MOORE INDUSTRIES

IPX

Explosionproof Field-Mount
Current-to-Pressure Transmitter

USER'S MANUAL

April 2016

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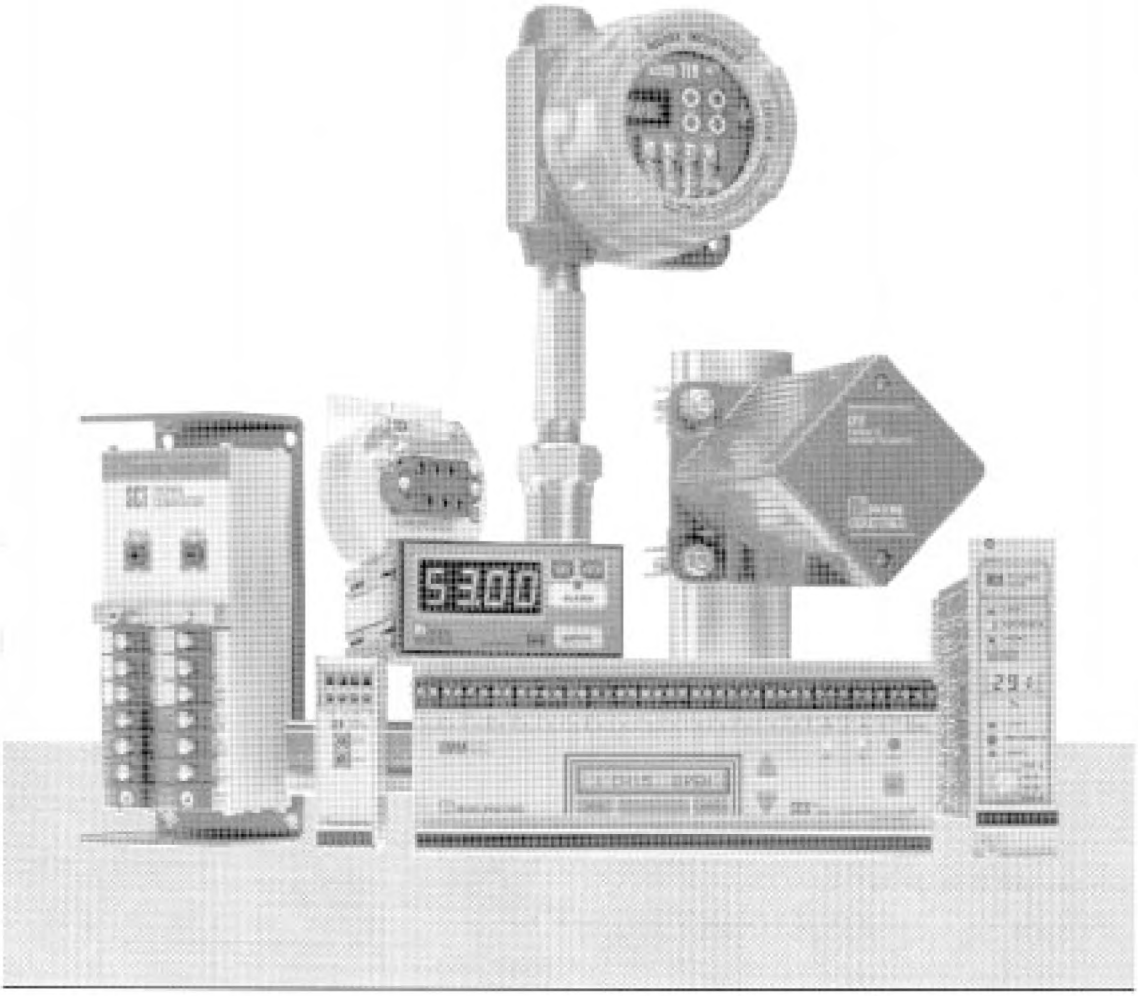

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IPX

Introduction

Moore Industries' field-mount, current-to-pressure transmitter in the explosionproof housing is called the IPX. The unit is a two-wire device designed to provide highly accurate pneumatic through-put control, even in the most arduous of environments.

This manual contains a brief description of the IPX, explanation of the unit model number, and a table of IPX performance and operational specifications. It also includes instructions for calibration, information on installation, the procedure for maintenance, and recommendations for use in troubleshooting.

Appendix A consists of information on instrument-quality air and filtration, essential for optimum IPX performance and reliability.

Notes and Cautions, where they appear in text or illustrations, are used to call attention to practices that otherwise may result in inconveniences for the user (Notes) or damage to the IPX (Cautions).

Description

The IPX is used to effect changes in pneumatic through-put pressure in a process loop. These changes are proportional to, and based upon, changes in the standard, process current input to the unit. There are two options for unit input (current), and eight for unit output (pressure).

External. The IPX housing is an extruded enclosure, made of rugged, anodized aluminum. It is designed to meet the specifications of several third party, industrial certifying agencies as non-incendive, explosionproof, and intrinsically safe.

Refer to the IPX datasheet in the Moore Industries Product Catalog, or contact your Moore Industries Sales Representative for the most current list of IPX certifications and approvals.

The housing has two electrical conduit dimension options; a 1/2"-14 N.P.T. female port (EXI or EXIP housing), and an M20 x 1.5 metric female port (EXIM or EXIMP). Pneumatic connection ports are female, 1/4"-14 N.P.T., standard.

The unit can be installed in a surface-mount configuration (EXI or EXIM), or, with optional hardware, on 2-inch pipe (EXIP or EXIMP). The symmetrical arrangement of holes in the IPX mounting bracket provides for mounting on horizontal or vertical pipes.

The IPX housing affords the unit excellent protection against shock, vibration, and corrosion. The unit is also inherently immune to electromagnetic and radio frequency interference (RFI/EMI).

Unit Operation Controls. The two IPX controls are located under the unit's top, protective end-cap. They consist of a mechanical adjustment screw and an electronic potentiometer (pot). Each is labeled with a symbol.

...controls the setting for unit zero.

...controls the setting for unit span.

The Zero adjustment screw is a cone-tipped, machined screw that mechanically provides a control range for zero offsets of ±3-percent of the rated unit span.

The Span pot electronically adjusts unit full-scale output to 100-percent of rated span. It requires approximately 22 turns to move its wiper from one extreme to the other, clockwise for maximum or counterclockwise for minimum span. It is equipped with a slip clutch to prevent damage if the adjustment is turned beyond the wiper stop.

IPX

Options

There are several options available for the IPX. The following list provides an overview. A complete list, including information on available mounting hardware and more data on the current IPX approvals and certifications, is available from your Moore Industries Sales Representative or directly from the factory.

FR1 Option – *Coalescing Filter/Regulator w/Integral Gauge.* Maximum 4 SCFM flow at 90 psig inlet pressure (refer to the appendix of this manual for information on the filtration requirements for the IPX). Performs to specifications that exceed ISA requirements for instrument-quality air. Removes particulate matter to 0.01 micron. Gauge has scales in both 0-60 pounds per square inch (psi) and 0-4 bars.

PTJ Option – *Pneumatic Test Jack.* Permits connection of testing equipment to installed units without interruption of air flow.

GA1 Option – *Output Gauge.* Scaled in psi and bars.

Table 1 lists the performance and operational specifications for the IPX.

Model/Serial Number. Moore Industries uses a system of individual unit model and serial numbers to keep track of factory configuration and options for all IPX's shipped or serviced.

If service information or assistance is required for your IPX, provide the factory with the unit's model and serial number to assist our professional technicians in their effort to give you prompt, efficient service.

The IPX serial and model numbers are attached to the bottom, protective end-cap of the housing.

The example below outlines the significance of each field of information in a typical IPX model number.

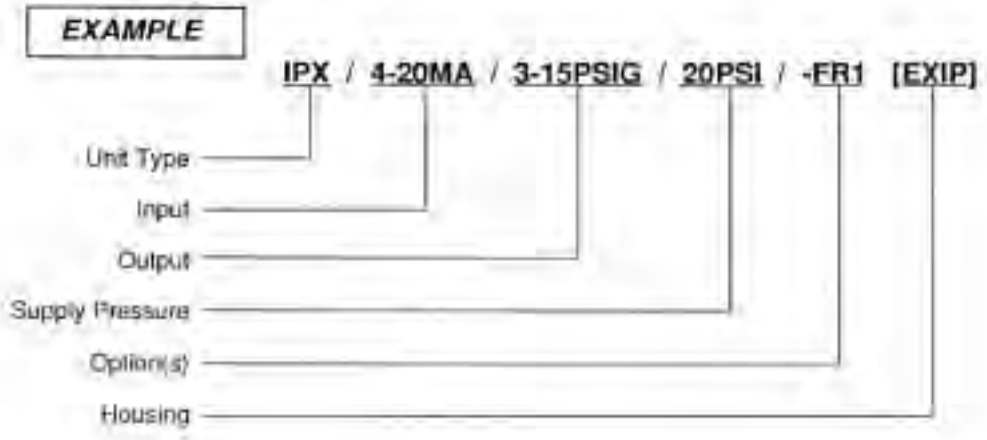

Table 1. IPX Performance and Operational Specifications

Characteristic	Specifications
Input	Factory-configured. **4-20 mA** into 200Ω, nominal **10-50 mA** into 75Ω, nominal (available with 3-15 psig output units only)
Output	Factory-configured. **0.2-1 bar (20-100 kPa)** **1-0.2 bar (100-20 kPa)** **3-15 psig** **15-3 psig** **3-16.6 psig** **3-27 psig**
Supply Pressure	Factory-configured. **20 psi** (140 kPa, 1.4 bar) nominal **35 psi** nominal. 35 psi required for 3-27 psig output units. Filtered, regulated, instrument-quality air only. 20 psi units accommodate up to 30 psi without damage. 35 psi units accommodate up to 40 psi without damage.
Controls	**Span:** Multiturn pot electronically adjusts full scale output to 100% of rated span. **Zero:** Multiturn adjustment screw mechanically provides offsets of ±3% of span.
Performance	**Accuracy:** Error less than 0.5% of span, including the combined effects of linearity, hysteresis, and repeatability. For 3-27 psig output units or 10-50 mA input units, error not to exceed 1% of span. Linearity defined per SAMA standard PMC 20.1-1973. **Ambient Temperature Effect:** ±0.1% of span per °C change within the rated ambient temperature operating range (±0.055% of span per °F change). **Supply Pressure Deviation Effect:** Maximum of 0.3% per 1.4 psig change (0.3% per 0.1 bar). **Mounting Position Effect:** Negligible. Meets NEMA 4X specification only when installed upright (0°), or at relative angles less than 90°. Refer to Installation Section for details. Unit should be calibrated in final orientation. **RFI/EMI Effect:** ±0.1% of span in field strengths of 10 V/m at frequencies of 20-500 MHz. **Step Response:** 0.3 seconds into 100 ml (6 cu in) at 90% of span.
Pneumatic Load	**Air Capacity:** 1.4 scfm. **Air Consumption:** 0.1 SCFM (0.18 kg/hr) dead-ended.
Environmental Ratings	**Recommended Ambient Temperature Operating Range:** –20 to 80 °C (–4 to 140 °F).
Weight	Approximately 1.8 kg (3 lb, 15 oz) including mounting flange.
NOTE: Refer to Installation Section for unit outline dimensions.	

Calibration

Every IPX is fully tested and calibrated at the factory prior to shipment. Before installation, however, your IPX(s) should be bench checked to verify proper operating levels, and to set the desired unit zero and span.

Calibration should be conducted in an appropriate testing environment. By carrying out the procedures at a technician's bench or in a similar lab-type setup, any unit damage that may have occurred during shipment can be discovered safely, i.e., isolated from the intended application.

Calibration Equipment

Table 2 lists the equipment required to calibrate the IPX. This equipment is not supplied by Moore Industries, but should be available in most labs or maintenance areas.

Calibration Setup

To prepare the IPX for calibration, disassemble the unit as shown in figure 1, and connect it to your calibration equipment as shown in figure 2, which shows the IPX Calibration Setup.

NOTE

Do not remove the IPX internal assembly from its housing when performing calibration. Doing so may effect the integrity of the seals of the pneumatic ports.

Any unit whose internal assembly is removed from the housing should be re-calibrated before it is returned to service.

Always use clean, dry, instrument-quality air, whether calibrating or operating the IPX. Refer to the appendix of this manual for information on filtration.

Table 2. *IPX Calibration Equipment*

Equipment	Specifications
Current Source	Calibrated, adjustable. Must be capable of discrete output levels within the appropriate, rated range for the unit under test; 4-20 or 10-50 mA. Refer to model number and table 1.
DC Milliammeter	Calibrated. Accuracy of ±0.1% (optional equipment)
Air Supply	Filtered, regulated, instrument-quality. Refer to appendix A of this manual for more detailed specifications/filtration requirements.
Air Pressure Gauges	Two calibrated gauges; #1 with accuracy of ±2%, #2 with accuracy of ±0.1%.
Pneumatic Test Lead	Calibrated. Volume of approximately 120 ml (75 in³), per IEC spec #770.
Removable Thread-Locking Compound	Loctite® #242, or equivalent.
Screwdriver	Slotted-tip. Head width of 5 mm (0.1975 in), maximum.

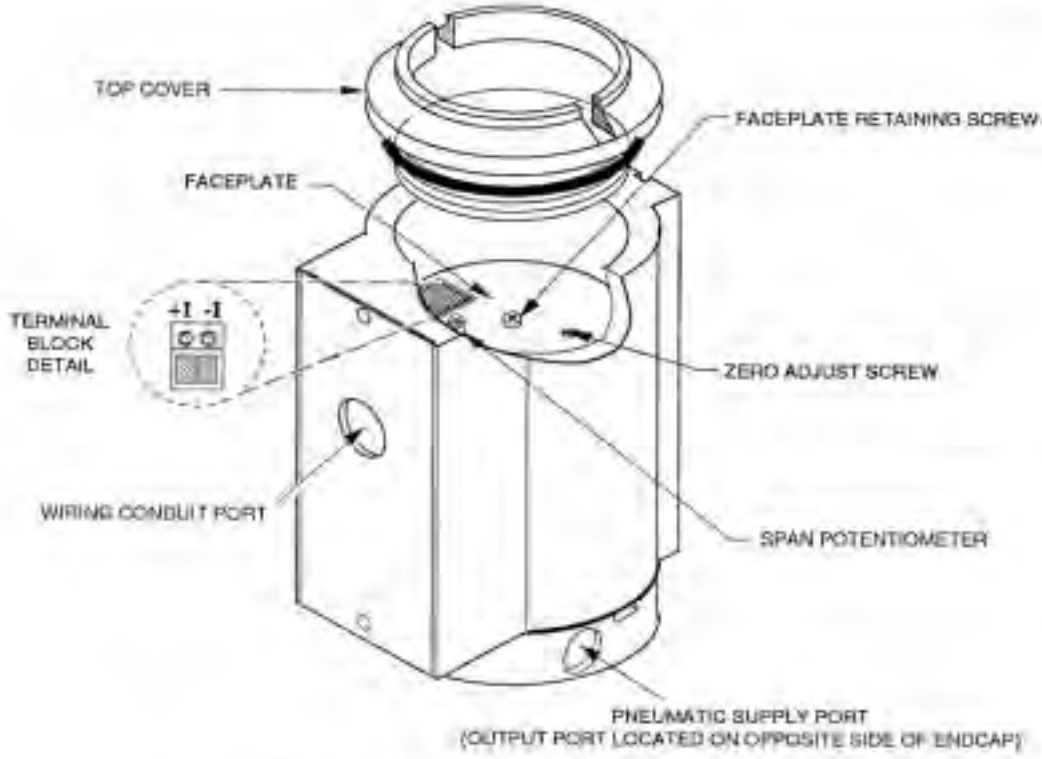

Figure 1. *IPX Disassembly, Controls, and Terminals for Calibration*

All pneumatic lines used in calibration and operation must be "blown down" prior to their being connected to the IPX. Any condensation or oil residue in the lines, if introduced into the pneumatic chambers of the IPX, may result in poor unit performance.

1. Orient IPX as it will be positioned in the application. That is, if unit is to be oriented vertically when installed, orient vertically to calibrate, etc.
2. With zero air input (supply off), connect 1/4-inch pneumatic tubing between appropriate output port of regulated instrument air supply and calibrated pressure gauge #1 (accuracy of ±2% of span). Connect another hose from gauge to port labeled "SUPPLY" on IPX.
3. Connect 1/4-inch pneumatic tubing between IPX port labeled "OUTPUT" and gauge #2 (accuracy of ±0.1% of span), and from gauge to pneumatic load.

NOTE

Use of 1/4-inch tubing is recommended for calibrating the IPX. In the field, output tubing with a larger diameter may be desirable for long runs.

4. Run current source wiring through conduit opening in housing, and to front panel of IPX.
5. Connect positive lead of adjustable current source to +I terminal of IPX. Connect negative source lead to –I IPX terminal.

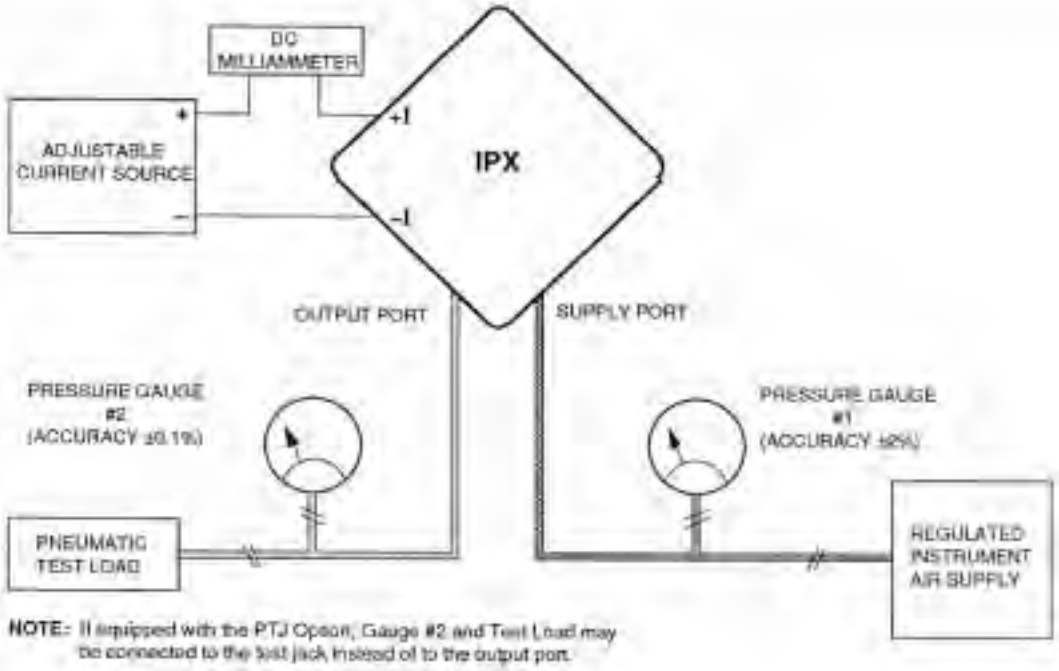

Figure 2. *IPX Calibration Setup*

A dc milliammeter may also be connected to verify current input level.

5. When connections are complete, apply 0% of appropriate input current; 4 mA for 4-20 mA units, or 10 mA for 10-50 mA units.

7. Apply appropriate level of filtered, instrument-quality air to supply line; 20 or 35 psi (140 kPa or 1.4 bar). Unit model number lists appropriate supply pressure.

8. Set span pot to approximate mid-scale, 11 turns from either wiper stop (22 turns in either direction, then approximately 11 turns in the opposite direction).

9. Set zero adjustment screw fully clockwise, then five turns counterclockwise.

10. Allow approximately 5 minutes for calibration setup to stabilize.

Calibration Procedure

To perform the recommended bench check for the IPX, first perform the setup as described in the preceding section. The calibration procedure consists of a basic check and adjustment of unit zero and span, based on the readings of pressure gauge #2 (accuracy of ±0.1%).

Table 3 lists the values to be used during calibration. Refer to the table when performing the following steps:

1. Monitor reading of pressure gauge #2 (output), and turn Zero adjust screw counterclockwise to lower output, clockwise to raise output. Set Zero adjust screw so that pressure output is at 0% of appropriate range (±3%) when 0% of current range is applied.

CAUTION

The Zero adjustment screw has a flange to prevent its being turned too far counterclockwise. Forcing the screw past the point at which this flange comes into contact with the unit front panel could disengage the screw from the internal arm assembly.

If this happens, the IPX may have to be returned to the factory for refit. Refer to the Troubleshooting Section of this manual for more information.

2. Check the span setting. Increase input to 100% of rated span; 20 mA for 4-20 mA units, or 50 mA for 10-50 mA units.
3. Monitor reading of pressure gauge #2 (output), and adjust span pot so that reading is at 100% of rated pressure range for your unit.

   Check the values listed in Table 3.
4. Repeat steps 1 through 4 until IPX outputs 0% of rated pressure range at 0% current input, and 100% of output pressure range at 100% current input.

Table 3. *IPX Calibration Values*

IPX Output Configuration*	At 0% of Rated Input Range* (4 or 10 mA) Adjust Zero until Gauge #2 Reads:	At 100% of Rated Input Range* (20 or 50 mA) Adjust Span until Gauge #2 Reads:	Verify by Applying 25% of Rated Input Range*	Verify by Applying 50% of Rated Input Range*	Verify by Applying 75% of Rated Input Range*
			Gauge #2 will Read:		
3-15 psig	3 psi	15 psi	6 psi	9 psi	12 psi
15-3 psig	15 psi	3 psi	12 psi	9 psi	6 psi
0.2-1 bar	0.2 bar	1 bar	0.4 bar	0.6 bar	0.8 bar
1-0.2 bar	1 bar	0.2 bar	0.8 bar	0.6 bar	0.4 bar
3-27 psig	3 psi	27 psi	9 psi	15 psi	21 psi
3-16.6 psig	3 psi	16.6 psi	6.4 psi	9.8 psi	13.2 psi
20-100 kPa	20 kPa	100 kPa	40 kPa	60 kPa	80 kPa
100-20 kPa	100 kPa	20 kPa	80 kPa	60 kPa	40 kPa

* Verify appropriate output configuration and percentage of rated input range against unit model number.

5. Verify the accuracy of your adjustments by inputting the appropriate percent of span levels listed in table 3.

Installation

The installation of the IPX is carried out in three phases. The first phase is the physical mounting of the unit. Next is the electrical connections phase, and finally, pneumatic connections can be made. It is strongly recommended that IPX's be installed in this order.

It is also strongly suggested that each unit be calibrated according to the instructions in this manual before being placed into service.

The IPX may be installed at any angle; either surface-mounted, or attached to a pipe or round conduit. Consideration should always be given to any requirement that may arise for front panel access, checking the fittings, or reading the FR1 Option gauge and draining its filter.

Closed Loop/Open Loop Applications. The IPX works best when installed in a closed loop application. A closed loop is the best way to measure a control variable, and to dtermine if a deviation from the desired value exists, since it usually provides feedback for acutator loading presssure.

An open loop has inherent limitations that are not consistent with precise control. Long term drift of the loop dynamics, load fluctuations that require constant adjustments of the actuator loading pressure, and performance quality variations due to inconsistencies between operating personnel are all problems commonly associated with open loops. A control variable cannot be directly measured in an open loop; this prevents compensating adjustments to the system input.

Special Restrictions for NEMA 4X Applications. The IPX housing design meets the criteria for NEMA 4X rating only when the unit is oriented so that its electronic compartment is "higher" than its pneumatic compartment. Figure 3 illustrates the NEMA 4X installation restrictions.

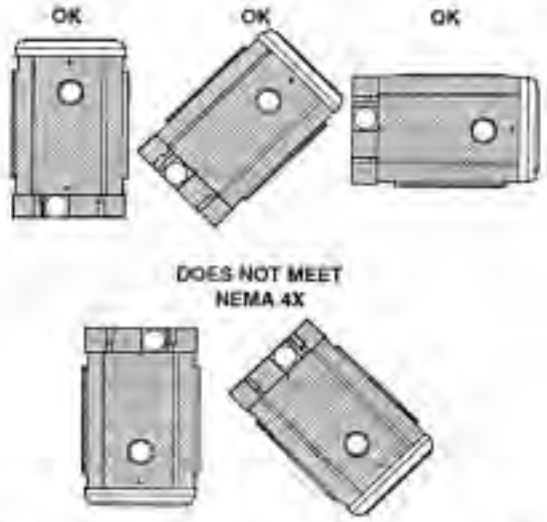

Figure 3. *IPX Installation Restrictions for NEMA 4X*

Note too that while unit performance is not affected by, for example, installing the unit upside down, a unit installed in such an orientation does not meet NEMA 4X requirements.

NOTE
Always recalibrate any IPX whose location or orientation is changed after initial installation.

Mounting

Figure 4 gives the IPX's outline dimensions. The illustration also gives the dimensions of the available FR1 and GA1 optional hardware, recommended for most installations.

After placing the IPX in the desired location and orientation, secure the housing with the optional pipe mounting hardware, or other appropriate fasteners.

Figure 5 illustrates IPX mounting using optional pipe mounting hardware.

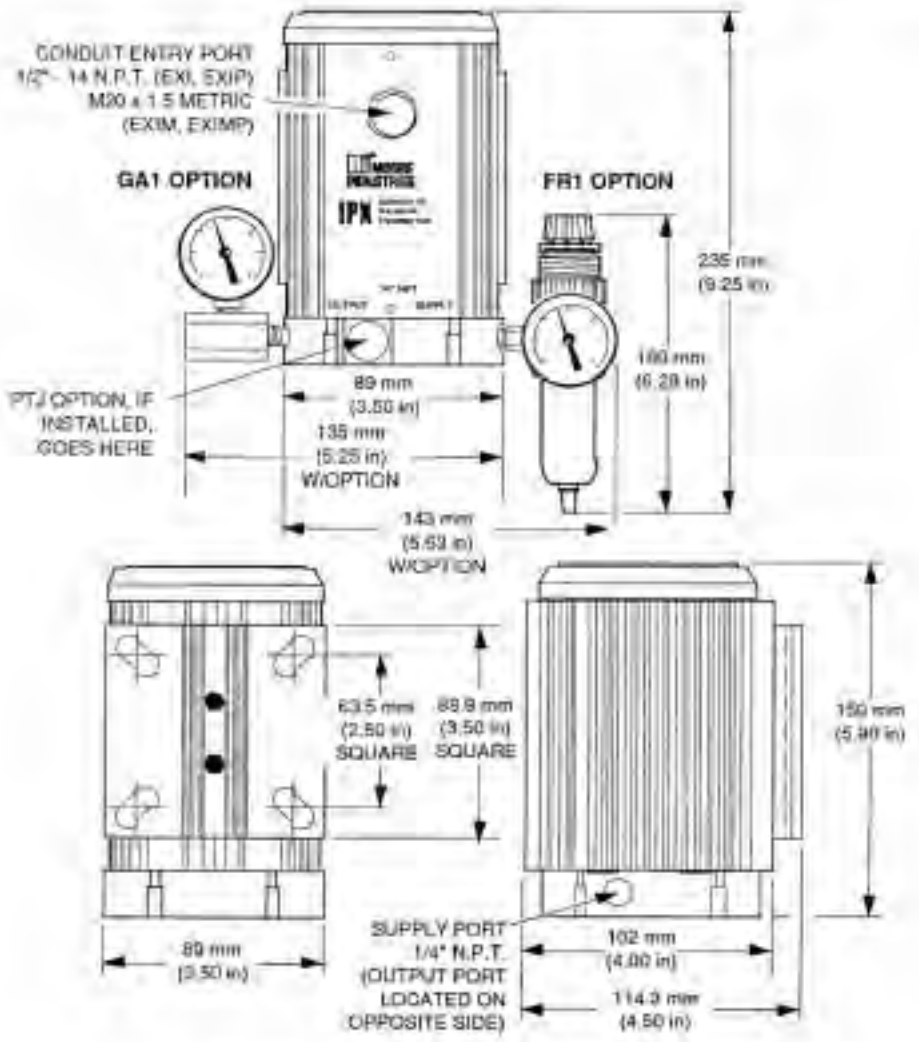

Figure 4. IPX Outline Dimensions

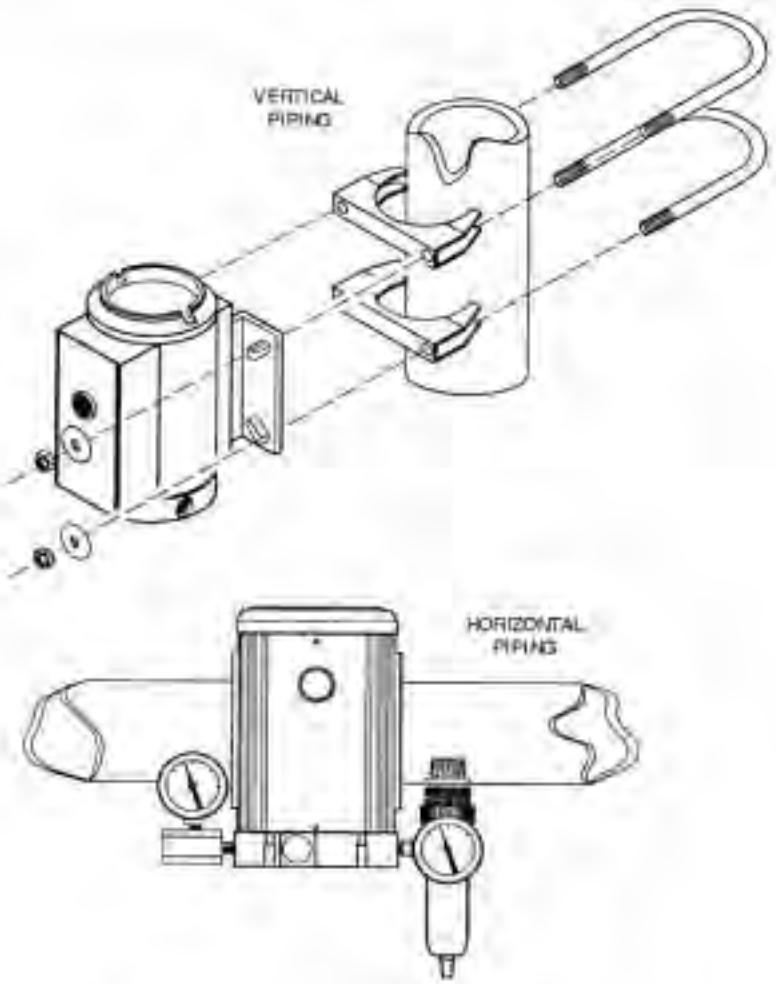

Figure 5. Mounting the IPX on Horizontal and Vertical Pipe

The holes of the mounting plate attached to the IPX housing are symmetrical. This allows the unit to be installed on either horizontal and vertical pipes.

Electrical Connections

Refer to figure 1 in the Calibration Setup Section of this manual for instruction on the level of disassembly required to make the electrical connections to the IPX.

Figure 6 is a generic diagram showing the installation hookup for the IPX.

To complete connections, route wiring through conduit port to terminal block, and use a slotted-tip screwdriver with a maximum head width of 3 mm or 0.125 inch to loosen the terminal screws.

The terminals are comprised of compression screw sockets that accept 22 –14 AWG wire.

Connect the positive input lead (+) to the terminal labeled "+I", and the negative lead (–) to the terminal labeled "–I". Tighten the terminal screws until snug.

NOTE

Use shielded, twisted-pair wiring for low-level input. Ground the shielding wire as close to the IPX as possible. A colored, or in some cases labeled, Phillips-head hex screw is provided inside the housing for this purpose.

Pneumatic Connections

The final phase of IPX installation consists of connecting the pneumatic lines. Figure 6 also illustrates these connections.

To complete the IPX pneumatic connections, connect the supply line to the 1/4-inch N.P.T. female SUPPLY port on one side of the unit, and connect the output line to the 1/4-inch N.P.T. female OUTPUT port. Refer to the unit front panel, which identifies the SUPPLY and OUTPUT ports.

Seal all fittings with Teflon® tape, or equivalent. "Pipe dope" is not recommended. If your application environment prohibits the use of Teflon, contact Moore Industries for assistance.

Always "blow down" (purge) all tubing and the controlled device before connecting the IPX.

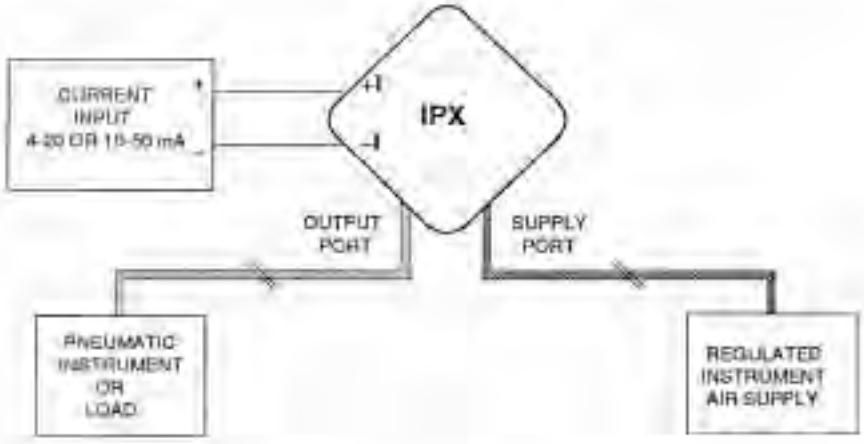

Figure 6. IPX Installation Hookup

General Recommendations:

- Use flexible or semi-flexible, plastic, pneumatic tubing and plastic fittings, if possible.
- Provide clip- or bracket-type support at 30 cm (1 ft) intervals, and provide independent support for any components or equipment installed in the lines. Use cushioning brackets to dampen vibration, if possible.
- Avoid "straight-line" connections.
- Provide auxiliary support for the filter/regulator (if equipped), especially in areas where shock and vibration are prevalent.
- Do not over-tighten fittings. A torque of 10 to 15 N•m (7.4 to 11.1 ft/lbs) is adequate.

Filters. The IPX requires filtered, dry, regulated, instrument-quality air to prevent clogging, and to ensure extended periods of maintenance-free operation. Refer to the appendix of this manual for more information on the types of filtration recommended for use with the IPX.

Generally, Moore Industries suggests the following levels of filtering protection:

- *Pre-filter* – A general purpose "rough" filter, used to reduce particulate matter to 5 microns in size. Also removes bulk liquids. Although not required, this filter is especially recommended to protect the 0.01 micron final filter when used.
- *Final Filter* – A second, final filter is recommended, to remove particulate matter in sizes down to 0.01 micron. This filter removes virtually all condensable liquids from the air stream as well.
- *Filter/Regulator Module Option* – The FR1 Option, offered as an accessory for the IPX, removes particles down to 0.01 micron, supplying regulated, instrument-quality air to the unit. This space-saving module is affixed to the IPX supply port, and comes with a pressure gauge scaled in both psi (0-60) and bars (0-4).

Operation

Once its calibration has been checked or adjusted, and the unit has been installed properly, the IPX operates unattended. It requires only a minor, periodic maintenance procedure, detailed in the next section of this manual.

Remember that an IPX should be installed as part of a closed loop applications. Units in an open loop may appear to drift over extended periods of time, due to the lack of corrective feedback.

If the unit is determined to be the cause of a loop irregularity, carry out the maintenance procedure in the next section of this manual. If problems persist, refer to the Troubleshooting Section.

Instrument-quality Air. Air from the application continuously flows through the IPX during operation. Depending upon the purity of the air supply, the unit's internal assembly may have to be removed and cleaned at comparatively short intervals to ensure continued optimum performance.

Initially, random checks can help establish a satisfactory maintenance interval geared to the user's air supply cleanliness.

Maintenance

Before beginning IPX maintenance, the unit must be removed from its application. It is strongly recommended that the maintenance procedures be performed in a clean, controlled environment, such as at a technicians' bench, in a laboratory, etc.. Several internal parts are small and precision-machined; easily lost or damaged if an attempt is made to perform maintenance in the field.

After maintenance, each IPX should be recalibrated before it is returned to service. Refer to the Calibration Section of this manual for instructions.

You Will Need...

To perform the basic maintenance procedure for the IPX, refer to table 4, which lists the equipment required. These materials are not supplied by Moore Industries, but should be available in maintenance areas that are prepared to perform this type of procedure.

If this equipment is not available, your facility may not be qualified to perform the operations described in this section. Contact Moore Industries' Customer Service Department for more information.

Table 4. IPX Maintenance Equipment

Equipment	Specifications/Notes
Instrument-Quality Air or Nitrogen Supply	Reduced to between 20 and 30 psig, and fitted with a hose and fine tip or nozzle.
White, Bond Paper	Clean, undyed, and unlaminated.
Cotton Swabs	Clean, general utility swabs for use in cleaning surfaces and absorbing excess solvent and alcohol.
Trichloroethane (TCE)	Rho-Tron-TPC-400 or equivalent
Isopropyl Alcohol	Clean, general purpose flushing solution.
Syringe	Or similar mechanism for injecting alcohol into small orifices.
Screwdriver	Slotted-tip. Head width of 5 mm (0.1875 in), maximum.
Probe	Technician's tool for manipulation of very small parts.
Cleaning Wire	0.005-inch diameter, maximum.
Hex Keys	One 4 mm, standard; One 3/32 in, minimum length 5.5 in. Ball-tipped head recommended; One 3/32 in, standard
Removable Thread-locking Compound	Loctite® #242 or equivalent removeable threadlocker.

Unit Disassembly

Figure 7 illustrates the level of IPX disassembly necessary to perform the internal maintenance procedures. See figure 1, which shows the initial steps of the disassembly procedure, then refer to figure 7 and figure 8, a detail of the disassembly.

1. Remove internal faceplate by unscrewing Phillips-head, retaining screw in its center.

CAUTION

The faceplate is connected to the electronic subassembly by the terminal block wiring.

2. If desired, detach faceplate by removing terminal block retaining screw located on faceplate back. Otherwise, allow faceplate to dangle free.

3. Remove mechanical subassembly from housing body by unscrewing the two socket-head screws located on subassembly base. These secure subassembly to compartment wall. Use a ball-tipped hex key, or a standard hex key at least 5.5 inches long.

4. Remove bottom endcap. It is secured by four retaining, socket-head screws. Carefully "work" endcap off by pulling straight out, away from housing body.

CAUTION

DO NOT ATTEMPT TO TURN/ UNSCREW THE BOTTOM ENDCAP. Damage to the internal pneumatic fittings will result. The fittings will remain either in the endcap or in bottom section of the pneumatic block.

5. Remove pneumatic block from housing body by unscrewing slotted retaining screw located in recess on the side of the top section of the pneumatic block.

Cleaning the Mechanical Subassembly

1. Place mechanical subassembly on work surface with zero screw and span pot down.

2. Use syringe to flush flapper air passage with trichloroethane (TCE). See figure 8.

NOTE

Use of commercially available TCE is strongly recommended (Rho-Chem-Rho-Tron-TPC-400, or equivalent). Do not substitute other chemical solvents.

3. Clean nozzle air passage by gently passing cleaning wire back and forth through opening in subassembly base.

CAUTION

The flapper mechanism is very delicate. Exercise extreme care in cleaning.

4. Soak several small strips of clean paper in TCE.

5. Set subassembly on its side, and slide one strip between nozzle and flapper. Carefully apply slight pressure to flapper until it rests against nozzle with soaked paper in between.

6. Maintain pressure while pulling paper out. Repeat with other strips of paper until no residue is transferred to paper.

7. Inspect air passage O-ring. If damaged, contact Moore Industries' Customer Service Department for replacement.

8. Use instrument air supply to dry and generally "blow out" subassembly. Put small amount of alcohol in air passage, and set subassembly aside.

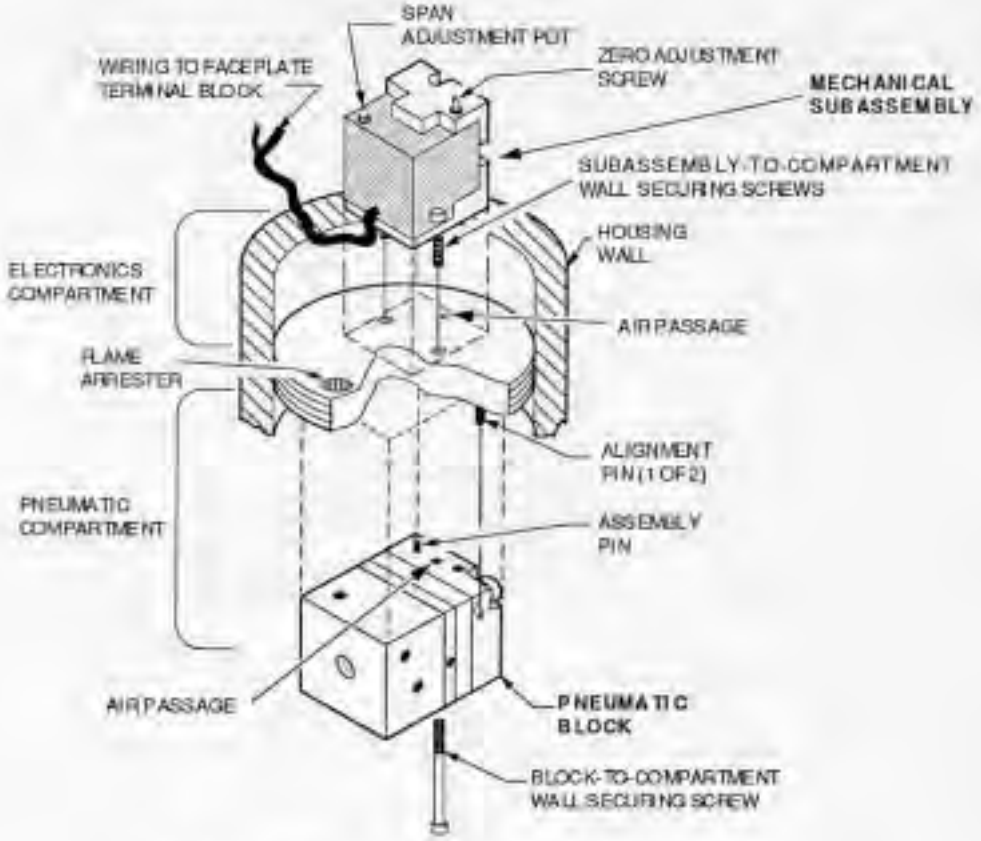

Figure 7. *Disassembly of the IPX for Maintenance*

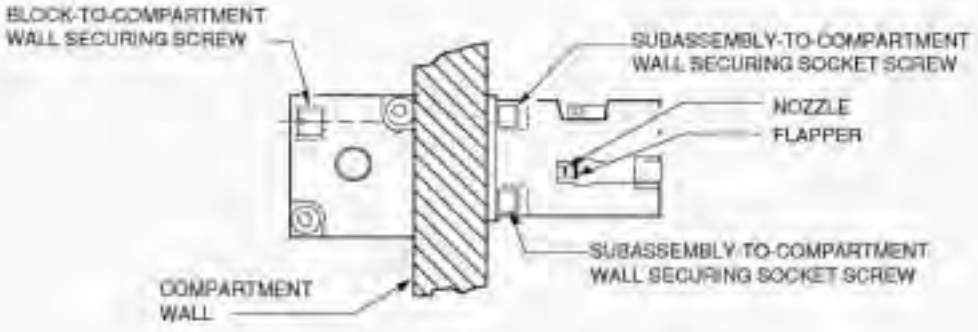

Figure 8. *Detail of IPX Disassembly*

Cleaning the Pneumatic Block

Refer to figure 9 to disassemble the IPX pneumatic block, and to perform the following:

CAUTION

Several of the parts that make up the pneumatic block are small and very delicate. Exercise extreme care in disassembly and cleaning.

1. Place block on work surface with its two socket-head screws facing up (section #1 on top). Use screwdriver to mark one side of block with several small scratches for use when re-assembling parts.
2. Dip cleaning wire in TCE, and use it to clean the air passage between block and mechanical subassembly (see figure 7).

   Flush orifice with alcohol after cleaning.
3. Remove two socket-head screws that hold block together. Remove section #1 from block.
4. Use swabs dipped in TCE to clean internal surfaces, and to remove any dirt particles or oil. Flush all parts with alcohol after cleaning.

CAUTION

Individual sections of the pneumatic block are separated by thin, rubber diaphragms. The integrity and orientation of these diaphragms is critical to proper IPX operation.

5. Push cleaning wire dipped in TCE through small orifices on underside of section #1, in center opening and along outside edge. Use syringe filled with alcohol to flush openings.
6. Remove spring, disk, and diaphragm from top of section #2. Inspect each for deterioration and dirt. Use compressed air to blow off all parts.
7. Remove diaphragm from bottom surface of section if necessary.
8. Push cleaning wire dipped in TCE through brass fitting in center of section.
9. Clean small orifices along edge of section (top and bottom) with cleaning wire, and flush with alcohol syringe.
10. Use swabs dipped in TCE to clean all surfaces.
11. Repeat cleaning/flushing procedure for orifices and surfaces of section #3.

NOTE

When cleaning sections of the pneumatic block, pay particular attention to the restrictor holes shown in the figure. These are especially susceptible to the accumulation of oil and dust.

12. Remove integrated diaphragm/disk from section #4.
13. Clean orifices and surfaces on section as before.

    Check to make sure that the spring is in good condition.
14. Locate supply port air filter screen on the pneumatic block. It may be necessary to remove left fitting to gain access to filter screen.

    Remove filter screen with needle, and flush with TCE. Rinse with alcohol, and set aside to dry.

Re-assembly

1. Dry all parts of both the pneumatic block and the mechanical subassembly with the specified air or nitrogen supply. Make sure all parts are clean and dry.
2. Inspect flame arrestors in compartment wall, and O-ring in top cover. If damaged, contact Moore Industries' Customer Service Department for replacement parts.
3. Use the disassembly figures, 1 and 7 through 9, to re-assemble pneumatic block. Incorrectly placed parts will cause air blockage and will effect IPX performance.

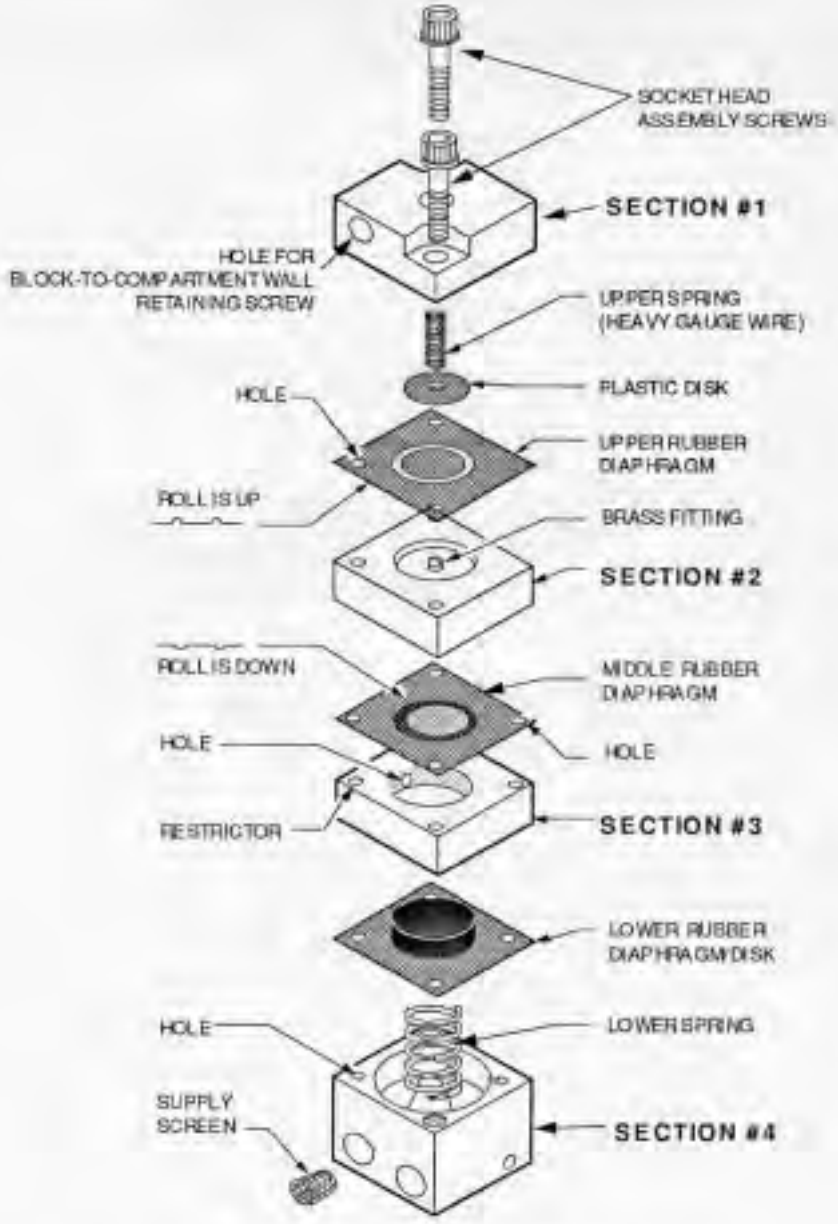

Figure 9. *Disassembly of the IPX Pneumatic Block*

Use scratch markings made earlier to make sure that each section of pneumatic block is oriented properly. Tighten block assembly screws until very snug (between 35 and 45 N-m (26 to 33 ft/lbs) of torque).

5. When re-inserting pneumatic block in IPX housing, line up air passage with O-ringed hole in compartment wall. An alignment pin on section #1 of pneumatic block fits into hole next to small flame arrestor in compartment wall of housing.

   Place a small amount of removable thread-locker on threads of slotted retaining screw, and attach pneumatic block to compartment wall. Tighten screw until snug.

CAUTION

Do not use too much thread-locker. Excess amounts of the compound could ooze into the air passage, severely impairing unit operation, and possibly resulting in damage.

6. Place a small amount of removable thread-locker on threads of the two socket-head screws used to secure the mechanical subassembly to the housing compartment wall. Insert screws in holes on base of mechanical subassembly.

7. Line up air passage in mechanical subassembly with hole in upper compartment wall, and secure subassembly with small socket-head screws.

8. Re-attach terminal block to faceplate, re-attach IPX faceplate, and apply removeable thread-locker to threads of the four, socket-head screws that secure the bottom endcap.

9. Re-secure top and bottom end-caps, and refer to Calibration Section of this manual to re-calibrate IPX.

NOTE

It is not necessary to use thread-locker on the top endcap.

Drain Check. System filters have automatic drains, which depend on the fluctuation of system pressure to induce drainage. A stable system may not drain efficiently.

Periodically check for clogs and drain system's filters by pushing the drainage valve with a narrow probe or wire.

Troubleshooting

Any properly maintained unit found to be performing below specifications may be returned to the factory in accordance with the instructions found on the back cover of this manual.

If a problem is suspected with the IPX, review the following steps:

1. Verify that bench instruments used to take measurements have the proper range and accuracy and are within current certification period limits.

2. If a change in the relationship between the input and output is detected, attempt a re-calibration of the IPX.

3. If the response time lengthens, or if the span drops, this may indicate a blockage due to air supply contamination. Follow the instructions in the Maintenance Section of this manual.

The Zero Adjust Screw. This screw has a flange to prevent its being turned too far counterclockwise during adjustment. Forcing the screw past the point at which its flange comes into contact with the unit front panel could disengage it from the internal assembly.

If this happens, disassemble the IPX as described in the Maintenance Section of this manual. Visually inspect the screw, and if serviceable, hold down the flapper arm, and turn the screw clockwise until its pin is in a position to hold the arm.

Refer to the Calibration Section of this manual, and perform a unit recalibration.

Appendix A

Instrument Air and Filtration

The selection and use of a good air filtration system is essential in ensuring optimum performance of pneumatic instrumentation and devices. Most users find that it is much less expensive and troublesome to design a system that includes a good air filtration than to deal with downtime and repairs later. The cleaner the air, the longer the time before servicing will be needed.

Obtaining good instrument-quality air involves removing solids, oil, and water after compression. Oversizing elements helps to avoid performance aberrations, and should reduce the need for periodic maintenance. Redundancy should be used where possible to avoid shutdown during maintenance.

The IPX is available with an optional coalescing filter/regulator module, the FR1 Option, that combines a 0.01 micron air filter and a miniature supply-line regulator. The unit has a 1/4-inch N.P.T. female port and 4 SCFM maximum flow at 90 psig inlet pressure. It is furnished with an integral pressure gauge that reads-out in both psi (0-60) and bars (0-4).

The Problems

Oil: Oil is the most common problem in compressed air instrument systems. A coalescing filter removes sub-micron liquid oil droplets from the air, and is usually supplied with an automatic drain.

The filter works by trapping oil and water droplets in a bed of microfibers. Droplets run together at fiber cross-over points, form large liquid drops, and are forced by air flow to a drain. A filter system consisting of a general purpose first-stage filter (about 5 micron) and a high efficiency coalescing final filter is recommended to obtain contaminant-free air.

The exact location of the first-stage filter in the loop is not important; it can be located just ahead of each final filter, or a single first-stage filter can be located on a main line to protect a number of final filters on branch lines. Each final filter (coalescing) should be located just ahead of each pressure regulator.

Water: The amount of water in an air system depends on temperature, pressure, and the relative humidity of the air. The amount of contamination, therefore, tends to vary widely with geographic location and weather. To obtain instrument-quality air, sufficient water must be removed to lower the dew point of the air to a temperature below ambient. The dew point (at line pressure) is expressed as the temperature at which any moisture in the system begins to condense.

Water may be removed using a number of techniques, including coalescing filters, refrigeration dryers and desiccant-type dryers. Care must be taken in the selection and location of the filter, because cooling, downstream of the filter, can cause more condensation.

Typically, a coalescing filter should be installed immediately upstream of the pressure regulator. In this way the filter removes most of the water before the air enters the regulator. Air leaving the regulator then continues to dry due to expansion.

Solids: Random solid dirt, such as pipe scale and rust, is rarely a problem in compressed air instrument systems. A good filter will remove these solids. However, if there is a desiccant dryer in the line, a high-efficiency sub-micron filter is recommended for removing the highly abrasive sub-micron particles produced by the dryer. A high-efficiency filter is desirable in any system, and is often a feature of coalescing filters.

For systems subjected to freezing temperatures, the portion of the system that runs outdoors should have a dryer installed. The dryer reduces the dew point below the lowest expected outdoor temperature.

IPX

A desiccant dryer is used upstream from a coalescing filter to keep the dryer from being damaged by oil or from being overloaded with excessive condensed water. Another high-efficiency coalescing filter is recommended downstream of the dryer, to remove desiccant particles.

Figures A1 and A2 illustrate typical non-redundant systems with multiple branch lines. They both work in any environment above freezing and differ only in the placement of the first-stage, general purpose filter. Gauges, valves, and differential pressure indicators (for filter service monitoring) are not shown

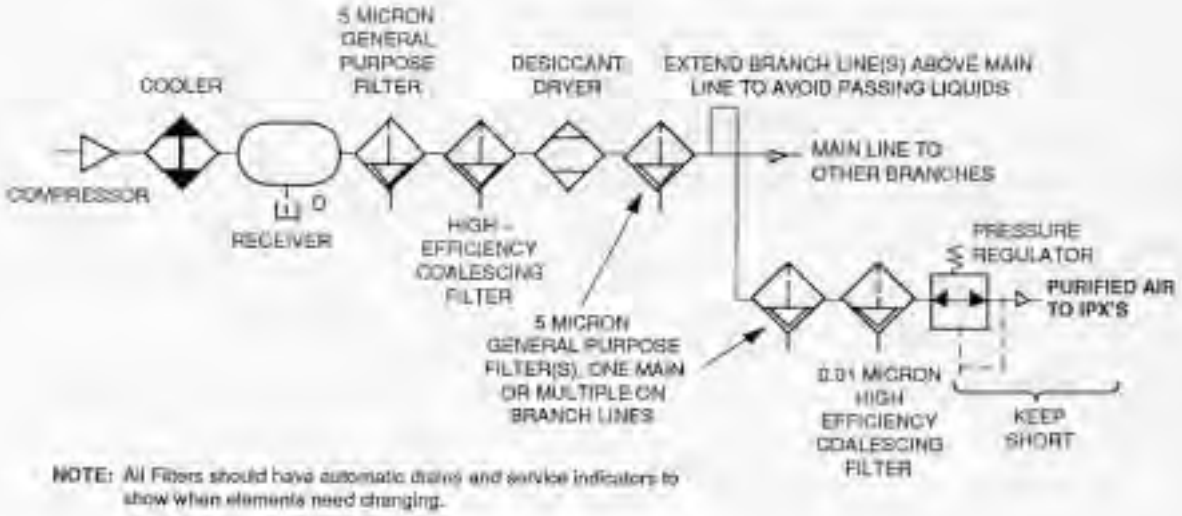

Figure A1. *Non-Redundant System with Desiccant Dryer*

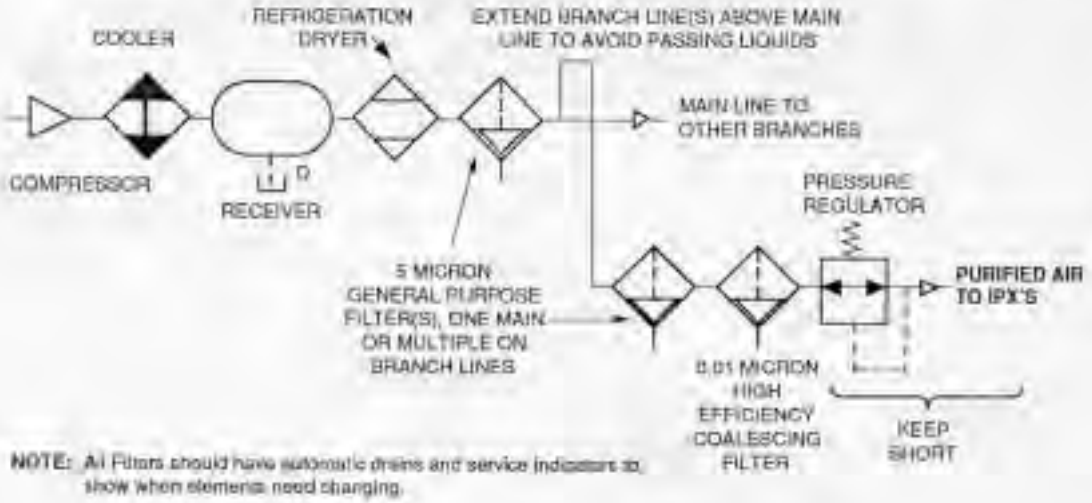

Figure A2. *Non-Redundant System with Refrigerator Dryer*

It is recommended that filters with integral service life indicators or differential pressure indicators be used to help ensure proper servicing. Use redundancy in a filtering scheme to preclude any necessity for shutdown during servicing.

Note that the systems depicted in the figures differ in the method used to remove water. The use of a desiccant dryer, as in figure A2, requires both upstream and downstream filtration to prevent oil contamination of the desiccant, as well as to prevent desiccant fines from introducing new contamination.

ISA Specifications

The Instrument Society of America standard ISA-S73, 1975 (ANSI MC11.1-1975) comprises the air quality requirements for instrument-grade air for use in pneumatic installations.

These specifications call for particle size not to exceed 3 microns, and oil content not to exceed 1 ppm. Moore Industries offers a line of coalescing filters that remove particles down to sub-micron sizes (as small as 0.01 micron), while also removing oil to below 0.01 ppm.

Contact your Moore Industries Sales Representative, or the factory Sales Department for information on available filters for the IPX.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

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