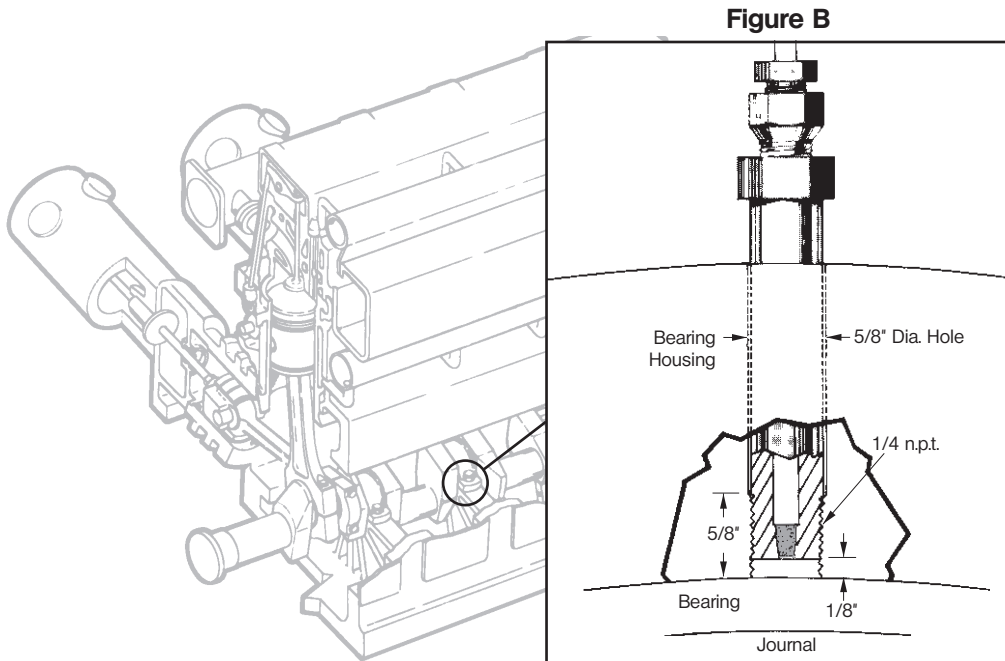


Figure A



Typical Bearing Installation



## Striker Sensor

The Exline Striker Sensor is used primarily in sensing the temperature of connecting rod bearings and other moving engine parts. The Striker Sensor is made of stainless steel for positive service in corrosive environments.

The Striker Sensor contains a temperature sensitive fuse-metal collar which holds a spring-loaded plunger in position. The collar is made of specific quantities of special metal alloys which melt at a predetermined temperature. The Striker Sensor is installed with the fuse-metal end closest to the bearing or temperature-producing area. A break-off dowel or trip valve is mounted directly in line with the Striker Sensor at a stationary point and connected to the pneumatic or hydraulic control media via tubing.

Clearance is set so that the Striker Sensor passes the break-off dowel or trip valve on each revolution. If an excessive temperature buildup occurs in the protected area, the fuse-metal collar melts. The plunger then strikes the break-off dowel, trip valve, or electronic trip switch. A pressure drop in a pneumatic or hydraulic control system or electronic signal results. This pressure drop can be used to shut down the equipment or sound an alarm.

The fuse-metal collar can be economically and quickly replaced at our factory. The break-off dowel is easily removed and replaced.

### Standard Sizes in Stock

Length (L)	Striker Part No.	*Striker & Break-off Dowel Assembly Part No.	**Striker & Trip Valve Assembly Part No.
1.5"	300303	310303	320303
2.0"	300304	310304	320304
2.5"	300305	310305	320305
3.0"	300306	310306	320306
3.5"	300307	310307	320307
4.0"	300308	310308	320308
4.5"	300309	310309	320309
5.0"	300310	310310	320310
5.5"	300311	310311	320311
6.0"	300312	310312	320312
6.5"	300313	310313	320313
7.0"	300314	310314	320314
7.5"	300315	310315	320315
8.0"	300316	310316	320316
8.5"	300317	310317	320317
9.0"	300318	310318	320318
9.5"	300319	310319	320319
10.0"	300320	310320	320320

\* Assemblies include brass break-off dowel, adjusting stud and nuts, or trip valve. To order brass dowels separately, order Part No. 300116. Aluminum break-off dowel Part No. 300105, available on request.

\*\* To order trip valve assembly separately, order Part No. 310150.

Non-stocked sizes available on request. Allow for additional delivery time.

### How to Order

Determine length of striker and temperature desired. Show part number and temperature.

Example: #300308 – 205°

### Available Fuse Collar

#### Melting Temps

117° F	178° F	243° F	349° F	449° F
136° F	198° F	255° F	361° F	478° F
142° F	205° F	281° F	374° F	
150° F	217° F	291° F	390° F	
162° F	228° F	310° F	408° F	

Information concerning special temperatures available on request.

## Typical Areas Protected by the Striker Sensor

- Power Rod Journal
- Compressor Rod Journal
- Crosshead Pins
- Skirt of Piston\*

\* Used as part of Dual Sensor

## Details of Installation

A 7/16" diameter hole is drilled through the cap or rod. Then the hole is counter-bored 9/16" to within 5/8" of the bottom. This can be done in one operation with a step drill. The remaining 5/8" of depth is threaded with 1/4" n.p.t.

The striker body is then installed in the hole. (See Drawing.)

**It should be torqued to a maximum of 35 foot-pounds.**

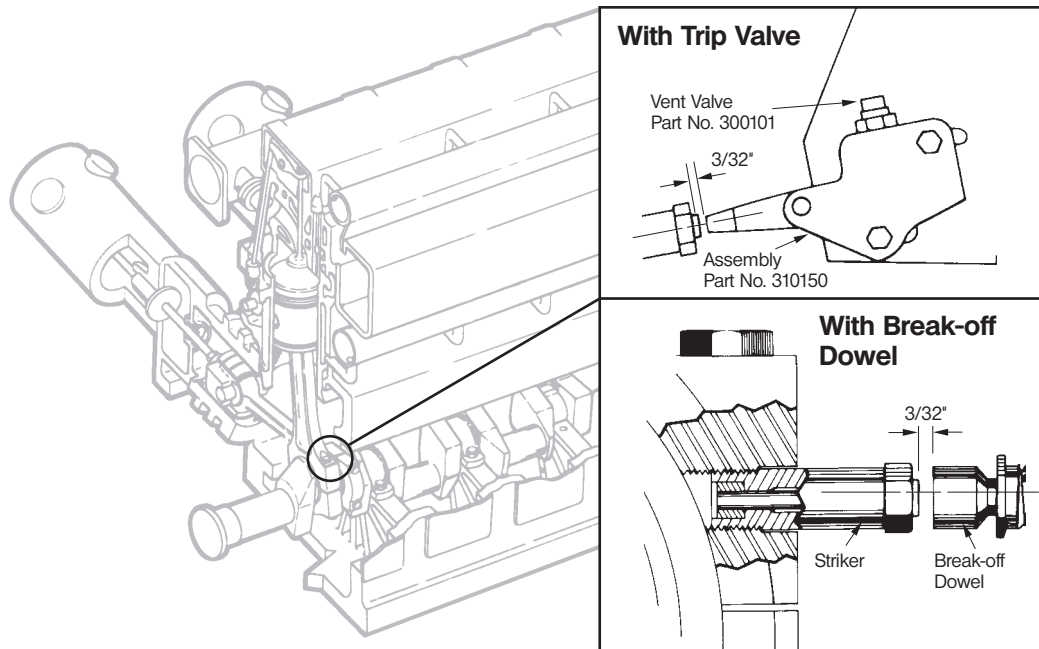
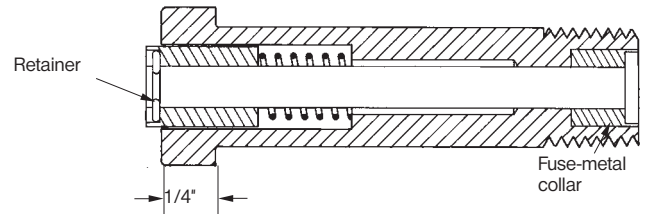
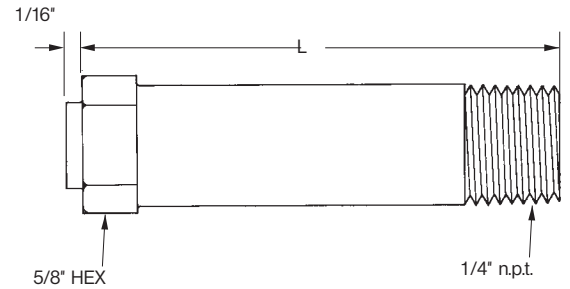
The fuse-metal end should be 1/8" to 3/16" from the back of the bearing.

Use a bracket to mount the break-off dowel or trip valve on a common centerline with the striker sensor.

Adjust clearance to 3/32" with break-off dowel or trip valve arm directly in line. Then connect the break-off dowel or trip valve to control media with tubing and fittings. Heavy wall brass or stainless steel tubing is recommended. The proper bracket, fittings, and hardware can be supplied by Exline for your particular engine.

## Crosshead Pins

The device is installed in the end of the crosshead pin as near the center as possible. Drill the combination 7/16" x 9/16" hole, to receive the sensor, approximately halfway through the length of the pin. The 7/16" bore should be tapped with an extra length tap (1/4 n.p.t.). The sensor is then ready to be installed and torqued to 35 foot-pounds.



Typical Rod Installation



## Stationary Striker Sensor Assembly

The Exline Stationary Striker Sensor Assembly is used primarily in a Thermowell or directly in a surface application, as in a valve flange or packing case.

The sensor is designed to operate in specific areas where it is not practical to utilize the brass Stationary Sensor. The Stationary Striker Sensor Assembly is made of stainless steel to allow positive service in highly corrosive environments. The fuse-metal material is totally isolated from the pneumatic or hydraulic control media to prevent possible contamination.

The Stationary Striker Sensor Assembly contains a temperature sensitive fuse-metal collar which holds a spring-loaded plunger in position. The collar is made of specific quantities of special metal alloys which melt at a predetermined temperature. The vent valve assembly is mounted directly to the sensor and is connected to the control media via tubing.

At the predetermined temperature the fuse-metal collar melts and the spring-loaded plunger is released. The plunger makes contact with the vent valve, creating a pressure drop in the pneumatic control system. This pressure drop can be used to shut down the equipment or sound an alarm.

The fuse-metal collar is the only required replacement when temperature activated and can be economically and quickly replaced at our factory.

### Standard Sizes in Stock

Length (L)	Stationary Striker Part No.	*Stationary Striker Assembly Part No.
1.5"	300223	310223
3.0"	300226	310226
4.0"	300228	310228
5.0"	300230	310230
6.0"	350359	351359
8.0"	350268	351268
9.0"	300231	310231
10.0"	350285	351285

\* Assembly includes sensor, vent valve, and adaptor.  
When ordering vent valve separately, use Part No. 300101;  
for the adaptor, Part No. 300396.

Non-stock sizes available on request. Allow for additional delivery time.

### Available Fuse Collar

#### Melting Temps

117° F	178° F	243° F	349° F	449° F
136° F	198° F	255° F	361° F	478° F
142° F	205° F	281° F	374° F	
150° F	217° F	291° F	390° F	
162° F	228° F	310° F	408° F	

Information on special temperatures available on request.

## How to Order

Determine length of sensor and temperature desired.  
Show part number and temperature.

Example:

4" Stationary Striker Sensor #300228 – 205°

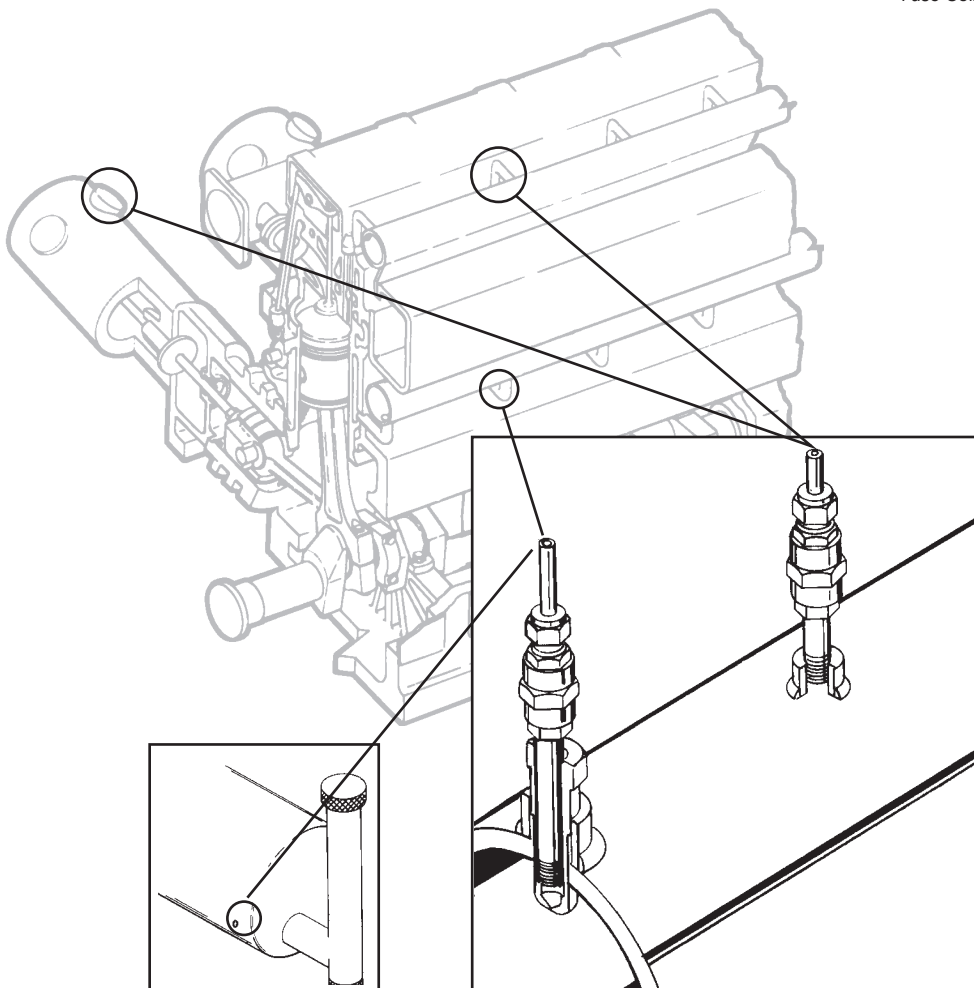
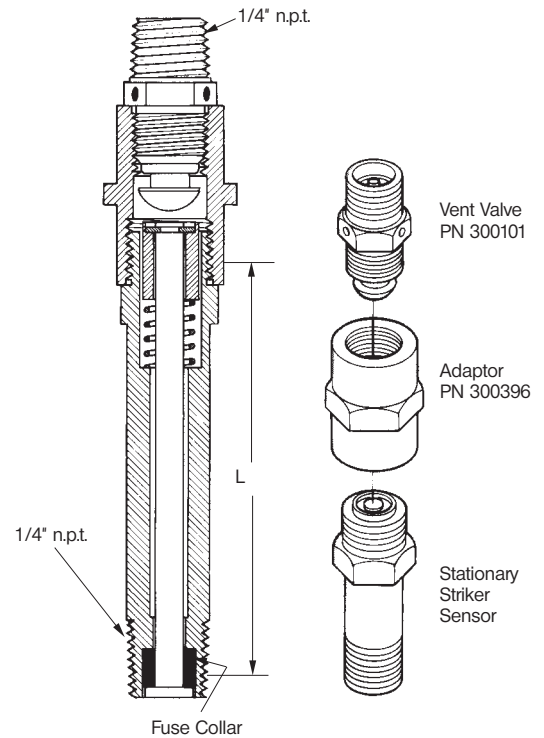
4" Assembly #310228 – 205°

## Typical Areas Protected by the Stationary Striker Sensor Assembly

- Thermowell in Header
- Valve Flanges
- Bearing/Housings & Mains
- Pedestal Bearings
- Motor, Pump Casings
- Crosshead Slides
- Heater Treaters and Similar Fired Vessels
- Main Bearings
- Packing Cases

## Details of Installation

Insert sensor and **tighten to maximum of 10 foot-pounds.**  
**Use no sealants on the probe end threads.** Connect to control media via tubing and fittings.



Typical Installation  
in Fired Vessels

Typical Thermowell and  
Surface Installation





## Exhaust Gas Temperature Sensor

The Exhaust Gas Temperature Sensor is used in high temperature applications. A typical installation of this type of device is in the engine exhaust header.

The E.G.T. device is made of stainless steel to assure years of durability. The device is connected to a control air system via tubing and fittings. At a predetermined temperature the eutectic solder will melt creating a pressure drop in the pneumatic control system. This pressure drop can be used to shut down the equipment or sound an alarm.

- Total Reliability
- No Maintenance
- No Calibration
- No Deterioration
- Reusable
- Device can be reloaded quickly and easily at our factory.

### How to Order

Select applicable length and temperature. Order by part number and temperature.

Example: #300408 – 1170°

To order Thermowell see "Thermowell" "How to order" section page 10.

### Standard Sizes in Stock

Length (L)	Standard Part No.	*E.G.T. w/Slot
1-1/4"	300408	-
4"	300417	300428
5"	300431	300430
6"	300418	350426
7"	300419	300414
8"	350198	300416
9"	-	350418

Approximate Overall Length - 2-5/8" plus (L)

Special sizes available on request. Allow for additional delivery time. Please specify melting temperature desired.

\* To be used in applications where external venting is required; such as flammable media.

### Available melting temperatures

1170° F	1300° F
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When ordering, specify temperature desired.

## Details of Installation

### E.G.T. direct installation:

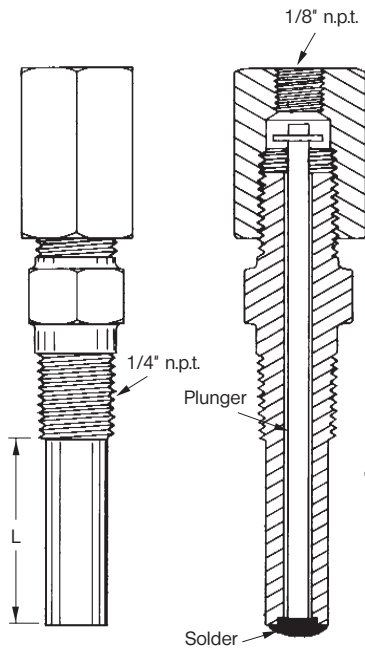
Use 1/4" n.p.t. pipe coupling, weld to exhaust pipe, and drill 7/16" hole through exhaust pipe.

### E.G.T. with slot for use with a Thermowell:

To install E.G.T. into Thermowell, insert sensor and **tighten to maximum of 10 foot-pounds. Use no sealants on the probe end threads.** Connect control media via tubing and fittings.

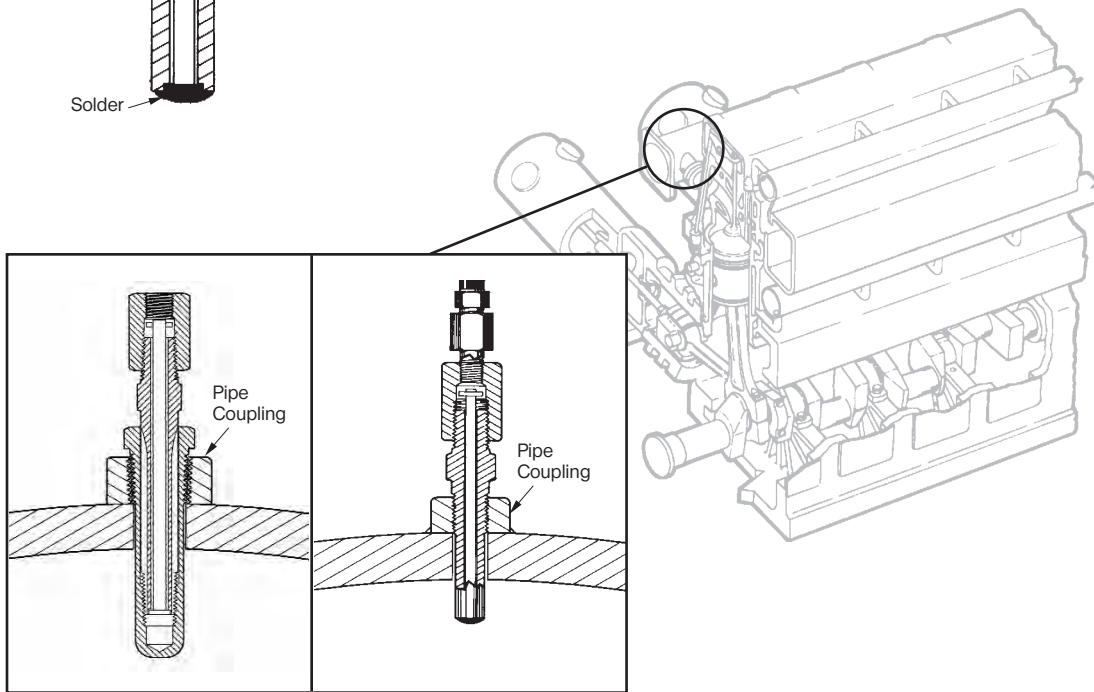
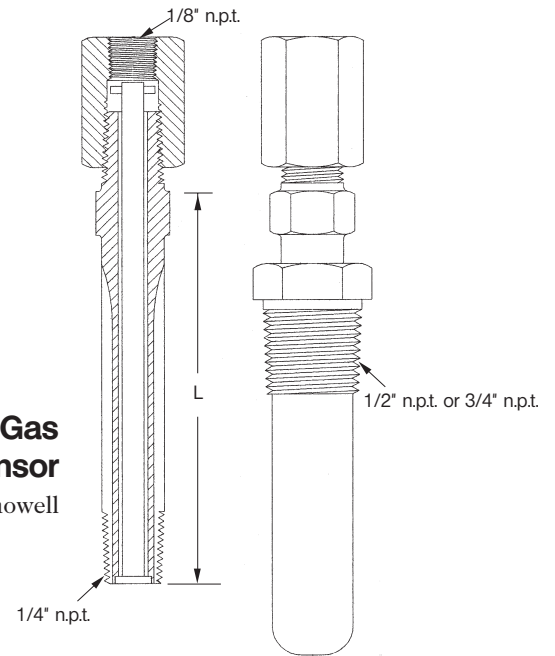
For Thermowell see "Details of Installation" on page 11.

Thermowell (L) length equivalent to Exhaust Gas Temperature Sensor (L) length.



**Exhaust Gas Temperature Sensor**

**Exhaust Gas Temperature Sensor**  
with slot for use with Thermowell



**Typical Installation with Thermowell in Exhaust Header**

**Typical Installation Exhaust Header**



## Thermowell

The Thermowell is a stainless steel unit, used in conjunction with the Exline Stationary Sensor, Exline Stationary Striker Sensor, or Exline Exhaust Gas Temperature Sensor.

The Thermowell unit houses the fuse-metal end of the device, adapting it to be used where the temperature of oil, water, gas, or other element is to be monitored. Typical applications are fuel gas headers, oil sumps, water systems, and natural gas headers.

The Thermowell is designed for use in pressures not to exceed 3000 psi maximum.

- Total Reliability
- No Maintenance
- No Deterioration
- Reusable

### How to Order

Determine overall length and order by part number.

### Typical Areas Protected by the Thermowell

- Fuel Gas Header
- Water Pipes
- Oil Pipes
- Suction and Discharge Gas Headers
- Heater Treater and Similar Fired Vessels

### Standard Sizes in Stock:

#### 1/2" External Pipe Thread

Length (L)	1/2" n.p.t.	3/4" n.p.t.	1" n.p.t.	Minimum Applicable Sensor Length
1-13/16"	300704	300723	-	1 1/2"
3"	300706	300716	350192	3"
4"	300708	300724	350261	4"
5"	300710	300713	350232	5"
6"	350165	350105	350464	6"
7"	300717	300729	350256	7"
8"	350363	350360	350452	8"
9"	300736	300737	350419	9"
10"	350286	350481	350412	10"

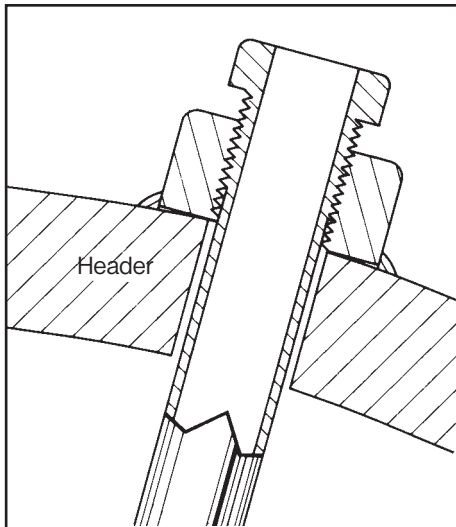
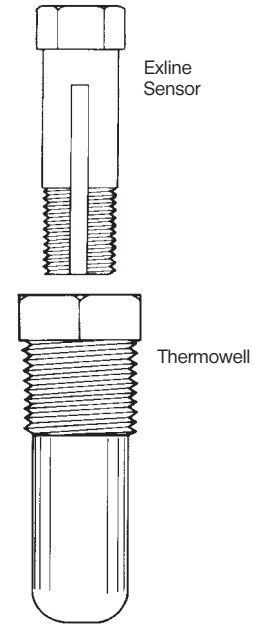
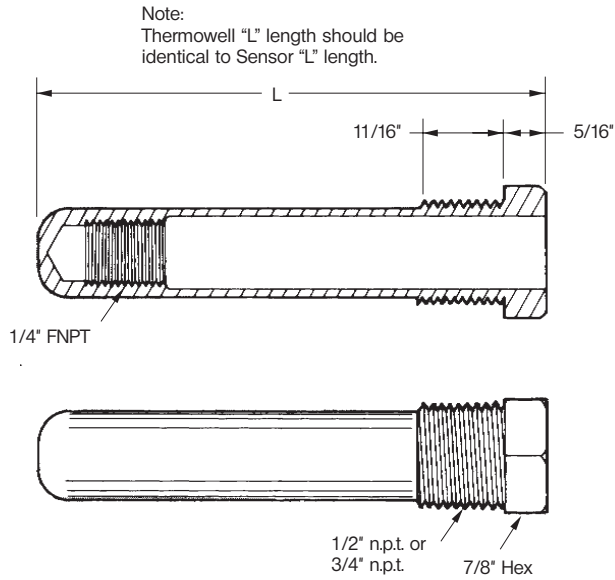
*Special sizes and material available on request. Allow for additional delivery time.*

## Details of Installation

Use 3/4" or 1/2" coupling\*. Weld to header or piping. Drill hole in header after coupling has been installed. Care should be used in drilling 1/2" to prevent thread damage.

When installing Exline Stationary Sensor, Exline Stationary Striker Sensor, or Exline Exhaust Gas Temperature Sensor in Thermowell, refer to the "Details of Installation" section of each individual sensor instruction sheet. Use no sealants on Stationary Striker Sensor, Exhaust Gas Temperature Sensor, or Stationary Sensor probe end external pipe thread.

\* Dependent on male pipe thread ordered.



Typical Installation



## Compressor Rod Drop Indicator

The Exline Compressor Rod Drop Indicator is installed directly beneath the compressor rod to detect wear.

If wear occurs on the piston, piston riders, or cylinders, the compressor rod drops and makes contact with the indicator. This contact creates a friction temperature which melts the fuse-metal plug in the device. A pressure drop in the pneumatic control system results. This pressure drop can be used to shut down the equipment or sound an alarm. A flat end indicator can be used to detect excessive end play in rotating equipment.

- Total Reliability
- No Maintenance
- No Calibration
- No Deterioration
- Wide Range of Temperatures
- Reusable
- Device can be reloaded quickly and easily at our factory

### Details of Installation

#### Compressor Rod Drop Indicator:

Using the packing case nuts as mounting points, a bracket can be fabricated to support the CRD directly under the compressor rod. Two holes are drilled and tapped in the surface of the bracket to attach the device. A shim stock (for example .010) is inserted between the surface of the compressor rod and curved surface of the device. The device is positioned firmly against the shim stock and bolts are tightened. This permanently positions the CRD in place. The shim is removed and the device is piped to the control header. The flat end device can be used to detect excessive end play in rotating equipment.

#### Vented Compressor Rod Drop Indicator:

Install as described above. Tube supply "SUP" side to air header. Tube vent side "VENT" to atmosphere or appropriate area.

*\* Not recommended for use with units that operate with synthetic oils.*

### How to Order

Determine rod diameter and temperature desired  
Show part # and temperature.

Example:           3" Dia. Rod – 178° F  
#300506 – 178° F

### Standard Sizes in Stock

Rod Diameter	Part No.	Vented CRD
Flat end	300500	350396
1.5"	300503	350535
2.0"	300504	350388
2.5"	300505	350536
3.0"	300506	350387
3.5"	300507	350355
4.0"	300508	350254
4.5"	300509	350272
5.0"	300510	350389
5.5"	300511	350538

*Special sizes available. Allow for additional delivery time.*

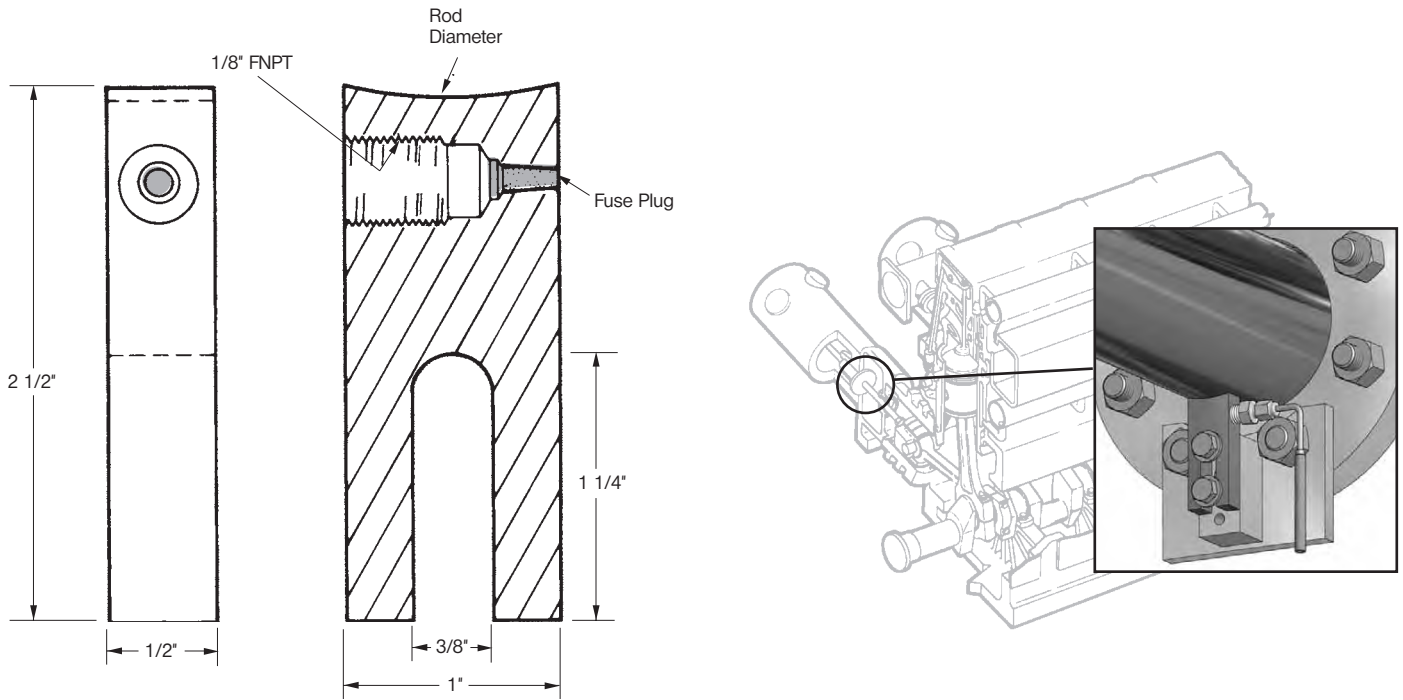
*Metric sizes available upon request.*

### Available Fuse-Metal

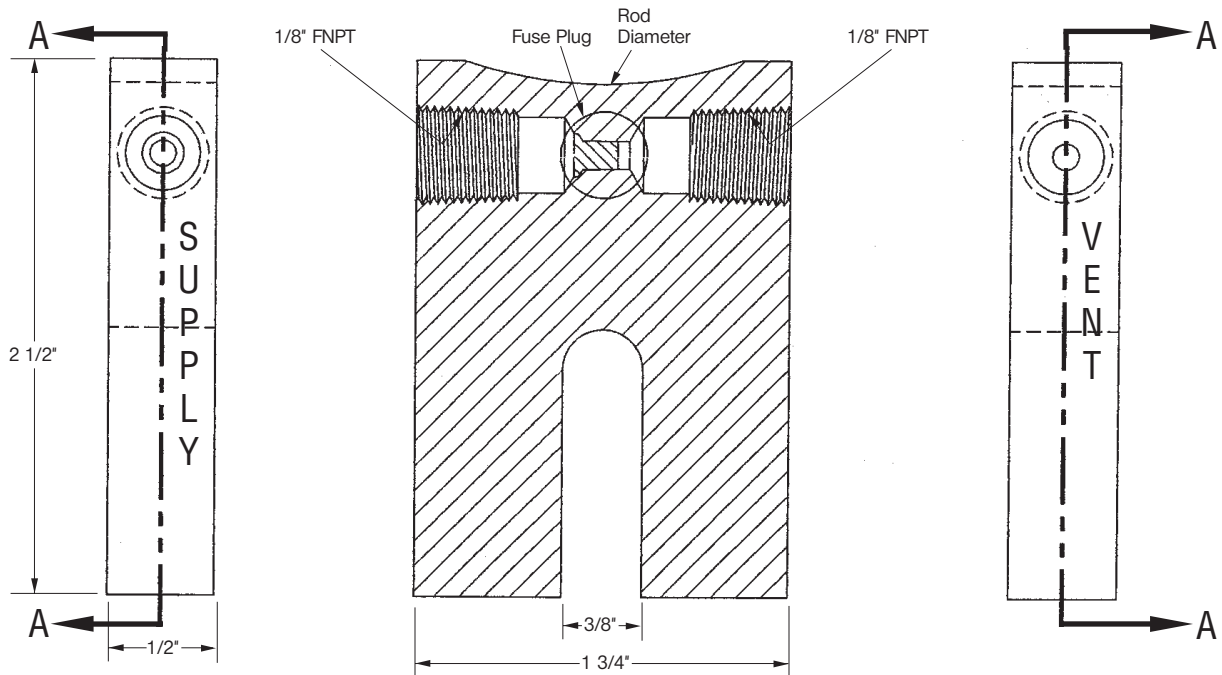
#### Melting Temps

117° F	162° F	217° F	281° F	361° F
136° F	178° F	228° F	291° F	374° F
142° F	198° F	243° F	310° F	390° F
150° F	205° F	255° F	349° F	

## Compressor Rod Drop Indicator



## Vented Compressor Rod Drop Indicator





### How To Order

For a complete assembly, order Part No. 310150.

For body only, order Part No. 300150.

For vent valve only, order Part No. 300101.

## Trip Valve

Exline Trip Valves are used to protect moving, rotating, or oscillating components fitted with Exline Striker Sensors. This durable bronze Trip Valve is also used with Overspeed Safety Equipment fitted with a Centrifugal Plunger. Tripping the valve creates a pressure drop in the control system. That, in turn, automatically shuts down the equipment or triggers an alarm.

The Exline Trip Valve is available for initial installation. You can also use the Exline Trip Valve with existing trip valve systems – no mounting or bracket changes are required. A superior design virtually eliminates the maintenance usually associated with this type of valve. The unique body design permits crankcase oil “flow-through” which minimizes carbon or varnish buildup in the piston area. No “O” rings are used in the trip valve body design. A reduced cross-sectional area of the trip valve lever reduces the possibility of premature valve tripping due to cold crankcase oil turbulence during “start up”.

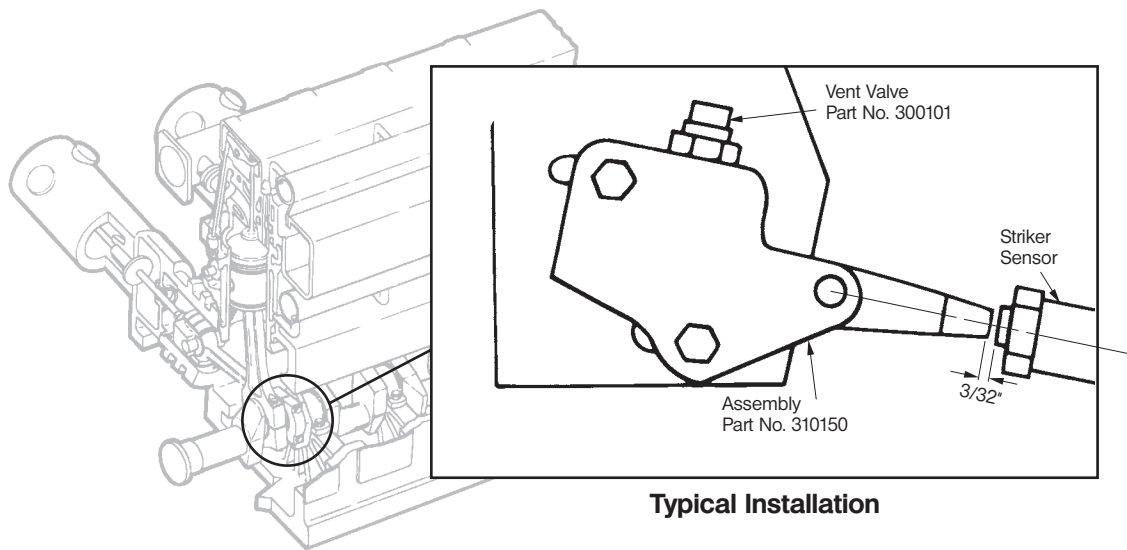
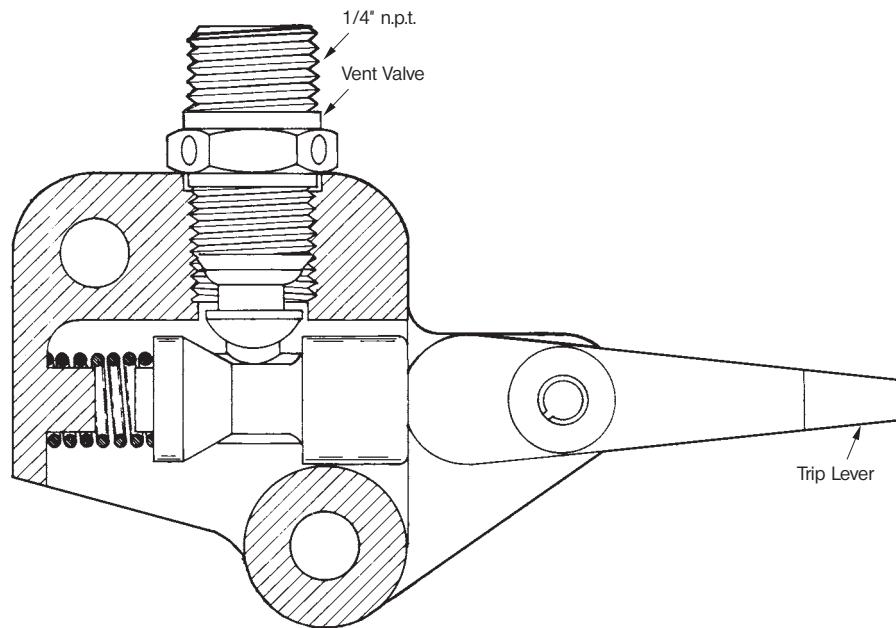
The stainless steel Vent Valve used to create the pressure drop in a pneumatic system can be easily removed and replaced without disturbing the setting or adjustments of the trip valve body. The Vent Valve uses a Viton™ seal rated at 375° Fahrenheit and has a 1/4" male n.p.t. for connection to the Pneumatic Control System.

### Typical Installation:

A bracket is used to mount the Trip Valve directly in line with a Striker Sensor. Clearance is adjusted with the moving component at a stationary point, where normal travel brings the Striker Sensor closest to the Trip Valve. At this point, the trip lever and the Striker Sensor should share a common centerline.

The Trip Valve is then connected to control media by tubing and fittings. Heavy wall brass or stainless steel tubing is recommended. The proper bracket, fittings, and other hardware can be supplied by Exline for your particular engine or other installation.

# Pneumatic Trip Valve



**Typical Installation**





## Over-Travel Indicator

The Exline Over-Travel Indicator is a wear indicator. Its purpose is to detect wear to connecting rod bearings and wrist pin bushings.

This device is excellent for protection of articulated rods on 2-cycle engines. Early wear detection can save extensive damage to the master rod.

The Over-Travel Indicator is installed, in most applications, on the bottom of the cylinder liner. In the event of wear of the pin bushings, etc., a slight variation in piston travel occurs. The piston strikes the adjusting screw, breaking the dowel. This creates a pressure drop in the pneumatic or hydraulic control system that can be used to shut down the equipment or sound an alarm.

This device is also ideal for horizontal engine power rod and crosshead "override."

- Total Reliability
- No Maintenance
- No Calibration
- No Deterioration
- Reusable

### How to Order

To determine size of device for your engine, measure distance from bottom of cylinder to bottom of piston when it is in its lowest position. Use this distance to the nearest 1/2" and add 2". This gives you Length (L) for ordering correct device. Specify make and type of engine and number of cylinders.

### Standard Sizes in Stock

Length (L)	Assembly* Part No.
2.5"	310605
3.0"	310606
3.5"	310607
4.0"	310608
4.5"	310609
5.0"	310610
5.5"	310611
6.0"	310612
6.5"	310613
7.0"	310614
GMV Series	310651

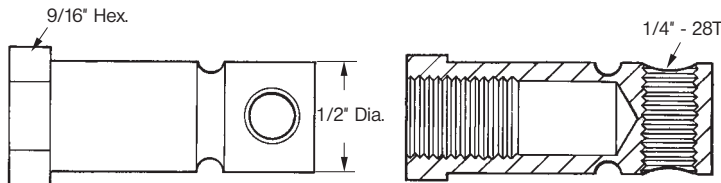
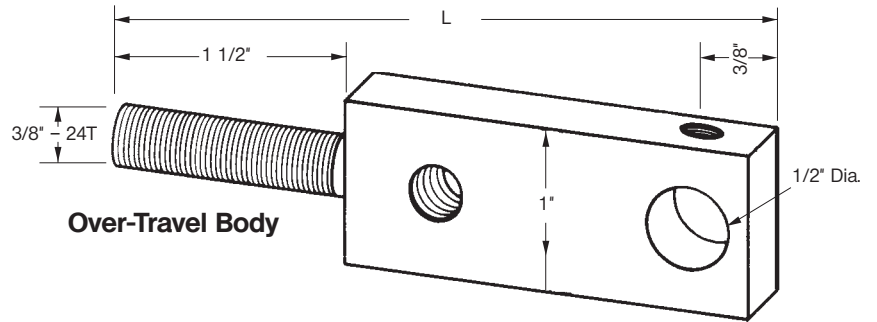
\* Assembly includes Aluminum Break-Off Dowel adjusting stud & nuts. To order Aluminum Break-Off Dowel separately, order Part No. 300108.

Brass Break-Off Dowel, Part No. 300103 available upon request.

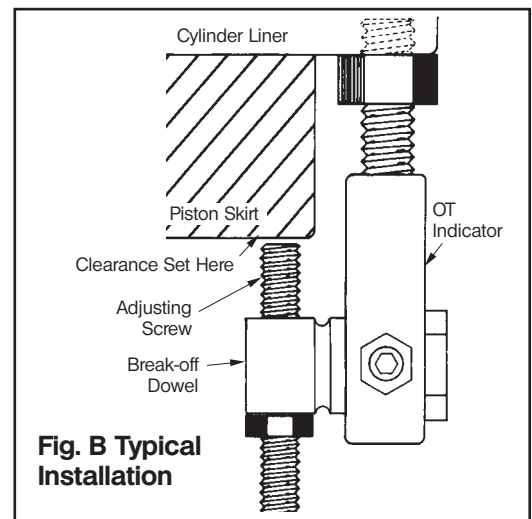
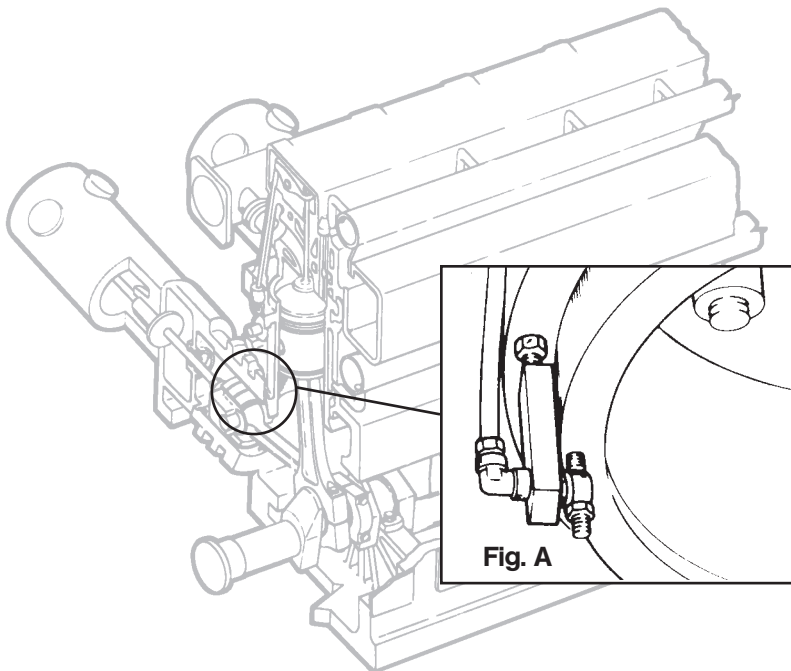
Special sizes and applications available on request. Allow for additional delivery time.

## Details of Installation

The Over-Travel Indicator is installed on or near the bottom of the cylinder liner. It should be located as close as possible in a position directly below the end of the piston pin (Figure "A"). When installed as shown, simply drill a  $\frac{21}{64}$ " hole approximately 1" deep and tap for SAE  $\frac{3}{8}$ " - 24 thread (Figure "B"). A locknut secures the device to the cylinder liner. A predetermined clearance (Example: .015 - .020) is set between the lowest position of the piston skirt and the adjusting screw. Tubing then connects the device to control media. Heavy wall brass or stainless steel tubing is recommended and can be supplied upon request.



**Break-off Dowel**





## Dual Sensor Assembly

The Exline Dual Sensor Assembly provides compact and practical protection for piston pin bushings, cylinders, and pistons. This assembly incorporates two devices as a single unit. One senses high piston skirt temperature and the other detects any wear resulting in piston overtravel.

Because the lower portion of the piston skirt does not readily transfer heat to the cylinder wall and therefore runs at a more consistent operating temperature, the temperature sensor is installed on the inside diameter of the piston skirt. Any excessive temperature rise of the piston skirt will melt a fuse-metal alloy, permitting a spring-loaded plunger to extend toward the inside of the piston. This plunger then strikes a break-off dowel, creating a pressure drop in the pneumatic control system that can be used to shut down the equipment or sound an alarm. Excessive downward travel of the piston will also create a pressure drop by striking a separate break-off dowel located on the same header of this “two-in-one” device.

- Total Reliability
- No Maintenance
- No Calibration
- No Deterioration
- Reusable

### Part Numbers

Part	Part No.
Aluminum Break-off*	300109
Brass Break-off Dowel**	300107

\* *Dowel (2 required)*

\*\* *Available upon request. (2 required)*

*Part Number determined by customer requirements.*

### How to Order

Specify make and model of engine and number of cylinders.

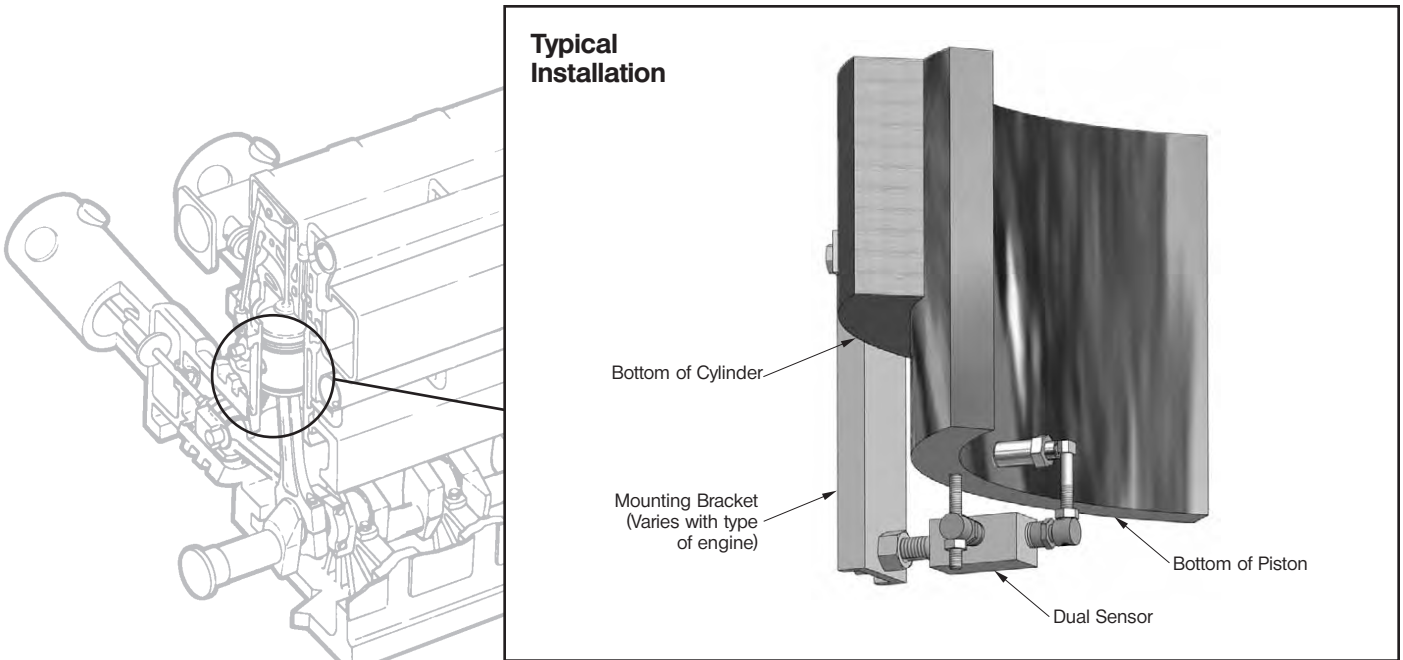
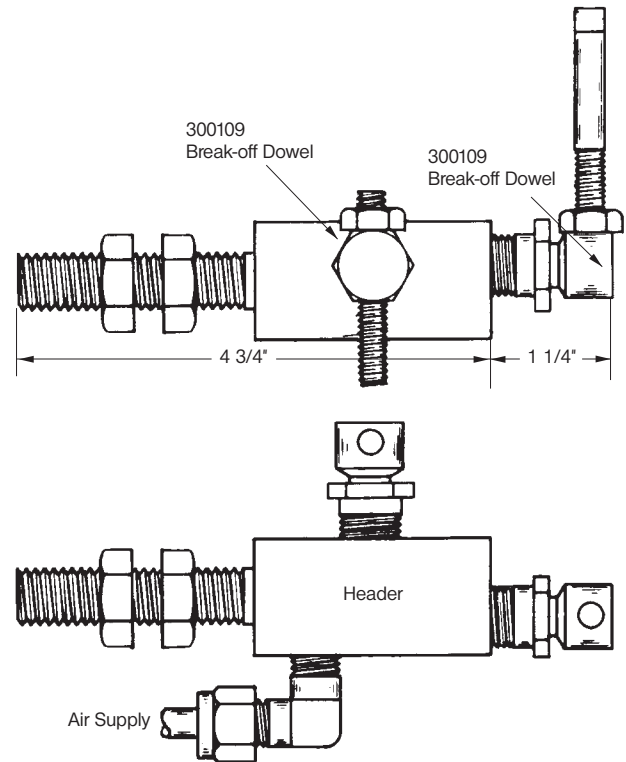
### Application

Protects Piston Pin Bushings, Cylinders, and Pistons.

## Details of Installation

The Dual Sensor Assembly should be mounted at the bottom of the cylinder directly below the end of the piston pin. Mount the bracket at the bottom of cylinder and install header on bracket. Drill and tap hole in piston skirt to install striker sensor.\* The striker should be located directly above the break-off dowel adjusting screw. Plunger of striker should have 1/16" clearance from adjusting screw (shown in Figure A). Clearance between piston and adjusting screw (shown in Figure B) should be field adjusted to operating clearance. Install tubing to control system.

\* See Striker Sensor on page 5, for "Details of Installation" and "Available Fuse Collar Melting Temperatures" on page 4.





## Roller Type Wear Detector

The Exline Roller Type Wear Detector may be used to monitor horizontal or vertical movement of reciprocating or rotating parts.

The Detector has a replaceable stainless steel Vent Valve with a Viton™ seal rated at 375° F and a 1/4" n.p.t. male connection threaded to accept a pneumatic control system air line.

Principal application is to signal compressor rod drop. The Roller Type Wear Detector may be installed directly below the compressor rod, where rod travel is horizontal, or on the thrust side where the rod travels vertically. If wear occurs on the piston, piston riders, crosshead, or cylinders, the rod contacts the Detector's knurled wheel. Rod motion rotates the wheel, which in turn opens the Vent Valve connected to the pneumatic control system. A spring-loaded pin locks the rotated wheel into the "shutdown" position. The resulting pressure drop may be used to shut down the compressor automatically.

The Roller Type Wear Detector can be used in applications where low ambient temperatures, certain synthetic lubricants and incompatible rod coatings have ruled out the installation of heat-sensitive friction-type protective devices.

- Total Reliability
- No Maintenance
- No Calibration
- Temperature Independent
- Reusable
- Easy To Reset In Place

### How to Order

The Roller Type Wear Detector comes in one size only and can be used with rods of any diameter. Its aluminum body is drilled and tapped so that the Vent Valve and spring-loaded plunger can be mounted on either side of the device.

### Order by part number

Roller Type Wear Detector Assembly  
with Aluminum Wheel 310550

*Assembly includes (1) ea. of the following items which can be ordered as spares:*

Body, Aluminum	300550
Wheel, Aluminum	300555
Vent Valve	300101
Locking Pin/Spring Plunger	030301

Roller Type Wear Detector Assembly  
with Nylon Wheel\* 350350

*Assembly includes (1) ea. of the following items which can be ordered as spares:*

Body, Aluminum	300550
Wheel, Nylon	300551
Vent Valve	300101
Locking Pin/Pin Plunger	030301

*\*Not suitable for engines that run over 350 rpm*

## Details of Installation

The packing case nuts can be used as mounting points. Fabricate a metal bracket to support the Detector directly under, or on the thrust side of, the compressor rod. Drill and tap two holes in the bracket to attach the Detector.

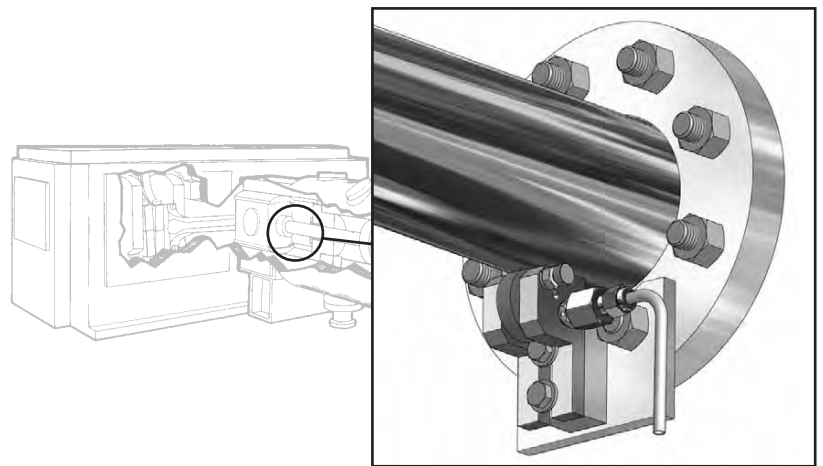
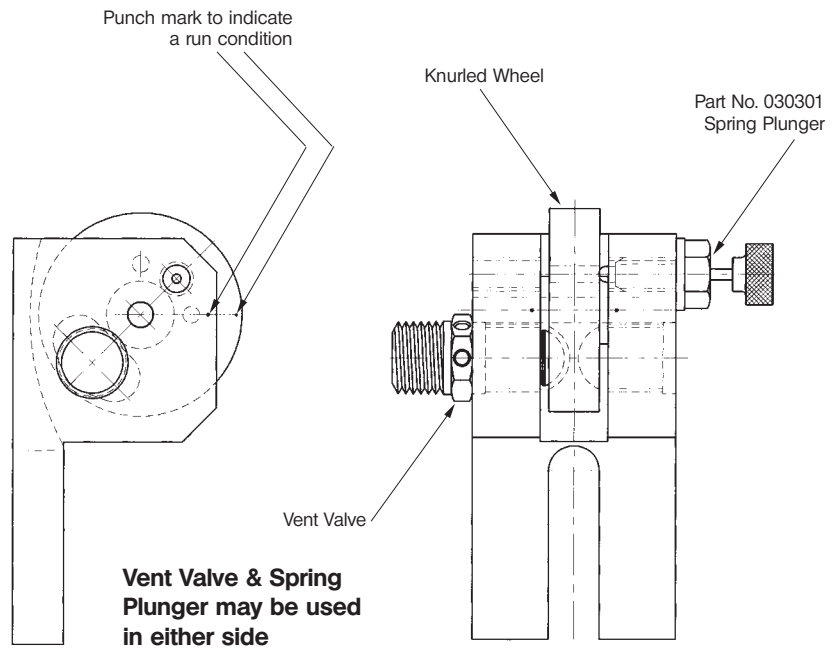
To determine the appropriate clearance between Detector wheel and rod, consider the thickness of the piston rider band material, the location of the device in relation to the crosshead pin, and the desired sensitivity. Insert a shim stock of the appropriate thickness between the rod and

wheel, hold the device firmly against shim stock and bracket as the bolts are tightened. Remove the shim and pipe the Vent Valve to the control header.

No regular maintenance or calibration is required unless new compressor components are installed or packing is replaced. The Vent Valve can be replaced and the device reset to the marked "run" position without recalibration, but it is advisable to confirm the preset clearance after new parts are installed.

### Setting Instructions

1. Determine which side will be accessible after installation.
2. Install bleed valve, Part No. 300101 into body of RTWD.
3. Install spring plunger/locking pin, Part No. 030301 into body of RTWD:
  - a. Pull back plunger head and rotate the wheel until punch marks line up – this is the run position. Punch marks area located on each side of the wheel and on top of the RTWD body.
  - b. Release the plunger head. The pin should seat down into a 1/8" stop hole in the face of the wheel.
4. Turn the wheel, making sure the plunger will release and hold in the shutdown position after dropping into the 1/8" hole. There will be a strong drag on the wheel as it is turned. It is important that the wheel is not locked into place too tightly so that it cannot move at all and not too loose so that it can move too easily.
5. Install complete Roller Type Wear Detector assembly, set proper clearance. Check for shut-down by simply turning the wheel.
  - a. Suggested clearance for worn rings/riders should be set at approximately .005" to .010".
  - b. Suggested clearance for new rings/riders should be set at approximately .010" to .015".





## Vented Roller Type Wear Detector

The Exline Vented Roller Type Wear Detector may be used to monitor horizontal or vertical movement of reciprocating or rotating parts in applications where gas is used as control media.

The Detector has a replaceable stainless steel Vent Valve with a Viton™ seal rated at 375° F and a 1/4" n.p.t. male connection threaded to accept a pneumatic control system air line.

Principal application is to signal compressor rod drop. The Vented Roller Type Wear Detector may be installed directly below the compressor rod, where rod travel is horizontal, or on the thrust side where the rod travels vertically. If wear occurs on the piston, piston riders, crosshead or cylinders, the rod contacts the Detector's knurled wheel. Rod motion rotates the wheel, which in turn opens the Vent Valve connected to the pneumatic control system. A spring-loaded pin locks the rotated wheel into the "shutdown" position. The resulting pressure drop may be used to shut down the compressor automatically.

The Vented Roller Type Wear Detector can be used in applications where low ambient temperatures, certain synthetic lubricants, and incompatible rod coatings have ruled out the installation of heat-sensitive friction-type protective devices.

- Total Reliability
- No Maintenance
- No Calibration
- Temperature Independent
- Reusable
- Easy To Reset In Place

### How to Order

The Vented Roller Type Wear Detector comes in one size only and can be used with rods of any diameter. Its aluminum body is drilled and tapped so that the Vent Valve and spring-loaded plunger can be mounted on either side of the device.

### Order by part number

Vented Roller Type Wear Detector Assembly with Aluminum Wheel 320550

*Assembly includes (1) ea. of the following items which can be ordered as spares:*

Body, Aluminum	300550
Wheel, Aluminum	300555
Vent Valve	300101
Locking Pin/Spring Plunger	030301
Vent Adapter Assembly: Jam nut, gasket, vent adapter, vent tube	030302

Vented Roller Type Wear Detector Assembly with Nylon Wheel\* 320550-NLY

*Assembly includes (1) ea. of the following items which can be ordered as spares:*

Body, Aluminum	300550
Wheel, Nylon	300551
Vent Valve	300101
Locking Pin/Spring Plunger	030301
Vent Adapter Assembly	030302

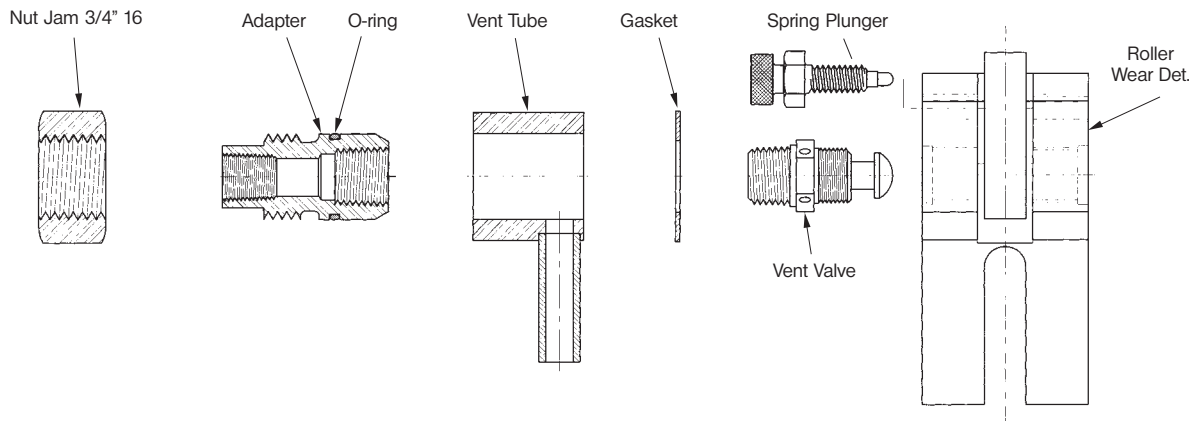
*\*Not suitable for engines that run over 350 hp*

## Details of Installation

The packing case nuts can be used as mounting points. Fabricate a metal bracket to support the Detector directly under, or on the thrust side of, the compressor rod. Drill and tap two holes in the bracket to attach the Detector.

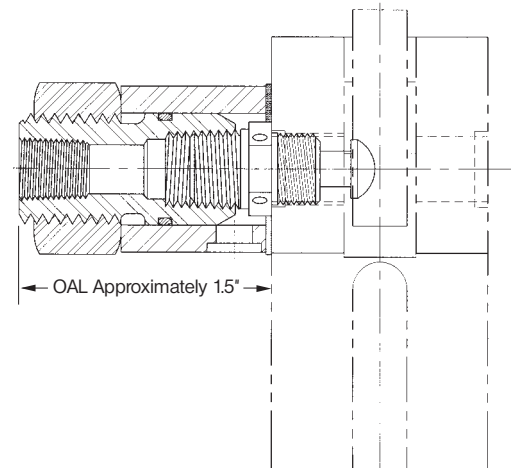
To determine the appropriate clearance between Detector wheel and rod, consider the thickness of the piston rider band material, the location of the device in relation to the crosshead pin and the desired sensitivity. Insert a shim stock of the appropriate thickness between the rod and wheel, hold the device firmly against shim stock and bracket as the bolts are tightened. Remove the shim and pipe the Vent Valve to the control header. Tie into vent tube to vent to atmosphere or appropriate area.

No regular maintenance or calibration is required unless new compressor components are installed or packing is replaced. The Vent Valve can be replaced and the device reset to the marked "run" position without recalibration, but it is advisable to confirm the preset clearance after new parts are installed.



### Setting Instructions

1. Determine which side will be accessible after installation.
2. Install bleed valve, Part No. 300101 into body of RTWD.
3. Install spring plunger/locking pin, Part No. 030301 into body of RTWD:
  - a. Pull back plunger head and rotate the wheel until punch marks line up – this is the run position. Punch marks area located on each side of the wheel and on top of the RTWD body.
  - b. Release the plunger head. The pin should seat down into a 1/8" stop hole in the face of the wheel.
4. Turn the wheel, making sure the plunger will release and hold in the shutdown position after dropping into the 1/8" hole. There will be a strong drag on the wheel as it is turned. It is important that the wheel is not locked into place too tightly so that it cannot move at all and not too loose so that it can move too easily.
5. Install complete Roller Type Wear Detector assembly, set proper clearance. Check for shut-down by simply turning the wheel.
  - a. Suggested clearance for worn rings/riders should be set at approximately .005" to .010".
  - b. Suggested clearance for new rings/riders should be set at approximately .010" to .015".







## Positive Flow Indicator

Designed for the protection of hydraulic and pneumatic systems, the Positive Flow Indicator will tell the operator at a glance the current condition of the equipment involved.

Panel mounted or installed in-line in any number of applications, flow of any magnitude from no-flow to full-flow is indicated.

The device functions on a differential pressure principle with a number of calculated orifices to control movement of the color coded indicator pin.

Simply push to reset. This automatically equalizes differential pressure. The indicator is not affected by atmospheric pressure.

Components are fabricated from anodized aluminum. This allows use in most environments including sour gas areas.

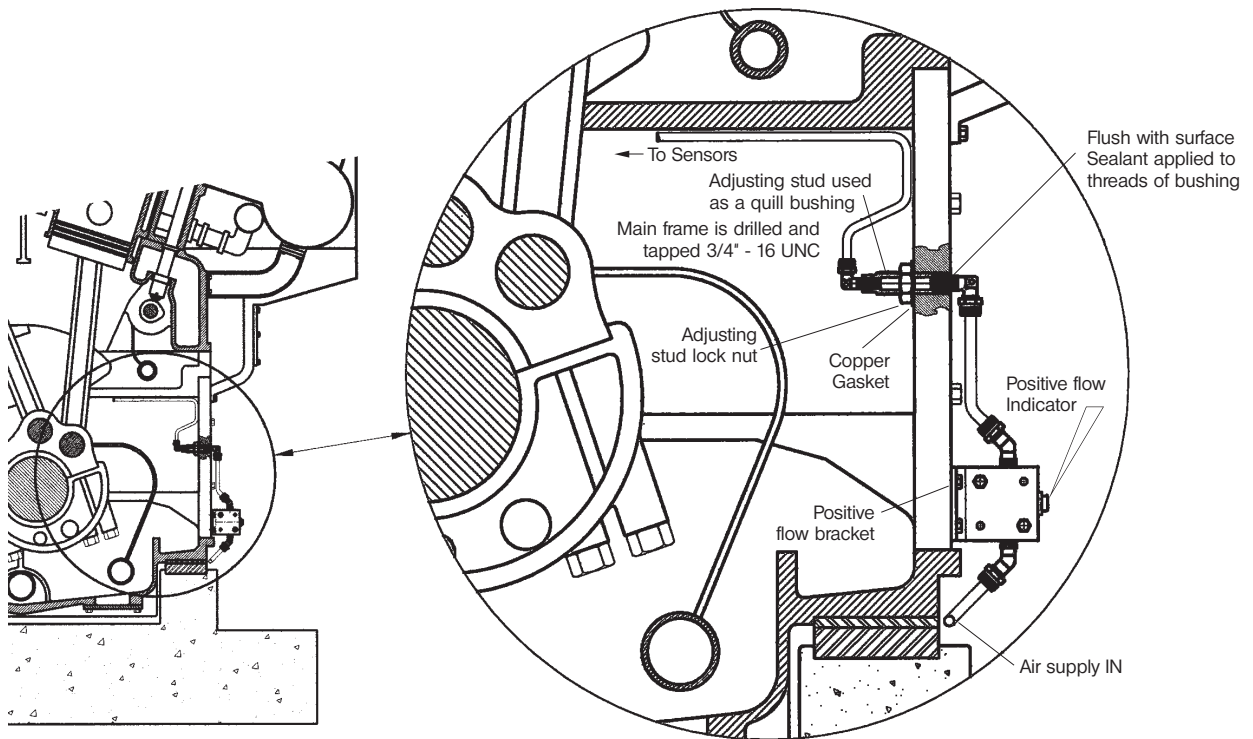
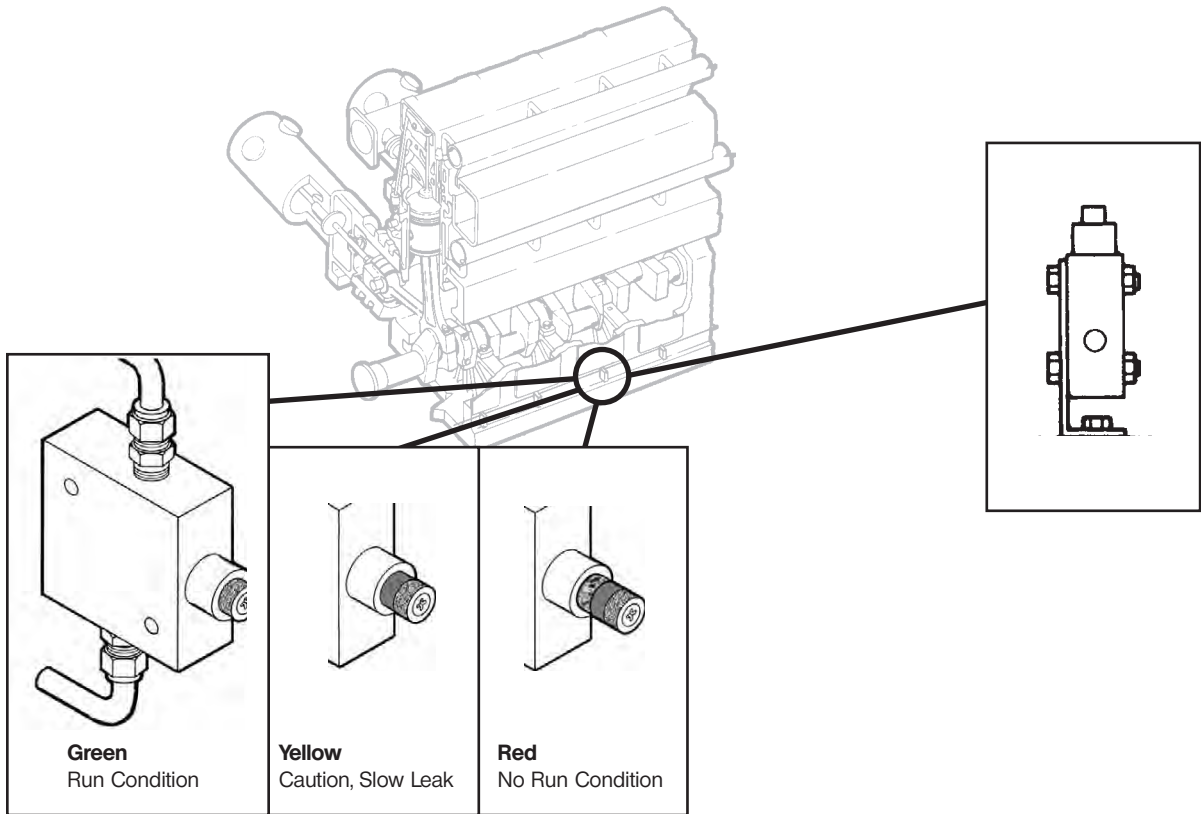
### Application

- Instant visual indication of operating condition on temperature sensors and wear indicators.
- Also used to show the stage in which a sequence of operations has progressed, from the smallest leak to a full flow.

### Ordering Information

Part No. 340101

In ordering base unit, specify quantity and whether you plan to mount on surface or panel.



**Typical Positive Flow Indicator Installation**



## Electronic Compressor Rod Drop Indicator

The Exline Electronic Compressor Rod Drop Indicator is installed directly beneath the compressor rod to detect wear.

If wear occurs on the piston, piston riders, or cylinders, the compressor rod drops and makes contact with the indicator. Continuous temperature readout will trigger a shutdown or an alarm upon temperature increase. Connect them to existing control circuitry or have us install a complete system, including a monitoring panel.

### Durable No-Maintenance Design:

Standard units house a Type "J" ungrounded thermocouple. The Electronic CRD is equipped with a standard 15' TFE-coated lead wire length that can be either encased in a flexible braided stainless steel overlay or supplied ready to be installed in metal conduit. The thermocouple allows for a temperature range from approximately 32° F to 1380° F.

### Options

Options include custom length lead-wire in 5' increments.

### Details of Installation

Using the packing case nuts as mounting points, a bracket can be fabricated to support the CRD directly under the compressor rod. Two holes are drilled and tapped in the surface of the bracket to attach the device. A shim stock (for example .010) is inserted between the surface of the compressor rod and curved surface of the device. The device is positioned firmly against the shim stock and bolts are tightened. This permanently positions the Electronic CRD into place. The shim is removed and the device is wired into the existing monitoring system.

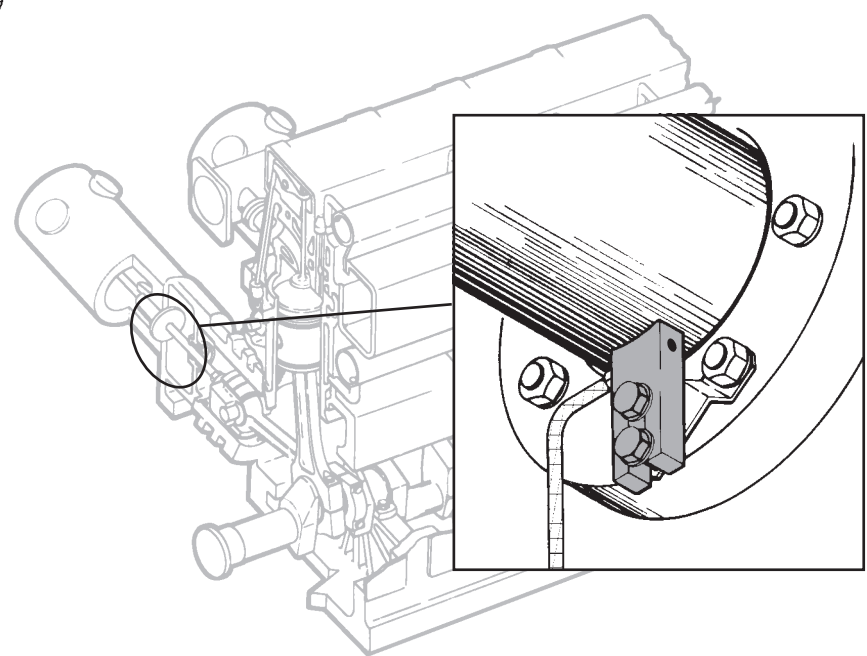
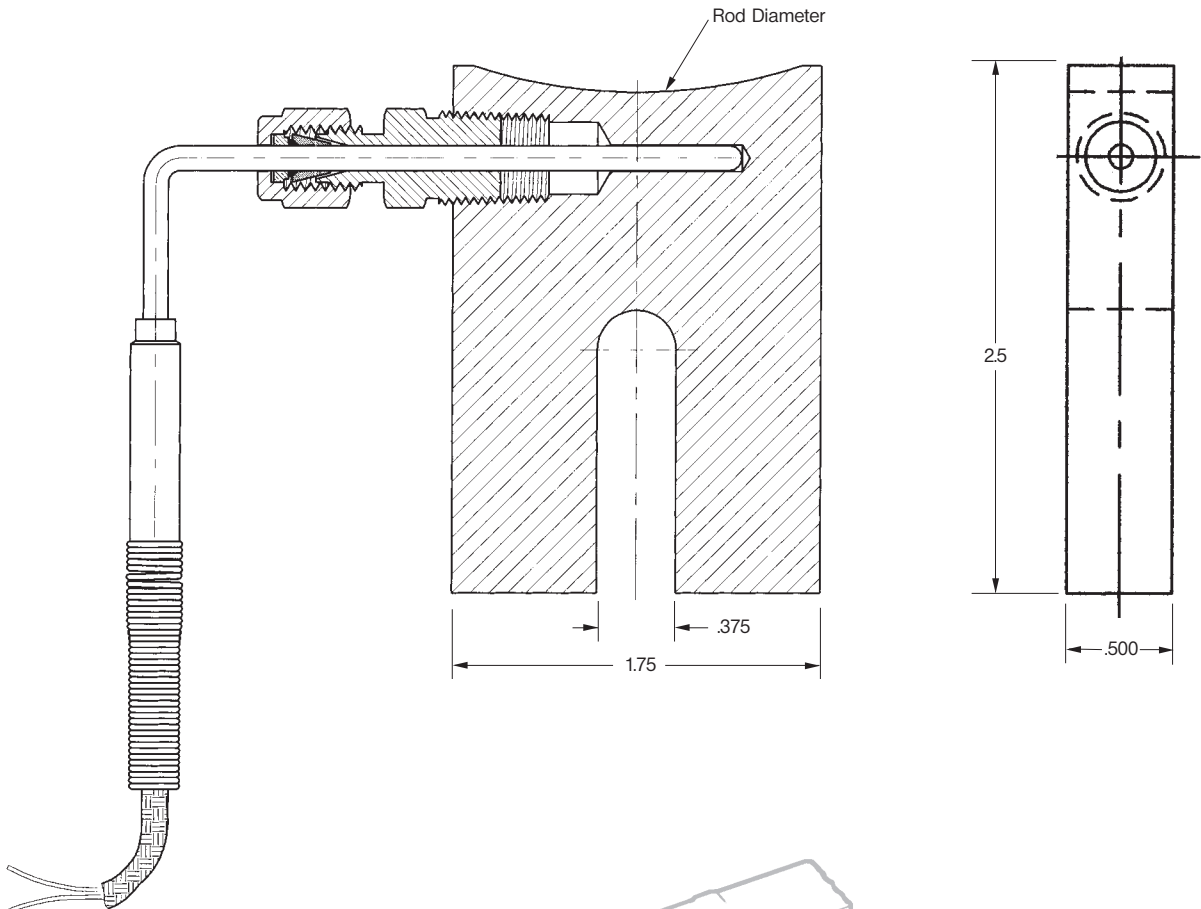
### Standard Sizes in Stock

Rod Diameter	Part No.
Flat end	313500
1.5	313503
2.0	313504
2.5	313505
3.0	313506
3.5	313507
4.0	313508
4.5	313509
5.0	313510

*Special sizes available on request. Allow for additional delivery time.*

*To purchase spare thermocouples for above assembly, use Part No. 303103*

# Electronic Compressor Rod Drop Indicator





## Electrical Temperature Sensor Assembly

The Exline Electrical Temperature Sensor Assembly is designed to open or close an electrical circuit when the device senses a predetermined temperature. Common applications include compressor discharge gas headers, lube oil, or jacket water headers on stationary engines, and heater treaters or similar fired vessels.

The assembly contains a temperature-sensitive eutectic alloy collar which holds a spring-loaded plunger in position under a micro switch. The collar melts at a predetermined temperature, releasing the plunger and opening or closing the switch.

The micro switch housing is dust tight and explosion proof malleable iron. The Thermowell and sensor assembly provide positive service in highly corrosive environments and the Thermowell is rated to withstand pressures of up to 8,000 psi. The assembly represents an economical alternative to other types of sensing devices where absolute dependability is required, as in remote or unmanned installations.

The fuse-metal collar is the only required replacement when the sensor has been activated. Factory collar replacement is fast and inexpensive.

### Electrical Component Specifications

#### Micro Switch Part No. 003078

- Single Pole – Double Throw #V7-6C17D8-048-1  
15.1 amps. & 1/2 hp 125, 250, or 277 V.A.C. 1/2 amp.  
125 VDC; 1/4 amp. 250 VDC 5 amp. 120 VAC “L”  
(Lamp Load).

#### Malleable Iron Junction Unilet Part No. 350296

Explosion-Proof and Dust-Tight outlet box for hazardous locations. Class I, Groups C and D; Class II, Groups E, F, and G; and Class III.

Option: Copper Free #350296 – A

*When ordering only the electrical shutdown box and micro switch, use part no. 350296 or 350296-A.*

#### Available Eutectic Alloy Collar

##### Melting Temps

117° F	162° F	217° F	281° F	361° F	449° F
136° F	178° F	228° F	291° F	374° F	478° F
142° F	198° F	243° F	310° F	390° F	
150° F	205° F	255° F	349° F	408° F	

### Nipple/Union Electrical Temperature Sensor Assembly

Thermowell Length (L)	Header Collar Threads	Thermowell Part No.	Striker Part No.	Nipple/Union Assy. Part No.
1 13/16"	1/2" n.p.t.	300703	300310	310703
3 3/16"	1/2" n.p.t.	300718	300313	310718
4 3/16"	1/2" n.p.t.	300711	300315	310711
1 13/16"	3/4" n.p.t.	300722	300310	310722
3 3/16"	3/4" n.p.t.	300725	300313	310725
4 3/16"	3/4" n.p.t.	300712	300315	310712

### Standard Electrical Temperature Sensor Assembly

Thermowell Length (L)	Header Collar Threads	Thermowell Part No.	Striker Part No.	Standard Assy. Part No.
1 13/16"	1/2" n.p.t.	300703	300306	310903
3 3/16"	1/2" n.p.t.	300718	300309	310918
4 3/16"	1/2" n.p.t.	300711	300311	310911
1 13/16"	3/4" n.p.t.	300722	300306	310922
3 3/16"	3/4" n.p.t.	300725	300309	310925
4 3/16"	3/4" n.p.t.	300712	300311	310912

## How To Order

Determine desired length of Thermowell, taking into account the depth of your mounting collar and the Thermowell threads. Next select the appropriate assembly part number. Then select desired collar melting temperature.

## Typical Areas Protected by the Electrical Temperature Sensor Assembly

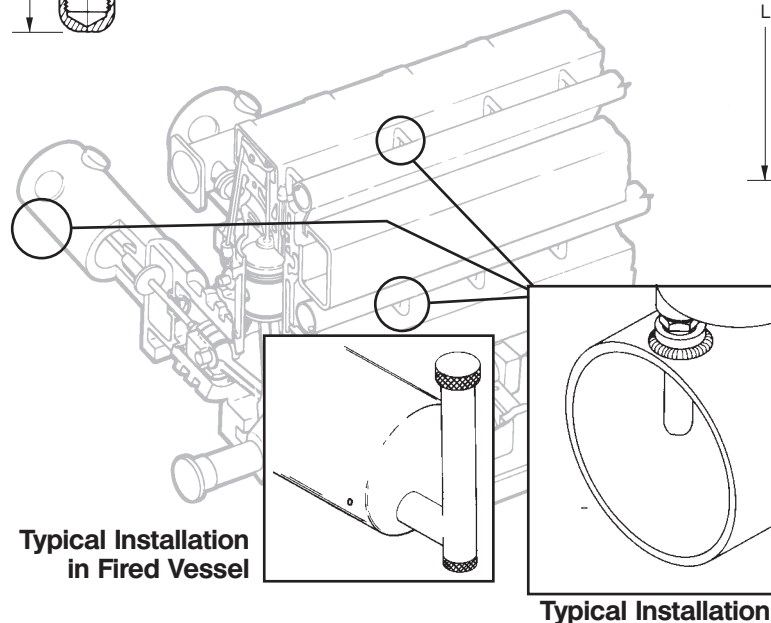
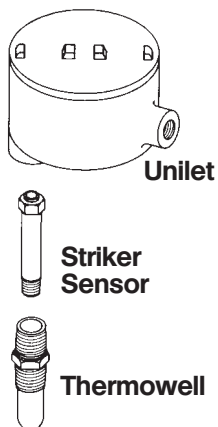
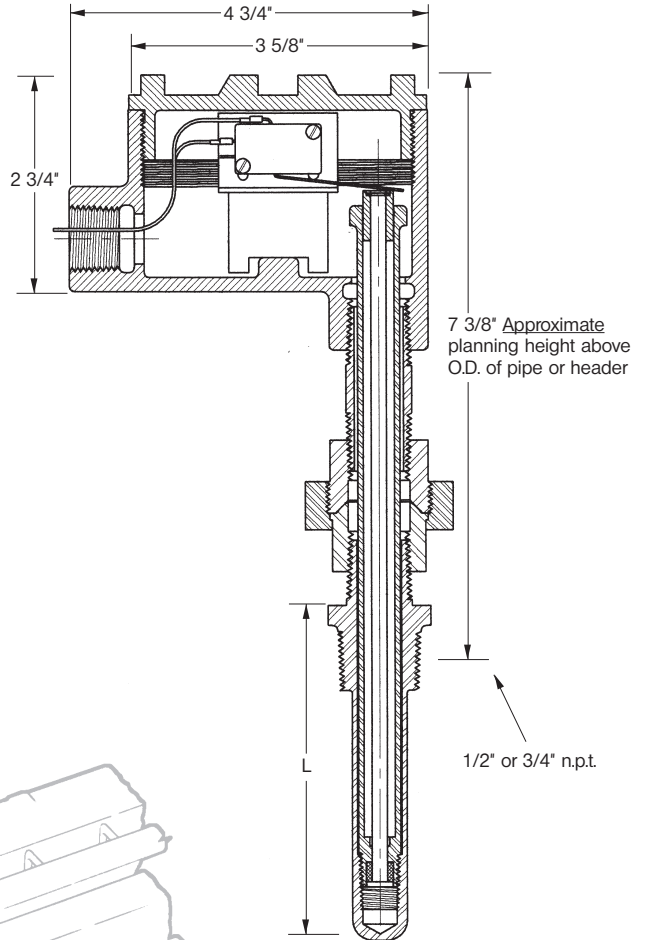
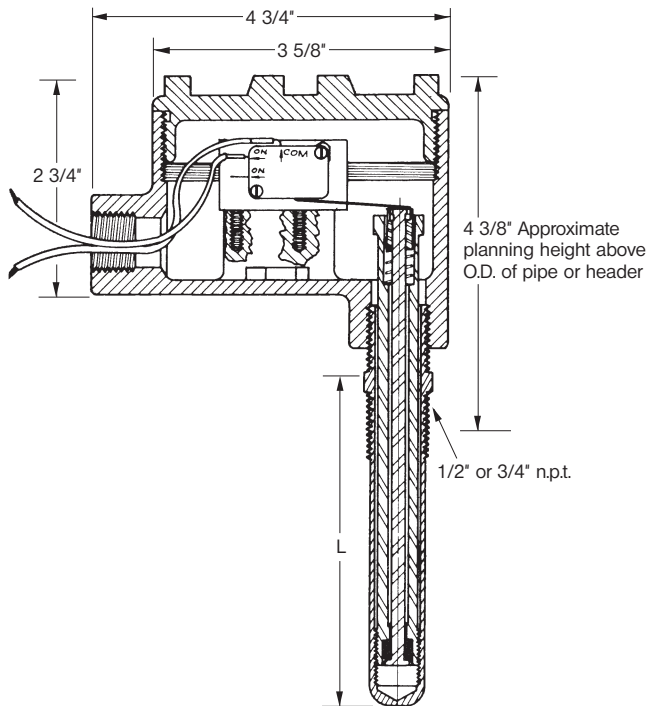
- Discharge Gas Headers
- Jacket Water Headers
- Lube Oil Headers
- Heater Treaters and Fired Vessels

## Details of Installation

Use 1/2" coupling (unless optional 3/4" n.p.t. Thermowell was ordered). Weld coupling to header or piping. Drill hole in header after coupling has been installed, taking care when drilling to prevent thread damage to the coupling.

Insert Thermowell through collar and tighten to add desired torque value. Use appropriate sealant on Thermowell threads. Connect micro switch to control circuit using either NC or NO contacts and attach conduit to housing.

### Standard Electrical Temperature Sensor Assembly





## Electronic Devices Stationary/Thermowell

Exline Thermocouple Devices allow continuous temperature readout plus remote, unattended, computer-monitored machinery operation. Use them to trigger shutdown or an alarm. Connect them to existing control circuitry or have us install a complete system, including monitoring panel.

### Applications

Bearing caps, slides, packing cases, headers, water jackets, and sumps. Exline Thermocouple Devices are designed for initial installation and to replace our pneumatic Stationary Sensors. These devices are also available in Thermowell configurations.

### Durable, No-Maintenance Design

Standard units are Type "J" ungrounded thermocouples housed in a brass body with a temperature range from approximately 32° F to 1380° F. Type "K" thermocouples are also available to handle a broader temperature range. TFE-coated lead wires are either encased in a flexible braided stainless steel overlay or supplied ready to be installed in metal conduit.

Options include custom-length lead wires and stainless steel bodies.

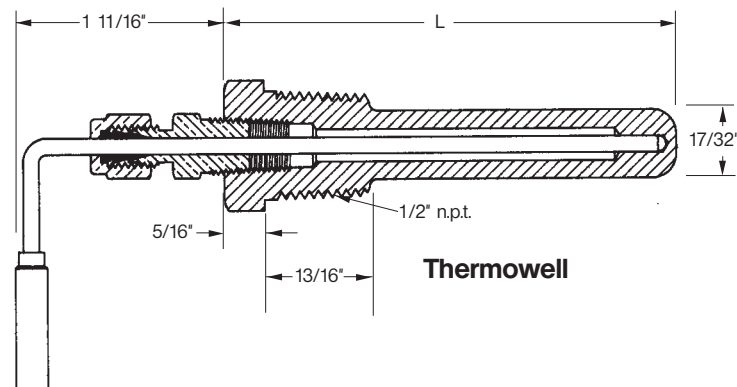
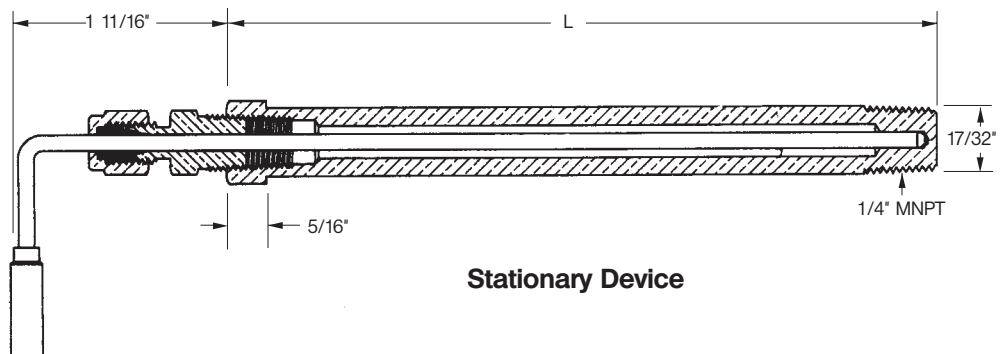
## To Order

Determine the length of sensor you need and whether you want to use braided wire or conduit. Select the appropriate Stationary Device or Thermowell Part Number from the table and call Exline at 1-800-255-0111.

(L) = Length In Inches	Stationary Device* Braided	Thermowell** Braided	(L) = Length In Inches	Stationary Device* Braided	Thermowell** Braided
1.0"	313102	314102	5.0"	313110	314110
1.5"	313103	314103	5.5"	313111	314111
2.0"	313104	314104	6.0"	313112	314112
2.5"	313105	314105	6.5"	313113	314113
3.0"	313106	314106	7.0"	313114	314114
3.5"	313107	314107	7.5"	313115	314115
4.0"	313108	314108	8.0"	313116	314116
4.5"	313109	314109			

\* These devices can also be inserted into existing Exline Thermowells. For direct replacement of pneumatic Exline Stationary Sensors refer to page 2. TYPE "K" Thermocouples have a N.I.S.T. rating of temps. ranging from -450° F to 2300° F.

\*\* Standard assemblies include Thermowells with 1/2" MNPT process connection size. If 3/4" MNPT or 1" MNPT is needed, please indicate 3/4" or 1" at the end of the part no. Example - 313102 - 3/4" or 313102 - 1"







## Electronic Trip Switch

The Exline Trip Switch can be used to sound an alarm or initiate shutdown. It is available for initial installation and as a replacement for existing trip valve installations. Normally no mounting or bracket changes are required on replacements, and the switch will work with any make or model tripping device. Superior design virtually eliminates maintenance.

### Applications

Exline Trip Switches are used to protect moving, rotating, or oscillating components fitted with Exline Temperature Sensors. When tripped by sensors, these switches can automatically shut down equipment or trigger an alarm.

When used in engines or compressors, the unique body design permits crankcase oil “flow-through” to minimize carbon and varnish buildup in the piston area. In hazardous locations, the Trip Switch must only be used with intrinsically safe controls.

### Easy Installation

The Trip Switch mounts directly in line with an Exline Striker Sensor, as in the illustration. Proper brackets, fittings, and other hardware can be supplied by Exline for your particular installation. We can also provide and install complete systems, including monitoring panels. Contact your Exline representative for more information.

### Micro Switch Electrical Characteristics

Electrical Rating	28VDC/115VAC, 400 Hz
Resistive	5 Amps
Inductive	3 Amps
Dielectric Withstanding Voltage	1000V rms at sea level for 1 minute or 1250V rms for 1 second with maximum leakage current 0.5 milliamperes.
Contact Arrangement	SPDT
Temperature Range	-65° F to 660° F (-54° C to 349° C) Intermittent
Shock	100g for 6 ± 1 ms
Vibration	10 - 2000 Hz ± 20g peak
Ambient Pressure	High Vacuum (negative) to 50 psi (positive) 3.5 atmospheres
Military Specification	MIL-PRF-8805

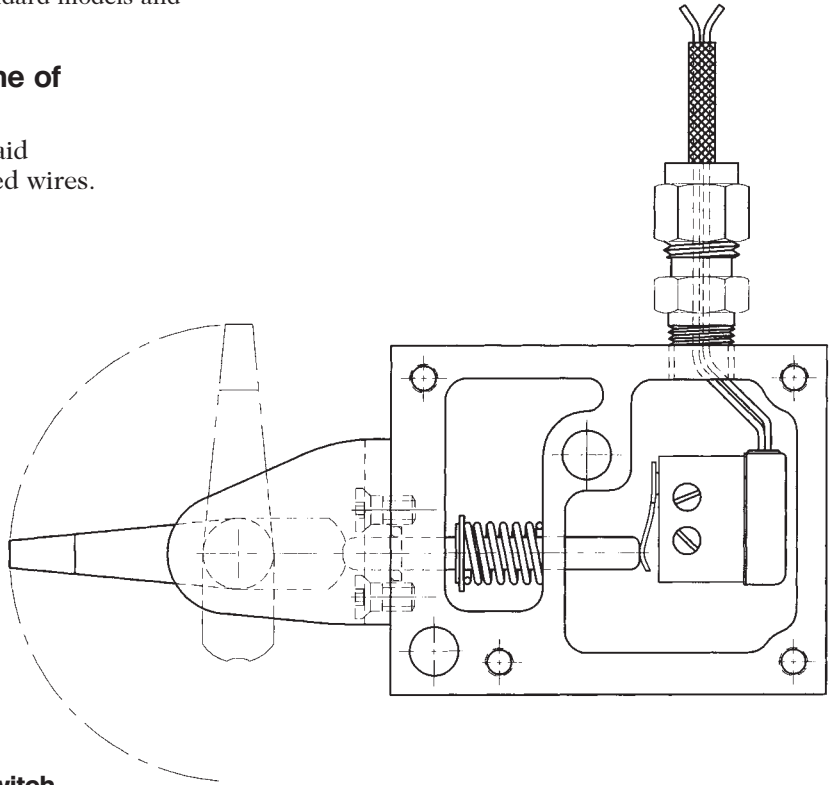
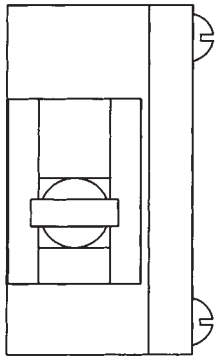
## To Order

The Trip Switch can handle up to a 15 amp load and comes “normally closed.” Specify if you want a “normally open” configuration. TFE-coated lead wires are either encased in a flexible braided stainless steel overlay. Determine the upper temperature limit desired. Then select an appropriate Striker Sensor. See “Striker Sensor” for standard models and temperatures.

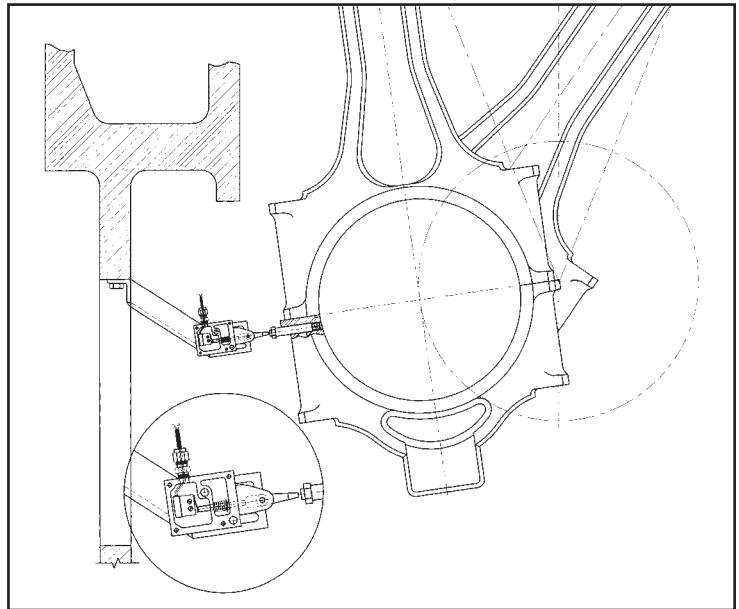
## To order the Trip Switch, specify one of the following

Part No. 303164 Trip Switch with braid protected TFE-coated wires.

*Refer to Striker Sensor page 4.*



## Trip Switch Assembly with Haydon Switch



Typical Trip Switch Installation



## Pneumatic Air Start Distributor

### Featuring Variable Injection Timing

The Exline Air Start Distributor is designed for easier, more reliable starting of large stationary engines. It replaces original equipment air start distributors to provide:

- High Breakaway Torque
- Efficient Air Usage
- Elimination of “Dead Spots”
- Total Reliability

A patented feature automatically retards air injection timing during the initial “breakaway” roll of the crankshaft. With the distributor set in this configuration, there are no “dead spots” and a much higher breakaway torque is achieved.

This air injection timing is accomplished by automatically rotating the distributor housing by means of an air cylinder and lever arm. When the engine stops, the distributor is set in the retarded position. At approximately two seconds into the starting sequence, the distributor position automatically advances to the most efficient air injection point.

The unit features adjustable pilot valves, push rods, and a venting valve timing arrangement to ensure elimination of dead spots. Wear is minimized since internal components do not contact the cam and therefore do not operate unless the starting air is supplied.

Turn page for ordering information, specifications, and detail.

### Ordering Information

When ordering distributor, specify engine make and model.

### Additional Components Needed to Complete Installation

#### Time Delay

Distributor	Bracket
Control Valve	Time Delay Control
Filter	Valve
Pneumatic Terminal	Regulator

### Selected Popular Air Start Distributor Installations\*

Clark	Cooper Bessemer	Ingersoll Rand	Worthington
TLA-10	JS-5	KVG-8/10/12	ML-6/7/10/12
TCV-12	GMV-6/8/10/12	KVS-8/10/12	MLV-10/14/16
TVC-6	GMW-6/8/10/12	SVG-8/10	SDR-8
	V250-10/12/16	PVG-8	SLHC-10
	W330-8/10/12/16	KVR-512/16/410	SUTC-10
	LSV-12/16	KVT-10/12/16	UTC-5/6/7/8/10
		PSVG-8	Horizontal
		XVG-8	SLHP-5

\* A variety of other engines can be fitted with the Exline Air Start Distributor. For information, call 1-800-255-0111.

If you'd like a trial run of an Exline Air Start Distributor, call us. We'll gladly discuss this reliable system with you.

## Details of Installation

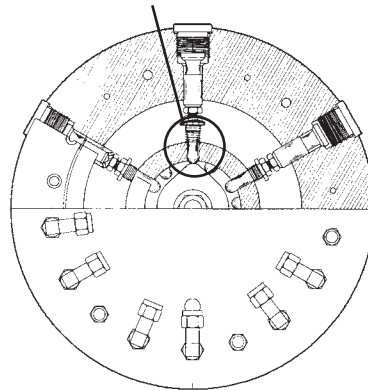
The Exline Air Start Distributor replaces the original equipment distributor. The system is custom designed by Exline professionals to fit your engine so no machining is needed. This reduces installation time and gets your engine back into service quickly. Flexible tubing is fabricated from the distributor to the pneumatic terminal bracket. Necessary brackets for controls are field fabricated.

## Application

The Exline Air Start Distributor can be installed on all engines equipped with starting air check valves at each power cylinder. Pneumatic control valves are available on some engines not so equipped. Call us for more information.

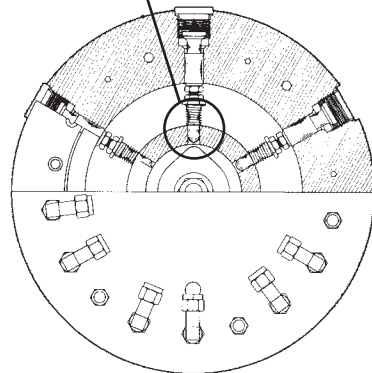
## Custom Design

Distributor push rods are in contact with cam during starting sequence only.

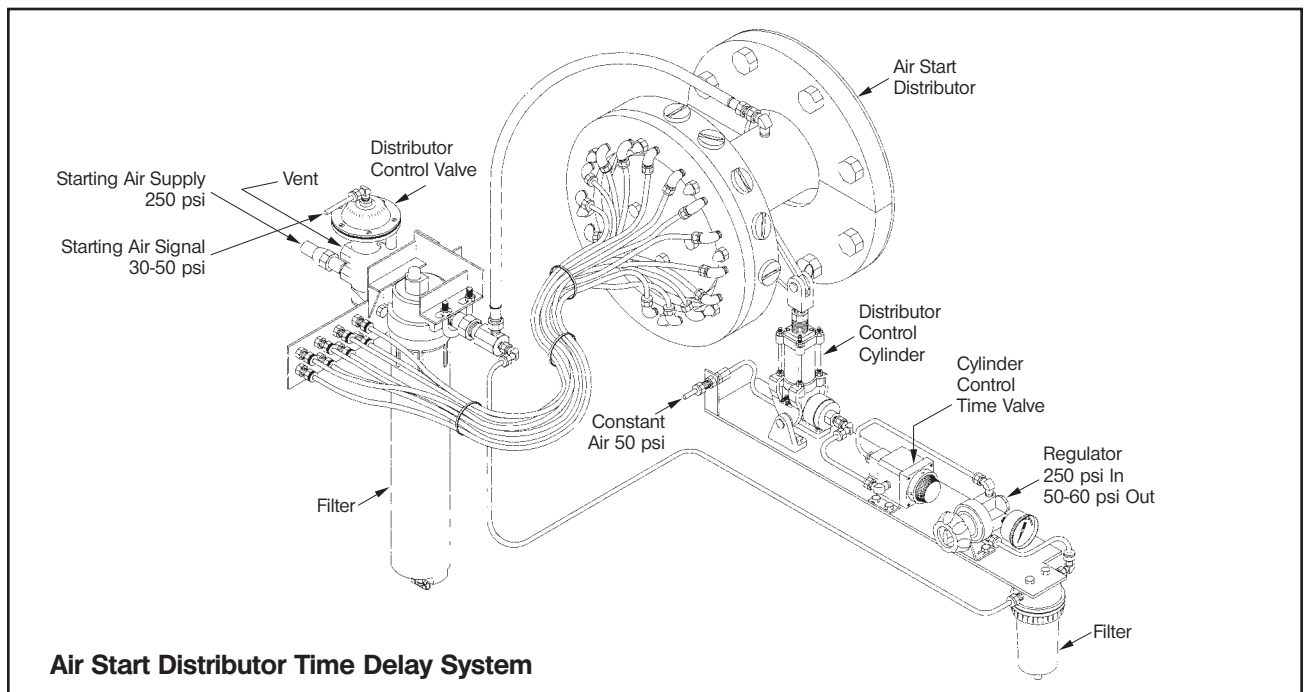


**Engine Start Sequence**

Distributor push rods do not engage cam while engine is operating or stopped. This practically eliminates any wear problem.



**Engine Running & Stopped**



**Air Start Distributor Time Delay System**

# SAVE Air™

Electronic Air Start System

## For Air-In-Head-Equipped Integral Compressor Engines

- Replaces existing air-in-head starting systems with solid-state microprocessor-based control technology
- Reduces starting air consumption by as much as 70% per start
- Eliminates “dead spots”
- Eliminates manual barring of engine – increases operator safety
- Provides more reliable remote starting
- Eliminates failure prone mechanical air start and cam actuated valves
- Less costly and complex than ring-gear based starting conversion systems
- “Universal” system can be installed on virtually any suitable engine
- CSA certified for use in Class I, Division 2, Group C and D hazardous areas

The Exline-Altronic SaveAir Electronic Air Start System brings solid-state electronic control to the starting function on air-in-head starter-equipped integral compressor engines. Eliminating virtually all of the mechanical air-start related components, the solid-state SaveAir system introduces significant operational advantages, including a substantial reduction in the required starting air (up to 70%) and the elimination of starting “dead spots”.

The SaveAir system replaces the existing OEM or pneumatic air distributor system with an innovative position sensing device (the Logic/Distribution Module) to determine the precise angular location of the engine crankshaft. Given accurate radial position data, the SaveAir system electrically actuates air-starting solenoid valves which precisely control both the turn-on time of the in-head valves as well as the duration of the air admission events during startup. These unique capabilities enable the SaveAir system to deliver starting air to those cylinders which are most appropriate given the angular position of the crankshaft – virtually eliminating engine starting “dead spots” – and to dramatically reduce the amount of air ultimately required for the engine start. The net effect of the SaveAir system is more reliable remote starting, improved operator safety (no mechanical barring), reduced air consumption, and more efficient compressor station operation.

All SaveAir control electronics are “universal” in their design and common to all air-in-head starting applications. Engine specific Logic/Distribution Module flanges and/or adaptors allow easy installation on virtually any engine. Please refer to page 38 and the SaveAir Application Guide for additional details. Configuration and monitoring of the SaveAir system is accomplished through the use of the system Display Module or via the PC-based terminal program supplied with every system (see page 38).

The Exline-Altronic SaveAir is certified for use in Class I, Division 2, Group C and D hazardous areas by the Canadian Standards Association (CSA).



## The SaveAir™ Theory of Operation

The Exline-Altronic SaveAir Electronic Air Start System is designed to be retrofit to almost any engine utilizing the air-in-head starting method. A description of the function of the major components and their integrated operation appears below:

The **Logic/Distribution Module** is installed in place of the existing pneumatic or mechanical air start distributor, or on a shaft turning at cam speed for those engines that admit their starting air via a cam actuated configuration. This innovative device provides a highly accurate source of crankshaft position data, both while the engine is at a stop and while running.

The SaveAir **Output Module** accepts the angular position data derived by the Logic/Distribution Module and electronically actuates the start air solenoid valves to admit high pressure starting air into the appropriate cylinder(s).

Monitoring and system troubleshooting is made simpler and more convenient by the operator **Display Module**. This interface device gives the user access to all of the setup, monitoring, and diagnostic capabilities of the system. An included SaveAir **Terminal Program** offers the same functionality for remote access and control.

In operations, the starting sequence is begun in the normal way by manually or remotely actuating a valve which pressurizes the engine's air supply piping. The SaveAir system automatically senses the rising pressure (via a pressure transducer input) or else reacts to a contact closure from a pressure switch in the air piping. The SaveAir system knows the precise crank position of the engine at all times and automatically applies air to the cylinder(s) in optimum position to deliver the maximum torque to the engine. User configurable "maps" of air admission angle and duration of the air event versus engine speed allow the user to regulate the cranking speed to the optimum value without wasting air. Turning off the air before the intake and exhaust ports (valves) open eliminates both wasted air and starting air back pressure in the intake and exhaust manifolds. The user can also configure a purge cycle to purge the engine thoroughly without wasting starting air. The system outputs a "purge confirm" signal which can be utilized by the starting control system to energize ignition if so desired. When the user specified "running" rpm is reached and maintained for a user specified number of revolutions, the starting air is automatically turned off and locked out until the system is reset.

## The SaveAir™ Start Sequence

The sequence described below outlines the SaveAir system startup and associated screens that would appear through the process on the system Display Module and in the Terminal Program:

**TRYING** 220° 0  
ON 110° RPM

TRYING - A system start has been initiated, but the engine has not yet begun to rotate.

**ROLLING** 220° 15  
ON 110° RPM

ROLLING - The engine is rolling on starting air, but has not yet exceeded the user-defined purge RPM.

**PURGING** 40  
ON 90° RPM

PURGING - The engine starting speed has exceeded the user-defined purge RPM, but has not yet completed the user-defined number of engine cycles.

**STARTING** 60  
ON 80° RPM

STARTING - Purging has been completed and the purge confirm output has been activated.

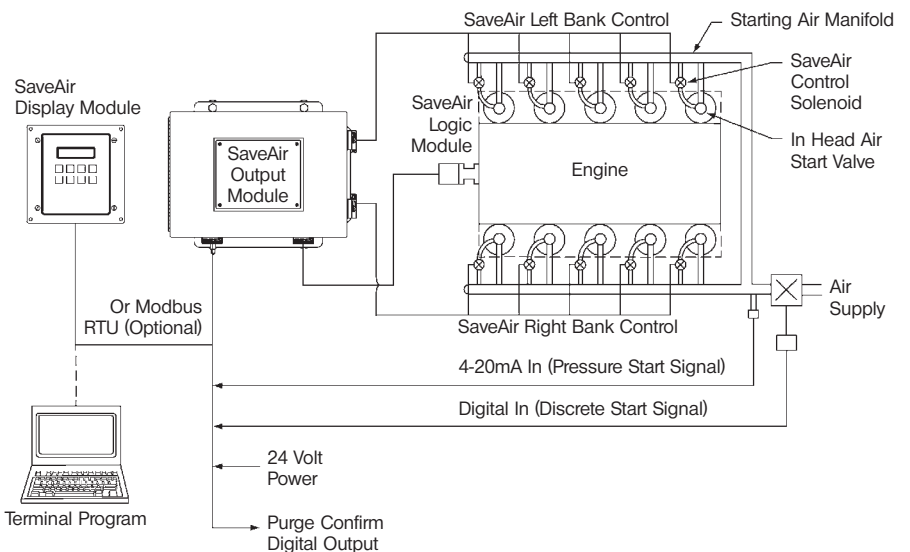
**FIRING** 90  
ON 0° RPM

FIRING - Indicates that the unit has reached a pre-configured RPM known to be associated with "light-off" or engine operation based upon in-cylinder combustion.

**RUNNING** 300  
RPM

RUNNING - Final stage of the start cycle. The engine is now running and starting air is shutoff and locked out until system reset.

## The Exline-Altronic SaveAir™ Electronic Air Start System



## Typical SaveAir™ System Configurations



Pneumatic air distributor with pilot-actuated air-in-head valve

Installation of the SaveAir system on engines with an existing pneumatic air distributor (OEM or aftermarket) and pilot actuated in-head starting valve represents the least complex installation requirements to the user.

Using the Cooper GMW-8 in the photo as an example, the retrofit required the removal of the mechanical/pneumatic air-start distributor, and all of the associated air tubing to the existing air-start valves. The Logic/Distribution Module was mounted on the air-start distributor drive, with the SaveAir Output and Display Modules mounted on the engine (the Display Module can also be mounted in the engine control panel). The electrically-actuated SaveAir solenoids are mounted near to each engine air-starting valve, with their pilot air drawn from the high volume starting air pipe local to each cylinder or via a small diameter starting air manifold running the length of the engine. Each solenoid admits the high pressure air charge into the associated cylinder to begin and maintain engine rotation.



Cam actuated start valves with pressure-actuated in-head check valves

Some Clark engines (BA, HBA, and TLA) utilize camshaft-actuated air starter valves for each cylinder, which in turn direct high volume starting air directly to in-head starting air check valves.

Using the Clark BA-8 in the photo as an example, mounting of the Logic/ Distributor Module requires use of an engine specific SaveAir Mounting Adapter to adapt it to the engine camshaft. The OEM cam actuated air start valves are no longer used (permanently eliminating camshaft lobe repairs), and are disabled during SaveAir installation. The SaveAir electrical solenoid pilot valve is supplemented with a pilot actuated high volume “relay” valve. A high-capacity stainless steel flex-hose completes the installation by connecting to the in-head check valve on each cylinder. Thus, for these applications, the SaveAir air solenoid pilot valve trips the associated air handling relay valve which directly admits the high pressure air into the cylinder for starting. Refer to the accompanying photos as well as the SaveAir technical documentation for further installation details.

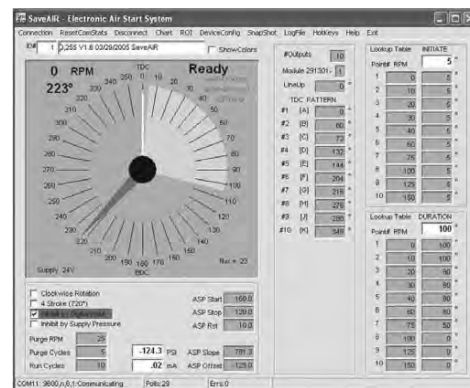


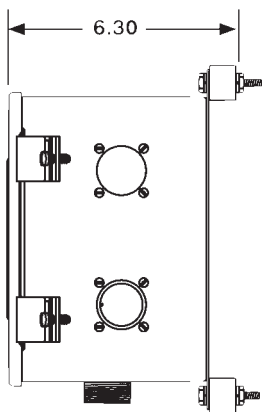
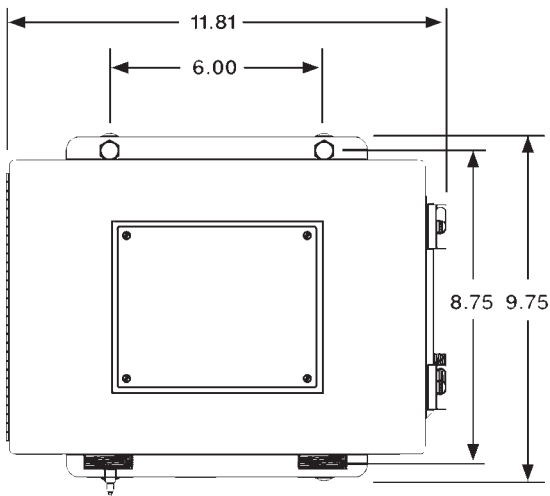
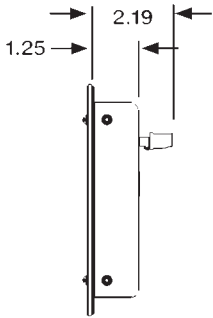
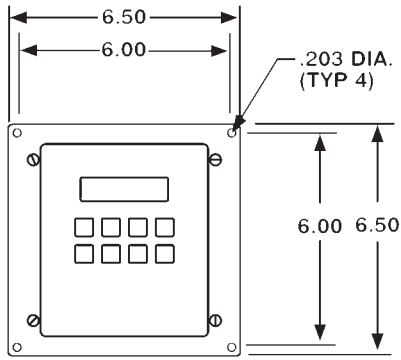
## SaveAir™ Terminal Program

- Provides for simple monitoring and configuration of the SaveAir system
- Intuitive graphical user interface (GUI)
- Innovative remote operator interface (ROI) duplicates the SaveAir system display for convenient remote access
- Built-in data logging and screen capture capability for system troubleshooting

The SaveAir system includes a comprehensive ModBus-RTU-based Terminal Program for monitoring and configuration. As an alternative to the system Display Module, all system setup, including the angles between cylinders, air initiation, and air duration maps, and engine-specific RPM settings for purge and engine run indication, can be configured using this software. To assist in system installation and troubleshooting, the Terminal Program also enables the user to create a

Microsoft Excel™ spreadsheet of all operating data associated with the SaveAir system (speeds, pressures, angles, etc.) from data logs taken and recorded three times per second. A unique screen capture option embedded into the system software also allows the user to acquire and save the monitored display and values for future reference or troubleshooting.





## Specifications

### Inputs

- (1) Integrated Angular Position Sensor
- (1) Discrete Start Signal (Digital)
- (1) Pressure Start Signal (4-20mA)

### Outputs

- (10) or (20) Control Solenoid Outputs
- (1) Purge Confirm Output (Digital)

### Display

Alphanumeric 2x16 character backlit

### Power Requirement

For existing CPU-95 or CPU-2000 Applications: No power supply upgrade is required

For applications operating without upgraded digital ignition systems: 24VDC, 5-10 Amps

### Temperature

-40° F to +158° F/-40° C to +70° C

### Communications

ModBus RTU Protocol (RS-485)  
(Supports Display or PC communications)

### Ordering Information

Logic/Distribution Module .....	291300-xxx (1)
Mounting Adapter .....	210024-xxx (1)
Output Module, 10 outputs .....	291301-1
Output Module, 20 outputs .....	291301-2
Display Module .....	291302-1
Harness, Output, 48" .....	293023-16
Harness, Output, 84" .....	293026-16
Harness, Output, 96" .....	293028-16
Harness, Output, 144" .....	293027-16
Harness, Logic to Output, 24" .....	293031-24
Harness, Logic to Output, 48" .....	293031-48
Harness, Logic to Output, 72" .....	293031-72
Harness, Display & I/O, 48" .....	293034-48
Solenoid Valve, standard .....	690017-1
Solenoid Valve Ass'y, Clark engine .....	690018-1
In-line Filter (690017-1) .....	615007
Hose Assembly, Clark engine, 24" .....	580035-24
Hose Assembly, Clark engine, 48" .....	580035-48

(1) See SaveAir™ Application List for details.



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# PRODUCT and SERVICE WARRANTY

## 1. Exline Product Warranty

“Exline Products” covered under this WARRANTY are warranted to be free from defects in materials and workmanship, when installed and used in the manner for which they are intended, for a period of 12 months from the date of shipment from Exline.

Products characterized by Exline as having been *Remanufactured* are covered by this Warranty the same as newly manufactured Exline Products.

“Exline Products” include: (i) products manufactured by Exline, as well as parts or components of such products as are manufactured exclusively for Exline, by any other party, to Exline specifications and drawings produced by Exline.

“Non-Exline Products” **not covered by this Warranty**, include: (i) products supplied by Exline manufactured by another party. Such Non-Exline Products are resold by Exline in their original form and are not modified by Exline in any way. Purchaser’s remedy for defective Non-Exline Products shall be limited to the applicable warranty of the manufacturer or supplier.

## II. Exline Service Warranty

Exline warrants its Services, such as overhauls, repairs, site supervision and installation services, including WARRANTY Services, to be free from defects in materials and workmanship for a period of 12 months from the date of service completion/start-up. Exline Products installed as part of a Service provided, will be covered by this WARRANTY for a period of 12 months from date of installation. Following WARRANTY Services, the period of warranty coverage for the unexpired portion of the PRODUCTS WARRANTY shall also apply.

## Limitations

The sole obligation of Exline hereunder is to repair or replace, at its option, and without charge, any Exline Product which is defective, or, in the case of defective Services, to reperform such Services. Other than the foregoing repair, replacement, or reperformance, the purchaser shall have no other remedy against Exline, and Exline shall not be liable for loss or damage arising from statute, law, strict liability in tort, or negligence resulting from any defect in an Exline Product or in Exline Services, even though the defect was caused by negligence, breach of warranty, or strict liability in tort of Exline. In any event, Exline shall not be liable for incidental and/or consequential damages including loss of income or profits, lost sales, or economic loss.

## Conditions

Such repair, replacement, or reperformance will be effected at a location of Exline’s choice (including Exline plants and service facilities, Exline subsidiary plants, or authorized service facilities). In replacing any Exline Product pursuant to this WARRANTY, Exline may replace such Exline Product with a modified or improved product or component.

Purchasers claiming warranty service should contact the Customer Service department at its Salina, KS facility.

## Other Exclusions

This WARRANTY does NOT APPLY TO:

- Exline Products which, in Exline’s opinion, have been damaged by misuse, misapplication, negligence, or accident.
- Exline Products on which disassembly and/or repairs have been attempted without prior authorization from Exline.
- Any Exline Product if any component part has been repaired or replaced by any part not manufactured or furnished by Exline.
- Products or Services, totally or partially, under the condition of customer furnished engineered specifications/design and/or procedures for lack of serviceability resulting from faulty engineered specifications/design and/or procedures.

Apart from the obligations set forth herein (unless otherwise agreed in writing) Exline makes no other warranty or condition, expressed or implied (by stature, common law, trade usage, or otherwise) and specifically excludes the implied warranties or merchantability and fitness for a particular purpose, as well as all other warranties expressed or implied.



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