Instruction ES6700
10/97

Model 7000
Electropneumatic Transducer
Instructions

Masoneilan
Valve & Controls DRESSER

Table of Contents

Use of **DANGER, WARNING, CAUTION,** and **NOTE**.

These instructions contain **DANGER, WARNING, CAUTION,** and **NOTE** where necessary to alert you to safety related or other important information.

DANGER - Hazards which result in severe personal injury or death.
WARNING - Hazards which could result in personal injury.
CAUTION - Hazards which could result in equipment or property damage.
NOTE - Alerts you to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and the **CAUTION** hazards involve equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance which may lead to personal injury or death. Therefore, comply fully with all **DANGER, WARNING,** and **CAUTION** notices.

IMPORTANT: SAFETY WARNING

Please read these instructions carefully BEFORE this instrument is installed or maintained.

These transducers are intended for use in industrial compressed air systems only. Ensure that adequate pressure relief provision is installed if application of system supply pressure could cause downstream equipment to malfunction. Installation should be in accordance with local and national compressed air and instrumentation codes.

Products certified for use in explosionproof (flameproof) or intrinsically safe installations MUST

a) Be installed in accordance with local and national codes for hazardous area installations.

b) Only be used in situations which comply with the certification conditions stated in this handbook.

c) Only be maintained by qualified personnel with adequate training on hazardous area instrumentation.

Before using these products with fluids other than air, or for nonindustrial applications, consult Masoneilan Dresser. Not intended for use in life support systems.

Items sold by Masoneilan Dresser are warranted to be free from defects in materials and workmanship for a period of three years from the date of manufacture, provided said items are used according to Masoneilan Dresser's recommended usages.

Masoneilan Dresser reserves the right to discontinue manufacture of any product or change product materials, design, or specifications without notice.

Brief User Guide

This is a quick guide to connecting the instrument for the convenience of personnel who are familiar with this type of product. More comprehensive instructions are contained later in this manual:

1. Connect a clean air supply of about 30 psig (2.1 bar) to the IN port (1/4" NPT).
2. Connect a pressure gauge or actuator to the OUT port.

CAUTION: DO NOT use PTFE tape or similar to seal the ports. Use a minimum amount of a soft setting anaerobic compound, e.g., Loctite Hydraulic Seal 542.

DANGER: Do not remove the instrument cover in an explosionproof area when the instrument is powered.

3. Unscrew the lid to obtain access to the terminals.

WARNING: The cable will need to be sealed by an approved gland for explosionproof installation.

4. Connect a 4-20 mA current source. Ensure that it can supply at least 6.5 V at 20 mA.

   Check for correct polarity.

CAUTION: DO NOT use a voltage source; it will irreversibly damage the converter.

5. Switch on the air supply and current source and allow a few seconds stabilization time. Adjust span and zero if necessary.

If the instrument fails to operate, refer to the Trouble-shooting Guide.

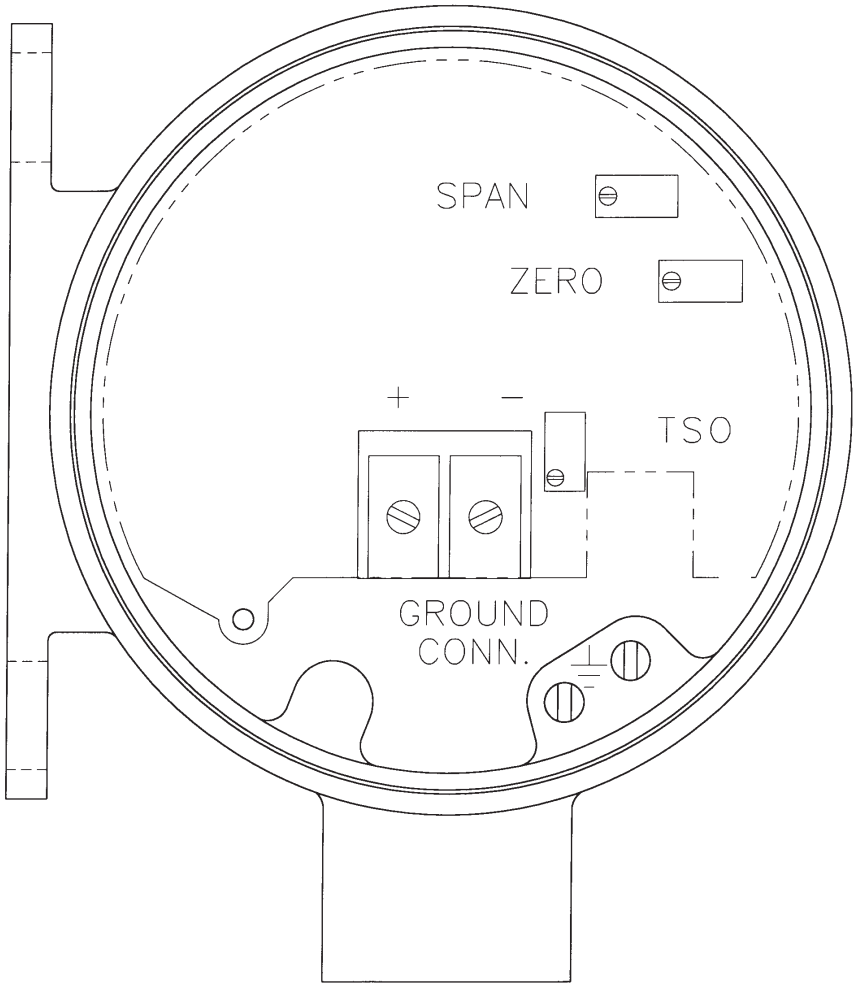


DIAGRAM 1

General Description

The Model 7000 instrument is a completely new design of electronic I/P transducer for field-mounted process control applications. It features fail-safe operation, i.e. the output falls to a low pressure upon failure of the input current. The minimum current is adjustable by a shutoff control.

These converters are precision electronic pressure controllers designed for continuous process control applications. They use internal closed loop feedback, in which outlet pressure is continuously monitored by a pressure sensor, to give high performance and long term stability.

These instruments have substantial flow capacity, with the ability to give precise control into closed volume “dead end” applications. Typically, the fill/exhaust response times into loads of up to 10 liters are below 1 and 4 seconds respectively for 90% step changes in pressure.

The instrument is inherently insensitive to shock, vibration and positional effects, and may be mounted directly upon a control valve. A mounting bracket is provided for surface mounting, or the instrument may be fixed directly to rigid pipework.

The electronics are enclosed within a watertight housing which is suitable for outdoor use if a suitable cable gland is used.

CAUTION: The lid should be tightened firmly approximately half turn after it becomes hand tight. Use a suitable lever, but do not overtighten.

Instrument Mounting

The converter can be mounted directly onto a valve, onto any suitable flat surface, or onto 2" (50 mm) pipe. Dimensional details follow.

These converters will operate in any position, but should be mounted upright, i.e., with the screwed lid horizontal, if dust and water ingress effects are to be minimized. Avoid situations where debris, etc., may fall into the unit when the lid is removed for connection or calibration. They are relatively unaffected by shock and vibration, but severe vibration environments are best avoided.

If installed upright, the instruments are protected against environmental effects to a level of NEMA 4X (IP 66). Sensible positioning should be used if the local environment is severe.

Temperature compensation is designed into these converters which will operate over a range of -40° to +185°F (-40° to +85°C).

The pneumatic bleed and exhaust are taken to a removable water ingress protection baffle on the side of the unit. The case pressure equalization vent is via a baffle in the base.

CAUTION: Avoid blocking these baffles with paint, etc.

Pneumatic Installation

These instruments are designed to operate only with clean, dry, oil-free instrument grade air to BS.6739 : 1986 or ANSI/ASA-57.3 1975 (R1981).

Dew Point:	At least 50°F (10°C) below minimum anticipated ambient temperature.
Dust:	Filtered to below 3-5 micron.
Oil Content:	Not to exceed 1 ppm mass.

The supply pressure to the instrument should normally be set to 30 psig (2.1 bar) ± 10%. Operation is possible at any pressure between 18 and 60 psig (1.2 to 4.1 bar), though recalibration may be necessary towards these limits to maintain specified accuracy.

The inlet and outlet ports are threaded 1/4" NPT female and suitable fittings should be used. For most installations, 1/4" (6 mm) pipe will be adequate. If a large actuator, high flow rates, or long pipework are necessary, then a larger diameter should be used.

Plastic tubing, e.g., nylon, is preferable where circumstances permit, since it is normally very clean internally. In all cases, purge the supply pipework before connection to the converter.

Two gauge ports are provided to facilitate direct mounting of a pressure gauge. To use one of these ports remove the plug (1/4" Hexagon Key) and connect the gauge. These ports are also threaded 1/4" NPT female.

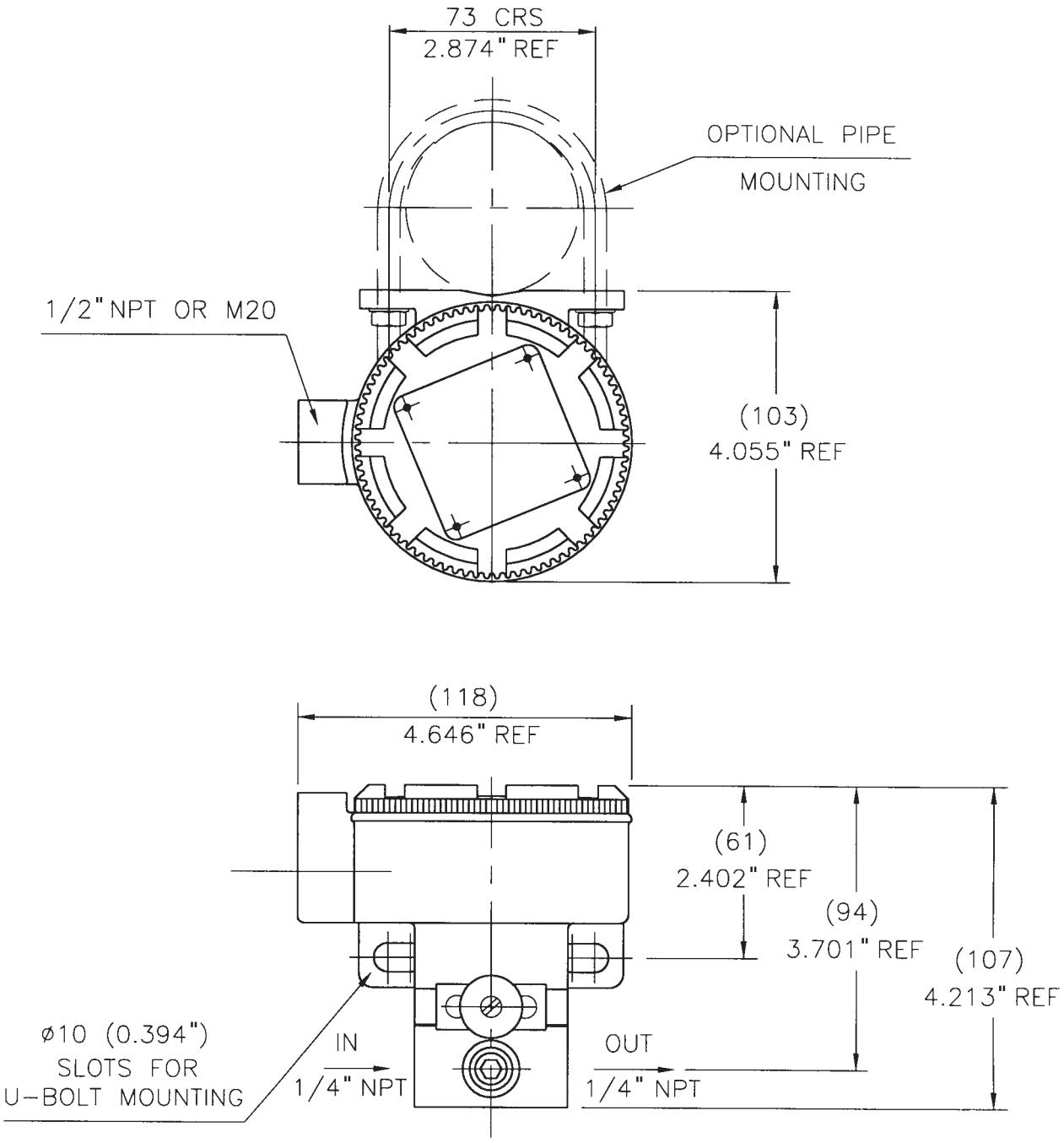


DIAGRAM 2: Dimensional Diagram

CAUTION: Under no circumstances should PTFE tape be used for sealing the fittings, as this tends to shred into small particles which find their way into the instrument and cause malfunctions.

The use of a soft setting anaerobic hydraulic seal is recommended, (e.g., Loctite Hydraulic Seal 542). Follow the manufacturer's recommendations.

CAUTION: Do not use an excessive amount as this will not set and could find its way into the instrument.

If the air supply is not of adequate quality, this can normally be achieved by the use of a combination of Masoneilan air filter regulators. The exhaust baffle plug can be unscrewed and replaced with a suitable fitting and pipework for captured exhaust and bleed arrangements, e.g., fuel gas applications. The baffle port is threaded 1/8" NPT female.

Electrical Installation

The electrical connections should be made as shown in the dimensional drawing Diagram 1. The instrument is protected against reverse polarity to -100 mA; no operation is possible in this condition.

The Model 7000 approximates to a constant voltage load of approximately 6.5 volts across the loop terminals.

It is essential that the loop controller be capable of providing a constant current in the range 4-20 mA, with an output voltage of at least 6.5 volts, compliance.

CAUTION: Voltage output controllers (e.g., variable voltage power supplies) are entirely unsuitable for the Model 7000 and could severely damage the electronic circuits.

The available output voltage of a current source will be reduced by the effects of the loop cable resistance. If in doubt connect a resistor of value (325Ω + Loop Resistance) across the output of the controller and measure the current with a suitable milliameter. At the 100% setting of the controller, a current of 20 mA should be available.

Wiring and Cable Entry

WARNING: These instruments must be installed in accordance with local and national codes of practice, especially for hazardous area installations. The instruments are fully isolated from ground and therefore grounding is unnecessary for functional purposes. However, grounding may be necessary to conform to installation codes.

NOTE: It is strongly recommended that shielded cable or conduit be used to achieve maximum RFI immunity, if the installation has any risk of electromagnetic interference.

Conduit Entry

The instruments can be supplied with 1/2" NPT or M20 conduit entries. For explosionproof installation, the 1/2" NPT version must be used, with a sealed conduit gland conforming to explosionproof specifications. A ground terminal is provided internally and should be used if ground continuity is essential.

Hazardous Area Versions

The instrument is available in versions suitable for use in hazardous areas. The hazardous area versions carry information on their certification on a special label. This gives an indication to the correct areas of use.

Installation of any hazardous area equipment should be made in accordance with hazardous area installation codes and also of course to the installation and operating instructions provided for each instrument. Masoneilan Dresser cannot be held responsible for incorrect installation. If a certified instrument should fail, no attempt should be made by the user to affect repair. The unit should be returned to the factory.

Masoneilan Dresser cannot be held responsible for any customer modifications to, or repair of, a certified instrument as this may invalidate the certified design.

FM Approvals

Two FM approved models are available.

1. Explosionproof/Dust-Ignitionproof

Approved by Factory Mutual as explosionproof for Class I, Division 1, Groups B, C, and D; dust-ignitionproof for Class II, Division 1, Groups E, F, and G. T6 @ 167°F (75°C) AMB, T5 @ 185°F (85°C) AMB, indoor and outdoor (NEMA Type 4X) hazardous (classified) locations.

In this application, it must be installed in accordance with the current edition of the National Electrical Code ANSI/NFPA-70, and the installation and operating instructions provided with each instrument.

2. Intrinsically Safe

Approved by Factory Mutual as intrinsically safe for Class I, Division 1, Groups A, B,C, and D. T4 @ 104°F (40°C) AMB, T3B @ 158°F (70°C) AMB, T3A @ 185°F (85°C) AMB hazardous outdoor (NEMA Type 4X) locations.

In this application it must be installed in accordance with:

a) The National Electrical Code (ANSI/NFPA 70) and ANSI/ISA RP 12.6, “Installation of Intrinsically Safe Instrument Systems in Class I Hazardous (Classified) Locations.”

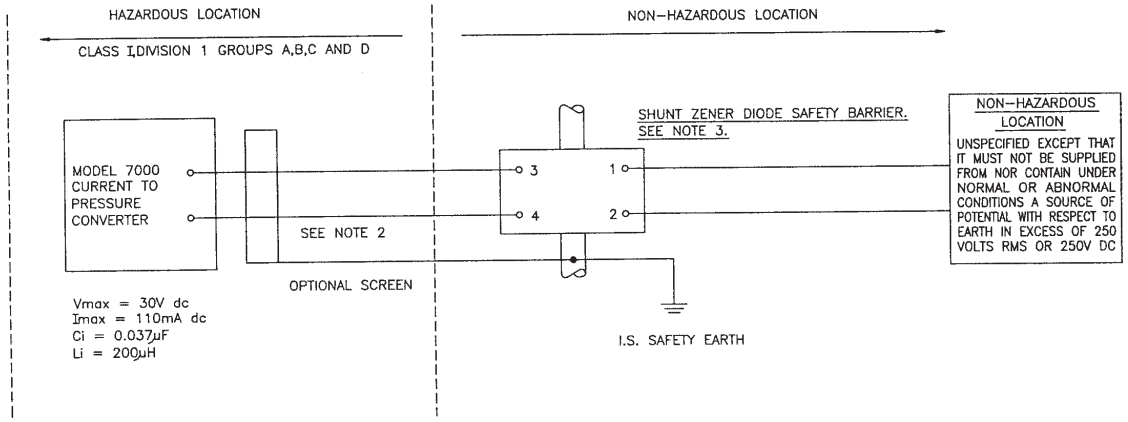
b) The installation drawing 95-107, Diagram 3, shown below.

c) The Installation and Operating Instructions provided with each unit.

DO NOT SCALE DRAWING IF IN DOUBT ASK

DIAGRAM 3

DR'G No : 95–107 ISSUE 'A'. MODEL 7000 INTRINSICALLY SAFE FM CONTROL DR'G



NOTES

1. THE ELECTRICAL CIRCUIT IN THE HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS R.M.S. TO EARTH OR FRAME OF THE APPARATUS FOR 1 MINUTE.
2. CABLE CAPACITANCE AND INDUCTANCE PLUS THE I.S. APPARATUS UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) MUST NOT EXCEED THE ALLOWED CAPACITANCE (Ca) AND INDUCTANCE (La) INDICATED ON THE ASSOCIATED APPARATUS.
3. ANY POSITIVE POLARITY SHUNT ZENER DIODE SAFETY BARRIER APPROVED BY FMRC FOR GROUPS A,B,C AND D WHOSE OUTPUT PARAMETERS ARE :–

   Voc or Vt $\leq$ 30V
   Isc or It $\leq$ 110mA
   Pmax $\leq$ 0.8W
   eg. MTL 728
   P & F Z428/Ex

   THE OUTPUT CURRENT MUST BE LIMITED BY A RESISTOR R SUCH THAT R $\geq$ Voc/ Isc

4. THE INSTALLATION INCLUDING THE BARRIER EARTHING ARRANGEMENTS MUST COMPLY WITH THE INSTALLATION REQUIREMENTS OF THE COUNTRY OF USE, ie.ANSI/ISA RP12.6 (INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED)LOCATIONS)AND THE NATIONAL ELECTRICAL CODE. INSTALLATION MUST BE IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES.

FM
CERTIFIED PRODUCT
No modifications are permitted without reference to FMRC.

CSA Approvals

Two CSA approved models are available.

1. Explosionproof

Approved by Canadian Standards Association as explosionproof for Class I, Groups B, C and D; Class II, Groups E, F and G; Class III; T6 @ 167°F (75°C) AMB, T5 @ 185°F (85°C) AMB, Type 4X.

2. Intrinsically Safe

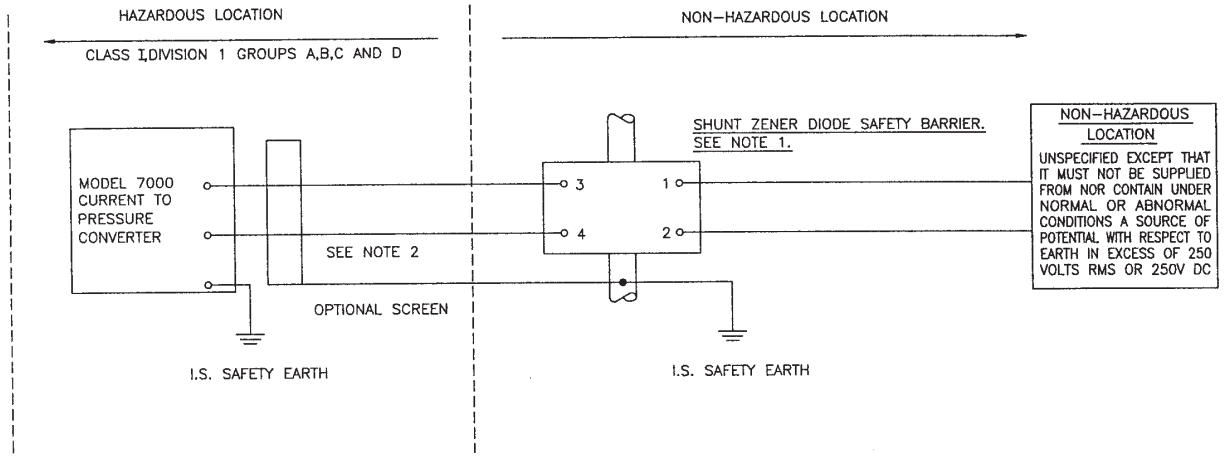
Approved by Canadian Standards Association as intrinsically safe for Class I, Groups A, B, C and D; Class II, Groups E, F and G; Class III; T4 @ 104°F (40°C) AMB, T3A @ 158°F (70°C) AMB, T3B @ 185°F (85°C) AMB.

In this application it must be installed in accordance with the relevant system drawing 95-108, Diagram 4, shown below.

DO NOT SCALE DRAWING IF IN DOUBT ASK

DIAGRAM 4

DR'G No : 95–108 ISSUE 'A' . MODEL 7000 INTRINSICALLY SAFE CSA CONTROL DR'G.



NOTES

1. ANY POSITIVE POLARITY SHUNT ZENER DIODE SAFETY BARRIER APPROVED BY C.S.A. FOR GROUPS A,B,C AND D WHOSE OUTPUT PARAMETERS ARE :–

   28V (max)
   300 Ohms (min)
   eg. MTL 728 +
   P & F Z428/Ex

2. THE INSTALLATION INCLUDING THE BARRIER EARTHING ARRANGEMENTS MUST COMPLY WITH THE CANADIAN ELECTRICAL CODE PART I

C.S.A.
CERTIFIED PRODUCT
No modifications are permitted without reference to C.S.A.

CENELEC Approvals

Two CENELEC approved models are available.

1. Flameproof (CENELEC)

EEx d IIB + H_2
T6 Ta 158°F (70°C)
T5 Ta 185°F (85°C)

2. Intrinsically Safe (CENELEC)

EEx ia IIC
T4 Ta 176°F (80°C)
Ambient range -40° to 176°F (-40°C to 80°C)

In this application it must be installed in accordance with the relevant system drawing 95-109, Diagram 5, shown below.

Type N (British)

Ex N IIC
T4 Ta 176°F (80°C)
Ambient range -40° to 176°F (-40°C to 80°C)

The supply to the apparatus must not exceed 50 V DC and shall be current-limited to 30 mA maximum in this application. Consult the supplier for approval certificates.

DO NOT SCALE DRAWING IF IN DOUBT ASK

DIAGRAM 5

DR'G No : 95–109 ISSUE 'A'. MODEL 7000 SCS INTRINSICALLY SAFE SYSTEM.

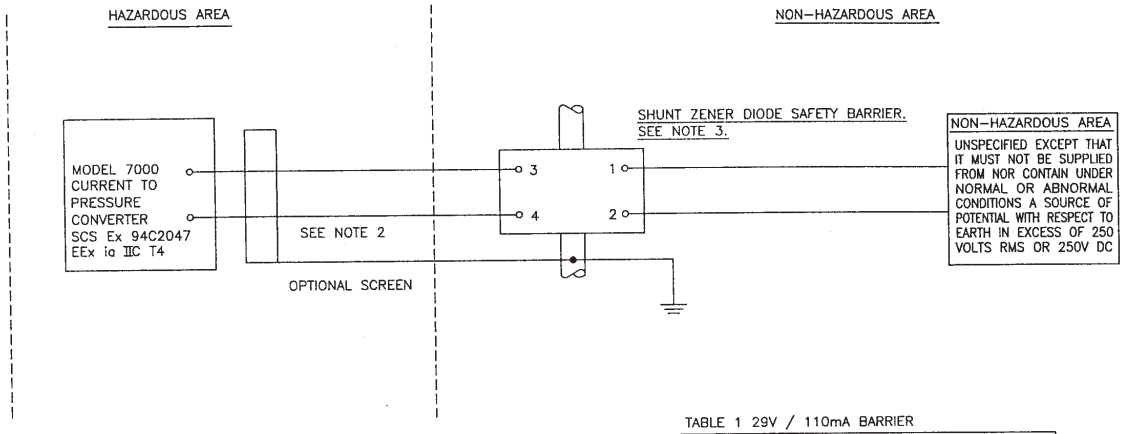


TABLE 1 29V / 110mA BARRIER

GROUP	CAPACITANCE in μf	INDUCTANCE in mH	OR	L/R RATIO in, μH/Ω
II C	0.08	2.6		43
II B	0.32	11.9		129
II A	0.92	23.6		344

TABLE 2 30V / 100mA BARRIER

GROUP	CAPACITANCE in μf	INDUCTANCE in mH	OR	L/R RATIO in, μH/Ω
II C	0.07	3.2		46
II B	0.29	13.9		138
II A	0.84	28.6		368

NOTES

1. THE ELECTRICAL CIRCUIT IN THE HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS R.M.S. TO EARTH OR FRAME OF THE APPARATUS FOR 1 MINUTE.
2. THE CAPACITANCE AND INDUCTANCE OR INDUCTION/RESISTANCE (L/R) RATIO OF THE HAZARDOUS AREA CABLES MUST NOT EXCEED THE VALUES SPECIFIED IN TABLES 1 & 2.
3. ANY SHUNT ZENER DIODE SAFETY BARRIER CERTIFIED BY AN EEC APPROVED CERTIFICATION BODY TO [EEx ia] II C WHOSE OUTPUT PARAMETERS ARE :–

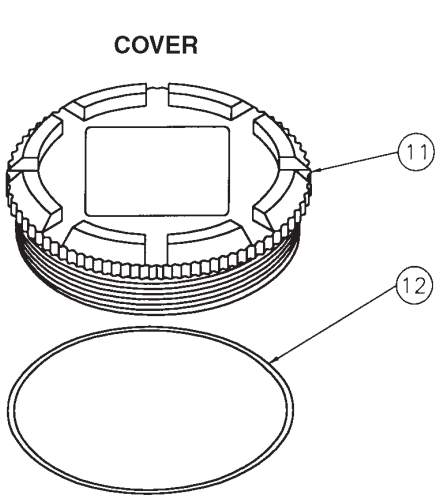
   $U_z \leq$ 29Vdc, I MAX : OUT $\leq$ 110mAdc, W MAX : OUT $\leq$ 0.8W MAX — OR — $U_z \leq$ 30Vdc, I MAX : OUT $\leq$ 100mAdc, W MAX : OUT $\leq$ 0.75W

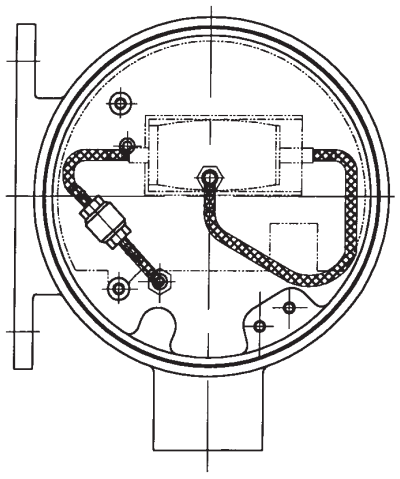
   THE OUTPUT CURRENT MUST BE LIMITED BY A RESISTOR R SUCH THAT I max : out = Uz/R
4. THE INSTALLATION INCLUDING THE BARRIER EARTHING ARRANGEMENTS MUST COMPLY WITH THE INSTALLATION REQUIREMENTS OF THE COUNTRY OF USE, ie IN THE U.K. AS SPECIFIED IN BS5345:PART4:1977.

SYSTEM LABEL.

MASONEILAN–DRESSER
INDUSTRIES
MODEL 7000 CONVERTER SYSTEM
SCS Ex94C2051
EEx ia IIC T4
Ex

SCS
CERTIFIED PRODUCT
No modifications are permitted without reference to SCS





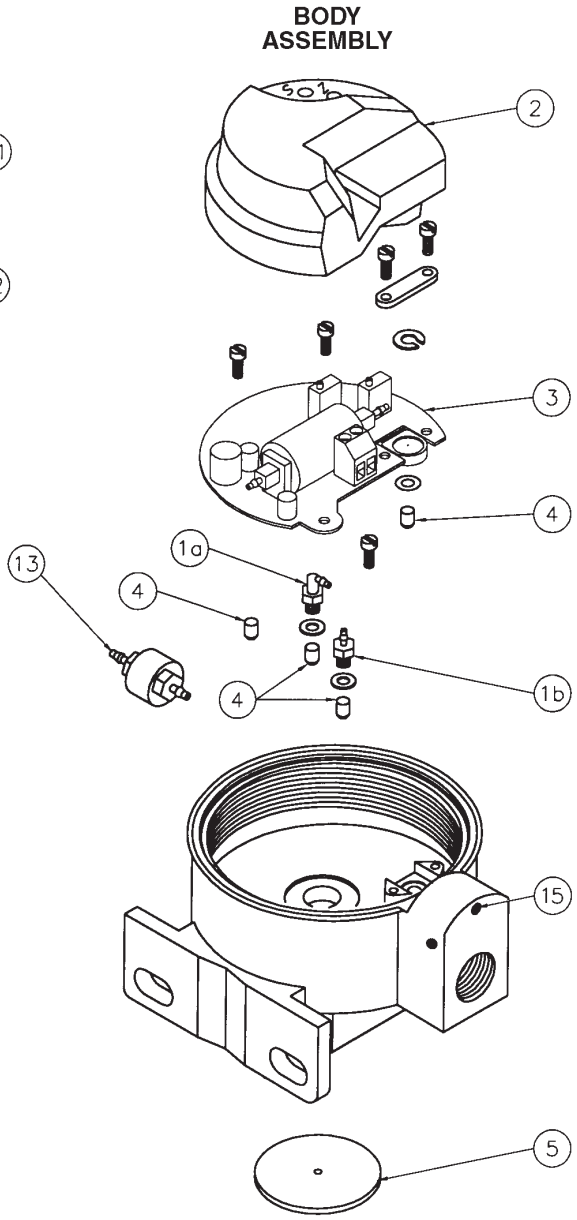
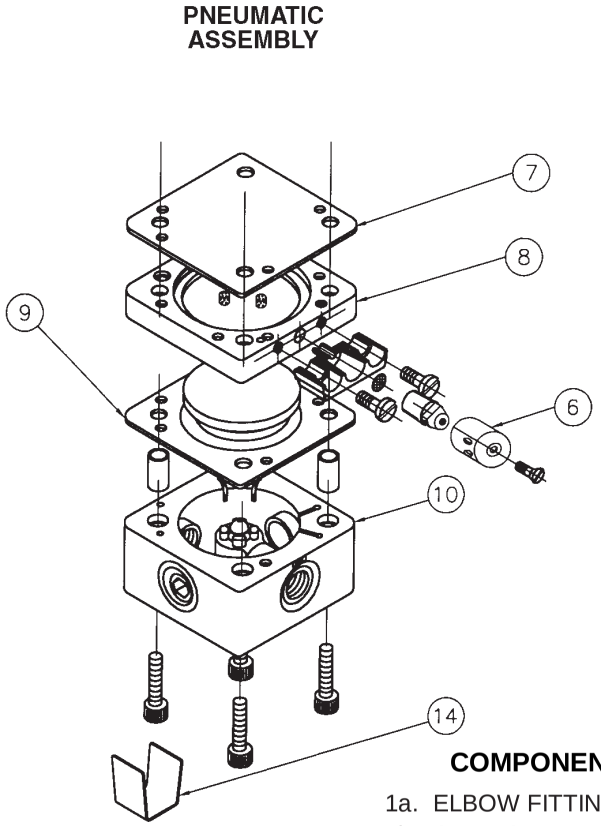


DIAGRAM 6



COMPONENTS

1a. ELBOW FITTING
1b. STRAIGHT FITTING
2. SHIELD COVER
3. P.C.B. ASSEMBLY
4. FLAME TRAPS
5. DAMPING DISCS
6 BREATHER
7. CONTROL DIAPHRAGM
8. SPACER ASSEMBLY
9. SERVO ASSEMBLY
10. BASE ASSEMBLY
11. CAP
12. CAP O-RING
13. FILTER ASSEMBLY
14. BAFFLE
15. SAFETY SCREW

Calibration and Maintenance

Model 7000 series instruments are designed for continuous operation without the necessity for routine maintenance.

The most common source of failure for pneumatic instrumentation has been found to be inadequate air quality, allowing contaminants to block internal orifices. Air filtering is included within the instrument but cannot cope with sustained poor air quality which may ultimately lead to failure.

The recommendations in the Pneumatic Installation section should be rigorously observed.

Calibration

NOTE: These instruments are factory calibrated at a supply pressure of 30 psig (2.1 bar). At supply pressures more than 5 psig (0.3 bar) away from this, recalibration is advised.

NOTE: Some Bourdon tube gauges resonate at 10 Hz and exaggerate the low-level ripple content present on pneumatic outlet. The use of a snubber or a small load volume will reduce this effect.

NOTE: Special versions are available from Masoneilan with calibration signal differing from 4 - 20 mA, e.g., 10 - 50 mA. In these cases the specified signal should be used for calibration.

The instrument cover must be unscrewed to obtain access to the span and zero trimpots.

DANGER: Do not remove the instrument cover in an explosionproof area when the instrument is powered.

An accurate current source of 4-20 mA and pressure gauge are required. These should be of good quality with an accuracy of 0.1 % or better.

The current source should be checked to ensure that it has at least 6.5 V output compliance.

Connect the instrument as described in the Installation section. Remove the top cover to gain access to the trimpots.

Set the current to 4.00 mA. The instrument outlet should be 3.00 ± 0.05 psig (0.207 ± 0.003 bar) or 6.00 ± 0.1 psig (0.414 ± 0.007 bar). Adjust the Zero trimpot if necessary.

NOTE: If the output level remains at zero pressure, the cause may be that the tight shutoff level has been set to a value about 4 mA. To avoid this, back off the shutoff trimpot about 10 turns and reset it to the required value after calibration is complete.

Set the current source to 20.00 mA - the instrument outlet should be 15.00 ± 0.05 psig (1.034 ± 0.003 bar) 30.00 ± 0.1 psig (2.068 ± 0.007 bar). Adjust the Span trimpot if necessary.

If either Span or Zero controls are adjusted it will be necessary to repeat the above steps until both ends are within the calibration limits.

When changing between 4 mA and 20 mA the response time can be observed and should be approximately 2 seconds upscale and 6 seconds downscale if the load volume does not exceed 10 liters.

Setting the Shutoff Point

1. With the instrument to be tested connected to the required supply pressure and load ports, apply a demand current signal of that value at which shutoff is required (e.g., 3.7 mA).
2. If the Reedex™ valve is clicking and the outward pressure is >0 psi, adjust potentiometer P3 slowly clockwise until the Reedex valve stops clicking and the outward pressure falls to zero. The shutoff point is now set.
3. If the Reedex valve is not clicking and the output pressure is 0 psi, adjust potentiometer P3 slowly counterclockwise until the Reedex valve starts clicking, and the output pressure falls to zero (take care: this final adjustment will typically be less than half a turn of the potentiometer). The shutoff point is now set.

Shutoff Point Check

Increase the input signal by 0.1 mA (e.g., to 3.8 mA). The Reedex will begin to click and the output pressure will rise above 0 psi. Reset the input signal to the required shutoff point (e.g., 3.7 mA). The Reedex will stop clicking and the output pressure will fall to zero.

Maintenance

The factory operates an efficient repair service for defective instruments. In all cases repair should only be attempted by skilled, qualified personnel who are familiar with this type of instrument.

User maintenance is generally not recommended for the following reasons:

- The instrument uses surface mount electronics which cannot easily be repaired without specialized equipment.
- Air leaks may be introduced which could upset the performance of the instrument.
- Any foreign matter introduced into the pneumatics, particularly the Reedex valve, may cause malfunction. This may not be immediately apparent, only occurring later in the life of the instrument.
- The hazardous area certification may be invalidated.

Description of Operation

The principle of operation is shown in the schematic (Diagram 7). Control of outlet pressure is achieved by variation of pressure in the control volume.

The steady state position of the pistons is such that both ports are closed, thus minimizing the air consumption. (The diagram shows both ports open for clarity).

Increasing the control volume pressure causes the pistons to move downward, opening the inlet port. Supply air flows to the outlet and the outlet pressure starts to increase. This increases the force on the bottom of the pistons. The inlet port returns to the closed position when a state of pressure balance has been re-established.

Reducing the control volume pressure causes the diaphragm block and pistons to rise, opening the relief port and closing the inlet port to allow the outlet pressure to decrease. When pressure balance is once more achieved, the relief port is closed.

Pressure control is achieved by the use of a Reedex precision micro-miniature high speed solenoid valve. These valves operate similarly to an electrical reed relay in which a flexible reed can be deflected by a magnetic field generated in a coil. In the Reedex the reed has a small orifice which is normally closed by a seal. Deflection of the reed causes the orifice to be opened. Air is constantly being bled from the control volume via the bleed orifice. This causes a steady fall in the control volume pressure. The Reedex valve is opened for a few milliseconds at a frequency of approximately 10 Hz to allow supply pressure to enter the control volume and increase its pressure.

In the steady state condition, the air supplied through the Reedex balances that lost through the bleed. Thus a constant average pressure is maintained in the control volume and hence at the outlet port. Due to this periodic opening and closing of the Reedex valve the outlet pressure oscillates slightly about the set point at a frequency of approximately 10 Hz. The magnitude of this oscillation is too small to affect valve actuators and has no significant effect in normal installation. This dithering can help to reduce hysteresis and dead zone effects.

The outlet pressure is constantly monitored by the electronics via the pressure sensor. The pressure signal produced is compared with the demand current signal to produce an error signal. The width of the pulse sent to the Reedex is proportional to this error signal.

If the outlet pressure falls or the signal current rises then the length of the pulse sent to the Reedex increases causing the average pressure in the control volume to rise. This causes air to be supplied to the load to increase the outlet pressure. As the outlet pressure rises the width of the Reedex pulse decreases until the state of balance is achieved. Conversely if the outlet pressure rises or the signal current falls the width of the pulse sent to the Reedex is decreased, allowing the control volume pressure to fall and open the relief port.

As the outlet pressure falls, the Reedex pulse width is gradually increased until the state of balance is achieved.

The maximum rate of decrease of pressure is obtained with moderate to large downward steps in signal current which cause the Reedex pulse width to fall to zero. This maximum rate is limited by the size of the bleed orifice. The maximum rate of increase of pressure is determined by the maximum Reedex pulse width which is limited by the electronics.

When the signal current fails or is reduced below about 3 mA, the Reedex is unable to open and the pressure falls to a low value due to the bleed, thus ensuring fail-safe operation.

An additional voltage comparator compares the value of the control signal in the region of 4 mA to the shutoff point set by the shutoff trimpot. If the control current is below the required shutoff level, Reedex drive is inhibited and the output pressure will fall to its minimum level, thereby closing the controlled valve tightly: “tight shutoff.”

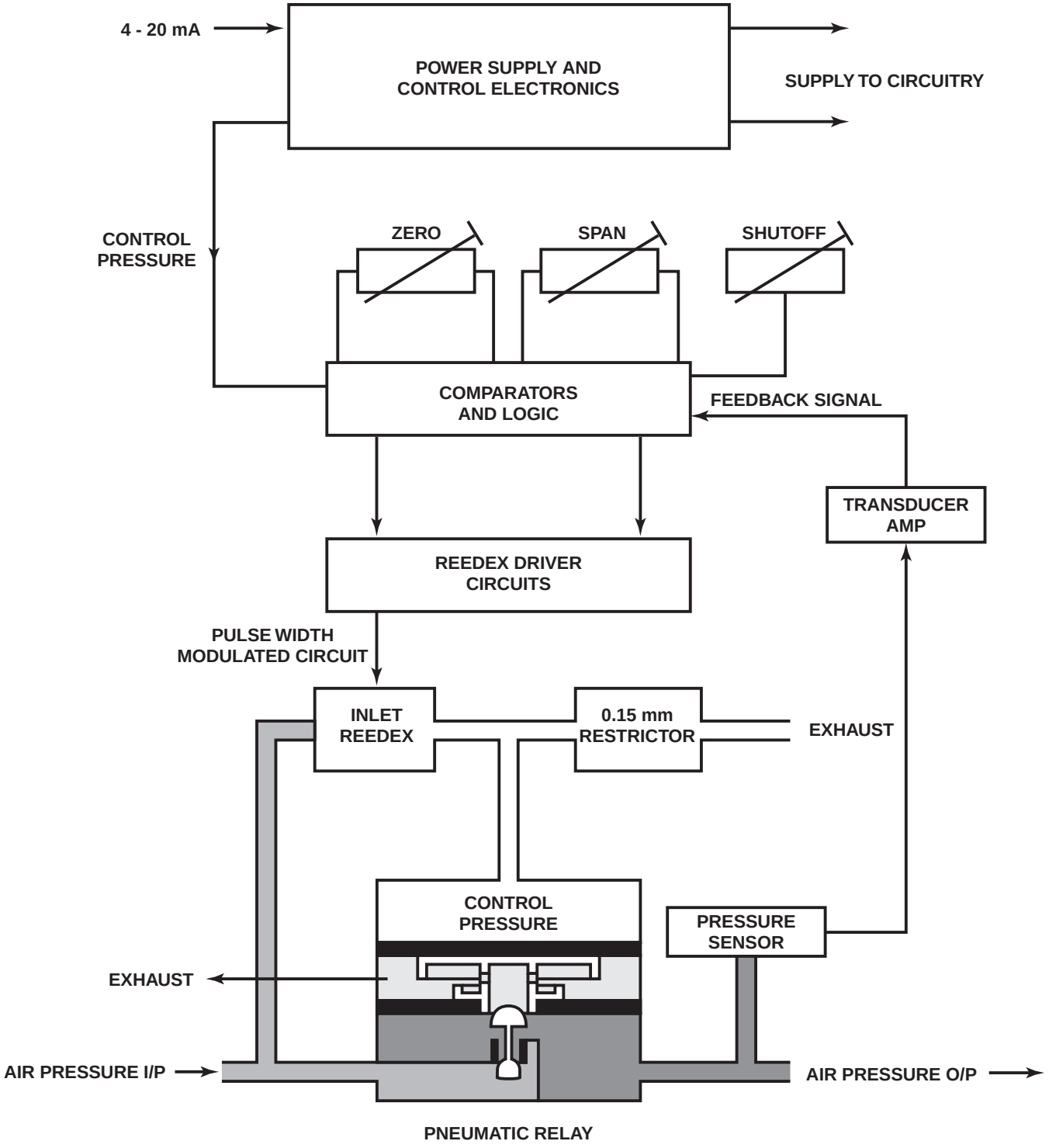


DIAGRAM 7: Operation Schematic

Troubleshooting Guide

Simple Functional Checks

Apply a 4-20 mA signal and an air supply an observe the output on a pressure gauge. It should control smoothly. In normal operation (control signal and supply pressure applied) the Reedex valve can be heard to click at a constant rate of approximately 10 Hz.

If no clicks are audible, either the electronics board or the valve could be faulty. The latter can be checked by observing the drive voltage across its pins with an oscilloscope (approximately 8 V pulses at 10 Hz).

Problem	Possible Causes	Suggested Action
No outlet pressure. Reedex not clicking.	• Reversed current polarity or faulty connections • Faulty internal wiring • Faulty Reedex • Insufficient voltage • Shutoff control set too high	• Check signal current with milliameter. (No current if input reversed). • Repair • Replace • Check for approx 6 V across terminals • Reduce control setting
No outlet pressure. Reedex clicking.	• No air supply	• Check pneumatic installation
Continuous full output. Reedex clicking.	• Incorrect electrical signal • Faulty electronics	• Check with milliameter • Replace
Continuous full output. Reedex not clicking.	• Leaking Reedex • Blocked bleed restrictor	• Replace • Replace Spacer Assembly
Maximum output not available.	• Supply pressure too low • Calibration error • Air leak in instrument • Excess outlet flow	• Check and adjust supply • Recalibrate • Locate leak and repair • Check with specification
Minimum output too high.	• Faulty Reedex or restrictor • Calibration error	• Replace • Recalibrate
Delay on start-up.	• A delay of a few seconds is normal	• None
Output oscillates.	• 0.5% oscillation is normal	• Gauge may be resonating at 10 Hz. Try a different type of gauge, or use snubber.
Erratic operation at low pressure.	• Signal currents below 3.5 mA are insufficient for normal operation	• Increase current. May need recalibration.
Erratic at all pressures.	• Controller cannot provide 6.5 V continuously	• Reduce loop resistance or change controller

Specifications

Functional

Input	4-20 mA DC (100 mA max) Split Range 4-12 mA, 12-20 mA.
Output	3-15 psi (0.2-1.0 bar) 6-30 psi (0.4-2.1 bar) 0.2-1 bar 0.4-2 bar Minimum output (no signal) less than 0.2 psi (0.01 bar).
Supply Pressure	20-60 psi (1.4-4.1 bar) operating supply pressure range, preferred ranges 25-35 psi (1.7-2.4 bar).
Supply Pressure Effect	Span and Zero; less than 1% span for 10% supply pressure change.
Medium	Standard Instrument quality air to ISA S7.3.
Air Consumption	3-15 psi (0.2-1 bar) version typically 0.01 scfm, (0.017 m^3/hr).
Operating Temperature	-40°F to +185°F (-40 to +85°C).
Relative Humidity	0 to 100% (condensing) under operating conditions.
Output Capacity	10 scfm (17 m^3/hr) at 60 psi (4.1 bar) supply.
Relief Capacity	5 scfm (8.5 m^3/hr) at 15 psi (1 bar) output.
Terminal Voltage Required	5.5 - 6.5 volts.
Minimum Operating Current	Less than 3.5 mA, adjustable to 4.5 mA to achieve tight shutoff
Current Reversal Protection	No effect within normal 4-20 mA range; protected to -100 mA continuous.
Insulation	Electrical circuits are isolated from housing. Tested to 850V DC, 100MW.

Performance

At 68°F (20°C), 25 psi (1.7 bar) supply, 3-15 psi (0.2-1 bar) range, for a typical instrument, except where stated.

Accuracy	±0.25% span (typical). Test Limit; ± 0.5% of calibrated span, terminally based (includes conformity, hysteresis, repeatability and deadzone).
Linearity (independent)	±0.12% span (typical).
Hysteresis, Resolution and Deadband	±0.06% span (typical).
Temperature Effect	Span and zero. Mean temperature coefficient over full operating range -40 + 185°F (-40 to +85°C) less than 0.035% span/deg F.
Vibration	Less than1% span output pressure change for vibration amplitude: 5 mm displacement 10-30 Hz 10 g acceleration 30-500 Hz
Mounting Position	Universal, no measurable influence.
Long Term Stability	Span and zero. Typically better than 0.25% span per year.
Electromagnetic Compatibility	To meet the EMC specification, install the I/P using shielded cable. The cable shield should be connected at the instrument. In situations where this is not permitted (e.g., IS version), the shield should be connected at the source end. In this configuration the typical output shift is ≤±1% FS whene subjected to a radiated field of 10 V/M 80% AM at 1 KHz in the frequency band 80 MHz to 1 GHz.
Step Response Upscale Downscale	(between 10 and 90%) 1 sec (typical) 4 sec (typical)

The Model 7000 installed with shielded cable conforms with the protection requirements of Council Directive 89/336/EEC (amendments 92/31/EEC and 93/68/EEC) on the approximation of the laws of the Member State relating to electromagnetic compatibility SI 2372:1992 (amendments SI 3080:1994). Consult supplier for further details.

Controls	TSO adjustment Span and Zero trimpots. Rangeability ±20% span.

Physical

Air Supply and Output Connections	1/4" internal NPT.
Electrical Connection	1/2" internal NPT (M20 option), 2 internal screw terminals for 2.5 mm^2 cable.
Weight	2 lbs (0.93 kg).

Materials

Die cast aluminum and zinc. Powder paint coating. Weatherproof to NEMA 4X (mounted upright, cover in horizontal/top position), IP66. Nitrile diaphragms.

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