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EPX²

*Explosion Proof Voltage-to-Pressure
(E/P) Transmitter*

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Introduction

This is the user's manual for the Moore Industries Voltage-to-Pressure Transmitter (EPX²). It contains all of the information that is needed to calibrate, install, operate, maintain and troubleshoot the instrument.

The following guidelines are used in this manual:

WARNING - Hazardous procedure or condition that could injure the operator.

Caution - Hazardous procedure or condition that could damage or destroy the unit.

Note - Information that is helpful for a procedure, condition or operation of the unit.

EPX²

The rugged EPX² Voltage-to-Pressure (E/P) Transmitters are designed specifically for extended duty in harsh field environments. The extruded aluminum housing of the EPX² is explosion-proof and waterproof, making it perfect for most any location.

This 3-wire (auxiliary-powered) transmitter converts a voltage signal to a pneumatic actuator, valve or damper drive. This instrument accepts a 3-wire (1-5Vdc, 20-100kPA, etc.) input.

Units are available with an optional coalescing filter/regulator that combines an air filter and miniature supply line regulator with a pressure gauge that reads in both psi and bars.

Specifications

<p>Performance Accuracy: $\leq \pm 0.25\%$ of span including the combined effect of linearity, hysteresis and repeatability (between 0 and 3psig output, error will not exceed $\pm 1.0\%$ of span) Input: 1-5 Volts Voltage Input Impedence: 1 Mohm Output: 3-15psig; 0-30psig; 6-30psig Stability: Not to degrade from stated accuracy for six months Step Response: < 0.2 seconds into 100ml load (6 in³) from 10% to 90% of span; Not guaranteed below 3psig output. Supply Pressure Effect: Negligible from 20-40psig, steady pressure Air Capacity: 5.0SCFM minimum (20psig supply, 0psig output) Relief Capacity: 2.5SCFM minimum (15psig output) Air Supply: Instrument air only, 20-40psig (Must be 5psig greater than maximum output) Gas Supply with -NG1 or</p>	<p>Performance (Continued) -NG2 Options: Same cleanliness as instrument air. H₂S not to exceed 20ppm Air Consumption (Dead-ended): At 3psig output, 20psig supply, consumes 0.08SCFM (0.14m³/hr), maximum; At 15psig output, 20psig supply, consumes 0.10SCFM (0.17m³/hr), maximum; At 15psig output, 40psig supply, consumes 0.15SCFM (0.26m³/hr), maximum; At 30psig output, 40psig supply, consumes 0.17SCFM (0.29m³/hr), maximum Maximum Input: 80psig without damage for units with output pressure rating of > 15psig; 45psig without damage for units with output pressure rating of > 15psig Power Supply: 9-30Vdc, 5mA maximum Mounting Position Effect: Negligible, unit can be mounted in any position; Should be mounted upright or horizontal to keep water out if it is not in a dry environment</p>	<p>Ambient Conditions Operating & Storage Range: -40°C to +85°C (-40°F to +185°F) Ambient Temperature Effect: $\leq \pm 0.025\%$ of span/°C, maximum from -20°C to 80°C; $\leq \pm 0.1\%$ of span/°C, maximum RFI/EMI Effect: $\leq \pm 0.1\%$ of span change in field strengths of 10V/m @ frequencies of 20-500MHz Shock and Vibration Effect: Meets SAMA PMC 31.1 as detailed in the field mounted category Relative Humidity: 0-100%, non-condensing Adjustment Zero & Span: Screw adjusts zero or span by $\pm 10\%$ minimum, non-interactive Weight 2.0kg (4.4 lbs)</p>
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Specifications and information subject to change without notice.

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Calibration

Every EPX² is fully tested and calibrated at the factory prior to shipment. However, before installation, your instrument should be bench-checked to verify the desired unit zero and unit span. Calibration should be conducted in an appropriate testing environment.

Necessary Equipment

Table 1 lists the equipment required to calibrate the unit. This equipment is not supplied by Moore Industries, but should be available in most labs or maintenance areas.

Table 1. EPX² Calibration Equipment

Description	
Adjustable voltage source	0-10 Volts
Voltage Power Source	8-30Vdc
DC Multimeter	Accurate to $\pm 0.05\%$
Instrument air supply	Filtered
Air pressure gauge #1	Accurate to $\pm 2\%$
Air pressure gauge #2	Accurate to $\pm 0.1\%$
Pneumatic load	Volume of 7.5 cubic inches (approximately 120 milliliters)

Preparing for Calibration

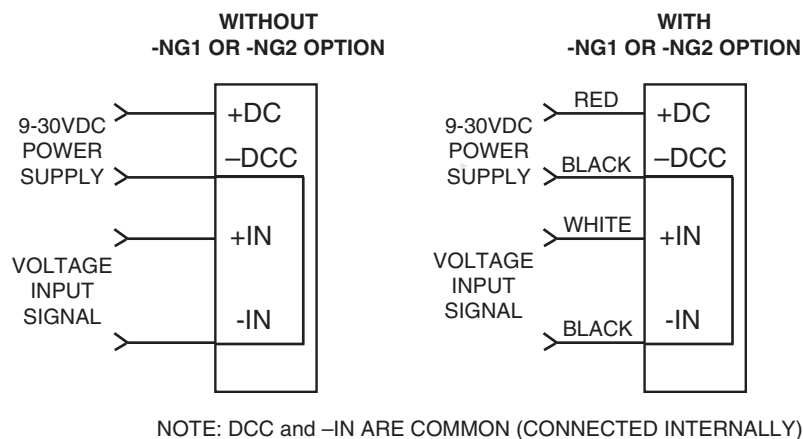
To prepare the EPX² for calibration, remove the screw-on cap and connect the unit to your configuration equipment as shown in Figure 1.

Unit Connections and Controls. The EPX² 3-wire units are connected to the conduit and wire inside the unit.

The two controls are also located inside the unit housing under the screw-on cap. They consist of two potentiometers, each accessed through the front panel. They are labeled “zero” and “span”. The zero potentiometer provides a control range for offsets of $\pm 10\%$ of rated unit span, while the span potentiometer adjusts unit full-scale output to 100 percent of rated span.

To adjust the potentiometer move its wiper from one extreme to the other: clockwise for maximum, or counterclockwise for minimum values. Each is equipped with a slip clutch to prevent damage if the adjustment is turned beyond the wiper stop.

Figure 1. EPX² Hook-Up Diagram



Note:

Always use clean, dry, instrument air when calibrating or operating the EPX².

All pneumatic lines used in calibration and operation must be purged prior to connection to the unit. Any condensation or oil residue in the lines, if introduced into the pneumatic chambers of the unit, may result in poor unit performance.

Calibration Process

To perform the recommended bench-check for the EPX², first perform the setup as described in the next section. See Figure 1 for illustration of the Calibration Setup, then follow the steps under *Calibration Setup* and *Calibrating the EPX²*.

Calibration Setup

1. Connect 1/4-inch pneumatic tubing between the appropriate output port of the regulated instrument air supply and the pressure gauge #1 (accuracy of $\pm 2\%$ of span). Connect another tube from the pressure gauge to the port labeled "IN" on the EPX².
2. Connect 1/4-inch pneumatic tubing between the port labeled "OUT" and the appropriate port of pressure gauge #2 (accuracy of $\pm 0.1\%$ of span), then from gauge #2 to the appropriate pneumatic load.
3. Run voltage source wiring through conduit opening in housing.
4. Connect the positive lead of your adjustable voltage source (white wire) to the +IN terminal of the unit. Connect the negative input source lead (black wire) to the -IN terminal. Connect the positive lead of the power source (red wire) to the +DC, and the negative lead of the power source (black wire) to the DCC. A multimeter may also be connected to verify level of voltage input.
5. When connections are complete, apply an input voltage of 0% of span (i.e. 1Vdc).
6. Apply appropriate filtered, instrument-quality air to supply line: 20 or 35psi (1.4bar to 2.4bar). Verify appropriate supply pressure by checking Supply Pressure field of unit model number.
7. Allow approximately 30 seconds for calibration setup to stabilize.

Calibrating the EPX²

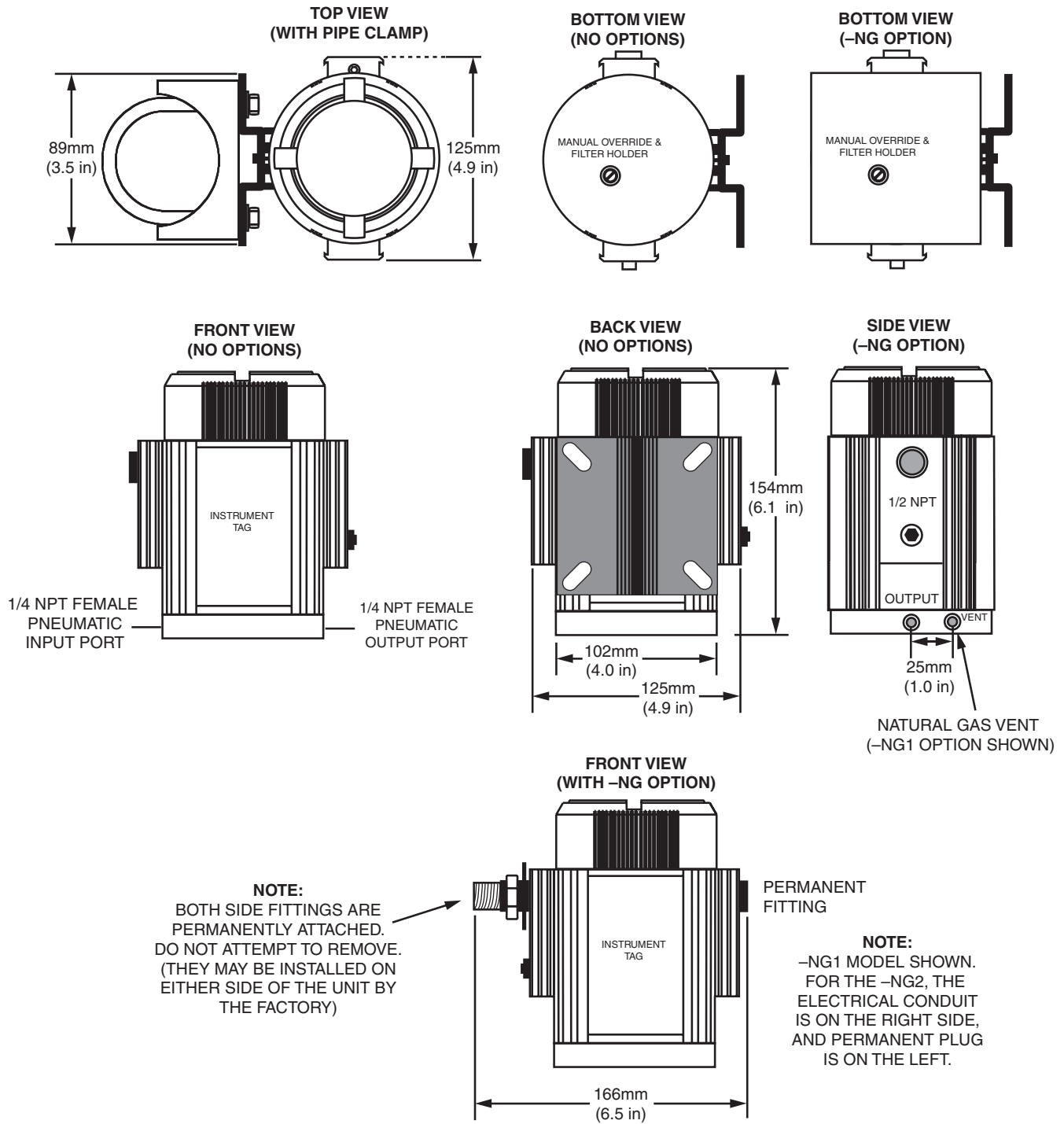
This calibration procedure consists of a basic check and adjustment of unit zero and span, based on the reading of pressure gauge #2. To calibrate, perform the following:

1. Check unit zero setting. Monitor reading of pressure gauge #2 (output), and turn zero potentiometer counterclockwise to lower output, clockwise to raise output. Set zero potentiometer so that pressure output is at 0% of span when a current input of 0% of span is applied (i.e. 3psi for a 3-15psi unit).
2. Check unit span setting. Increase input to 100% of rated span (i.e. 5Vdc).
3. Monitor reading of pressure gauge #2 (output), and adjust span potentiometer so that reading is at 100% of span for your unit (i.e. 15psi for a 3-15psi unit).
4. Repeat steps 1 through 3 until the unit outputs 0% of rated pressure range at 0% current input, and 100% of output pressure range at 100% of span.
5. Verify the accuracy of your adjustments by inputting 0%, 25%, 50%, and 75% of span inputs, and monitoring the output.

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Figure 2. EPX² Voltage-to-Pressure Transmitter Housing Dimensions



Installation

The installation of the EPX² is carried out in three phases: the physical mounting of the unit, the electrical connections phase and the pneumatic connections phase. It is strongly suggested that each unit be calibrated according to the instructions in this manual before being placed into service.

Phase One: Mounting

Figure 2 gives the dimensions of the EPX². The illustrations also give the dimensions of the available option hardware, which is recommended for most installations. After placing the unit in the desired location and orientation, secure the housing with the optional pipe mounting hardware or other appropriate fasteners.

The EPX² may be installed at any angle—either surface-mounted or attached to pipe or round conduit. However, if water entering the unit is a consideration the EPX² should be mounted with at least one vent on a low side. The EPX² with natural gas (–NG1 or –NG2) option does not have an open vent, so water is not a consideration.

Phase Two: Electrical Connections

Connect the positive lead of your adjustable voltage source (white wire) to the +IN terminal of the unit. Connect the negative input source lead (black wire) to the –IN terminal. Connect the positive lead of the power source (red wire) to the +DC, and the negative lead of the power source (black wire) to the DCC. A multimeter may also be connected to verify level of voltage input..

Caution:

When connecting the EPX² Natural Gas (–NG1 or –NG2) model, use an appropriately certified conduit box and wire connectors. Do not attempt to remove the seal fitting. For input source, connect the positive lead (+) to the white wire from the seal fitting, and the negative lead (–) to the black wire from the seal fitting.

Note:

*+Power is connected to the DC red wire.
–Power is connected to the DCC black wire.*

Use shielded, twisted-pair wiring for low-level input. Ground the shielding wire as close as possible to the installed unit.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making any other connections.
- All input signals to, and output signals from, Moore Industries' products should be wired using a shielded, twisted pair technique. Shields are to be connected to an earth or safety ground at the unit itself. Ground only one end of the shield.
- The maximum length of unshielded input and output signal wiring should be 2-inches.

Power Sourcing Parameters for General Locations, Intrinsically Safe, and Non-Incendive/Type N applications

In accordance with IEC 1010.1 Annexes F.2.1 and H (all models) or any equivalent international standard, the input terminals must be connected to and/or supplied from a certified energy limiting Class 2 or a Separated Extra Low Voltage (S.E.L.V.) power supply separated from all mains by double/reinforced insulation.

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Phase Three: Pneumatic Connections

To complete the final phase of installation, connect the supply line to the ¼-inch NPT female port labeled “IN”. Connect the output line to the ¼-inch NPT female port labeled “OUT”. All tubing must have at least 6mm (¼-inch) inside diameter or the maximum flow will be limited.

Note:

*Seal all fittings with Teflon[®] tape, or equivalent.
Always purge all tubing and the controlled device
before connecting the EPX².*

Manual Override Screw

If you are in a potentially explosive environment and do not want to apply electric power to the unit with the cover removed, the pneumatic installation may be tested by loosening the manual override screw on the bottom of the unit. The output pressure will go to the supply pressure. Be sure to tighten the manual override screw after test.

WARNING:

*EPX² units installed in a natural gas application **must** have the natural gas vent properly connected. Follow the directions below to install an EPX² with –NG1 or –NG2 options into a natural gas application.*

Natural Gas Applications

Customers using the EPX² with –NG1 or –NG2 options to regulate a sweet natural gas application (H₂S levels are not to exceed 20ppm) must also make the vent port connections. Connect the Natural Gas Vent (shown in Figure 2) to a device prepared to receive natural gas. After connection, the fittings, cover and filter/test screw should be tested for leaks.

For an outdoor system, ventilation should consist of a weather-proofed connection between the transmitter exhaust and a riser, six feet above the transmitter and control valve assembly. The riser should be shepherd-crooked to prevent rain or incident water from accumulating at the base. In accordance with local safety regulation, an in-line flame arrestor should be applied to the riser to prevent flash back to the transmitter from an external, spontaneous flame source.

For an indoor system, ventilation must consist of a leak-proof connection from the exhaust of the transmitter to a process vent. The process vent should already be dedicated for natural gas excursions and should conform to all standards for flaring or after-burn, and flame arrest, as dictated by local environmental and safety regulations.

Indoor natural gas operations are typically monitored to maintain safety conformance outside the lower and upper explosion limits (LEL and UEL). To add a natural gas operated transmitter in these cases, consideration should be made as to the extent of natural gas leak detection legacy to the installed transmitter. Placement of the transmitter should be such that detection and alarming surround any critical connections between the transmitter and the natural gas process.

If the natural gas driven transmitter is to be installed indoors with no legacy monitoring capabilities, additional consideration must be made to ensure the operating area is well-ventilated and the transmitter can be exhausted to a process vent. Furthermore, monitoring with remote annunciation within LEL and UEL should be projected as an upgrade to the facility, concurrently with this installation. The transmitter installation must adhere to local environmental and safety regulations.

WARNING:

EPX² units installed in a natural gas application must have the natural gas vent properly connected. Failure to do so may result in an explosion. The –FR1 option is not suitable for flammable gas use. A filter-regulator suitable for natural gas use without a vent may be used. For natural gas certification to be valid, the vent system must be able to maintain <1psig.

Filters. The EPX² requires filtered, dry, regulated, instrument-quality air to prevent clogging and to ensure extended periods of maintenance-free operation. 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 – A combined filter/regulator assembly, the -FR1 Option, offered as an accessory for the EPX², removes particles down to 0.01 microns, supplying regulated, instrument-quality air to the unit. This space-saving module is affixed to the supply port, and comes with a pressure gauge scaled in both psi (0-60) and bars (0-4).

Operation

Once the unit has been configured and installed, it operates unattended with the exception of the minor maintenance procedures that are described in the next section.

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 EPX² during operation. Depending upon the purity of the air supply, the unit's internal assembly may have to be removed and cleaned to ensure continued optimum performance.

Initially, random checks can help establish a satisfactory internal maintenance geared to the user's air supply cleanliness. Refer to the next section for instruction on the disassembly and cleaning of your unit.

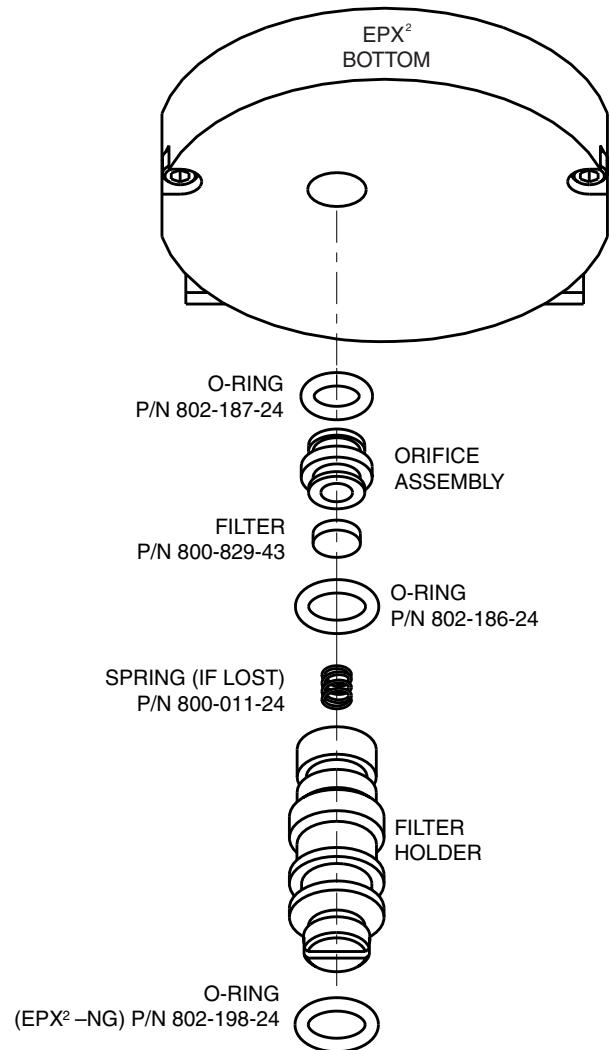
Maintenance

For most applications, no maintenance outside of routine inspection and calibration of the EPX² will be necessary. These units are designed to work unattended for up to six months with little change in accuracy.

Occasionally, a unit will become clogged when its air source becomes contaminated. An internal filter will prevent the control orifice and nozzle from being clogged. To replace the filter, you will need to order the filter and two (for EPX²) or three (EPX² –NG1 or –NG2) o-rings from Moore Industries, (see Figure 3 for part numbers) then follow the instructions below. This filter is not intended to replace any of the filters described in the *Installation* section.

Use a screwdriver to remove the filter holder from the bottom of the unit. Remove the orifice assembly and filter from the filter holder, taking care not to lose any of the parts. Replace the filter and o-rings in the filter holder. Screw the filter holder back into place. If this is an EPX² unit with –NG1 or –NG2 options and is being used in a natural gas application, you will also want to test for natural gas leaks at this time.

Figure 3. Filter Replacement Diagram



Note:

After maintenance, the EPX² should be recalibrated before it is returned to service. Refer to the *Calibration* section of this manual for instructions.

Drain Check. System filters (not EPX² filters) have automatic drains that depend on the fluctuation of system pressure to induce drainage. A stable system may not drain efficiently. Check periodically for clogs and drain system's filters by pushing the drainage valve with a small probe or wire.

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Troubleshooting the EPX²

Many components of the EPX² have been thermally aged, tested and selected. This usually makes field repair unnecessary.

It is recommended that any properly maintained unit found to be performing below specifications 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 EPX², 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 unit.
3. If the response time lengthens, or if the span drops, check the system for a blockage due to air supply contamination.

The complete valve assembly can be removed from the housing for replacement without disturbing the connections to the housing. Contact customer service for details.

Customer Service

If service assistance is ever required for your EPX², refer to the back cover of this manual for the telephone numbers to Moore Industries' STAR Center customer service department.

If possible, make a note of the model number of the offending module before calling. For the fastest assistance, try to gather information on the unit(s) serial number and the job and purchase order number under which it was shipped.

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.

WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES. BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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The information contained within this document accompanies the EPX² User's Manual, 170-765-00A.

When using the –NG1 and –NG2 options for natural gas applications, ensure that the electrical conduit is sealed within 18 inches of the EPX² in order to prevent gas from leaking into the conduit.