Industrial Pressure Transducers

User's Manual

T Model

T Model

The Swagelok® T model transducer is engineered for use in industrial pressure measurement applications where intrinsically safe ratings are required, such as hazardous environments or media, including gases, vapors, or dust.

Introduction

Swagelok industrial pressure transducers allow for electronic monitoring of system pressures in a variety of industrial applications. The products feature an accuracy of 0.5 % Limit point calibration (0.25 % Best fit straight line), temperature compensation to ensure accuracy and long term stability when exposed to temperature variations. The transducers are zero and span adjustable, and are available in a wide variety of process and electrical connections, pressure ratings and pressure units to fulfill many application requirements.

Contents

Safety Definitions

Warning — Potential danger to life or of serious injuries.

Warning — Potential danger to life or of serious injuries due to catapulting parts.

Caution — Potential danger of burns due to hot surfaces.

Notice, important information.

The product was tested and certified by CSA International. It complies with the applicable Canadian standards on safety. Certificate-No.: 2199503

The product was tested and certified by FM Approvals. It complies with the applicable U.S.A. standards on safety.

Safety Instructions

Warning — For proper and safe operation, Swagelok T model transducers must be installed, operated, and serviced according to NEC, applicable local regulations, and these instructions. Otherwise, serious personal injuries, damage or both can occur.

Warning — Except for adjusting the length of the wires, the electrical connection provided on the transducer must be used as originally supplied and not bypassed. Only qualified persons should work on theses instruments.

Warning — Do not exceed the overpressure rating.

Warning — Before servicing any installed pressure transducer you must
- **depressurize system**
- **purge the transducer**

Residual material may be left in the transducer and system.

Warning — Models with Mounted Cooling Element, ensure there is proper air circulation around the cooling element and the element is protected from dust.

Warning — Models with Mounted Cooling Element, do not touch the cooling element while the transducer is in operation.

Warning — Models with Mounted Cooling Element, the surface temperature of the cooling element and the transducer must not exceed the maximum ambient temperature of the application's intrinsically safe rating.

Safe Product Use

Follow any enclosed instructions and refer to the product catalog for detailed product information. When using a transducer, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user. **Improper selection or misuse of the product may result in serious personal injury or property damage**.

Mechanical Installation

50 N·m (36 ft·lb) max.

Service and Maintenance

Zero and Span Adjustment

Do not twist or remove housing nut without first removing the fastening screw and electrical connector. Damage to the connector wiring may result.

1. Open the pressure transducer by removing the fastening screw. See Fig. A
2. Adjust the zero point **(Z)** with the transducer in the pressureless state. See Fig. B and Fig. D.
3. Adjust the span **(S)** while using a pressure standard with adequate accuracy. See Fig. B and Fig. D..
4. Check the output signal for each transducer adjustment. Repeat steps 1 through 3 as necessary.
5. Reassemble transducer as shown in Fig. A.

Fig. A

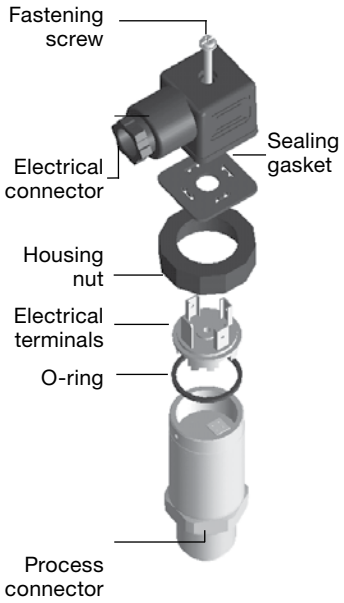
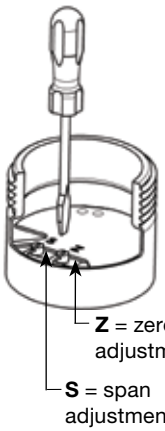


Fig. B



Do not attempt to clear the pressure port with a screwdriver or other sharp objects as this may damage the sensing element of the transducer.

Electrical Installation

Do not exceed the max. permissible power supply DC 30 V.

The shield / ground connection must be wired to ground at one end to protect the instrument from electromagnetic disturbances. For devices with flying leads, the screen is connected to the housing. The simultaneous connection of the housing and cable screen to ground is only permitted if ground loop problems between the shield connection (e.g. at the power supply) and housing can be excluded.

- Attach wiring to the appropriate terminals, Fig. C and Fig. D, as shown in diagrams on page 3. Wiring information is also printed on the instrument label.
- Be certain that the voltage supply is higher than the minimum required voltage as determined by the maximum load equations.
- Refer to the installation conditions shown in the IS Apparatus Control Drawings on page 4.

Maximum Load Equations

Milliampere output signal, 2 wire

Output	4 to 20 mA
Supply	V (dc) = 10① to 30 V
Max. Load	R_L (Ω) = (V [dc] – 10 V①) ⎪ 0.02 A - (Length of flying lead × 0.14 Ω)
Terminals	See drawings

① 11 V for field-case version.

Fig. C

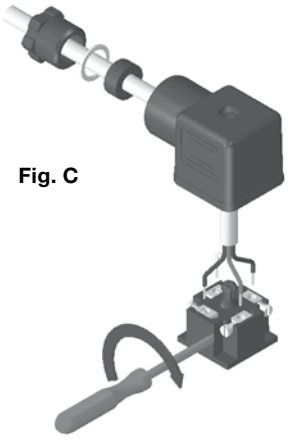
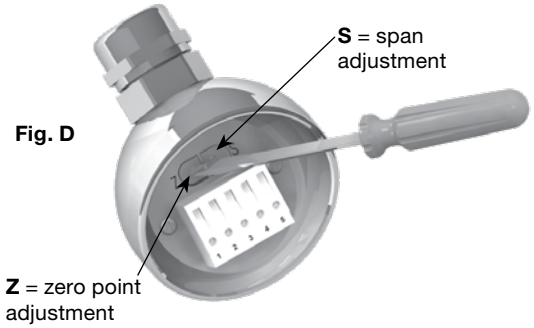


Fig. D

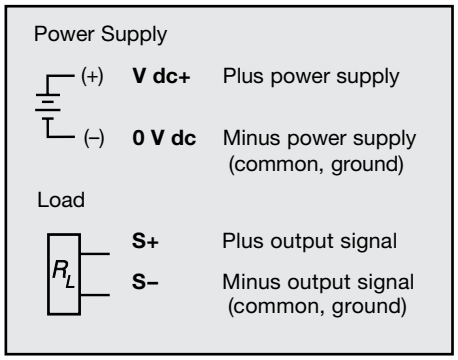


Wiring Diagrams

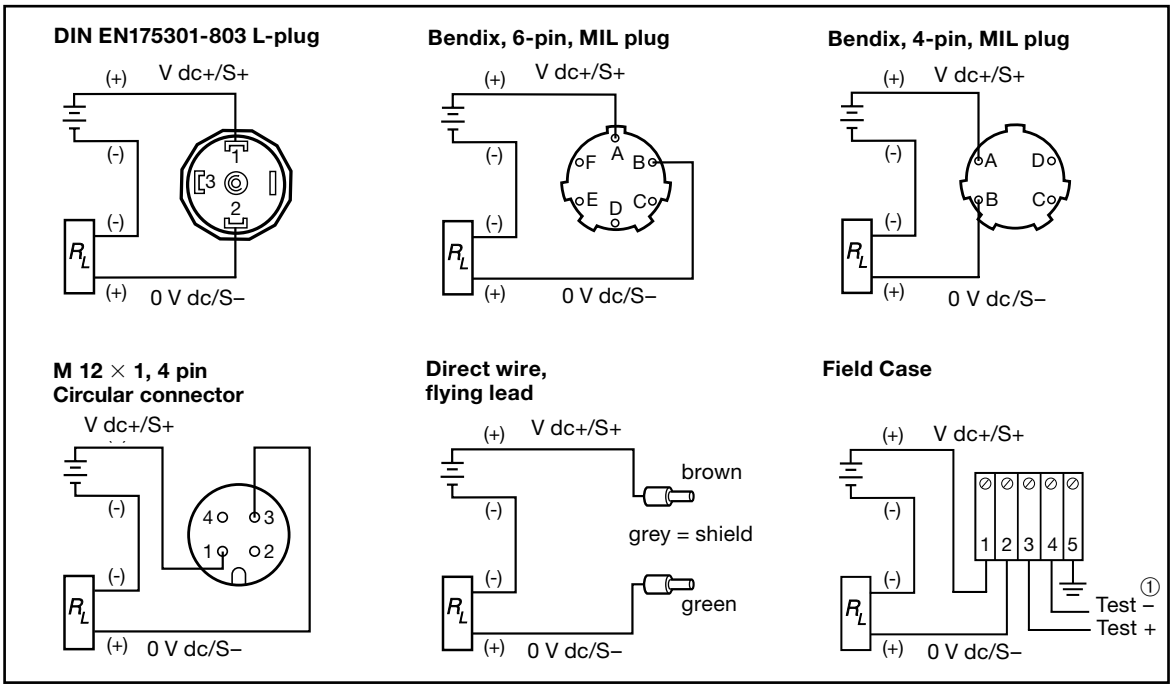
Special Instructions for Wiring

- Do not use the MIL-plug for mining applications due to the light metal material.
- Always connect the housing to earth ground to protect the instrument against electromagnetic fields and electrostatic charges.

Legend



2-Wire Systems



① The transducer current can be monitored during normal operations by connecting an ammeter across the test terminals. For applications in hazardous locations, the internal resistance of the ammeter must be < 15 Ω.

Note: Refer to the IS Apparatus Control Drawing on page 4 for additional safe installation information.

FM and CSA Approval

- CSA (Canada and U.S.A.) and FM intrinsically safe:
  - Class, I Division 1, Groups A, B, C, and D
  - Class II, Division 1, Groups E, F, and G
  - Class III Division 1
  - Class I, Zone 0, Group IIC AExia IP65
  - Entity parameters:

    V_{max} = 30 V (dc)

    I_{max} = 100 mA at $T_{amb} \leq 85°C$

    I_{max} = 87 mA at $T_{amb} > 85°C$

    P_i = 1 W

    C_i = 22 nF

    L_i = 0 mH

- CSA (Canada and U.S.A.) and FM nonincendive:
  - Class I, Division 2, Groups A, B, C, and D
  - Class II, Division 2, Groups F and G
  - Class III, Division 2
  - Field wiring parameters:

    V_{max} = 30 V (dc)

    I_{max} = 100 mA at $T_{amb} \leq 85°C$

    I_{max} = 87 mA at $T_{amb} > 85°C$

    P_i = 1 W

    C_i = 22 nF

    L_i = 0 mH

- Temperature class:
  - T6 at maximum ambient 140°F (60°C)
  - T5 at maximum ambient 176°F (80°C)
  - T4 at maximum ambient 221°F (105°C)

Intrinsic Safety

Special Instructions for Intrinsic Safety

- Intrinsically-safe transducers require the use of an approved barrier and an approved power supply to provide full protection in hazardous areas.
- The internal diaphragm of the transducer must be protected from abrasive substances and pressure peaks, and must not be touched by tools. A damaged diaphragm voids the intrinsic safety performance of the transducer.

IS Apparatus Control Drawings

Hazardous (Classified) Location

Intrinsically Safe Installation
Class I, Zone 0, Group IIC
Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class III, Division 1
Note: Dust-tight conduit seal must be used when installed in Class II and Class III environments.

Nonhazardous Location

Entity Parameters

Swagelok T Model

V_{max} =	30 V
I_{max} =	100 mA at $T_{amb} \leq 85°C$
I_{max} =	87 mA at $T_{amb} > 85°C$
P_i =	1 W
C_i =	22 nF (flying leads: +0.2 nF/m)
L_i =	0 mH (flying leads: +2 µH/m)

Associated Apparatus
The configuration of Associated Apparatus must be under entity concept and — for USA — FM approved.
Associated Apparatus manufacturer's installation drawing must be following when installing this equipment.
The Swagelok T model is certified by CSA and FM for Class 1, Zone 0 applications. If connecting Ex [ib] associated apparatus or Ex ib I.S. apparatus to the T Model, the I.S. circuit is only suitable for Class I, Zone 1 or Class I, Zone 2 and is not suitable for Class I, Division 1 Hazardous (Classified) Locations.

Control Equipment
Control equipment connected to the Associated Apparatus must not use or generate more than 250 V (rms) or V (dc).

Notes: The Intrinsic Safety Entity concept allows the interconnection of two intrinsically safe devices with entity parameters not specifically examined in combination as a system when: $\mathbf{U_o}$ **or** $\mathbf{V_{oc}} \leq \mathbf{V_{max}}$, $\mathbf{I_o}$ **or** $\mathbf{I_{sc}} \leq \mathbf{I_{max}}$, $\mathbf{C_a}$ **or** $\mathbf{C_o} \geq \mathbf{C_i + C_{cable}}$, $\mathbf{L_a}$ **or** $\mathbf{L_o} \geq \mathbf{L_i + L_{cable}}$, $\mathbf{P_o} \leq \mathbf{P_i}$. Installation should be in accordance with the Canadian Electrical Code (CEC) Part I for Canada or with ANSI/ISA RP12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and National Electrical Code (ANSI/NFPA70) Sections 504 and 505 for USA.
No revision to this drawing without prior approval by CSA and/or FM.

Hazardous (Classified) Location

Non-Incendive Installation
Class I Division 2, Groups A, B, C, D
Class II Division 2, Groups F, G
Class III, Division 2
Note: Dust-tight conduit seal must be used when installed in Class II and Class III environments.

Nonhazardous Location

Entity Parameters

Swagelok T Model

V_{max} =	30 V
I_{max} =	100 mA at $T_{amb} \leq 85°C$
I_{max} =	87 mA at $T_{amb} > 85°C$
P_i =	1 W
C_i =	22 nF (flying leads: +0.2 nF/m)
L_i =	0 mH (flying leads: +2 µH/m)

Associated Apparatus
The configuration of Associated Apparatus must be under entity or non-incendive field wiring concept and — for USA — FM approved.
Associated Apparatus manufacturer's installation drawing must be following when installing this equipment.
No revision to this drawing without prior approval by CSA and/or FM.

Control Equipment
Control equipment connected to the Associated Apparatus must not use or generate more than 250 V (rms) or V (dc).

Notes: The non-incendive field wiring concept allows the interconnection of two devices with non-incendive parameters not specifically examined in combination as a system when: $\mathbf{U_o}$ **or** $\mathbf{V_{oc}} \leq \mathbf{V_{max}}$, $\mathbf{I_o}$ **or** $\mathbf{I_{sc}} \leq \mathbf{I_{max}}$, $\mathbf{C_a}$ **or** $\mathbf{C_o} \geq \mathbf{C_i + C_{cable}}$, $\mathbf{L_a}$ **or** $\mathbf{L_o} \geq \mathbf{L_i + L_{cable}}$, $\mathbf{P_o} \leq \mathbf{P_i}$. Installation should be in accordance with the Canadian Electrical Code (CEC) Part I for Canada or the National Electrical Code (ANSI/NFPA70) Sections 504 and 505 for USA.

Based on control drawing 11055588.03-09

Troubleshooting Guide

Before servicing any installed pressure transducer, you must
- **depressurize the system**
- **purge the transducer**

- **If the transducer becomes damaged or unsafe for operation, remove it from service and mark to prevent it from being used accidentally.**
- **Have repairs performed by the manufacturer only.**

Do not insert any pointed or hard objects into the pressure port for cleaning.

Problem	Possible Causes	Remedy
Output signal unchanged after change in pressure	Mechanical overload through overpressure	Replace transducer①
Signal span too small	Mechanical overload through overpressure	Re-calibrate transducer
	Diaphragm is damaged, e.g. through impact	Replace transducer①
Signal span dropping off / too small	Abrasive / aggressive media; corrosion of diaphragm / pressure connector; transmission fluid missing.	Replace transducer①
Signal span erratic	Electromagnetic interference source in the vicinity, e.g. inverter drive	Shield the transducer; shield the cables; remove the interference source
	Working temperature too high / too low	Ensure permissible temperatures (see Operating Instructions)
Signal span incorrect	Working temperature too high / too low	Ensure permissible temperatures (see Operating Instructions)
Abnormal zero point signal	Medium or ambient temperature too high / too low	Control the internal temperature of the transducer within the permissible range; observe the allowable temperature error (see Operating Instructions)
	Abnormal mounting position	Correct the zero point through the potentiometer
	Overload limits exceeded	Ensure permissible overload limits are observed (see Operating Instructions); correct the zero point through the potentiometer
No output signal	Cable break	Check connections and cable
	Incorrect wiring or supply voltage	Check wiring and supply voltage

① Adjusting the controller or display device can usually compensate for small changes in the output signal. Test the system for proper operation after adjustments are made. An excessive change in the output signal indicates possible transducer damage. This may cause the output to be non-linear, requiring transducer replacement.

Storage and Disposal

Purge all media from the pressure transducer before storage or disposal of the transducer.

Mount the protection cap when storing the pressure transducers with flush diaphragms.

Dispose of transducer components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the transducer is supplied.

⚠ WARNING
Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.

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For product technical data, including materials of construction, see the *Swagelok Industrial Pressure Transducers* catalog, MS-02-225.

Translations available on **www.swagelok.com.**

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