Type 546, 546S, and 546NS Electro-Pneumatic Transducers

Contents

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts ordering information for the Type 546, 546S, and 546NS transducers and Type 82 relay. Refer to separate manuals for instructions covering equipment used with the transducer.

Only personnel qualified through training or experience should install, operate, and maintain this transducer. If there are any questions concerning these instructions, contact your Fisher Controls sales office or sales representative before proceeding.

Description

The Type 546 or 546NS transducer (figure 1) receives either a voltage (Vdc) or a current (mAdc) input signal and transmits a proportional pneumatic output pressure to a final control element. The Type 546S transducer receives a current (mAdc) input signal and transmits a proportional pneumatic output pressure. A typical application is in electronic control loops where the final control element, generally a control valve, is pneumatically operated. The input signal, output pressure range, and electrical classification, if approved, of each transducer is indicated on the nameplate attached to the cover (figure 2).

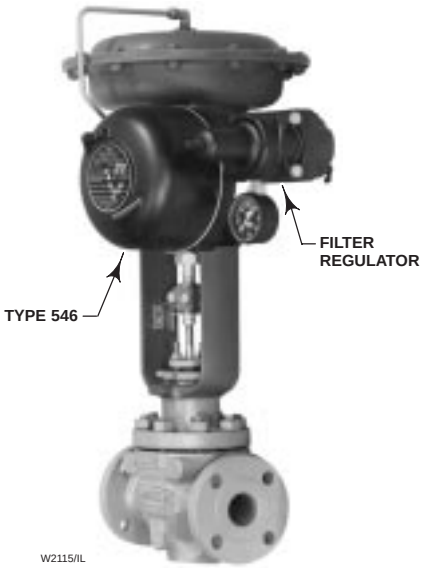


Figure 1. Type 546 Mounted on a Type 657 Pneumatic Diaphragm Actuator

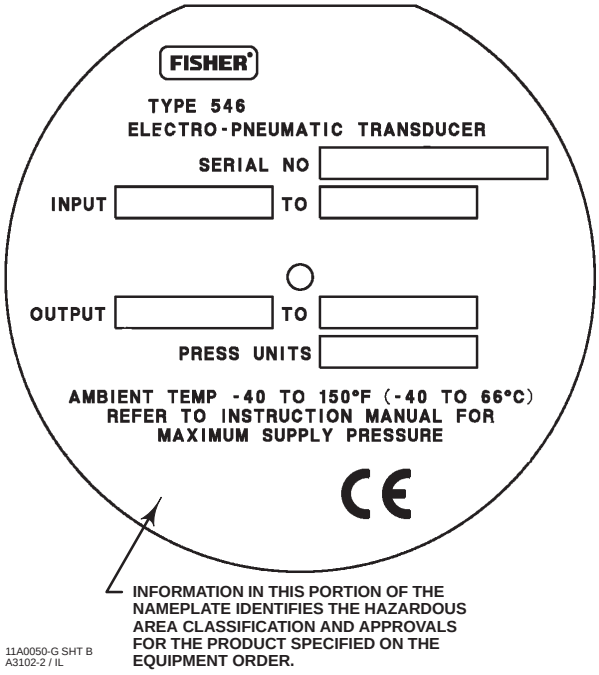


Figure 2. Typical Nameplate

The Type 546S transducer is approved as being intrinsically safe when used with certain barrier systems. Refer to the Loop Schematics section of this manual.

The Type 546NS transducer meets typical requirements of the nuclear power industry. The Type 546NS construction includes materials that provide superior performance in elevated temperature and radiation environments.

The O-rings are EPDM (ethylene propylene) and the diaphragms are EPDM/Nomex. EPDM(1) demonstrates superior temperature capability and shelf life over nitrile. The Nomex diaphragm fabric demonstrates improved strength retention at elevated temperature and radiation conditions.

In addition, the Type 546NS transducer is qualified "commercial grade dedicated" under Fisher's 10CFR50, Appendix B, quality assurance program. These can be supplied as 10CFR, Part 21 items.

Specifications

Specifications for the Type 546, 546S, and 546NS are listed in table 1.

Installation

WARNING

If a flammable or hazardous gas is being used as the supply pressure medium and the transducer is in an enclosed area, personal injury or property damage might result from fire or explosion of accumulated gas. To avoid such injury or damage, provide adequate ventilation.

Mounting

When a Type 546, 546S, or 546NS transducer is ordered as part of a control valve assembly, the factory mounts the transducer on the actuator and connects the necessary tubing, then adjusts the transducer as specified on the order.

Transducers also can be ordered separately for mounting on a control valve assembly already in service. The transducer may be ordered with or without mounting parts. Mounting parts include the appropriate bracket and bolts for attaching the unit to an actuator boss (with tapped holes) or for attaching it to the diaphragm casing. If preferred, mounting parts are available for mounting the transducer on a 2-inch (51 mm) diameter pipestand, a flat surface, or a bulkhead.

Tubing is not included if the transducer is not factory mounted. Use 3/8-inch (9.5 mm) outside diameter tubing for all supply and output connections. Tubing length between the transducer output and the final control element should be as short as possible to minimize its effect on control loop stability.

1. Use a clean, dry, oil-free air supply with instruments containing EPDM components. EPDM is subject to degradation when exposed to petroleum-based lubricants.

Table 1. Specifications

Available Configurations

Type 546: Electro-pneumatic signal transducer with explosion-proof case and cover
Type 546S: Similar to Type 546 except designed for intrinsically safe, non-incendive, or dust-ignition applications
Type 546NS: Similar to Type 546 except provided with EPDM elastomers for use in elevated temperature and radiation environments
All transducer types can be ordered with or without a 67 Series filter regulator. A 2 inch (51 mm) circular supply pressure gauge may be mounted on the regulator

Input Signals(1)

Type 546 and 546NS: 1 to 5 mAdc, 4 to 20 mAdc, 10 to 50 mAdc, 1 to 9 Vdc, or two-way split range using any half of one of the standard input signal spans
Type 546S: ■ 4 to 20 mAdc, or ■ For Factory Mutual only, a two-way split range using either half of the 16 mAdc span. Signal must not exceed 30 Vdc, 20 mAdc

Internal Resistance of Torque Motor

1 to 5 mAdc Input Signal: 2500 ±120 ohms (standard) or 12,000 ±50 ohms (temperature-compensated circuit)
4 to 20 mAdc Input Signal: 176 ±10 ohms
10 to 50 mAdc Input Signal: 90 ±10 ohms
1 to 9 Vdc Input Signal: 1300 ±50 ohms (temperature-compensated circuit)

Output Signals(1)

Ranges:(1)
For 546 and 546NS: 3 to 15 psig (0.2 to 1.0 bar), 6 to 30 psig (0.4 to 2.0 bar), 3 to 27 psig (0.2 to 1.9 bar), 0 to 18 psig (0 to 1.2 bar), or 0 to 33 psig (0 to 2.3 bar)
For 546S: 3 to 15 psig (0.2 to 1.0 bar), 6 to 30 psig (0.4 to 2.0 bar), 3 to 27 psig (0.2 to 1.9 bar), or 0 to 33 psig (0 to 2.3 bar)
Action: Type 546 and 546NS are field-reversible between direct and reverse action. The Type 546S is available with either direct or reverse action but cannot be reversed in the field.

Supply Pressure(1)

Recommended: 5 psig (0.3 bar) higher than upper range limit of output signal
Maximum: 50 psig (3.5 bar)

Maximum Steady-State Air Consumption(1,2)

At 20 psig (1.4 bar) Supply Pressure: 0.35 scfm (0.6 normal m^3/hr)
At 35 psig (2.4 bar) Supply Pressure: 0.50 scfm (0.8 normal m^3/hr)

Maximum Output Air Capacity(2)

At 20 psig (1.4 bar) Supply Pressure: 8.0 scfm (13.4 normal m^3/hr)
At 35 psig (2.4 bar) Supply Pressure: 11.5 scfm (19.3 normal m^3/hr)

Performance(3)

Actuator Loading Time: See figure 7
Reference Accuracy: ±0.75% of output signal span
Independent Linearity:(1) ±0.50% of output signal span
Open Loop Gain:(1) 26
Frequency Response:(1) Gain is attenuated 3 dB at 20 Hz with transducer output signal piped to a typical instrument bellows with 12 inches (305 mm) of 1/4 inch tubing

Operative Ambient Temperature Limits(1)

–40 to +150°F (–40 to 66°C)

Electrical and Enclosure Classification

Refer to the Hazardous Area Classification bulletins and the transducer nameplate (see figure 2)
Housing: NEMA 3R and CSA ENC 3 rating (NEMA 3R mounting orientation requires vent location to be below horizontal. Vent is shown in figure 10, key 69)

Adjustments

Zero and Span Adjustments: Screwdriver adjustments located inside case (see figure 5)

Connections

Supply Pressure: 1/4-inch NPT female located on side of case, (or located on the Type 67 AFR filter-regulator if mounted)
Output Pressure: 1/4-inch NPT female located on side of case
Vent: 1/4-inch NPT female with screen located on relay
Electrical: 1/2-inch NPT female located on bottom of case

Approximate Weight (Transducer Only)

9 pounds (4.1 kg)

1. These terms are defined in ISA Standard S51.1-1979.
2. Scfm—Standard cubic feet per minute (60°F and 14.7 psia). Normal m^3/hr—Normal cubic meters per hour (0°C and 1.01325 bar absolute).
3. Performance values are obtained using a Type 546 or Type 546S transducer with a 4 to 20 mAdc input signal and a 3 to 15 psig (0.2 to 1 bar) or a 6 to 30 psig (0.4 to 2 bar) output signal. Ambient temperature is 73°F (24°C). A transducer with other input or output signals might exceed these values. Reference accuracies of ±3.5% can be expected with output ranges starting near zero psig.

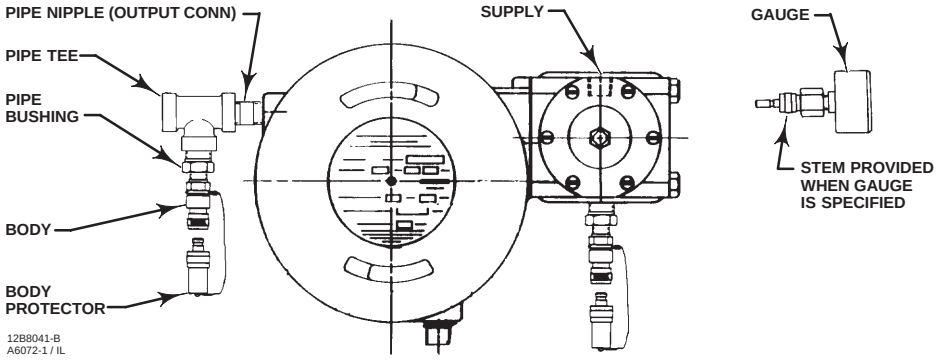


Figure 3. Diagnostic Connections

Pressure Connections

Note

The supply source must be clean, dry, oil-free,(1) non-corrosive air or gas at an unfailing pressure at least 5 psig (0.3 bar) higher than the upper limit of the transducer output pressure range. This means that for an output pressure range of 3 to 15 psig (0.2 to 1.0 bar) the supply pressure should be at least 20 psig (1.4 bar); for a 6 to 30 psig (0.4 to 2.0 bar) range, the supply pressure should be at least 35 psig (2.4 bar). The supply pressure to the filter regulator should not be more than 250 psig (17.3 bar) at a maximum temperature of 150°F (66°C).

If specified, the filter regulator is mounted on the transducer case. A pressure gauge on the regulator shows the supply pressure to the transducer.

1. Connect a supply pressure source to the 1/4-inch NPT IN connection on the filter regulator (if furnished) or to the 1/4-inch NPT SUPPLY connection on the transducer case (if a regulator is not furnished).

2. Run 3/8-inch (9.5 mm) outside diameter tubing from the 1/4-inch NPT OUTPUT connection on the transducer case to the input connection on the pneumatic actuator or valve positioner. This connection is made at the factory if the unit is shipped mounted on an actuator as shown in figure 1.

Diagnostic Connections

To support diagnostic testing of valve/actuator/positioner packages, special connectors and hardware are available. Typical connector installations are shown in figure 3. The hardware used includes a 1/4-inch NPT pipe nipple and pipe tee with a 1/8-inch NPT pipe bushing for the connector. The connector consists of 1/8-inch NPT body and body protector.

Note

If the transducer is used in a valve assembly with a positioner, no connections for diagnostic testing are required for the transducer. Install the connections for diagnostic testing at the positioner.

Install the connectors and hardware between the transducer and the actuator.

1. Before assembling the pipe nipple, pipe tee, pipe bushings, actuator piping, and connector body, apply sealant to all threads.

2. Turn the pipe tee to position the connector body and body protector for easy access when doing diagnostic testing.

Electrical Connections

WARNING

For explosion-proof applications, disconnect power before removing the transducer cover.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 18 inches (457 mm) from the transducer. Personal injury or property damage may result from explosion if the seal is not installed.

For intrinsically safe installations, refer to factory drawings or to instructions provided by the barrier manufacturer for proper wiring and installation.

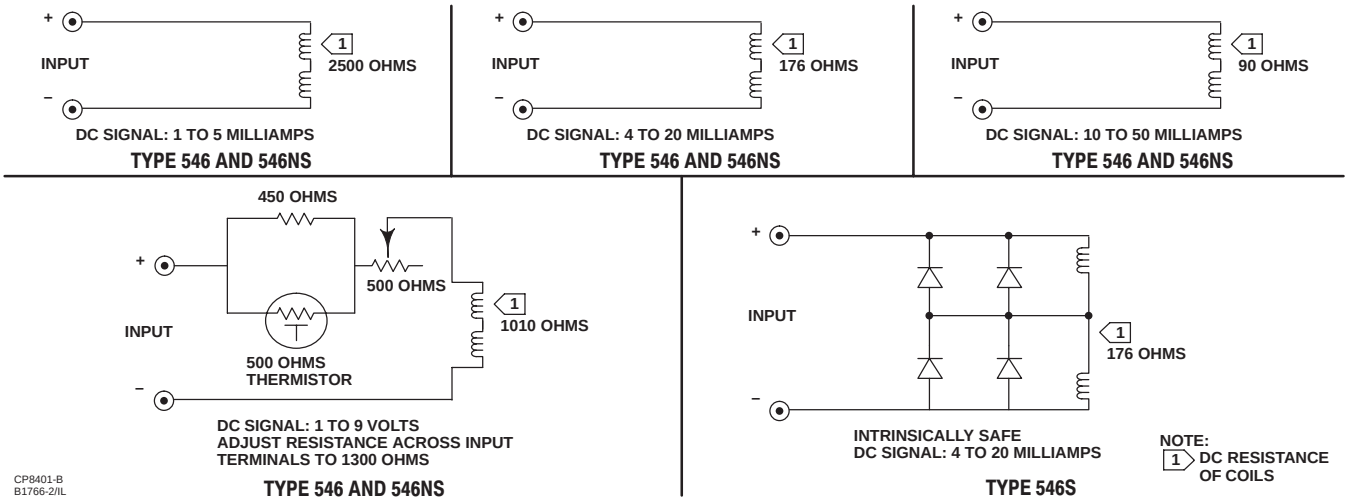


Figure 4. Typical Circuit Drawings

The electrical connections are made in the transducer case. A 1/2-inch NPT conduit connection is provided in the bottom of the case. Use a suitable conduit seal for hazardous locations. The wires that carry the input signal from the control device are connected to the terminal mounting bracket assembly (key 53, figure 9).

WARNING

To avoid personal injury or equipment damage, do not reverse the action of a Type 546S transducer in the field. Diodes in the input circuit (see figure 4) will short if a reversed input signal is applied. If the diodes are shorted, they are capable of producing a spark which might ignite a hazardous atmosphere causing a fire or explosion. A Type 546S transducer must be ordered from the factory as either direct or reverse acting.

For a direct-acting unit (i.e., increasing current produces an increasing output pressure), connect the positive wire from the control device to the positive terminal of the transducer and the negative wire to the negative terminal. For a reverse-acting unit (i.e., increasing current produces a decreasing output pressure), connect the positive wire from the control device to the negative terminal and the negative wire to the positive terminal. Typical circuits are shown in figure 4.

Note

Use a lubricant (key 95, figure 8) on the case-cover threads to prevent thread damage.

Operating Information

WARNING

Personal injury or property damage may result from fire or explosion if power is applied to the transducer with the cover removed in a hazardous area.

If the transducer is installed in an application where explosion-proof classification is required, perform the following steps when any procedure in this section requires removal of the cover:

- **Disconnect the electrical signal from the transducer.**
- **Remove the transducer to a non-hazardous area.**
- **Perform procedures as described in this section.**
- **Reinstall the transducer, and ensure the cover is secured before turning on the electrical signal.**

For intrinsically safe areas, current monitoring during operation must be with a meter approved for use in hazardous areas.

Adjustments

Adjust the filter regulator to provide the proper supply pressure to the transducer, then adjust the transducer span and zero (see figures 5 and 6) to match the application requirements and be within specifications.

The zero adjustment is used to set the output pressure so that it corresponds to the proper value of the input

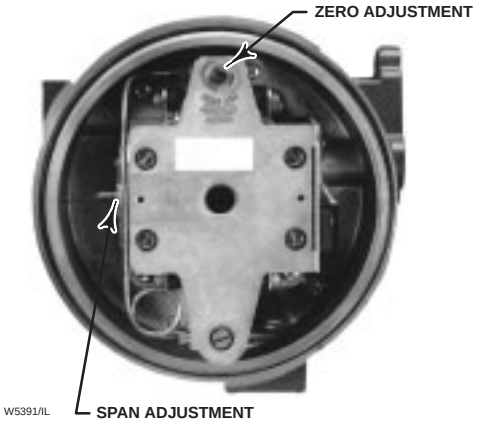


Figure 5. Zero and Span Adjustments (Cover Removed)

signal. For example, if the output range is 3 to 15 psig (0.2 to 1.0 bar) and the input range is 1 to 5 mAdc and the unit is direct-acting, use the zero adjustment to set the output pressure at 3 psig (0.2 bar) when the input signal is 1 mAdc. Use the span adjustment to set the output pressure span so that full output pressure change results for a full change in the input signal. In this example, the output pressure change would be 12 psi (0.8 bar). Thus, the output pressure should start at 3 psig and increase to 15 psig (1.0 bar) as the input signal is changed from 1 to 5 mAdc.

A span adjustment will affect the zero. Therefore, follow any span adjustment with a zero adjustment. Provide a suitable gauge to measure the pressure.

Calibration

Equipment Required

Choose a current or voltage source that is capable, without switching ranges, of driving the transducer through its entire input range. Switching ranges on a current or voltage source will produce spikes or midscale reverses in the input signal presented to the transducer, causing errors.

Calibration Procedure

Note

The following calibration procedure is for a Type 546, 546S, or 546NS transducer with a 4 to 20 mAdc input signal range and a 3 to 15 psig (0.2 to 1.0 bar) output range. Calibrate transducers with other inputs and outputs in a similar manner.

1. Check the supply pressure to ensure it agrees with the minimum pressure on the transducer nameplate.

2. Adjust the input current to 4.00 mAdc.

3. Turn the zero screw until the output pressure is 3.00 ±0.09 psig (0.2 ±0.006 bar).

4. Adjust the input to 20.00 mAdc.

5. If the output pressure is less than 14.91 psig (1.028 bar), turn the span screw clockwise to increase the span. If the output pressure is greater than 15.09 psig (1.040 bar), turn the span screw counterclockwise to decrease the span.

Note

Do not watch the output gauge while turning the span screw because the change in output is not a good indication of the change in span. While turning the span adjustment screw, the output pressure may move in the opposite direction than expected. For example, while turning the span screw in the INCREASING SPAN direction, the output pressure might decrease. This should be disregarded since even though the output pressure decreases, the output span is increasing.

6. Repeat steps 2 through 5 until the output pressure is within one-third of the accuracy limits at 4 and 20 mAdc. One-third of the accuracy limits for a 3 to 15 psig (0.2 to 1.0 bar) output range is 1/3 × (±0.0075) × (15.00 – 3.00) = ±0.03 psig (±2 mbar). Calibrate for maximum accuracy at the target end points [3.00 and 15.00 psig (0.20 and 1.00 bar)]. This allows for error at other calibration points in between.

7. Run the transducer through three calibration cycles before recording data. The cycles should be run from exactly 4.00 to 20.00 mAdc in a slow ramping fashion (no large step inputs).

8. After returning from 20.00 mAdc during the last exercise cycle, move back upscale to the midpoint (12.00 mAdc) and record the first data point. Table 2 is an example of recorded data.

9. Record at the other calibration points desired by moving upscale to 20.00 mAdc then down scale to 4.00 mAdc, then back upscale to 12.00 mAdc. Refer to table 2 for common calibration points.

Table 2. Typical Calibration Data

TRANSDUCER INPUT	ACTUAL OUTPUT PRESSURE		TARGET OUTPUT PRESSURE	
mA dc	Psig	Bar	Psig	Bar
12.00	8.89	0.612	9.00	0.620
16.00	11.95	0.823	12.00	0.826
20.00	15.02	1.035	15.00	1.033
16.00	12.02	0.828	12.00	0.826
12.00	8.96	0.617	9.00	0.620
8.00	6.00	0.413	6.00	0.413
4.00	3.01	0.207	3.00	0.206
8.00	5.95	0.409	6.00	0.413
12.00	8.97	0.618	9.00	0.620

Note

During the calibration cycle, use care to avoid overshoot. In other words, if data is to be recorded at an 8.00 mAdc input while moving upscale and you accidently pass 8.00 to some higher value, run the test again starting at step 7 with the three exercise cycles. *Do not* reverse direction and move down scale to 8.00 mAdc.

10. After completing the calibration cycle and recording data, verify that all data is within ±0.75% accuracy limits. If not, the transducer may need to be recalibrated to move the end points slightly to bring the entire calibration curve within the accuracy limits.

Recalibration

Table 2 shows typical recorded data where recalibration is necessary.

The 8.89 psig (0.612 bar) value at 12.00 mAdc is outside the accuracy limit of ±0.09 from the target value. This data point can be raised by recalibrating the transducer and raising the end points enough to bring this low value within –0.09 psig (–0.6 mbar) of 9.00 psig (0.62 bar). A reasonable recalibration would be 3.05 and 15.05 psig (0.21 and 1.04 bar) at 4.00 mAdc and 20.00 mAdc, respectively. Recalibrate the instrument and recheck the calibration data as described in steps 7 through 10.

If the transducer remains outside of accuracy specifications after altering the calibration end points as much as possible, return the transducer to the factory or consult your Fisher Controls sales office or sales representative.

For transducers inaccurate to less than 5 percent of output span, relay repair or replacement may correct the problem. Refer to the alignment procedures in the Troubleshooting section to correct the operation of a faulty transducer. Also check for air leaks at the tubing, nozzle, relay, and bellows.

If the accuracy error is greater than 5 percent of output span, check the clearance between the armature and the coils. These parts are referenced as key 40 and key 42, respectively, in the Parts List section. The armature and the white plastic coil bobbin should be approximately 1/64 inch (0.4 mm) apart. If the parts are in contact, loosen the machine screws that hold the bobbin and reposition the bobbin.

Changing Output Pressure Range

Changing the output pressure range from 3 to 15 psig (0.2 to 1.0 bar) to 6 to 30 psig (0.4 to 2.0 bar) or vice versa requires changing the feedback bellows (key 57, figure 9). To do this, refer to the replacing the feedback bellows assembly procedures in the Maintenance section.

Reversing the Action

Reversing the action of a Type 546 or 546NS transducer requires no special parts. The direction of armature rotation is dependent upon the direction of the current flow. Therefore, simply reverse the input current leads to the transducer to obtain the opposite action. Whenever the action is changed, readjust the zero of the transducer as outlined in the adjustments procedures.

WARNING

To avoid personal injury or equipment damage, do not reverse the action of a Type 546S transducer in the field. Diodes in the input circuit (see figure 4) will short if a reversed input signal is applied. If the diodes are shorted, they are capable of producing a spark which might ignite a hazardous atmosphere causing a fire or explosion. A Type 546S transducer must be ordered from the factory as either direct or reverse acting.

Split Range Operation

Type 546, 546S, and 546NS transducers are suitable for two-way split range operation. In a two-way split

Table 3. Feedback Bellows Output Pressure Range

OPERATION	INPUT SIGNAL, DC	BELLOWS SIZE					
		Full		Half		Quarter	
		Psig	Bar	Psig	Bar	Psig	Bar
Full Range	1 to 9 V(1) 1 to 5 mA(2) 4 to 20 mA 10 to 50 mA	3 to 15	0.2 to 1.0	6 to 30	0.4 to 2.0	– – –	– – –
Split Range	4 to 12 mA or 12 to 20 mA 10 to 30 mA or 30 to 50 mA 1 to 5 Vdc or 5 to 9 Vdc	– – –	– – –	3 to 15	0.2 to 1.0	6 to 30	0.4 to 2.0

1. Temperature compensated circuit.
2. Not appropriate for split range applications because of the high resistance of 1 to 5 mA dc coils. If split range operation is desired, consult your Fisher Controls sales office or sales representative.

the milliampere (mA) or voltage output signal of a single control device is split between two transducers electrically connected in series. Although each transducer receives the full signal, it is calibrated to provide a full output pressure range of 3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.0 bar) to the control valve with one-half the input signal. Since the transducer operates on only one-half of the normal input span, the feedback bellows must be changed to compensate for the shorter span. Change the bellows as described in the replacing feedback bellows assembly procedure in the Maintenance section. Table 3 indicates which bellows is required for your conditions. Reset the span and zero adjustments to the split range values. Note that these transducers cannot provide a three-way split range.

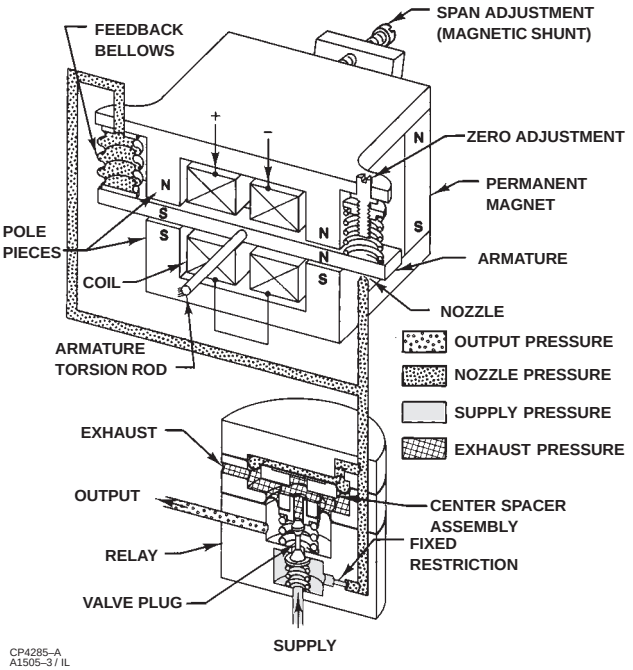


Figure 6. Transducer Schematic

Principle of Operation

Refer to the schematic drawing in figure 6. Assume that the transducer is direct-acting. An increase in the dc signal to the coils increases the magnetic field around the coils. This field increases the magnetic strength in the armature and the magnetic attraction across the air gap between the armature and the pole pieces.

The pole pieces are already polarized by the permanent magnet. The armature polarity is as shown in the schematic. The magnetic attraction will therefore be downward at the nozzle end and upward at the feedback bellows end, resulting in a torque that rotates the armature about the fixed torsion rod to cover the nozzle. The resulting restriction produces an increased pressure in the nozzle, in the upper chamber of the relay, and in the feedback bellows. The relay responds to the increase in nozzle pressure to increase the output pressure to the actuator and control valve. The increased pressure in the feedback bellows creates a force that acts on the armature to move it back to an equilibrium position. In this way, the new nozzle pressure is compared to the input current by the force-balance principle.

The relay operates in the following manner. The nozzle pressure acts on the large top diaphragm to force the center spacer assembly (mounted between the two diaphragms) downward against the valve plug, closing the exhaust port and opening the supply port. Supply air then flows through the open port to the output load. The output pressure continues to increase until the relay diaphragm assembly is pushed back to its original position by the force of the pressure acting on the small diaphragm. When this occurs, the valve plug is closed again.

When a decreasing dc signal is received, the magnetic attraction across the air gap is reduced. The armature rotates to uncover the nozzle and decrease the pressure in the nozzle, relay, and feedback bellows. The relay diaphragm assembly moves upward, and the exhaust port opens to bleed the output pressure to atmosphere.

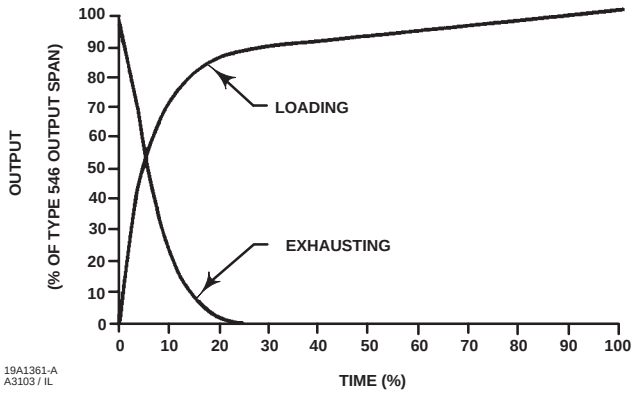


Figure 7. Output-Time Relationship for Type 546, 546S, and 546NS Transducers

The output decreases until the diaphragm assembly is forced back to its original position and the exhaust port is closed again. The reduced pressure in the feedback bellows diminishes the force to return the armature to the equilibrium position.

Figure 7 shows output-time relationship curves for loading and exhausting an actuator. Exhausting times are nominally 25 percent of the loading times.

Reverse-acting transducers operate in a similar manner except that when the dc input signal increases, the output pressure from the relay decreases. Conversely, a decreasing input signal increases the output pressure.

Maintenance

WARNING

For explosion proof applications, disconnect power before opening the transducer cover. Personal injury or property damage may result if power is not disconnected.

CAUTION

The presence of Fisher Controls personnel and also approval agency personnel may be required if you service (other than normal, routine maintenance, such as calibration) or replace components on a transducer that carries a third-party approval. When you replace components, use only components specified by the factory. Substitution with other components may void the third-party approval. Also, always use proper component replacement techniques, as presented in this manual. Improper techniques can cause poor quality repairs and impair the safety features of the device.

Maintenance of the transducer consists of relay repair or replacement, and replacement of the feedback bellows. These procedures are described at the end of this section. Due to the care Fisher Controls takes in meeting all manufacturing requirements (heat treating, dimensional tolerance, etc.), use only replacement parts manufactured or furnished by Fisher Controls International.

Figure 9 shows the torque motor and associated parts. Shaded key numbers indicate parts that should not be disassembled from the torque motor because the magnetism in the torque motor magnets will decrease permanently.

Certain troubleshooting and alignment procedures are described in the following steps. These may serve as a guide to correct some problems. Improper supply pressure and mechanical defects in pneumatic and electrical connections should be apparent upon inspection and repaired as appropriate.

CAUTION

Never disassemble the torque motor assembly because the magnetism in the torque motor magnets will decrease permanently. Shaded key numbers indicate parts that should not be disassembled from the torque motor (see figure 9). If troubleshooting or alignment attempts indicate either a faulty torque motor or the necessity of disassembling the torque motor, return the entire transducer to the factory, or consult your Fisher Controls sales office or sales representative.

Troubleshooting

This section contains some checks for operational difficulties that may be encountered. If correcting the difficulties is not possible, contact your Fisher Controls sales office, service center, or sales representative.

Electrical

1. Check the output of the control device. Make sure that it is reaching the transducer.

2. Check the dc input signal. It should be the same as the range stamped on the transducer nameplate.

3. Check the resistance of the transducer circuit to see that it coincides with the value listed on the circuit identification tag located on the torque motor.

4. Check the terminal lugs for proper connections. If reverse action of the transducer is observed, simply reverse the input leads as indicated in the Reversing the Action procedures in the Operating Information section.

Pneumatic

CAUTION

Do not attempt to remove the nozzle (key 19, figure 9) for any reason. Nozzle removal requires disassembling the torque motor. Disassembling the torque motor will permanently reduce the strength of the magnets, causing improper operation. Also, do not adjust the baffle (key 18, figure 9). The spacing between the baffle and nozzle is preset and locked at the factory to obtain optimum performance of the transducer.

1. Connect supply pressure and a pressure gauge to monitor the output. Check the operation of the transducer as follows:

   a. Force the baffle (key 18, figure 9) against the nozzle. The output pressure should build up to approximately the supply pressure. If it does not, check for a leak in the pneumatic system or a burr on the nozzle.

   b. Force the baffle away from the nozzle. The output pressure should drop to less than 1 psig (0.07 bar). If it does not, check the flame arrestors in the transducer case (see figure 8). If the flame arrestors require cleaning, first remove the torque motor assembly from the case by removing four machine screws (key 9, figure 8). Then, clean the flame arrestors by blowing them out with air pressure.

2. Check zero and span adjustment for proper setting. Refer to the adjustments procedure.

3. Check the supply pressure. It should be at least 5 psig (0.3 bar) above the upper limit of the output pressure range.

4. Check the filter regulator for moisture in the drip-well. Drain off any moisture, and clean the filter element if necessary.

5. If the transducer cycles, be sure there are no sharp bends in the copper capillary feedback tubing (key 56, figure 9) and that the tubing is not plugged.

6. Check the nozzle. If it is clogged, remove the entire torque motor assembly from the case by removing four machine screws (key 9, figure 8). Run a wire through the nozzle from the underside of the assembly.

7. Erratic operation may be caused by metal chips in the air gap between the armature and the pole pieces. Blow any chips out of the torque motor assembly with low pressure air.

8. If a problem persists, check the relay as described in the Type 82 Relay Maintenance procedures in this section.

Alignment

The following alignment procedures can be used in conjunction with troubleshooting procedures to correct the operation of a faulty transducer.

Span Adjustment

Refer to figure 9 for key number locations, unless otherwise directed.

If setting the required span is not possible, additional span adjustment can be obtained by shifting the entire span adjustment assembly (key 55) at the flexure pivot end. The alignment procedure is as follows:

1. Shut off the dc input signal and supply pressure to the transducer.

2. Disconnect the external lead wires from the terminal mounting bracket assembly (key 53).

3. Loosen the four machine screws (key 9, figure 8) that hold the torque motor assembly to the case. Remove the entire torque motor assembly from the case.

4. Loosen the two flexure pivot screws (key 25) that hold the flexure pivot to the torque motor assembly base.

5. Slide the span adjustment assembly in or out as required. Sliding it in toward the base decreases the span; sliding it out away from the base increases the span.

6. Tighten the flexure pivot screws. Replace the torque motor assembly, and tighten the screws (key 9, figure 8). Make sure that the O-ring (key 37) is in place. Connect the external lead wires, and turn on the air supply.

7. Make final adjustment of the span with the span adjustment screw.

Torque Motor Frame

The top pole piece plate (key 50, figure 9) of the torque motor can become twisted with respect to the bottom pole piece plate (key 51, figure 9). If this happens, return the transducer to the factory, service center, or contact your Fisher Controls sales office or sales representative.

Armature Travel Stop

The armature travel stop (key 52, figure 9) must be in place to prevent overstressing the armature and coil support (key 41, figure 9) due to over-travel. The clearance between the armature and travel stop should be 0.005 inches (0.13 mm).

The two screws at the base of the travel stop can be loosened if an alignment is necessary.

Coil

The coil assembly (key 42, figure 9) consists of a nylon bobbin wound with wire. The coils are not attached to the armature itself, and therefore, they must not touch the armature, or armature movements will be restricted. If this problem exists, loosen the two screws that attach each coil assembly to the armature and coil support. Sight down the armature and realign the coil assemblies for clearance with the armature. Tighten the screws.

WARNING

The following maintenance procedures require that the transducer be taken out of service. This requires that certain precautions be taken to avoid personal injury or equipment damage caused by sudden release of pressure or explosion of accumulated gas. Prior to maintenance:

- **Disconnect electrical power before removing the transducer cover (especially in explosion proof or hazardous applications).**
- **Shut off or disconnect pressure lines to the transducer.**
- **Disconnect any operating lines providing air pressure, electrical power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

Type 82 Relay Removal and Replacement

Use the following procedure when removing and replacing a relay assembly. Refer to figure 10 for key number locations, unless otherwise directed.

1. Loosen the two mounting screws (key 68), and remove the relay assembly from the transducer case (key 1, figure 8).

2. To install the replacement relay assembly, install the two relay mounting screws (key 68) into the relay assembly. Apply lubricant (key 96) to the O-rings, and make sure the O-rings (keys 72, 73, and 74) are in place on the relay assembly.

3. Install the relay assembly on the transducer case. Tighten the mounting screws.

4. With the torque motor installed, apply supply pressure to the transducer case, and check the relay assembly for leaks with a soap solution.

Type 82 Relay Maintenance

Use the procedure below to repair the relay assembly. Refer to figure 10 for key number locations.

Obtain the relay repair kit listed in the parts list. This kit provides the parts, alignment tool, and an instruction sheet used when repairing the relay assembly.

1. Remove the two screws (key 77), valve plug spring seat (key 64), valve plug spring (key 70) and valve plug (key 63).

2. Remove the six screws (key 76, not shown) and separate the relay body (key 60), casing spacer (key 61), and relay casing (key 62) by inserting a screwdriver between the external casting lugs. Twist the screwdriver to separate parts.

3. Remove the upper diaphragm (key 66), lower diaphragm assembly (key 65), and relay spring (key 71). Clean and inspect relay parts before replacing them.

4. Remove the restriction assembly (key 67) and replace the O-rings (keys 74 and 75). Apply lubricant (key 96) to the O-rings before installing the restriction assembly into the relay body.

5. The restriction hole (see figure 10) in the restriction assembly is 0.016 inches (0.41 mm) in diameter. Clean the hole with solvent and blow dry with compressed air. If the hole is plugged, insert a wire in the hole. Then, clean with solvent and blow dry with compressed air. Do not enlarge the hole. Reinstall the restriction assembly in the relay body. Do not overtighten.

6. The restriction hole in the relay body is 0.020 inches (0.51 mm) in diameter. If the hole is plugged, insert a wire into the hole and clean it out. Do not enlarge the hole.

7. Insert the new lower diaphragm assembly through the casing spacer, replace the relay spring, and position the parts on the relay body. Position the new upper diaphragm on the relay casing and position the relay casing on the upper diaphragm. Ensure that the exterior casting lugs on the relay body, casing spacer, and relay casing are aligned.

8. Invert the relay and install the six screws (key 76), but do not tighten.

9. Insert the alignment tool through the brass supply seat in the relay body, and into the exhaust seat of the lower diaphragm assembly to align the parts.

10. Ensure the diaphragms are flat between the relay body, casing spacer, and relay casing. Tighten the six screws (key 76).

11. Remove the alignment tool, and reassemble the valve plug, valve plug spring, valve plug spring seat and the two screws (key 77).

12. Install the two relay mounting screws (key 68) into the relay assembly. Apply lubricant (key 96) to the O-rings, and make sure the O-rings (keys 72, 73, and 74) are in place on the relay assembly.

13. Install the relay assembly on the transducer case. Tighten the mounting screws.

14. With the torque motor installed, apply supply pressure to the transducer case, and check the relay assembly for leaks with a soap solution.

Replacing the Feedback Bellows Assembly

Refer to figure 9 for key number locations.

1. Loosen the hex nut (key 31).

2. Remove the bellows screw (key 56) and O-ring (key 36) under the head of the bellows screw.

3. Pull the bellows assembly (key 57) out. The armature is slotted to allow removal of the bellows assembly.

4. Inspect and, if necessary, replace the two O-rings (key 36). Make sure the O-rings under the bellows assembly are in place.

5. Choose the correct bellows assembly as outlined in table 3. Install the new bellows assembly. Make sure that the O-ring (key 36) is in place.

6. Install the bellows screw and O-ring, and tighten the screw. Be sure the bellows assembly is not distorted in any direction. Tighten the hex nut (key 31).

7. Refer to the adjusting zero and span procedures in the Adjustments section.

Parts Ordering

Whenever corresponding with the sales office or sales representative about this equipment, mention the serial number of the unit. This serial number can be found on the nameplate (figure 2). When ordering replacement parts, also state the complete 11-character part number of each part needed as found in the following parts list.

Note

In the torque motor assembly drawing (figure 9), there are many shaded key numbers. The shading indicates that these parts should not be disassembled and that they are not available as individual items. Consequently, no part numbers are shown for these parts in the list below.

Parts List

Repair Kits for Type 546, 546S, and 546NS Transducers

Description	Part Number
Type 546 and 546S Transducer Repair Kit	
Kit includes keys 6, 12, 36, 37, and 58	R546X000022
Type 546NS Transducer Repair Kit	
Kit includes keys 6, 12, 36, 37, and 58	R546X000032
Type 82 Relay Repair Kit	
(for Type 546 and 546S only)	
This kit includes keys 63, 65, 66, 69, 70, 72, 73, 74, 75. Kit also includes instruction sheet and alignment tool	R82X0000022
Type 82 Relay Replacement Assembly	
(for Type 546 and 546S) Assembly includes two mounting screws (Key 68)	10A8593X082
Type 82 Relay Replacement Assembly	
(for Type 546NS) Assembly includes two mounting screws (key 68)	10A8593X142

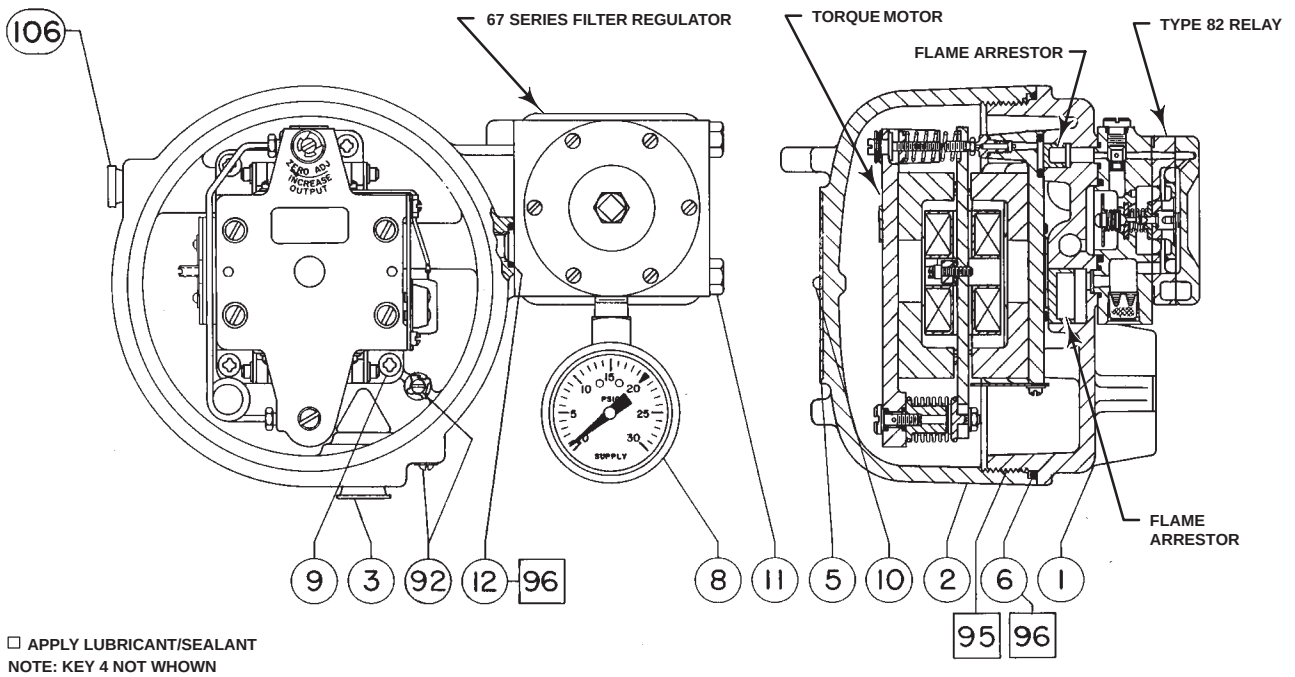


Figure 8. Type 546 Transducer Assembly

Type 546, 546S, & 546NS Transducers (figure 8)

Key	Description	Part Number
1	Transducer Case Ass'y, aluminum	1P4210000A2
2	Case Cover, aluminum	3P4213000A2
3	Protective Plug, plastic	1M3590X0012
4	Tagging Plate (optional)	
	Stainless steel (SST)	13B6776X012
5	Nameplate, Standard, SST	
6*	O-Ring	
	For Type 546 and 546S, nitrile	1D444806992
	For Type 546NS, EPDM Duro 80A	14B7744X012
8*	Pressure Gauge	
	Triple scale	
	0–30 psig/0–.2 MPa/0–2 bar	11B8582X012
	0–60 psig/0–.4 MPa/0–4 bar	11B8582X022
	Dual scale	
	0–30 psig/0–2 Kg/cm^2	11B8582X042
	0–60 psig/0–4 Kg/cm^2	11B8579X072
9	Machine Screw, brass pl (4 req'd)	17B0404X012
10	Screw, steel pl	1P426928982
11	Cap Screw, steel pl (2 req'd) use with integrally mounted filter regulator only	1C197024052
12*	O-Ring, use with integrally mounted filter regulator only	
	For Type 546 and 546S, nitrile	1E591406992
	For Type 546NS, EPDM Duro 80A	14B7748X012
13	Pipe Nipple, steel pl,	
	For filter regulator only (not shown)	1C678926232
92	Wire Retainer, steel pl (2 req'd)	17B7757X012
95	Lubricant,	
	For 546 and 546S use Lubriplate Mag 1 (not furnished with unit)	
	For 546NS use Molykote 33 (not furnished with unit)	
96	Lubricant, Molykote 33 (not furnished with unit)	
106	Protective plug, polyethlene (2 req'd)	1E878406992
107	Street Elbow, use with integrally mounted filter regulator w/0–60 dual scale gauge	1A913221992
108	Pipe Plug, steel	
	For regulator w/o gauge	1A767524662

Torque Motor (figure 9)

15(2)	Adjusting Screw	– – –
16(2)	Spring Seat	– – –
17(2)	Spring-Zero Adjustment	
	For Type 546 & 546S,	– – –
	For Type 546NS, SST	– – –
18(2)	Baffle	– – –
19(2)	Nozzle	– – –
20(2)	Hook-Up Wire Ass'y	– – –
21(2)	Hook-Up Wire Ass'y	– – –
22(2)	Hook-Up Wire (not shown)	– – –
25(2)	Machine Screw	– – –
26(2)	Cap Screw	– – –
27(2)	Cap Screw	– – –
28(2)	Machine Screw	– – –
29(2)	O-Ring	
	For Type 546 & 546S, nitrile	– – –
	For Type 546NS, EPDM Duro 80A	– – –
31	Hex Nut, brass pl	1N107318992
32(2)	Washer	– – –
33	Washer, brass pl	1P425315052
34(2)	Washer	– – –
35(2)	Washer	– – –
36*	O-Ring (2 req'd)	
	For Type 546 and 546S, nitrile	1D687506992
	For Type 546NS, EPDM Duro 80A	14B7743X012

*Recommended spare parts
2. Parts are not field repairable. The torque motor assembly should never be disassembled because the magnetism in the torque motor will decrease permanently. Shaded key numbers shown in figure 9 indicate parts that should not be disassembled.

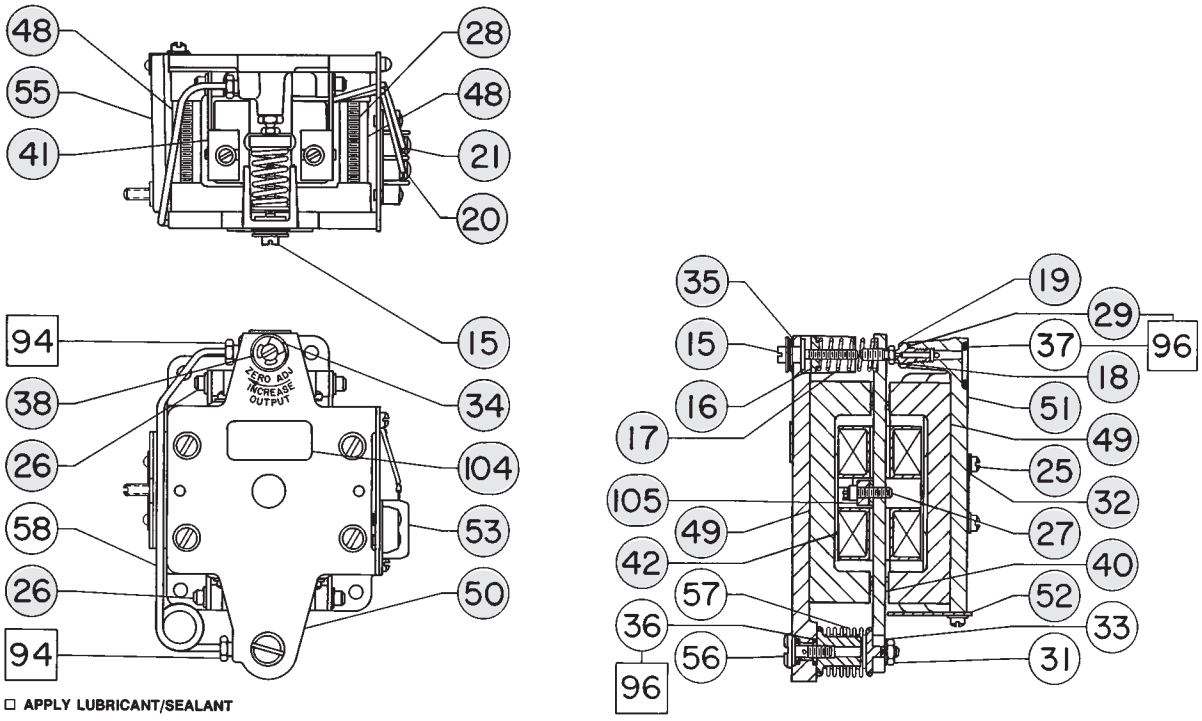


Figure 9. Torque Motor Assembly

Key	Description	Part Number
37*	O-Ring	
	For Type 546 and 546S, nitrile	1C782206992
	For Type 546NS, EPDM Duro 80A	14B7747X012
38(2)	E-Ring	– – –
40(2)	Armature	– – –
41(2)	Coil Support	– – –
42(2)	Coil Ass'y	– – –
48(2)	Magnet	– – –
49(2)	Pole Piece	– – –
50(2)	Top Pole Piece Plate	– – –
51(2)	Bottom Pole Piece Plate	– – –
52(2)	Travel Stop	– – –
53(2)	Terminal Mounting Bracket Ass'y	– – –
55(2)	Span Adjustment Ass'y(3)	– – –
56	Bellows Screw, brass	12B2577X012
57*	Bellows Ass'y, brass	
	Full Size, 27/32 inch (21 mm) O.D.	1U3958000A2
	Half Size, 1/2 inch (13 mm) O.D.	1U3975000A2
	Quarter Size, 3/8 inch (9.5 mm) O.D.	1R6521000A2
58	Tubing Ass'y, brass/copper	1P4242000A2
94	Sealant, Zink Plate 770 (not furnished with unit)	
96	Lubricant, Molykote 33 (not furnished with unit)	
103	Set Screw, SST/nylon (not shown)	11B2218X012
105(2)	Spacer	– – –

Key	Description	Part Number

Type 82 Relay (figure 10)

Note

The following parts are for repairing the Type 546 and 546S relays only. The Type 546NS relay is not repairable. If the relay is defective, order a Type 82 Relay Replacement Assembly for a Type 546NS transducer.

60	Relay Body, aluminum/brass	3P4192X0022
61	Casing Spacer, aluminum	2P419347052
62	Relay Casing, aluminum	2P419447052
63*	Valve Plug, brass	1P419514012
64	Spring Seat, brass	1P419615102
65*	Lower Diaphragm Ass'y	1P4197X0032
66*	Upper Diaphragm, nitrile	26A5657X012
67	Restriction Ass'y	1U8160X0012
68	Relay Mounting Screw, steel pl (2 req'd)	1P420324102
69*	Screen, Monel	0L078343062
70*	Valve Plug Spring, SST	1P420437022
71	Relay Spring, steel pl	15A3181X012
72*	O-Ring nitrile	1P420606992
73*	O-Ring, nitrile (2 req'd)	1P420706992
74*	O-Ring, nitrile (2 req'd)	1D687506992
75*	O-Ring, nitrile	1D134606992

*Recommended spare parts
3. The span adjustment assembly for the Type 546NS uses a bronze passive lock, rather than nylon, and a locking hex nut.

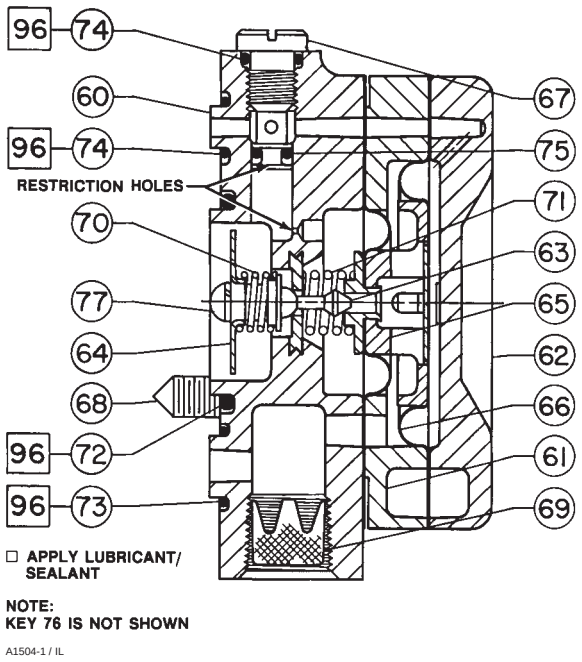


Figure 10. Type 82 Relay.

Key	Description	Part Number
76	Machine Screw, steel pl (6 req'd) (not shown)	10B6513X012
77	Machine Screw, steel pl (2 req'd)	59061140X22
96	Lubricant, Molykote 33 (not furnished with unit)	

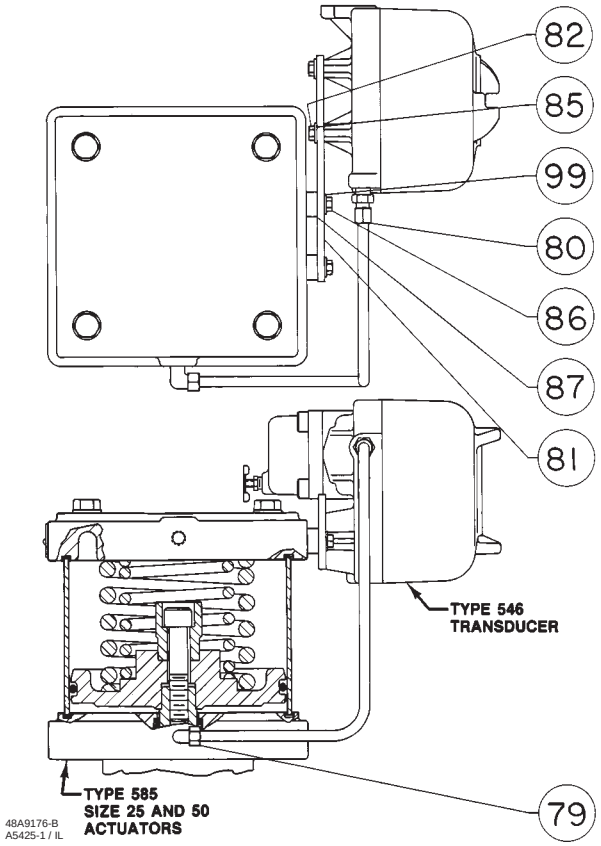


Figure 11. Typical Actuator Mounting

Diagnostic Connections

FlowScanner™ diagnostic system hook-up
Includes pipe tee, pipe nipple, pipe bushings, connector body, and body protector. See figure 3 for part identification. Also, part number provides correct quantities of each item.

Note

If the transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the transducer. The hook-up for diagnostic testing should be installed at the positioner.

For units with gauges	
SST fittings	12B8041X012
Brass fittings	12B8041X022
For units without gauges	
SST fittings	12B8041X032
Brass fittings	12B8041X042

Mounting Parts (figures 11 & 12)

Key	Description	Part Number
79	Elbow, brass	
	Yoke mounting, Types 513, 657, 1051, 1052, 1061 all sizes	15A6002X162
	Yoke mounting (2 req'd) Type 470, 480, 585, 585C, 667 all sizes	15A6002X162
79	Elbow, brass (cont"d)	
	Yoke mounting, Types 513, 657, 1051, 1052, 1061 all sizes	15A6002X162
	Casing mounting Type 1250, 657, 667 1051, 1052 all sizes	15A6002X162
80	Connector, brass	
	Yoke mounting Type 513, 657, 1051, 1052, 1061 all sizes	15A6002X202
	Casing mounting 1250, 657, 667, 1051, 1052	15A6002X202
81	Mounting Plate, steel	
	Yoke mounting	
	Type 470, 480, 513, 585, 585C 656, 657, 667, all sizes	
	Type 1051 size 33 all positions, size 40 and 60 position 1,	
	Type 1052 size 33 all positions, sizes 40 thru 70 position 1	
	Type 1061 size 30 all positions, sizes 40 thru 100 position 1	3P426825022
	Type 1250 and 1250R	30B1265X022
	Type 1051 size 40 and 60 position 3	
	Type 1052 sizes 40 thru 70 position 3	
	Type 1061 sizes 40 thru 100 position 3	2R1552X0022
	Type 657, 657NS, 667, 667NS, all sizes for seismic mounting of 546NS	35A4153X012

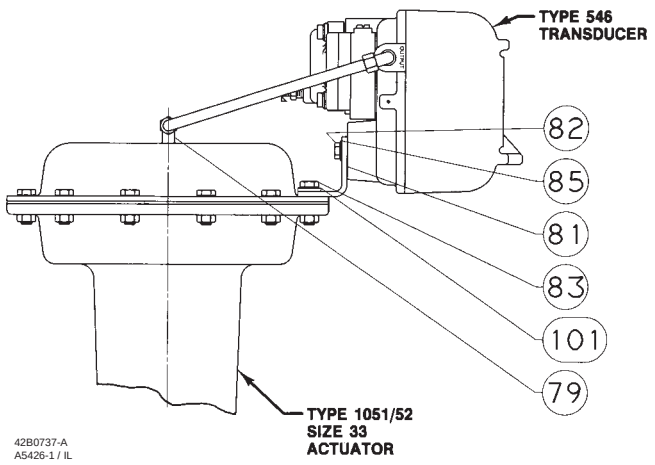


Figure 12. Typical Casing Mounting

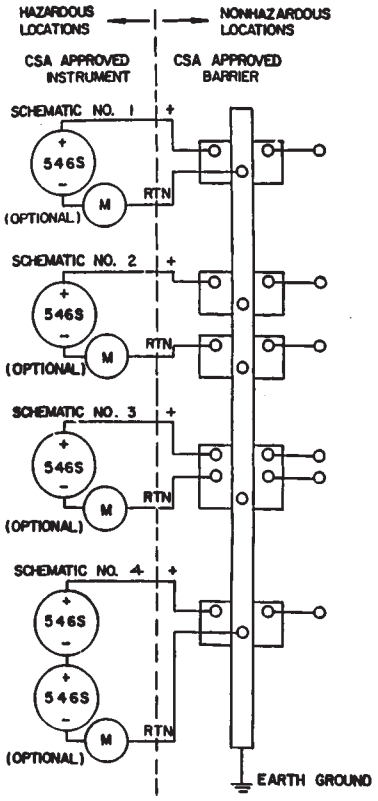
Key	Description	Part Number
81	Mounting Plate, steel (cont'd)	
	Casing mounting	
	Type 657 & 667, all sizes except size 80	
	Type 1051, 1052, all sizes, all positions	1F401225072
	Pipestand mounting	3P426825022
	Surface mounting	2R100125022
	Bulkhead mounting	22A7618X012
82	Cap Screw, steel pl	
	Yoke mounting (4 req'd)	
	Type 470 size 23 thru 40, 63 & 64	
	Type 480 all sizes	
	Type 513 all sizes	
	Type 656 size 40 thru 60	
	Type 657 & 667 size 30 thru 80	
	Type 1051 size 40 & 60 all positions	
	Type 1052 sizes 40 thru 70 all positions	
	Type 1061 all sizes all positions	1A381624052
	Yoke mounting (2 req'd)	
	Type 470, size 60 thru 130, except 63 & 64	
	Type 585, sizes 25 & 50	
	Type 585C, all sizes	
	Type 656, size 30	
	Type 657NS & 667NS, sizes 70 & 80	
	Type 1250 & 1250R	
	Type 1051 size 33 all positions	
	Type 1052 size 33 all positions	1A381624052
	Casing mounting (2 req'd)	
	All types, all sizes	1A381624052
	Pipestand mounting (2 req'd)	1A381624052
	Surface mounting (2 req'd)	1N789132992
	Bulkhead mounting (2 req'd)	1A381624052

Key	Description	Part Number
83	Cap Screw	
	Casing mounting (2 req'd)	
	Type 1051, 1052, all sizes, all positions	1A582824052
85	Washer, steel pl	
	Yoke mounting (4 req'd)	
	All types, all sizes, except Type 1250 & 1250R	
	Casing mounting (2 req'd)	
	Pipestand mounting (4 req'd)	1B865928982
	Yoke mounting Type 1250 & 1250R, none required	
86	Cap Screw, steel pl (2 req'd)	
	Yoke mounting	
	Type 470, Sizes 60 through 130	
	Type 490, all sizes	
	Type 657NS & 667NS, Sizes 70, 80	
	Type 1051 & 1052, size 33, positions 1 & 3	1C870224052
	Type 480, all sizes	1C5958X0022
	Type 585 & 585C, Sizes 25 & 50	1A352624052
	Type 656, Size 30	1B989624052
	Type 1051 & 1052, size 33, positions 2 & 4	1K747624052
	Casing mounting	
	Type 657 & 667, Sizes 30 through 60	1A582824052
	Type 657 & 667, Size 70	1A368324052
87	Spacer, steel (2 req'd)	
	Yoke mounting	
	Type 470, Sizes 60 through 130	
	Type 490, all sizes	
	Type 657NS & 667NS, Sizes 70, 80	1K766824092
	Type 656, Sizes 30	1R801924092
	Type 585, Sizes 25 & 50	1F906724092
	Type 1051 & 1052, size 33, positions 1 & 3	1V102624052
	Type 1051 & 1052, size 33, positions 2 & 4	1L200624092
	Surface mounting	18A1696X012
88	Mounting Bracket, steel	
	Yoke mounting	
	Type 480, all sizes	3L276725092
89	Hex Nut, steel pl (2 req'd)	
	Yoke mounting	
	Type 480, all sizes	1A352724122
90	Pipe Clamp, steel pl	
	Pipestand mounting	1P427028982
97	U-Bolt, steel pl (2 req'd)	
	Type 1250 & 1250R, all sizes	19A7930X012
98	Hex Nut, steel pl (4 req'd)	
	Type 1250 & 1250R, all sizes	19A4838X022
99	Lock washer, SST	
	Yoke mounting (4 req'd)	
	Type 585C, size 25 & 50	1C225728982
	Type 1250 & 1250R, all sizes	10B6610X012
	Yoke mounting (2 req'd)	
	Type 1051 & 1052, size 33, all positions	1C225728982
101	Washer (2 req'd)	
	Casing mounting	
	Type 1051, 1052, all sizes, all positions	1H723125072

Loop Schematics

This section includes loop schematics required for wiring of intrinsically safe installations. If you have any questions, contact your Fisher Controls sales representative or sales office.

CSA Schematics



29A1594-H Sheet 1 of 2

TYPE 546S: CSA PARAMETRIC RATINGS

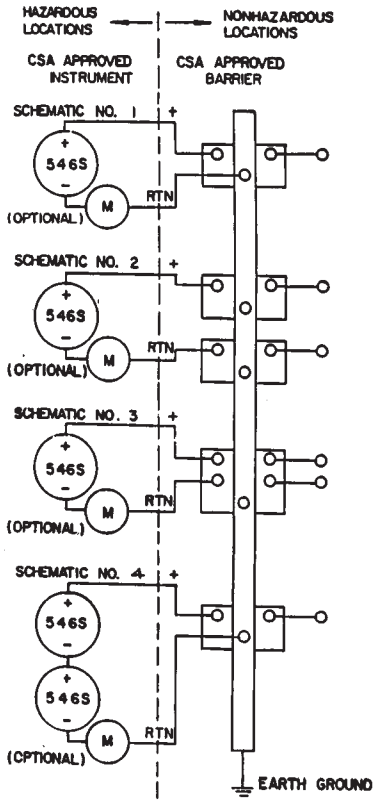
GROUP A,B,C,D CSA RATING 33V MAX, 581 OHM MIN, SINGLE INSTRUMENT
GROUP A,B,C,D CSA RATING 30V MAX, 411 OHM MIN, SINGLE INSTRUMENT
GROUP A,B,C,D CSA RATING 28V MAX, 346 OHM MIN, SINGLE INSTRUMENT
GROUP A,B,C,D CSA RATING 26V MAX, 342 OHM MIN, SINGLE INSTRUMENT
GROUP A,B,C,D CSA RATING 22V MAX, 150 OHM MIN, SINGLE INSTRUMENT
GROUP C,D CSA RATING 30V MAX, 150 OHM MIN, SINGLE INSTRUMENT
GROUP C,D CSA RATING 33V MAX, 150 OHM MIN, SINGLE INSTRUMENT OR SPLIT RANGE

APPROVED BARRIER	BARRIER TYPE	MANUF. INST. MANUAL	SCHEM NO.	METER OPTION	APPLICABLE HAZARDOUS LOCATIONS	CSA BARRIER RATING
TAYLOR	5850FL84100	IB-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	5851FL84100	IB-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	1130FG21000	IB-17E211	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 206 OHMS
TAYLOR	1135FG21000	IB-17E212	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 266 OHMS
TAYLOR	1150FZ81010	IB-17E220	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	26V, 342 OHMS
FOXBORO	2AO-V2I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2AO-V3I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2AO-V5I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2AO-VAI-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D2I CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D3I-CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2AS-I3I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	

THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6. W8-10/ 10

CSA Schematics (Continued)



APPROVED BARRIER	BARRIER TYPE	MANUF. INST. MANUAL	SCHEM NO.	METER OPTION	APPLICABLE HAZARDOUS LOCATIONS	CSA BARRIER RATING
STAHL	8903/51-200/050/7	89 036 01 31 0	2	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	20.41V, 300 OHMS
	8901/33-293/000/7	89 016 03 31 0				28.1V, 470 OHMS
STAHL	8901/31-199/100/7	89 016 03 31 0	1,4	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	19V, 220 OHMS
STAHL	8903/31-200/050/7	89 036 01 31 0	1,4	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	19.95V, 286.7 OHMS
STAHL	8903/31-263/050/7	89 036 01 31 0	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	26.5V 386 OHMS
STAHL	8901/31-280-165/8	89 016 03 31 0	2	43M/44M	CLASS I, DIV 1, GROUPS C,D	27.3V, 179 OHMS
	8901/33-293/000/7	89 016 03 31 0				28.1V, 470 OHMS
MTL	187+	PS-300-13	3	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS; 30V (DIODE)
MTL	128+	PS-300-13	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS
MTL	122+	PS-300-13	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	22V, 150 OHMS
MTL	787+	PS-700-2	3	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS; 28V (DIODE)
MTL	728+	PS-700-2	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS
MTL	722+	PS-700-2	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	22V, 150 OHMS
BAILEY	766610AAAV1	4576K16-034	3	NONE	CLASS I, DIV 1, GROUPS C,D	27V, 345 OHMS 10V, 40 OHMS
HONEYWELL	38545-0000-0110-113-C5D5	S 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS A,B,C,D	20V, 150 OHMS
HONEYWELL	38545-000-0110-111-C5D5	S 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
HONEYWELL	38545-000-0110-111-C5D5	S 385-22	2	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
	38545-0000-0110-112-C5D5					28V, 200 OHMS

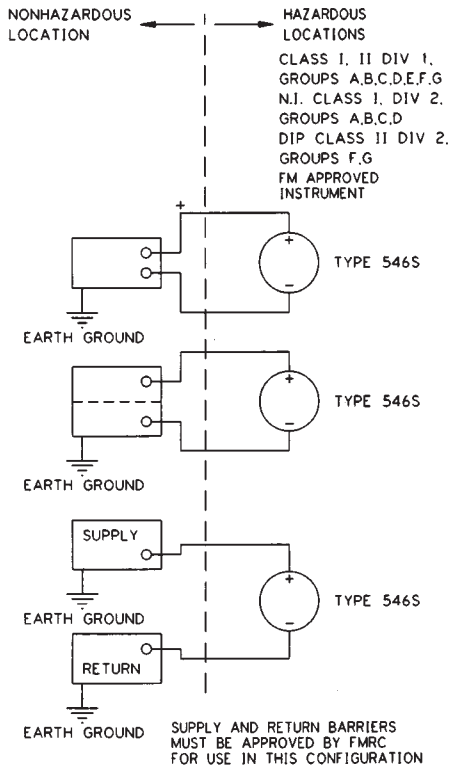
THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6.

WB-10/ 10

29A1594-H Sheet 2 of 2

FM Schematics



TYPE 546S ENTITY PARAMETERS

V_{max} = 33.3Vdc I_{max} = 175mA C_i =0 L_i =0

NOTES:

-LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURERS INSTRUCTION

-SEE ANSI/ISA RP12.6 FOR GUIDANCE IN INSTALLATION

-BARRIER PARAMETERS MUST MEET THE FOLLOWING REQUIREMENTS:
V_{oc} OR $V_T \leq V_{max}$ I_{sc} OR $I_T \leq I_{max}$ $C_a(\mu F) > 0.0$ $L_a(mH) > 0.0$

-THE C_a AND L_a PARAMETERS FOR THE BARRIER MUST BE GREATER THAN THE SUM OF THE CONNECTING CABLE PARAMETERS AND C_i AND L_i OF THE I.S. APPARATUS

-MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 V_{rms}

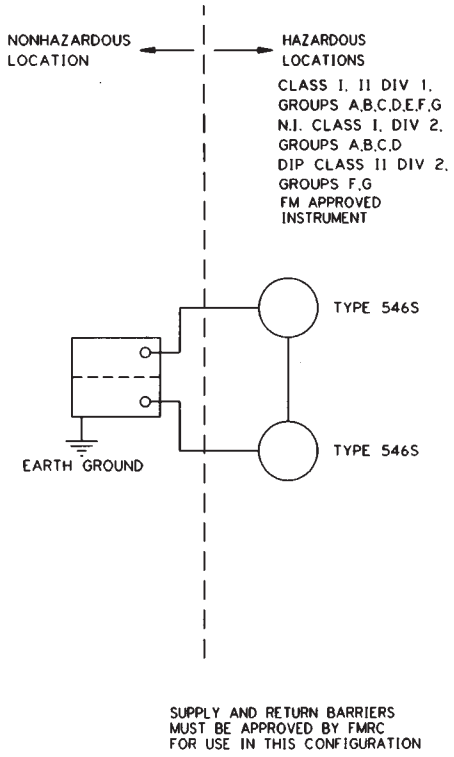
-RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

-CL I, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC SECTION 501-4 (b) WHEN BARRIERS ARE NOT USED

NORMAL OPERATING CONDITIONS 30 VDC, 20 mADC

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF: FM

26A5936-H Sheet 1 of 2



SUPPLY AND RETURN BARRIERS MUST BE APPROVED BY FMRC FOR USE IN THIS CONFIGURATION

TYPE 546S ENTITY PARAMETERS

V_{max} = 33.3Vdc I_{max} = 175mA C_i =0 L_i =0

NOTES:
-LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURERS INSTRUCTION

-SEE ANSI/ISA RP12.6 FOR GUIDANCE IN INSTALLATION

-BARRIER PARAMETERS MUST MEET THE FOLLOWING REQUIREMENTS:
V_{oc} OR $V_T \leq V_{max}$ I_{sc} OR $I_T \leq I_{max}$ $C_a(\mu F) > 0.0$ $L_a(mH) > 0.0$

-THE C_a AND L_a PARAMETERS FOR THE BARRIER MUST BE GREATER THAN THE SUM OF THE CONNECTING CABLE PARAMETERS AND C_i AND L_i OF THE I.S. APPARATUS

-MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 V_{rms}

-RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

-CL I, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC SECTION 501-4 (b) WHEN BARRIERS ARE NOT USED

NORMAL OPERATING CONDITIONS 30 VDC, 20 mADC

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF FM

26A5936-H Sheet 2 of 2

CE Fisher-Rosemount satisfies all obligations coming from legislation to harmonise product requirements in the European Union.

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