

A major challenge facing the natural gas production and transport industries is that they are often located in extremely remote locations. Natural gas gathering stations, compressor stations, pipeline feed applications, and booster stations all involve the operation of pneumatic control valve actuators that require a pneumatic supply for operation.

However, at these remote locations, the air demand is not large enough to warrant the significant costs of installing, operating and maintaining an on-site air compressor.

The Problem: Off-the-Shelf I/Ps Present Dangerous Safety and Liability Concerns

The traditional answer is to use natural gas from the pipeline to provide the operating pressure required by the pneumatic valve's current-to-pressure (I/P) transmitter. The I/P transmitter (often referred to as an I/P transducer or converter) is needed to convert an electrical signal, typically a 4-20mA from a DCS or PLC, to a proportional pneumatic signal, such as 3-15psig, for valve actuator control (Figure 1).

The threat is: Off-the-shelf I/P transmitters are not approved, designed or intended to use natural gas as their pneumatic supply. While they are often called upon to perform this duty, they are dangerous because inappropriate seals on their electrical conduit wiring fitting can permit natural gas to migrate into the conduit, leak to atmosphere, or leak into non-hazardous areas where the presence of gas could cause a potential fire or explosion hazard. Improper venting of an off-the-shelf I/P's exhaust gases, often caused by inappropriate pneumatic connections, can also lead to dangerous conditions.



Approved for Natural Gas!



Class I, II & III, Divisions 1 & 2, Groups A-G
EEx ia IIC & EEx d IIC (Zone 0 & 1)

Until now, there was no other choice but to rely on I/P transmitters that were not technically agency approved and designed for use in hazardous 'classified' natural gas applications. This presents a huge liability problem, and worse, a severe safety problem.

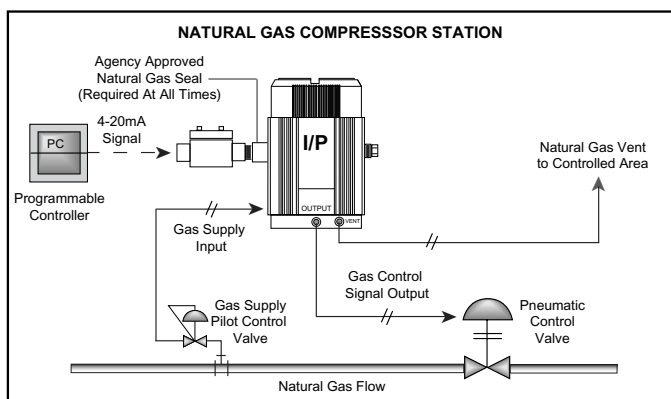
The Solution: An I/P Designed to Accept Natural Gas as Its Pneumatic Supply

Moore Industries has solved this predicament by developing the first I/P transmitter, the model IPX² (with the -NG option), that is CSA, FM and KEMA (ATEX) approved to be used with natural gas as its pneumatic supply.

The I/P can be used with sweet natural gas consisting of up to 20ppm of hydrogen sulfide (H₂S). **Approvals allow installation in Explosion-Proof and Intrinsically Safe applications covering Class I, II, III, Division 1, Groups A-G. The IPX2 is also suitable for installation in Class I, Division 2, Groups A-D hazardous 'classified' locations, with IP66 and NEMA 4X environmental protection ratings.**

Moore Industries' solution involves special conduit seal and gas venting methods. The nipple and seal

Figure 1. The IPX² Current-to-Pressure Transmitter provides an interface between electronic control systems, such as a DCS or PLC, and a pneumatic control valve actuator.



CSA, FM and KEMA (ATEX) Approved I/P Transmitter Prevents Dangerous Conditions in Hazardous Natural Gas Applications

assembly prevents natural gas from traveling into the electrical conduit or into the atmosphere. To accomplish this, the seal must be designed in a way that absolutely prevents natural gas from migrating into the instrument's wiring conduit. This includes gas traveling through the small space between the copper wires and its insulation, and escaping on the outside of the wires into the conduit. The seal must also positively prevent gas from escaping into the atmosphere from the conduit connection.

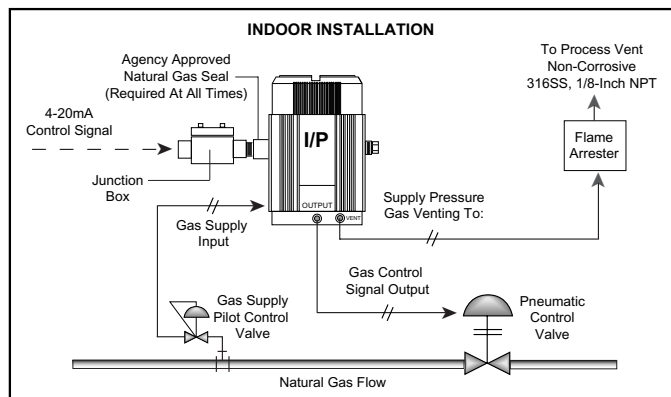
Most I/P transmitters have small, built-in vents that are used to release the air which powers the unit into the atmosphere. In a natural gas application, such as one in an enclosed compressor station, this is (of course) unacceptable. The gas must be released into a controlled area, often far away from the application. The IPX² solves this problem by providing a vent port where piping can be connected to transport the explosive gases to an area where they can be safely vented as required.

Indoor Installation

Indoor natural gas operations are typically monitored to maintain safety conformance outside Lower Explosive Limits (LEL) and Upper Explosion Limits (UEL). Placement of the transmitter should be such that detection and alarming surround any critical connections between the transmitter and the natural gas process (Figure 2).

Recommended ventilation for an indoor system should consist of a leak-proof connection from the exhaust of the transmitter to a process vent. The process vent should already be dedicated to natural gas operations and should conform to all standards for flaring, after-burn, or flame arrest, as dictated by local environmental and safety regulations. If the installation site maintains no monitoring capabilities, additional considerations must be made to ensure the operating area is well ventilated and the transmitter can safely be exhausted to a process vent.

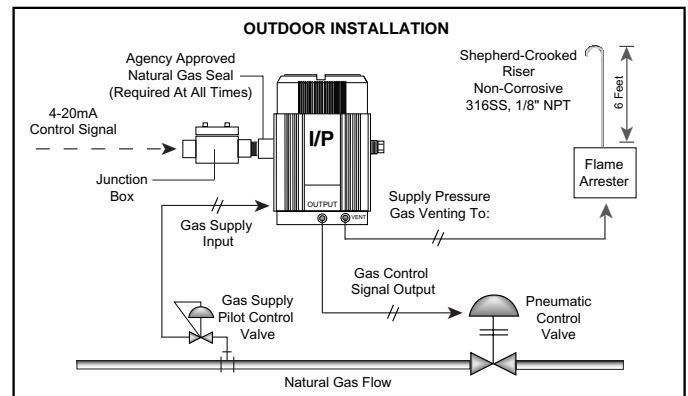
Figure 2. Recommended ventilation for an indoor system consists of a leak-proof connection from the exhaust of the transmitter to a process vent.



Outdoor Installation

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 inline flame arrestor should be applied to the riser to prevent flash back to the transmitter from an external, spontaneous flame source (Figure 3).

Figure 3. When venting a natural gas application outdoors, use a shepherd-crooked riser, six feet above the transmitter and control valve assembly, to prevent water accumulation at the base. In case of vapors igniting, the inline flame arrestor allows the vapors to burn harmlessly within its parameters, while preventing further ignitions or possible explosions.



Proper Installation Practices Are Essential

When applying any instrument in general or hazardous areas, it is vital that proper installation practices be observed in order to avoid unsafe and dangerous circumstances.

APPLICATIONS 1 through 6 illustrate six installation scenarios for the IPX² with the Natural Gas (-NG) option in General/Ordinary, and Hazardous (Division 1 and Division 2) classified areas.

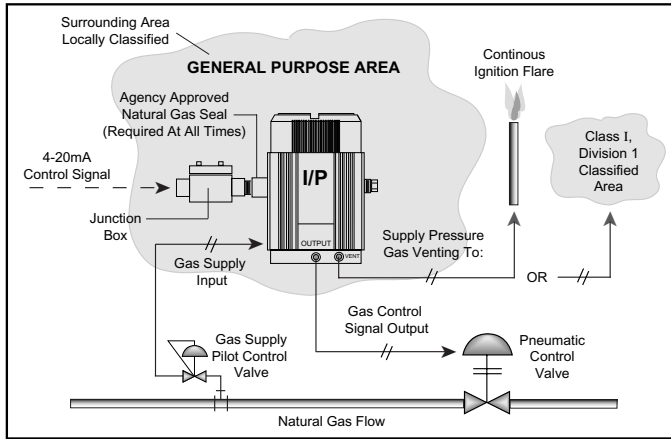
IMPORTANT INSTALLATION NOTES

NOTE 1: In all installations, the IPX² with the Natural Gas (-NG) option is approved as a Class I, Division 1 enclosure, and the electronics are Intrinsically Safe (Ex ia IIC) as manufactured.

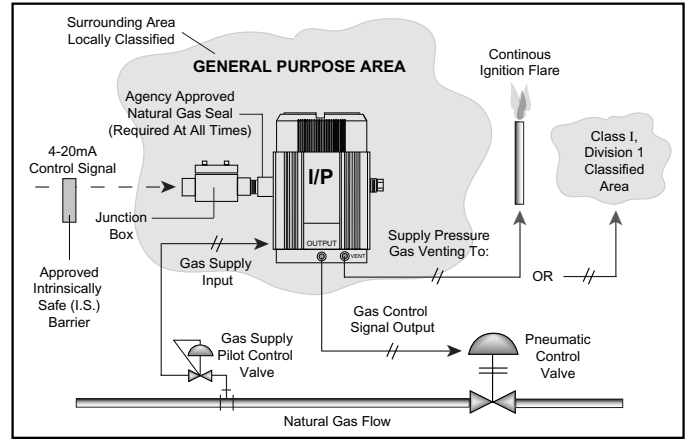
NOTE 2: In all installations, the interior chambers of the IPX² with the Natural Gas (-NG) option have constant natural gas present and are always classified as a Class I, Division 1 hazardous area

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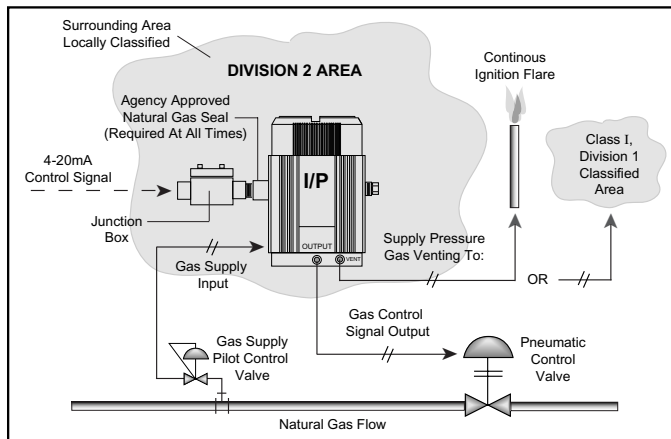
APPLICATION #1—Explosion-Proof Installation in General Areas*



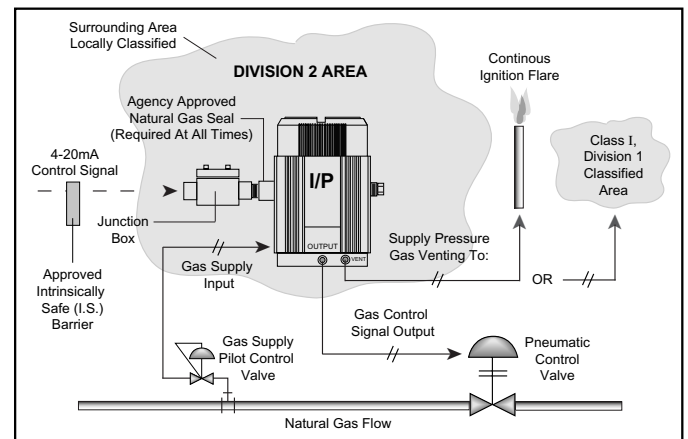
APPLICATION #4—Intrinsically Safe Installation in General Areas*



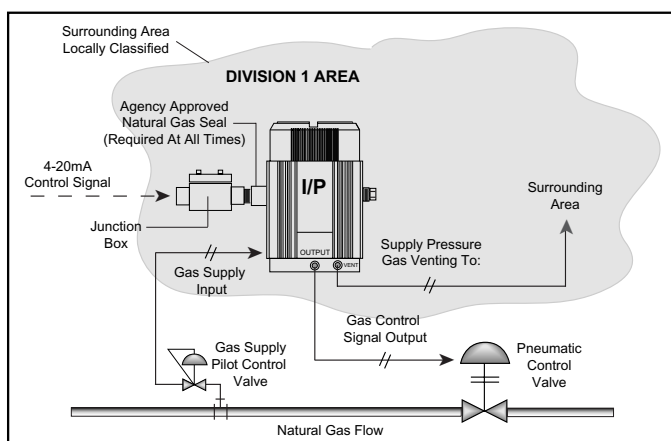
APPLICATION #2—Explosion-Proof Installation in Division 2 Areas*



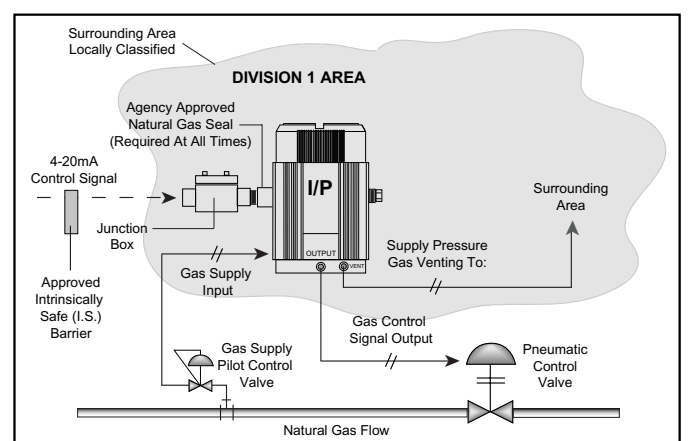
APPLICATION #5—Intrinsically Safe Installation in Division 2 Areas*



APPLICATION #3—Explosion-Proof Installation in Division 1 Areas*



APPLICATION #6—Intrinsically Safe Installation in Division 1 Areas*



* See "IMPORTANT INSTALLATION NOTES" on Page 2.

CSA, FM and KEMA (ATEX) Approved I/P Transmitter Prevents Dangerous Conditions in Hazardous Natural Gas Applications

Lower Emission Benefits

Moore Industries is a proponent in developing products that are safer for the environment and more cost-efficient for the end-user. The IPX² conforms to environmental regulation as a low emission device, well under 6 SCF/hour and provides a better alternative to high emission legacy transmitters. This is especially important to companies that implement practices to reduce natural gas emissions, and those that are members of a formal program such as the U.S. Environmental Protection Agency Natural Gas STAR Program.

Features

- **Approved for Natural Gas.**
Special design, construction and materials allow the IPX² with the Natural Gas (-NG) option to be CSA, FM and KEMA approved to use sweet natural gas as its pneumatic supply.
- **Wide variety of input and output choices.**
Available with 4-20mA or split range inputs, and 22 direct and reverse output ranges. Custom ranges are also available.
- **Low air consumption and high output volume.**
The IPX² outputs as much as 5SCFM and consume as little as 0.08SCFM.
- **Accurate and stable.** Featuring exceptional $\pm 0.25\%$ of span accuracy and six-month stability, they are ideal for precise applications in difficult to access locations.
- **Immune to supply pressure variation.** Maintain incredible accuracy even when the supply pressure fluctuates between 20 and 40psig.
- **Clog Resistant Filtered Nozzle and Orifice.** A larger orifice, combined with an easily replaceable internal filter protects against clogging caused by debris.
- **RFI/EMI protection.** Special circuit and enclosure designs protect against the harmful effects of radio frequency and electromagnetic interference.



Compact, rugged, and highly accurate, the IPX² is ideal for installation in harsh field environments (model that uses instrument air shown in this photo).

Handles Instrument Air Supplies Too!

The IPX² is offered in a rugged field-mount metal enclosure that stands up to installation for a variety of field conditions. In addition to natural gas, available models handle standard instrument air supplies. The IPX² offers 4-20mA, 4-12mA, and 12-20mA inputs with 22 direct and reverse output choices including 3-15psig, 15-3psig, 0.2-1Bar, and 20-100kPa.

For installation in harsh weather conditions, the transmitter is rated to operate in very low, and very high, ambient conditions between -40°C to $+80^{\circ}\text{C}$ (-40°F to $+176^{\circ}\text{F}$). The IPX² delivers accuracy of $\pm 0.25\%$ of span; high air capability of 5SCFM; and offers excellent immunity to the harmful effects of RFI/EMI and vibration.



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