ControlAir

Installation, Operation, and Maintenance Instructions

P200 P/I Transducer

INTRODUCTION

Scope

This manual provides instructions for the installation, adjustment, maintenance, and parts ordering of the P200 Pneumatic-to-Current P/I Transducer. Due to its over-engineered design, 100% burn-in and demanding QC test protocols you can expect years of unerring performance. As with any quality instrument, proper attention to the installation, wiring and calibration procedures is critical to the performance and longevity of the unit.

Description

The P200 transducer converts air pressure into an accurate proportional electrical signal. Its all solid state circuitry converts air pressures into a 4-20 milliamp output. The P200 is a self-contained unit with an explosion proof housing and is designed for hazardous locations.

CAUTION

1. When using the P200 in an intrinsically safe system, strict adherence to this manual and the manual of the zener barrier being used is critical. If there are any contradictions between instructions, then the most energy restrictive approach should prevail.

2. Any alteration made to the P200 could affect the intrinsically safe nature of the device.

3. In explosion proof installations, the proper electrical conduit must be correctly installed and both P200 covers tightly secured.

4. This unit should be used with dry instrument air. Minute amounts of moisture or oil will not damage it, but corrosives or abrasives will eventually destroy the sensor.

5. The P200 can withstand an over-pressurization of three (3) times the rated full scale without recalibration and four (4) times the full scale without damage to the transducer. **Do not** apply more than four (4) times the full scale rated pressure.

6. P200 (intrinsically safe) transducers must be operated with an approved zener barrier, and operating voltage is limited to the value allowed by the barrier. This unit can tolerate a maximum of 100 vdc at the input terminals indefinitely, although operation within published specifications is only guaranteed with power supplies between 10 and 42 vdc.

7. Do not operate this transducer in a temperature above 180^0 F. or below -40^0 F. The P200 can be stored between -60^0 F. and 185^0 F.

8. To achieve full RFI immunity as well as explosion-proof integrity, the enclosure must be earth grounded and both covers tightly secured.

9. In order to prevent possible damage from moisture or airborne contaminants, both covers should be tightly secured after installation.

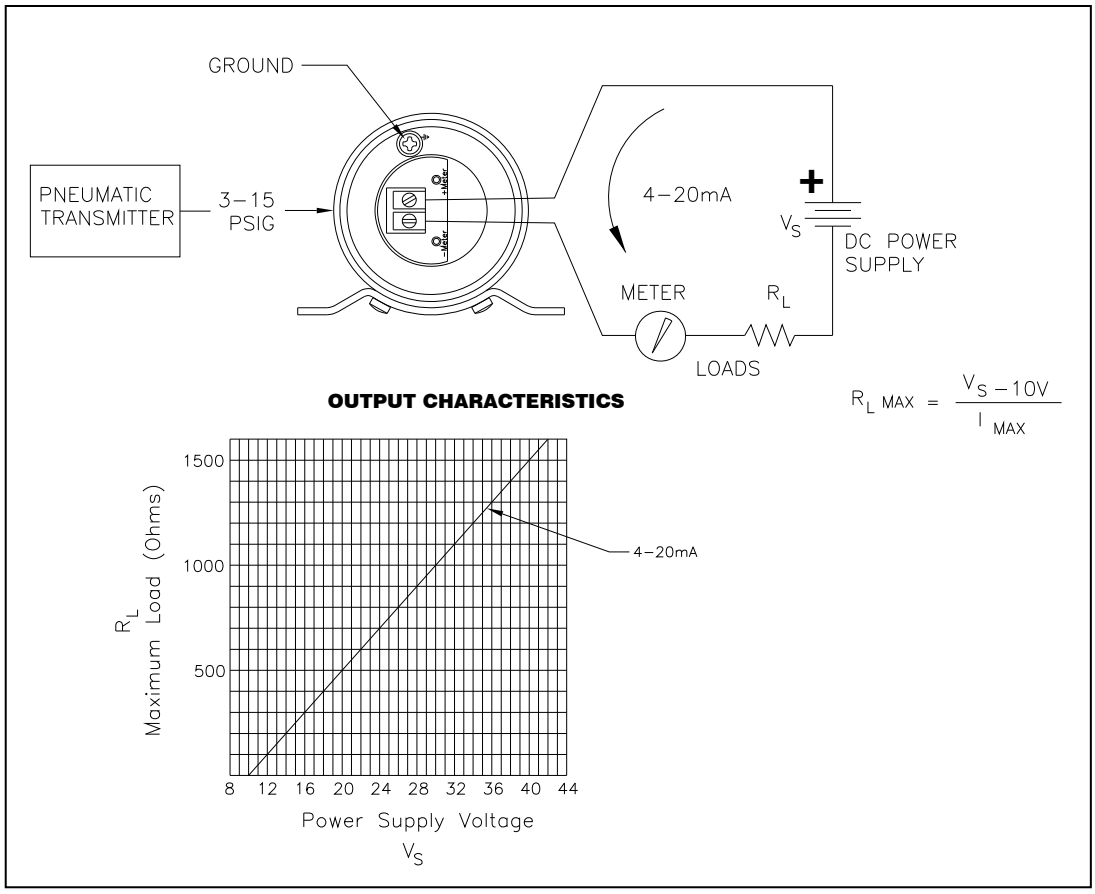


Figure 1

WIRING

Figure 1 shows the connections when shunt diode barriers are not being used. Generally the load should be placed in the negative leg of a two wire loop, although it isn't required. An earth ground can be placed on either end of the load or power supply, but you may prefer to have the negative terminal of the supply earthed as well. Care must be taken to insure that the polarity of the input connections is correct regardless of where the load or ground is placed. Reversing the polarity will not damage the P200, but it will not function until the wiring is corrected. In all instances, current flow enters at the positive terminal and exits the negative terminal.

CSA LISTED DEVICES TO BE USED AS ENERGY LIMITING BARRIERS FOR USE WITH INTRINSICALLY SAFE P200

<table>
<tr><td colspan="5">PARTIAL LISTING
CSA APPROVED PARAMETRIC INTRINSICALLY-SAFE BARRIER RATINGS</td></tr>
<tr><td colspan="5">HAZARDOUS AREAS CL.I DIV. I</td></tr>
<tr><td colspan="3">GR. ABCD</td><td>GR. BCD</td><td>GR. C & D</td></tr>
<tr><td>20V / 150Ω</td><td>28V / 240Ω</td><td>30V / 300Ω</td><td>28V / 240Ω</td><td>30V / 120Ω</td></tr>
<tr><td rowspan="3">HONEYWELL
38545-0000-0110-
113-CXXX GREEN</td><td>HONEYWELL
38545-0000-0110-
112-CXXX YELLOW</td><td rowspan="3">28.1V/510Ω
R. STAHL
#8901/32-307/065/8</td><td rowspan="3">TAYLOR
TYPE 3P
TYPE 3N</td><td>FISCHER+PORTER
805H023U01</td></tr>
<tr><td>38545-0000-0110-
111-CXXX RED</td><td>30V/150Ω
FISCHER+PORTER
805H027U01</td></tr>
<tr><td rowspan="2">27V/300Ω
BAILEY CONTS.
766510BAAX1</td><td rowspan="2">FOXBORO
2AI-12V-CGB
2AI-13V-CGB
2AS-131-CGB</td><td rowspan="2"></td></tr>
<tr><td>17.3V/166Ω
R. STAHL 8901/32-196/125/7</td><td>766510BCAX1</td></tr>
<tr><td>19.1V/220Ω
R. STAHL
8901/32-215/105/7</td><td>766610AAAX1</td><td colspan="3" rowspan="10">NOTE: GENERAL PARAMETER RATINGS OF SAFETY BARRIERS USED WITH CONTROLAIR P200 TRANSMITTERS ARE AS FOLLOWS:

CL I DIV. 1 GR. A, B, C AND D
20V/150Ω | 28V/240Ω | 30V/300Ω

CL I DIV. 1 GR. B, C AND D
30V/120Ω

CL I DIV. 1 GR. C AND D
30V/120Ω

ANY CSA APPROVED SAFETY BARRIER MATCHING THE PARAMETERS LISTED OR SPECIFIED WITH THE SAME OR LESS VOLTAGE AND WITH THE SAME OR GREATER REISITANCE, CAN BE USED WITH CONTROLAIR P200 + P28 TRANSMITTERS, AS INTRINSICALLY-SAFE, IN HAZARDOUS AREAS.</td></tr>
<tr><td rowspan="9"></td><td>27V/330Ω
BECKMAN INST.
644043</td></tr>
<tr><td>644044</td></tr>
<tr><td>644045</td></tr>
<tr><td>25V/360Ω
R. STAHL
#890/32-270/080/8</td></tr>
<tr><td>25V/294Ω
R. STAHL
#8901/32-270/100/8</td></tr>
<tr><td>22V/300Ω
MEASUREMENT TECH. LTD.
MTL #172</td></tr>
<tr><td>28V/240Ω
MTL #128, #179, #187, #188</td></tr>
<tr><td>28V/600Ω
MTL #178</td></tr>
</table>

Table 1

When using the P200 with zener barriers, the basic two wire configuration is maintained. Refer to **Figure 2** and **Table 1** for some of the shunt zener barrier options available. Care must be taken to select the barrier and grounding configuration compatible with the interface equipment in the safe area. Careful attention should be paid to the instructions provided by the manufacturer of the zener barrier you selected.

INSTALLATION

Wiring for intrinsically safe systems must be divided into three main groups: 1. hazardous area (field), 2. safe area (control room), and 3. mixed systems area (control room and field).

FIELD WIRING: Field wiring for an intrinsically safe, Division 1 system is easier to install than an explosion-proof, Division 1 system. Twisted pairs of 10 to 22 gage wire are recommended for all 4 to 20 mA transmission lines. In almost all instances, each wire that enters the hazardous area (field) must either be grounded or run through a zener barrier.

In general, the same rules for wiring which apply to general purpose systems (to prevent excessive noise pick up) apply also to intrinsically safe systems. Wiring trays between the control room and the field instruments are used for the mechanical support and protection of the wiring only. Similarly, ordinary conduit is used to branch off from the trays to the individual field transmitter, but is not necessary for safety. Multiconductor cables, both shielded and unshielded, may be used as long as good practice is used in grounding the shields.

All wiring (transmission lines) has distributed resistance, inductance, and capacitance. Inductance and capacitance can store electrical energy which is a serious consideration in any intrinsically safe system. Capacitance turns out to be the only limiting factor in the storage of energy for any transmission line composed of twisted pairs and protected by barriers. In an actual transmission line, the combination of distributed inductance and resistance provides some inherent current limiting as the transmission line becomes longer and longer.

MFGR. CAT. #	PAIRS/DWG	SHIELD	C (pf/ft)	L (pH/ft)	MAXIMUM SAFE LENGTH OF CABLES (LOOP MILES)			
					GROUP A	GROUP B	GROUP C	GROUP D
BELDEN 8205	1 / #20	NONE	26	0.205	0.73	0.73	3.65	8.76
BELDEN 8737	1 / #22	STRANDED	70	0.188	0.27	0.27	1.35	3.24
BELDEN 8762	1 / #20	FOIL	47	0.204	0.40	0.40	2.00	4.80
PLASTIC S-7964	1 / #20	NONE	20	0.215	0.95	0.95	4.75	11.40
ALPHA 124-3/4	2 / #22	1 PR-BRAIDED	77	0.183	0.25	0.25	1.25	3.00
		1 PR-NONE	23	0.240	0.82	0.82	4.10	9.84
CHESTER 1007	1 / #20	NONE	23	0.216	0.82	0.82	4.10	9.84

SELECTED WIRE PARAMETERS AND ALLOWABLE TRANSMISSION LINE LENGTHS FOR HAZARDOUS AREAS

TABLE 2

ELECTRICAL CODE CLASSIFICATION	CAPACITANCE pF	INDUCTANCE mH	INDUCTANCE / RESISTANCE (pH / Ω)
GROUP A AREAS	0.10	0.8	30
GROUP B AREAS	0.10	0.8	30
GROUP C AREAS	0.50	0.8	50
GROUP D AREAS	1.2	2.5	250

ALLOWABLE TRANSMISSION REACTANCES FOR VARIOUS HAZARDOUS AREAS

TABLE 3

Table 2 gives some inductance and capacitance parameters for several standard wire types used in industrial installations. Since the Factory Mutual Research Corp. sets limits on the allowable inductance and capacitance which field wiring may add to an intrinsically safe installation, ControlAir has adopted the conservative parameters given in **Table 3**. **Table 2** also gives the allowable transmission line lengths for the various wire types according to the limits set forth in **Table 3**. If the particular barrier instructions impose more rigorous limits on these parameters than stipulated in **Tables 2** and **3**, then those more conservative figures should be used.

SAFE AREA WIRING: All field wiring, upon entering the control room, should follow as short a path as possible, directly to the output side of the barriers. By keeping a minimum distance between the point of entry of field wiring and the connection to the barrier, the probability of a high energy source bypassing the barrier is minimized.

MIXED SYSTEMS AREA WIRING: For installations in the mixed systems area (control room and field), intrinsically safe and non-intrinsically safe wiring in the same panel board or rack can be:

(a) run in separate ducts that are identified by color code or labeling or

(b) run in the same ducts. But the intrinsically safe and non-intrinsically safe wiring bundles should be tied and securely fastened to maintain a separation of two inches. Both FM and IEC codes require a minimum separation of 2 inches between the two types of wiring.

Some intrinsically-safe and non-intrinsically safe field wiring may be connected to terminal blocks or strips on the field side (hazardous side) of the barriers. In this case, special care must be taken to preclude unsafe wires from touching the intrinsically safe terminal blocks. This result may be obtained by installing a physical barrier between the sets of terminal blocks. An alternative is to space the two classes of terminal blocks greater than the longest unbundled wire between the two systems.

TRANSMITTER WIRING, GENERAL: **Figure 2** shows the generalized wiring connections to be made to a P200 Transducer when shunt diode barriers are not being used. In most instances the load should be placed in the negative leg of a two-wire loop, although it is not necessary. An earth ground can be placed on either end of the load or the power supply, but again, many users prefer to have the negative terminal of the battery earthed as well. Care must be taken to insure that the polarity of the input connections is correct, regardless where the loads or ground are placed. An inadvertent reversal of wiring polarity will not damage the P200, but the instrument will not function until the polarity is correct. In all instances, current flow (positive-to-negative) is considered to enter the P200 at the + terminal and leave at the – terminal. **Figure 1** also gives a graph defining the maximum loop resistance which may be used for various values of power supply voltage. This loop resistance is the total of all resistive loads, distributed wiring resistance, and any zener barrier source resistance.

P200 WIRING WITH BARRIERS: When using zener barriers with the P200, the basic 2-wire configuration is maintained. Refer to the appropriate wiring configuration in **Figure 2** which involves the shunt zener barrier which has been selected for use. Care must be taken to select the barrier and grounding configuration which is compatible with the interface equipment in the safe area. Refer specifically and carefully to the instructions provided by the manufacturer of the zener barrier selected.

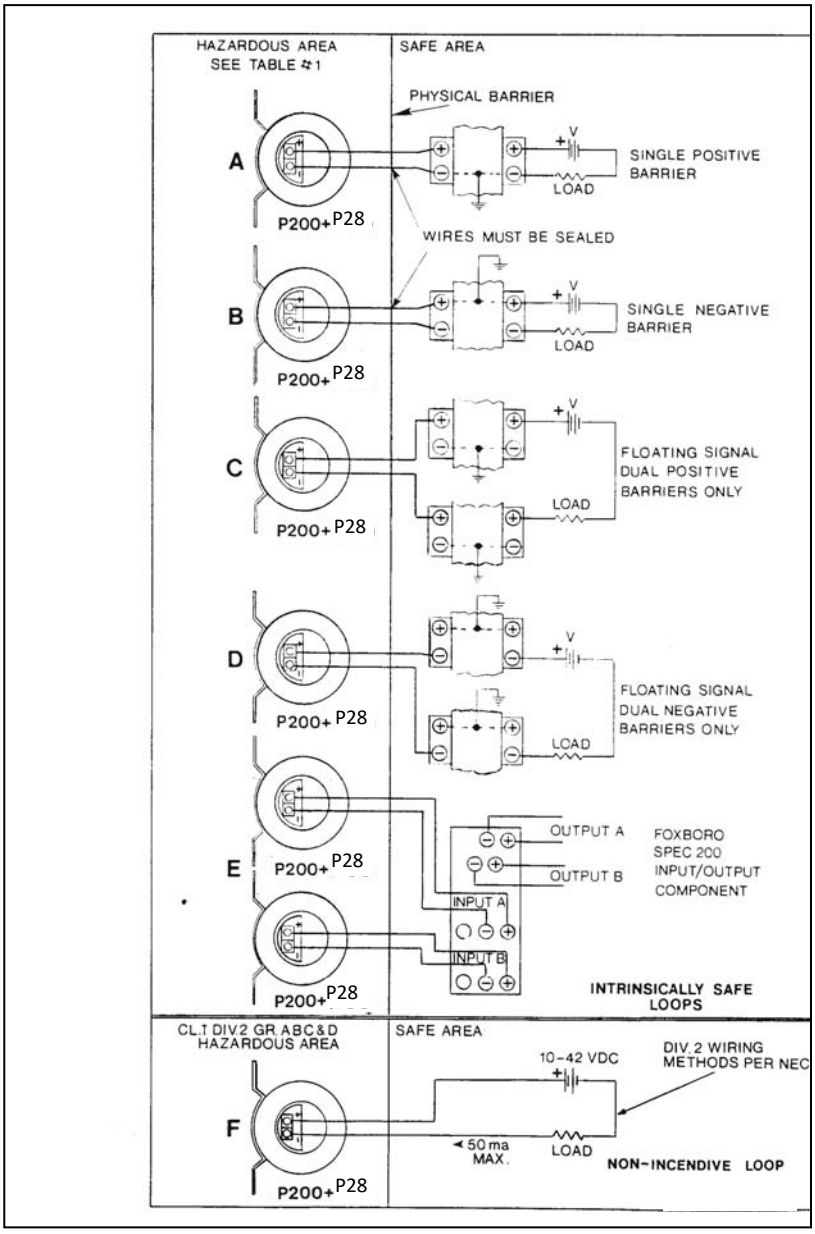


Figure 2

MOUNTING: A bracket is supplied with each P200 to allow mounting against any flat surface. The unit may be installed in any attitude or position whatsoever without affecting the functioning of the circuit. **Figure 3** shows four of the most common mounting arrangements for any P200.

For maximum rejection of Radio Frequency Interference, the enclosure must be grounded either by means of the grounding screw in the terminal wiring chamber or by mounting the transducer on a grounded metal surface, making sure the anodized coating on the aluminum bracket does not prevent electrical continuity through the mounting interface.

Female NPT conduit openings are provided for both signal air input and the power/signal leads. When piping the input air, all joints should be inspected for leaks, since inaccuracies would result from pressure drops along the signal line, due to an air flow. These transducers do not consume air. If there seems to be a leak within the device, the four mounting screws securing the printed circuit to the case may be loosened and the circuit card realigned slightly to eliminate the leak. The four printed circuit mounting screws must be retightened.

CALIBRATION

Explosion-proof transducers can not be calibrated in Division 1 hazardous areas, since the covers may not be removed while power is present. Calibration must be done in a safe area prior to installation. **Intrinsically safe** transducers may be calibrated while installed in Division 1 areas as long as they have been properly wired with a certified zener barrier and the covers are secured after the calibration. In Division 2 areas, a powered P200 may be calibrated without a zener barrier, as long as the power source is limited to 150 VA and 250 Vrms and the covers are secured afterward.

All ControlAir P200 transducers are fully calibrated at the factory to the ordered output. It may be advisable to confirm that calibration was maintained during shipment, for maximum accuracy. Zero and Span screws are located under the top cover. They are multi-turn potentiometers with slip clutches at the ends of travel that can provide +/- 20% of span adjustability. **Clockwise movement increases output** on both potentiometers.

Calibrate after the wiring has been completed and air pressure is connected. Intrinsic safety requirements do not allow current monitoring terminals in the loop. As a result, loop current must be measured in the safe area using an amp meter in the loop or a volt meter across a load while the calibration adjustments are made in the hazardous area. **When calibrating in Division 2 areas**, current measurement may be made near the P200 transducer by breaking the two wire loop and inserting a Division 2 approved amp meter. See **Figure 4** for calibration options based on application. Once the proper method is determined:

1. Apply minimum signal pressure and adjust the Zero screw until the output is 4 mA.
2. Apply maximum signal pressure and adjust the Span screw until the output is 20 mA.
3. Repeat steps 1 and 2 if necessary to stabilize output.

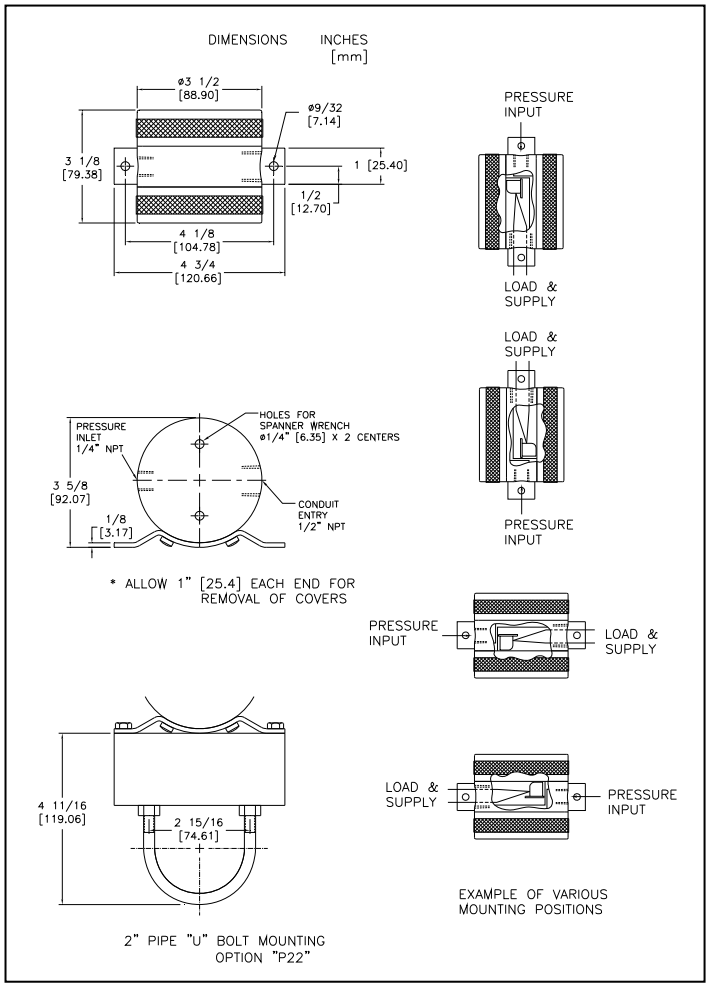
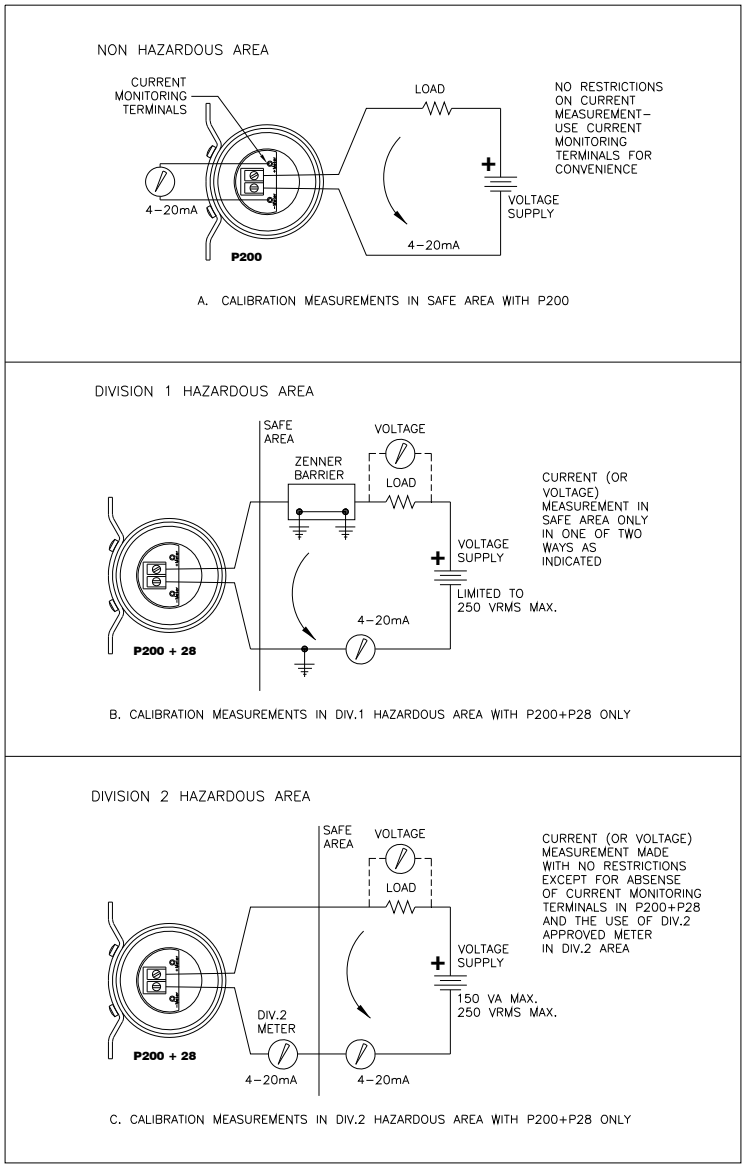


Figure 3



CALIBRATION MEASUREMENTS

Figure 4

TROUBLESHOOTING

Should there be a problem with the ControlAir P200 transducer, we recommend bench testing the unit away from the application. Connect a regulated air pressure and separate power supply to the unit and measure output with a meter to confirm that it is actually the transducer at fault. If the problem can be duplicated, please contact the factory for repairs to be done under the terms of the warranty. Other than calibration and output selection, there are no user serviceable parts inside. **Tampering with any internal components may void the warranty as well as safety approval ratings.**

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