IMI

Precision Engineering

Energy sector solutions

Reliable solutions in the most demanding applications.

IMI NORGREN®

IMI BUSCHJOST®

IMI HERION®

IMI MAXSEAL®

Contents

Innovation, products and service

Engineering GREAT solutions through people, products, innovation and service

IMI Precision Engineering is a world-leader in fluid and motion control. Building close, collaborative relationships with our customers, we gain a deep understanding of their engineering needs and then mobilize our resources and expertise to deliver distinctive products and solutions.

Wherever precision, speed and engineering reliability are essential, our global footprint, problem-solving capability, and portfolio of high performance products enables us to deliver GREAT solutions which help customers tackle the world's most demanding engineering challenges.

> **Reliability**
We deliver and support our high quality products through our global service network.

> **High performance products**
Calling on a world-class portfolio of fluid and motion control products including IMI Norgren, IMI Buschjost, IMI FAS, IMI Herion, and IMI Maxseal. We can supply these singly, or combined in powerful customized solutions to improve performance and productivity.

> **Partnership & Problem Solving**
We get closer to our customers to understand their exact challenges.

Production

Transportation

Refining

Petrochemical

Chemical

Power Generation

Setting the standard for safety, reliability and performance

IMI Precision Engineering has over 80 years experience in providing oil, gas and chemical solutions that are proven in safety, reliability, and durability in the most extreme environmental and operating conditions around the globe.

With world-class product ranges including IMI Norgren, IMI Buschjost, IMI Herion, and IMI Maxseal, our products are designed to work effectively in aggressive environments and extreme temperatures and meet international standards such as:

- ATEX
- TÜV
- TR-CU
- INMETRO
- CSA
- KOSHA
- DVGW
- FM AND UL
- NEMA

At the heart of our offering to the Energy sector are stainless-steel solenoid valves and air preparation equipment (filters, regulators and filter/regulators), pneumatic and hydraulic pressure switches, I/P and E/P convertors, 2/2 way and 3/2 way process valves and Redundant Valve Manifold (RVM) systems.

Our work with leading national and international oil and gas companies and global suppliers means that we talk our customers' language, and can bring specialized experience about legislation, standards and specifications.

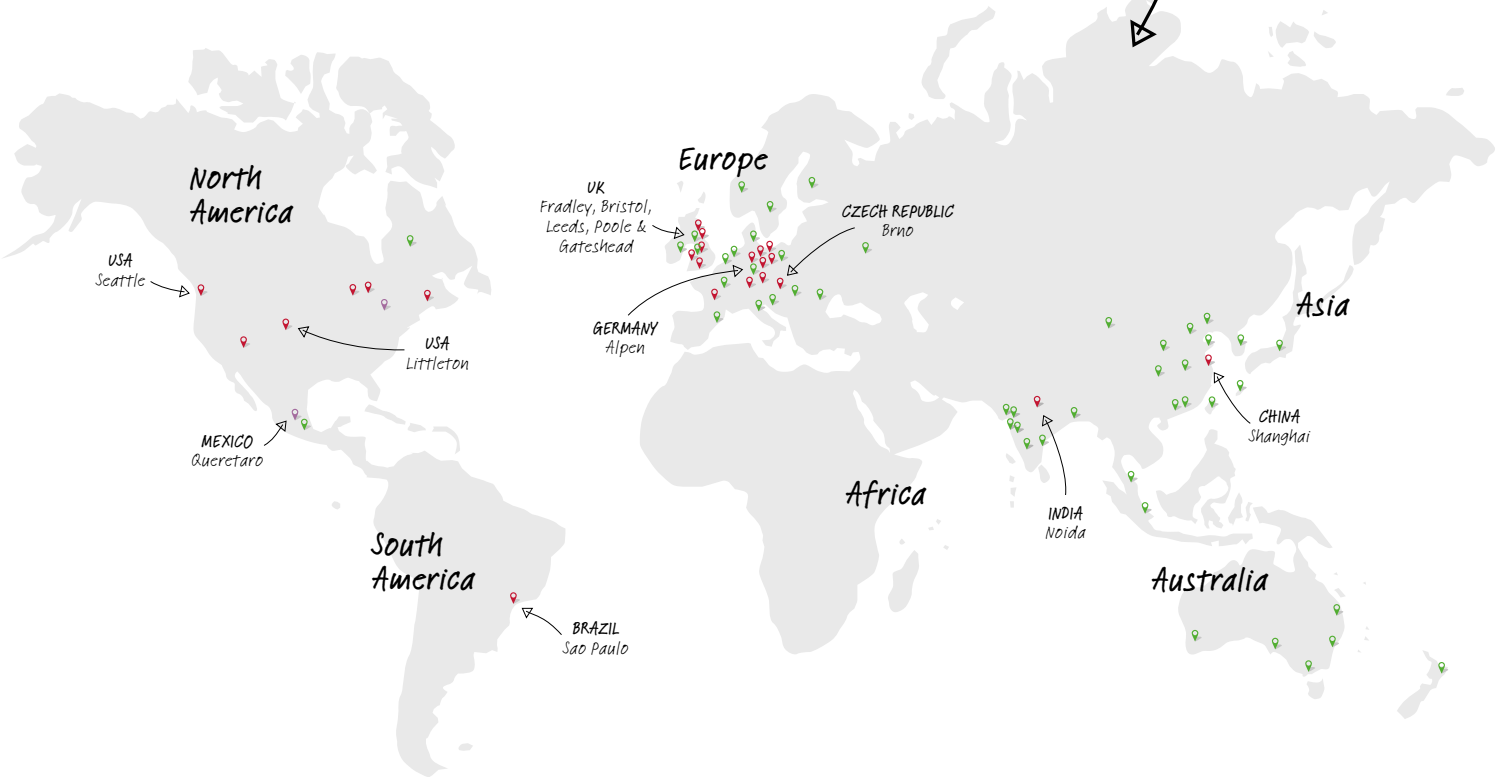
Our Reach
Global manufacturing and support

> We have a global network of technical centers close to our key markets where skilled and experienced design and development engineers produce custom-built solutions to give our customers competitive advantage.

> With established manufacturing facilities globally we have the manufacturing and support capabilities to be able to cope with the most demanding international projects.

> With an established sales and service network in 75 countries,we have the reach and capability to ensure continuity of supply and local support where it is needed.

Sales and manufacturing facilities in 75 countries give us the global reach, understanding and capabilities that customers look for



Sales & Service in 75 countries

- Sales, manufacturing and technical centers
- Sales locations
- Manufacturing locations

Expertise in the oil, gas & chemical sector

The IMI Precision Engineering Energy product offering covers a wide range of applications, in many of the processes all the way through onshore and offshore extraction to distribution. With references from some of the players in the industry, we have proven expertise and reliability.

Upstream solutions

IMI Maxseal is an extremely high quality range of stainless steel solenoid valves, designed and manufactured with reliability and integrity in mind. IMI Maxseal valves have performed exceptionally well in harsh environments all across the world for over 50 years.

These products are traditionally associated with offshore oil and gas applications and coastal environments where a fully stainless steel construction is advantageous.

IMI Maxseal valves are in operation at all the big international oil companies, and most of the significant nationals.

- Global certifications including SIL, ATEX, IECEx, TR-CU, CSA, CCOE, FM & Inmetro
- Suitable for SIL / Safety Instrumented Systems
- Reliable & resilient in hazardous environments
- Low power options
- Pneumatic & hydraulic options

Downstream solutions

Safe and reliable operation in chemical and petrochemical applications is increasingly vital to plant operations.

Our extensive range of high performance products includes the world-leading IMI Herion pilot and control valves, created specifically for the chemical and process industries.

- Global certifications including SIL, ATEX, IECEx, TR-CU, CSA, CCOE, FM & Inmetro
- High functionality
- Energy saving modular solenoid systems
- Compact design
- Resilient in hazardous environments

Solenoid valve technology

IMI Precision Engineering offers a number of safe, reliable and cost-effective integrated solenoid valve solutions for actuation control in upstream and downstream applications including the control of process pneumatic actuators and the control and handling of neutral and aggressive gases and liquids. Our valves are typically manufactured with stainless steel housings and Ex-proof coils, with a broad choice of materials for seals to suit the environmental and application specifications.

Our high integrity valves have:

- A field proven track record
- 10 year service interval (6 years to maintain SIL 3)
- Wide range of flow and function options
- Stainless Steel, Aluminum or Brass construction options
- Industry leading Force Friction Ratio (FFR)
- Cable terminations inside coil - No additional Ex terminations required
- Rated for 100% duty
- Wide temperature range -76°F to 248°F (-60°C to 120°C)
- International approvals
- SIL approved

Force friction ratio

The critical safety element of a solenoid valve is its Force Friction Ratio (FFR). The FFR is a measure of the relationship between the force presented by the spring return mechanism and the frictional resistance within the valve. In basic terms, the higher the FFR, the more likely the valve is to operate when demanded, as the spring will have a force in excess of the friction.

Poppet design solenoid valves generate much lower friction than spool design solenoid valves, and this advantage is greatly enhanced at extreme temperatures – both hot and cold.

IMI Maxseal and IMI Herion solenoid valves offer an FFR of 10 - the highest in the industry.

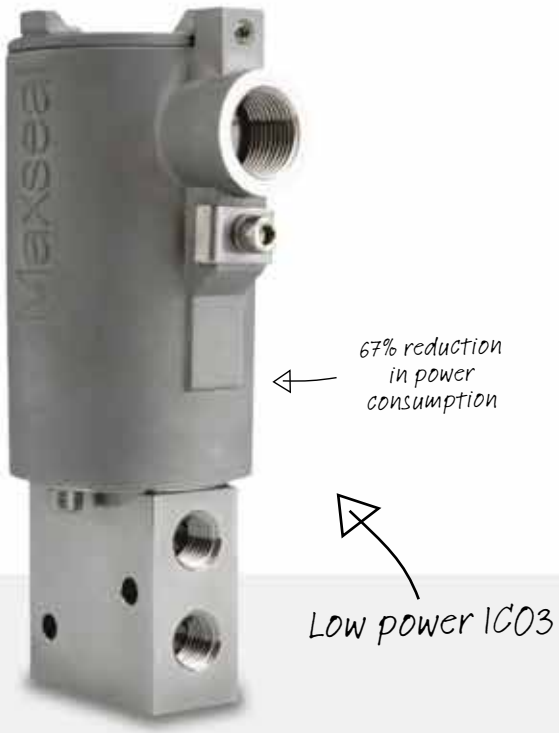
Low Power ICO3 Valves

The Low Power ICO3S range of direct acting solenoid valves provide a low power option for high-flow instrument change over applications. With a nominal steady state power consumption of 1.0W, the Low Power ICO3S exhibits a 67% reduction in steady-state power consumption when compared to the standard ICO3S, while retaining identical flow and safety integrity level due to an uncompromized 11 lb (5 kg) spring-force and associated high force/friction ratio.

Unlike many other Low Power valves, the IMI Maxseal Low Power ICO3S does not achieve reduced energy consumption though a weakened return spring or internal piloting. Instead, the valve uses an integrated PWM driver to regulate the power delivered to the coil. The benefit of this approach is that internally the valve is in all ways identical to a standard ICO3S.

The Low Power ICO3S has been developed for applications where power supply is at a premium, such as remote shale gas installations. Often such installations are renewable, generator or battery powered, and as such, a power consumption of just 1.0W per valve makes the Low Power ICO3S the solenoid valve of choice, particularly where safety is paramount.

- Full 316L Stainless Steel construction
- IP66/X8 ingress protection
- Saves 650kWh over 25 year life (compared with standard 4w valve)

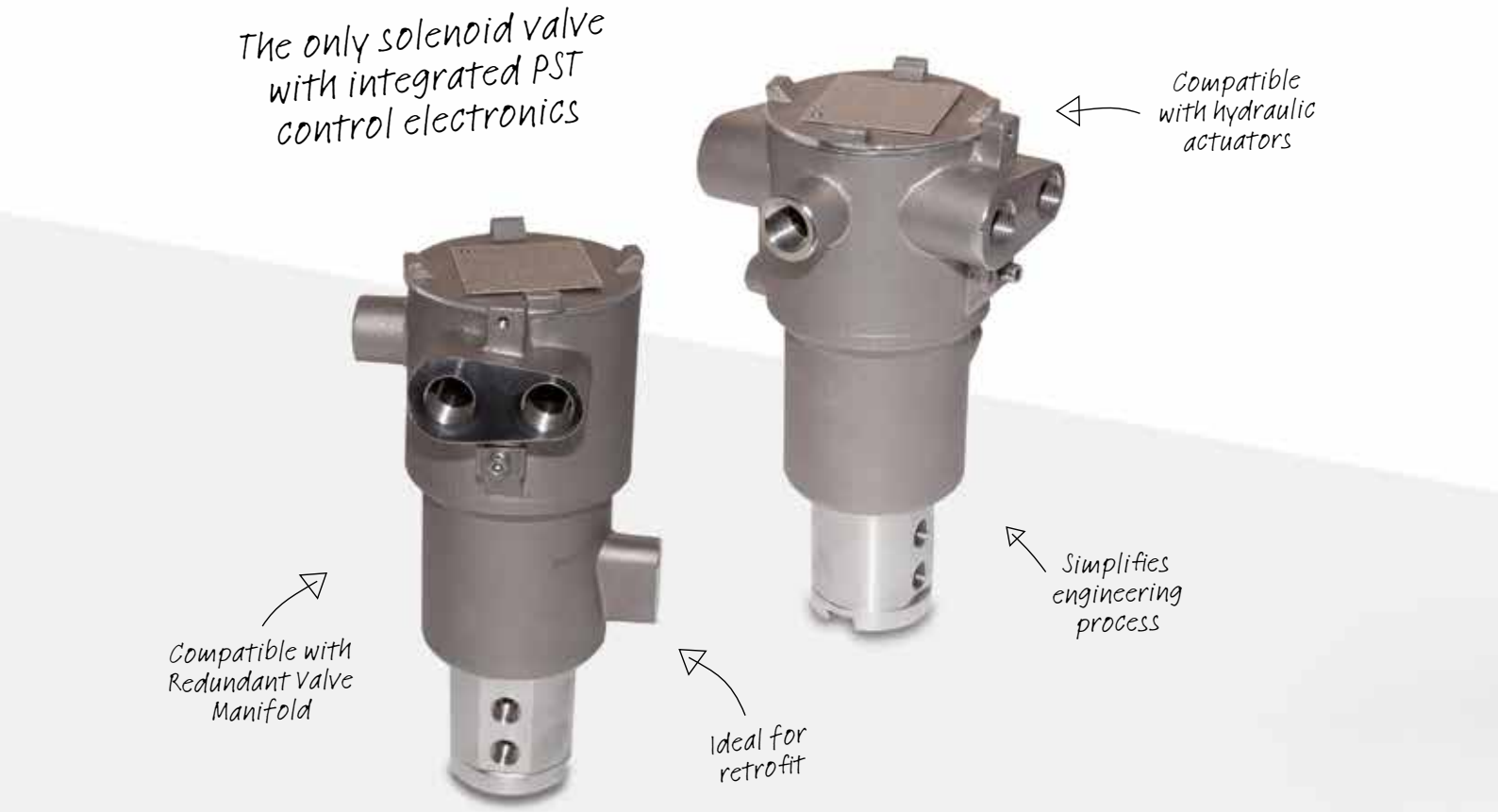


Introducing ICO4-SIS
The first smart solenoid valve with fully integrated partial stroke testing

Working closely with customers in the global oil and gas industry, we see the need for a no compromise solution for partial stroke testing. It is clear that the best way to eliminate the compromises of positioner systems is to use the control mechanism of the electronic solution; while the best way to eliminate the compromises of the electronic solution is to employ the packaging of the positioner system. Now add to this the benefits of using a high integrity solenoid valve and we are left with a clear path – namely, the integration of the PST control electronics into the termination housing of a high integrity solenoid valve.

The ICO4-SIS is the first fully integrated partial stroke testing solution with the control system built into the market leading IMI Maxseal ICO4 high integrity solenoid valve. With the lowest safe and dangerous failure rates of any intelligent PST system on the market and always providing the highest possible Diagnostic Coverage, the best possible SIL performance is guaranteed.

- No dedicated PST device required, significantly reduces engineering requirements
- High level diagnostics with position, pressure and time monitoring
- Simple Pass/Fail reporting
- Dual override mechanism eliminates possibility of over-stroke
- Compatible with valve speeds from 2 to 120 seconds
- SIL 3 certified as 1oo1
- -40°F to 158°F (-40°C to 70°C)
- Local testing using HART 475 communicator, remote testing via HART



ICO4-SIS
The flexible solution

Another product of our innovation and technical excellence, the ICO4-SIS is reliable and flexible, and can be designed to your specification. Manifold options are available depending specific environmental and application requirements.

- Solenoid configurations
  - > 1oo1, 1oo2, 2oo2, 2oo3
- High flow rate Cv up to 6.0
  - > Reduces requirements for QEVs, pilot valves & boosters
- Actuator Types
  - > Pneumatic, hydraulic
  - > Spring return, double acting
  - > Quarter turn, linear
- Valves
  - > Ball, butterfly, gate, globe, HIPPS
- Valve Speeds
  - > 2s to 120s
- Operating temperature range
  - > -40°F to 176°F (-40°C to 80°C)
- Retrofit
  - > Ideal for retrofit applications due to engineering simplicity

Fully flexible manifold options available

RVM systems for oil and gas applications

Redundant valve manifold (RVM) systems

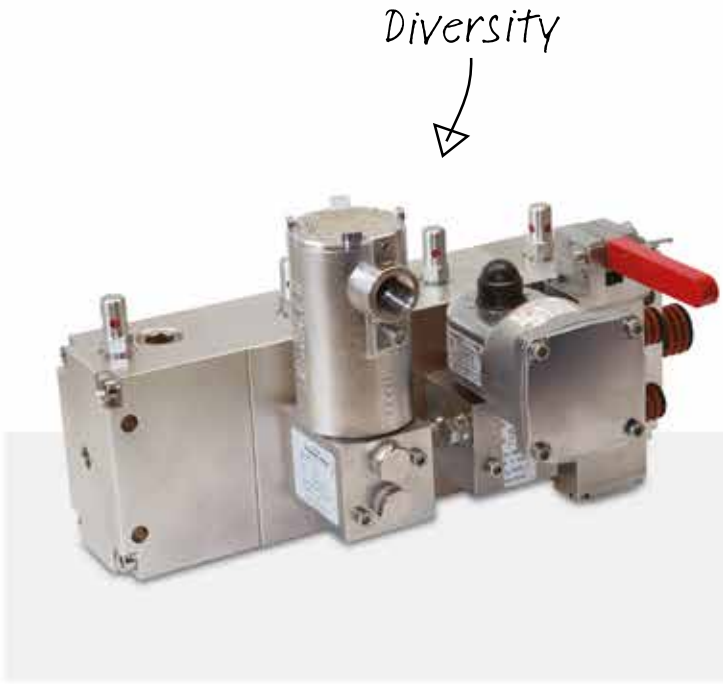
Redundant systems are required to increase uptime by ensuring the process continues to run in the event of a valve failure; or to increase safety by ensuring the process can be shut down in the event of a failure - or both.

The issues with existing solutions

- Current systems are hard piped systems, components bolted together on a back plate, or tie-rodded together
- The complete systems are not SIL certified
- Difficult to service and maintain
- Incorrect configuration can be dangerous
- Number of potential leaks
- No failure indication for valves and outputs

The RVM system solves these problems. Combining safety and availability in a single convenient package. Our RVM system offers simpler installation, helps eliminate unplanned shutdowns and is available in either aluminum or stainless steel to suit both upstream and downstream applications.

- System replaces components, panels and pipe work
- Available in aluminum or stainless steel construction
- Utilizing industry proven products and technology



- **Three design options - Compact, semi-modular, and modular**
  Reduces potential leak paths and installation time
  Mounted at the point of use next to the process valve
- **Compact design**
  Space saving with the smallest overall footprint
- **Modular design**
  Added benefit of a By-pass function enabling valve removal online, plus visual pressure indicators showing valve position status
- **Semi-modular design**
  Visual pressure indicators showing valve position status
- **Valve position sensors**
  Provide electrical feedback on the valve position status
- **Exhaust guards**
  Prevent moisture and particle ingress from the environment
- **Cable terminations inside coil**
  No additional Ex terminations required
- **SIL certified components enable complete SIL certified RVM systems**
  Ensures safe operation
- **International approvals**
- **Diversity option**
  Unique combination of valve technology from IMI Herion and IMI Maxseal on the same manifold

RVM system for chemical and petrochemical applications

V84-Compact RVM

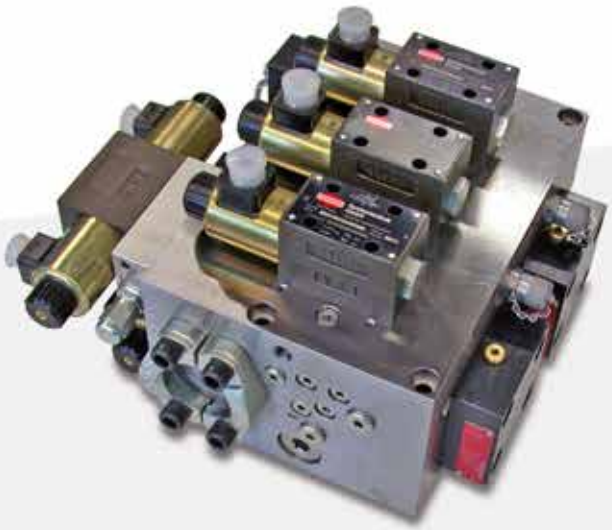
V81-Modular RVM with bypass

Hydraulic 2oo3 Fail Safe Trip System for Gas and Steam Turbines

The IMI Herion Hydraulic 2oo3 system provides safety and availability for main shut off emergency process valves with hydraulic actuators.

Using three identical solenoid valves to create a flexible 2oo3 voting logic for unequalled failure tolerance, the system uses redundant cartridges which allow high flow rate and a quick response time.

- Available for low and high operational pressure 72 to 4600 psi (5 – 320 bar)
- Different sizes provide high flow availability 53 to 1057 gpm (200 – 4000 l/min)
- Cartridges sizes DN 16; 25; 32; 40; 50 AND 63
- Fast reaction time
- Safety Control – direct monitoring of solenoid valves position closed/open (proximity switches)
- SIL 3 approval
- IP 65
- Certification to ATEX, GOST
- Redundant cartridges
- Partial Stroke Testing Option
- Maintaining Safety 2oo3 during operation (redundant 2oo3 system)
- Prepared outlets for pressure transducers



Instrument Air and Gas Preparation

Our air and gas preparation solutions protect sensitive and expensive instrumentation and controls from water, oil, or particle contamination.

Proper gas and air preparation can reduce or eliminate the number of unplanned shutdowns due to:

- Corrosion from condensates
- Clogging from particulates
- Seal softening and leakage due to attack from aggressive oils

High Pressure Regulation

Filter/regulators

IMI Norgren and IMI Maxseal 316 stainless steel filter/ regulators are specially suited for offshore applications

- 316 Stainless Steel for corrosive environments
- Suitable for instrument air or hydrocarbon gas

Filtration systems

3-Stage Filtration Systems

- Stage 1 – 25 µm particles, 70% water
- Stage 2 – 5 µm particles, 90% water
- Stage 3 – 0.01 ppm oil, submicron particles, trace moisture

Compressed air dryer systems with AMT technology

IMI Norgren's patented Adsorbent Media Tube (AMT) technology takes the best of current desiccant and membrane dryer systems, and eradicates the flaws associated with their short lifecycles, and the costs of regular replacement.

- It dries better than any current solution, no matter how extreme the environment
- It lasts up to 6 years, compared to 6-24 months, in most applications
- It's more reliable and far less maintenance
- Prevents unplanned shutdowns

A result of our expertise and deep experience in air preparation solutions, the AMT air dryer system is a far more effective, robust and reliable way of removing moisture and contaminants from compressed air in oil & gas applications.

Patented technology for improved performance:

- Service life of up to 18,000 hours (six years)
- Compact and flexible design, horizontally or vertically mounted
- Aluminum or stainless steel construction
- Typical dew point suppression of 104°F (40°C)
- Superior moisture uptake
- High energy efficiency
- Unaffected by saturation
- Faster regeneration
- Resistant to vibration
- No by-products produced

Natural Gas Solutions

Our market-leading products offer an extensive range of high quality components and complete system solutions to meet the specific requirements of the Compressed Natural Gas industry.

- Helping to increase energy efficiency
- Improving the environment by simplifying the delivery of CNG into vehicles and eliminating wastage
- Improving safety
- Solutions for CNG compressors and dispensers

Manifold solutions

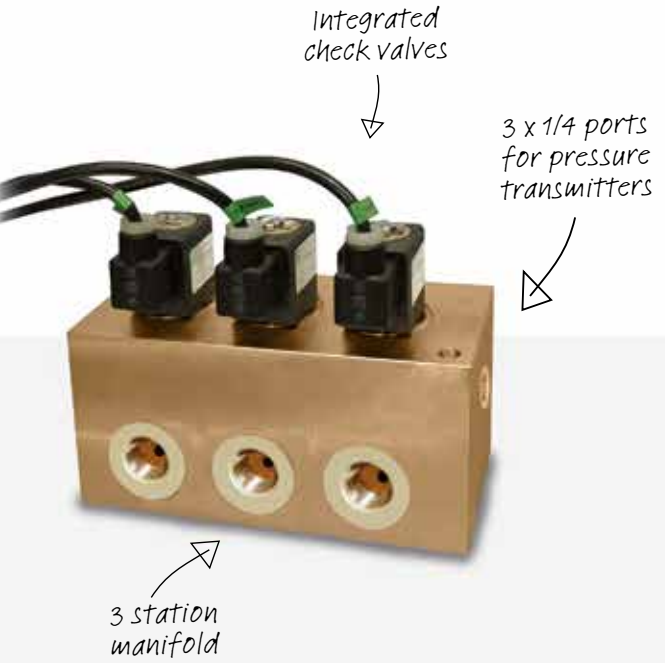
With 75 years' experience manufacturing sophisticated solenoid valves, we are confident in the reliability and performance of our products, and we are now providing value added solutions by incorporating our proven valve technology into customized valve manifolds to replace ball valves, rotatory actuators, and pilot solenoids in priority panels and dispensers.

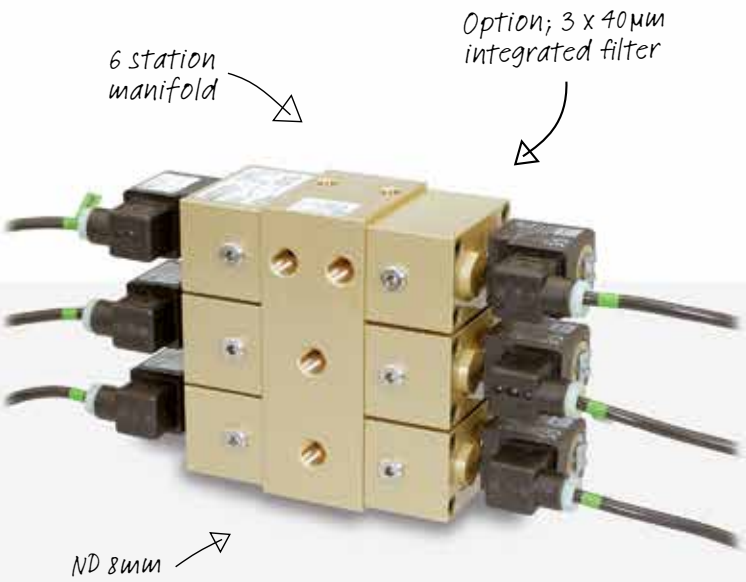
Three station manifolds

Solenoid valve manifold with integrated check valves which can be used in priority panels and even in a bus or truck dispenser.

Six station manifolds

Solenoid valve manifold with integrated check valves which can be used in a two sided small vehicle dispenser.





High pressure valves

With pressures up to 5076 psi (350 bar), we understand the need for valves to be safe, have very high levels of pressure integrity and to be reliable.

- Body Material: Aluminum, Brass or Stainless Steel
- PED: Compliant
- Mounting position: Horizontal or Vertical
- Interchangeable solenoids without the need for depressurization
- Temperature range from -40°F to 158°F (-40°C to 70°C)
- ATEX, IP65 and 97/23/EG approved

Pressure control solutions

Proven solutions for high pressure gas control on the outlet from the compressor and in downstream pressure reduction applications, such as in the dispenser.

- Pressure range: up to 6527 psi (450 bar)
- Body materials: Aluminum bronze
- Brass or Stainless Steel

Additional products

Our portfolio includes standard products and custom solutions suitable for the global energy industry.

Air piloted valves (APV'S)

APV's are required:

- For applications with large, heavy duty actuators
- To open or close the Armature/Valve (Globe/Gate/ Butterfly….)
- To fill or exhaust the Actuator when required e.g. Emergency Shut Down

Proportional expertise

Our pressure and flow control proportional valves incorporate advanced spool and balanced-poppet technologies. Unlike competitor products which rely upon miniature snap-action seats, our valves provide true stepless pressure or flow control. The result is smooth response, low noise, and a long trouble free cycle life. On-board digital electronics assure maximum flexibility and ease of tuning for specific application conditions. Self diagnostics, optional digital displays, and a variety of Fieldbus interfaces are all benefits of the microprocessor-based design.

Type 422 - Fail freeze ATEX IS Valve

The Type 422 IS is the only ATEX certified fail freeze proportional valve on the market today.

Fail Freeze operation means that if the signal to the valve fails suddenly, the unit will maintain its last output pressure, ensuring that critical systems do not shutoff or close on plant in the event of a power failure.

IS certification provides system designers, and users, the flexibility to safely use potentially flammable compressed process gases to pilot their applications, providing the opportunity to remove the need, and cost, of installing a pneumatic system.

One area of the Energy Sector that makes full use of these combined unique attributes is Gas Distribution. In reduction stations the natural gas is piped out of the line and into the Type 422 IS which then regulates it precisely positioning the actuator and the pipeline valve, the fail freeze capability ensures the gas stays on, even if power is lost locally.

- Operating Temp: 14°F to 158°F (-10°C to 70°C)
- Linearity: <0.5% of span
- Pressure range: 2.9 – 14.4 psi (0.2 – 1.0 bar)
- Response: <6 seconds
- Power Consumption: <0.25W
- Ingress protection: IP65

Pressure switches

Pressure sensor technology is critical when pressure monitoring for higher plant security or pressure control for higher functionality are needed in an application.

IMI Precision Engineering operates four global centers of technical excellence, and a sales and service network in 50 countries, as well as manufacturing capability in the USA, Germany, China, UK, Switzerland, Czech Republic, Mexico, Brazil, and India.

For information on all IMI Precision Engineering companies visit **www.imi-precision.com**

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