FLOWSERVE

Valtek StarPac
Intelligent Control System

Valtek StarPac Intelligent Control System
Components

Actuator Pressure Sensing Lines

I/P Positioner

Positioner Feedback Arm

User Access Terminal

Process Display

Temperature Sensor

StarPac Electronics Module

Electronics Conduit
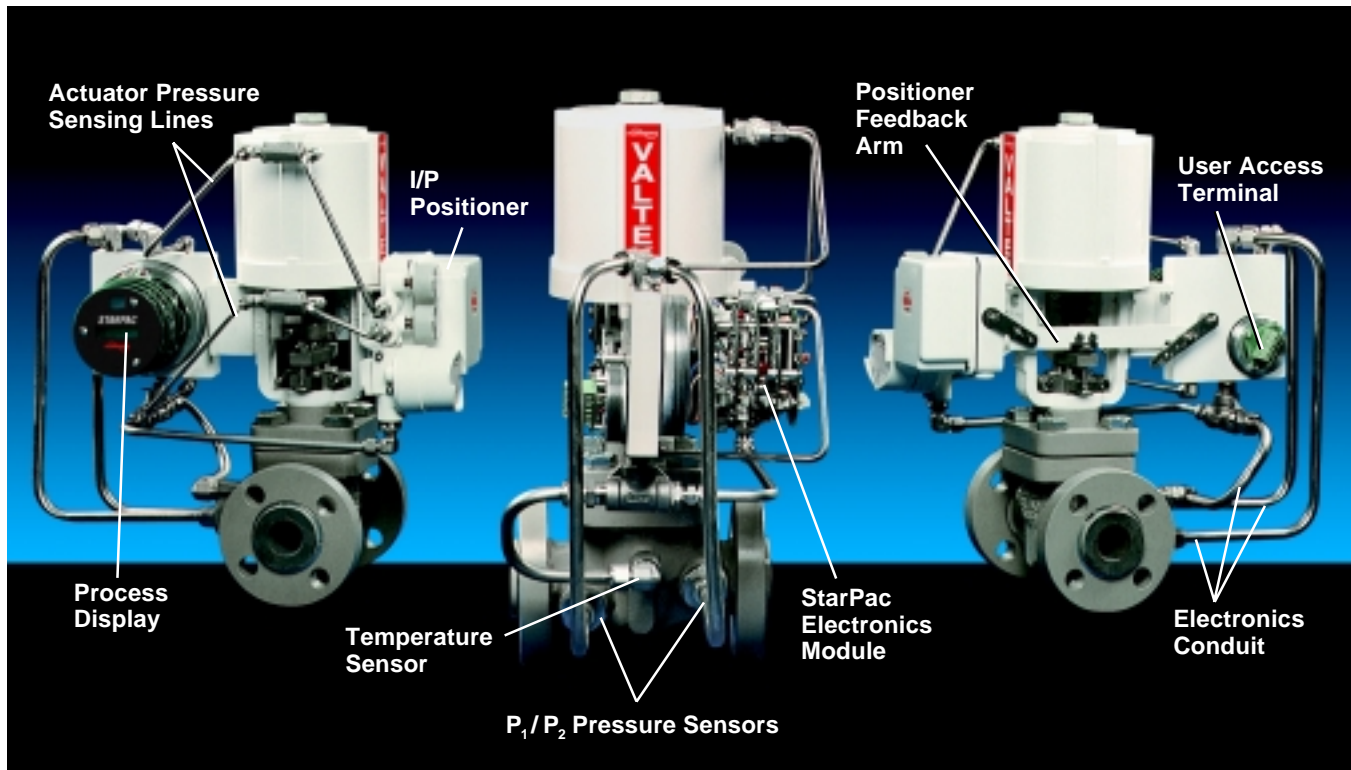
P_1 / P_2 Pressure Sensors

Figure 1: StarPac Intelligent Control System Components

Introduction

The Valtek® StarPac® Intelligent Control System in-cludes a microprocessor-based controller and process sensors mounted on a control valve. The system provides single-loop measurement and control of flow, pressure, or temperature, and allows data acquisition necessary for valve or process diagnostics.

Intelligent control systems can improve plant operation at a lower installed cost than conventional control systems. Installation of a total control loop is simplified by mounting the microprocessor directly on the valve with the pressure, temperature and flow sensors, elimi-nating separate line taps. The overall complexity and potential for leaks in a process system are reduced with fewer penetrations in the flow stream.

The StarPac unit can be programmed to operate as a traditional control valve (responding to a 4-20 mA controller) or as a stand-alone controller or transmitter requiring only a 24 VDC power source and air supply. In the stand-alone (controller) configuration, StarPac responds with PID action to: a 4-20 mA analog control signal, a digital signal through the serial data port, or a pre-programmed setpoint that is held with no external

communication. A personal computer can be used to set operating and tuning parameters or reading diag-nostics, but it is not needed for ongoing StarPac oper-ation. DCSs can be linked to the StarPac unit if they support the Modbus protocol.

Maintenance procedures are improved with StarPac's ability to record and report on valve or process equip-ment performance. For example, a signature of the valve or process (using StarPac sensors) can be re-corded by a PC upon installation of the StarPac system. Later, using this signature, StarPac software can help determine whether the valve or other process equip-ment needs servicing, reducing scheduled maintenance. In addition, the StarPac system provides self diagnos-tics with easy field replacement of modular parts.

The use of intelligent systems in hazardous applica-tion start-ups and shutdowns provides process in-sight and control – previously only available with expensive, complicated equipment installations. StarPac's "intelligent" reaction to system failure can give the user an extra element of safety over conven-tional control loop systems.

Valtek StarPac Intelligent Control System
Benefits and Advantages

Enhanced Plant Operation

Better Process Operation	Mounting the process sensors close to the final control element reduces lag and dead time, enabling much faster response. The high turndown results in better process control over the operating range.
Real-time System Analysis	StarPac's ability to gather and send flow and process data allows up-to-the-minute engineering analysis, aiding in reducing production costs and enhancing the process.
Wide Versatility	Multiple control modes – including fluid flow, upstream pressure, downstream pressure, differential pressure and temperature – permit StarPac systems to be used in a wide variety of process applications. Remote sensors can be tied into the StarPac unit for control of other process parameters. Cascade action is also supported.
Simple System Configuration	StarPac software is easy to use, allowing the system to be set up or reconfigured quickly as needed by the user to optimize the process system.
True Distributed Process Control	The StarPac unit can take load off a DCS by distributing measurement and control to the field. This allows the DCS to function as a process supervisor, acting on information from the whole system.

Increased Safety

Fewer Line Penetrations	Single-point installation limits line penetrations for sensors and reduces potential leaks to the environment, reducing EPA reporting requirements.
Continuous Monitoring	The StarPac system continuously monitors the valve position and the operation of several critical internal parameters, notifying the user when improper operation occurs, before upsetting the process.
System Warnings	Programmable settings permit the user to set process system parameters and to be notified when those limits are violated.

Improved Maintenance

Predictive Maintenance	StarPac software allows the intelligent control system to be used to diagnose the valve operation as well as upstream and downstream equipment (such as pumps, reactors, heat exchangers, etc.) while in operation to predict an acceptable performance or potential failure. Maintenance can then be performed before process failure occurs.
Reduced Complexity	With all functions located in one package, complexity of the total control system is reduced. Locating and troubleshooting the problem is easier.
Remote On-site Service	StarPac's modem capability means low-cost, on-site factory service is available through telecommunication technology.

Valtek StarPac Intelligent Control System
Features

Process Diagnostics – Evaluation of process equipment is possible with the StarPac intelligent control system. By generating an initial signature of the process and then identifying a standard process signature, a pump, compressor, heat exchanger, reactor, etc., can be discovered to be defective and in need of servicing. Process diagnostics can be performed with a personal computer or DCS connected to the unit via its serial data port.

Logging / Tuner Operation – The StarPac will take a 'snapshot' of process conditions at user-specified intervals (1 to 9999 seconds) and store them in its memory for later retrieval to aid in diagnosing process upsets. The personal computer operator interface will trend process variable, set point, and stem position to aid in tuning the control loop. This data is in a form that can be read by loop auto-tuning software to calculate the optimum PID constants.

Process Transmitters – The StarPac has sensors in the valve body to measure process conditions including upstream and downstream pressure, temperature, and flow. Flow is indicated both as the current value and a totalized amount. For gases, flow is reported in mass units, such as pounds per hour (since gas flow is always compensated for changes in pressure and temperature). Other sensors measure stem position and pressures in the top and bottom chambers of the cylinder actuator. All of these values are available over the serial link to a computer or DCS.

Connections to Operator Interface – The StarPac can be connected to an operator interface (personal computer, DCS console or hand station and recorder) through its analog, discrete and digital channels. The StarPac houses two analog inputs and one analog output. Up to six analog outputs are available using an external converter module. Two discrete inputs and two discrete outputs are also available at the StarPac. The user can define how these channels will be defined. Normally one analog input is a command signal, one discrete input sets the control mode, and the discrete outputs signal alarm conditions. The digital channel can be connected to computers and most DCSs through gateways or Modbus ports. All of the process and configuration information is available through the digital channels.
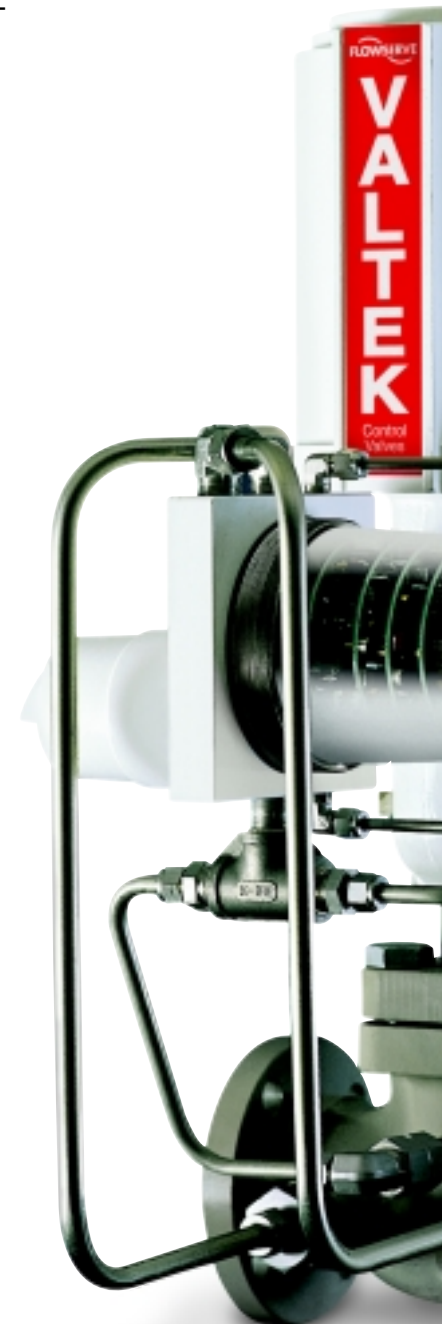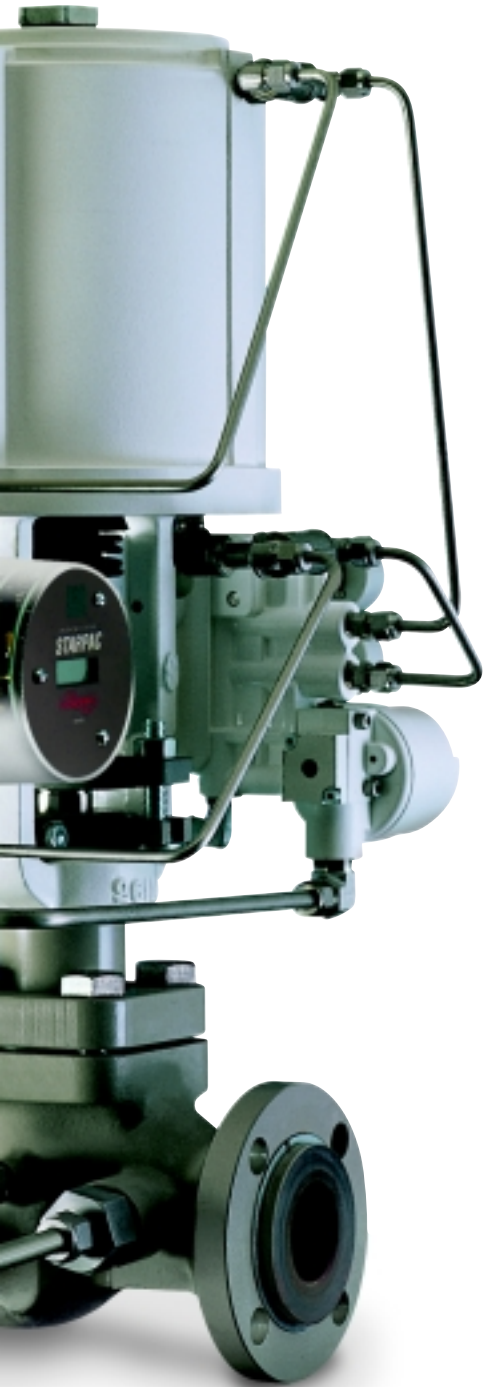
Figure 2: StarPac Intelliger

High Interchangeability – Since the Valtek Mark One™, MaxFlo™ and ShearStream™ control valves are the basis of the StarPac system, most valve parts are interchangeable with other Valtek valves, reducing parts inventory.

Local Display – Eight variables (P_1, P_2, temperature, gas flow, liquid flow, total flow, setpoint, stem position) can be displayed on a liquid crystal display in the electronics module. Each variable can be set to display continuously, or the StarPac can be set to scroll through the chosen variables at ten-second intervals. An error indicator will show if the StarPac system should fail any internal diagnostic or if the process is out of range.

Multiple Failure Modes – StarPac technology allows multiple failure modes to be set, including: power, air supply, command signal, or process failure. This results in greater reliability and consistency of the process during emergency shutdowns, protecting the process and people.

Valve Diagnostics – A maintenance feedback package allows StarPac intelligent systems to display the condition of the valve packing, seat, actuator, and O-rings with only a brief process interruption without removing the valve from the line. PC software displays the actuator or process signature for analysis. Optional valve diagnostic software can determine specific valve failures.

User Friendly Software – When the user is not connecting the StarPac unit to a DCS, StarTalk software can configure, operate, and diagnose the StarPac unit through a personal computer. The software has a graphical user interface, allowing most users to operate their StarPac systems with minimal training.

Environmental Considerations – Locating pressure and temperature sensors in the valve body eliminates several process connections. All pressure sensors have at least two seals to reduce the possibility of leaks to the atmosphere. Remote-mounted pressure sensors can be fitted with isolation and/or purge valves to aid maintenance of the sensors.

nt Control System Features

Valtek StarPac Intelligent Control System
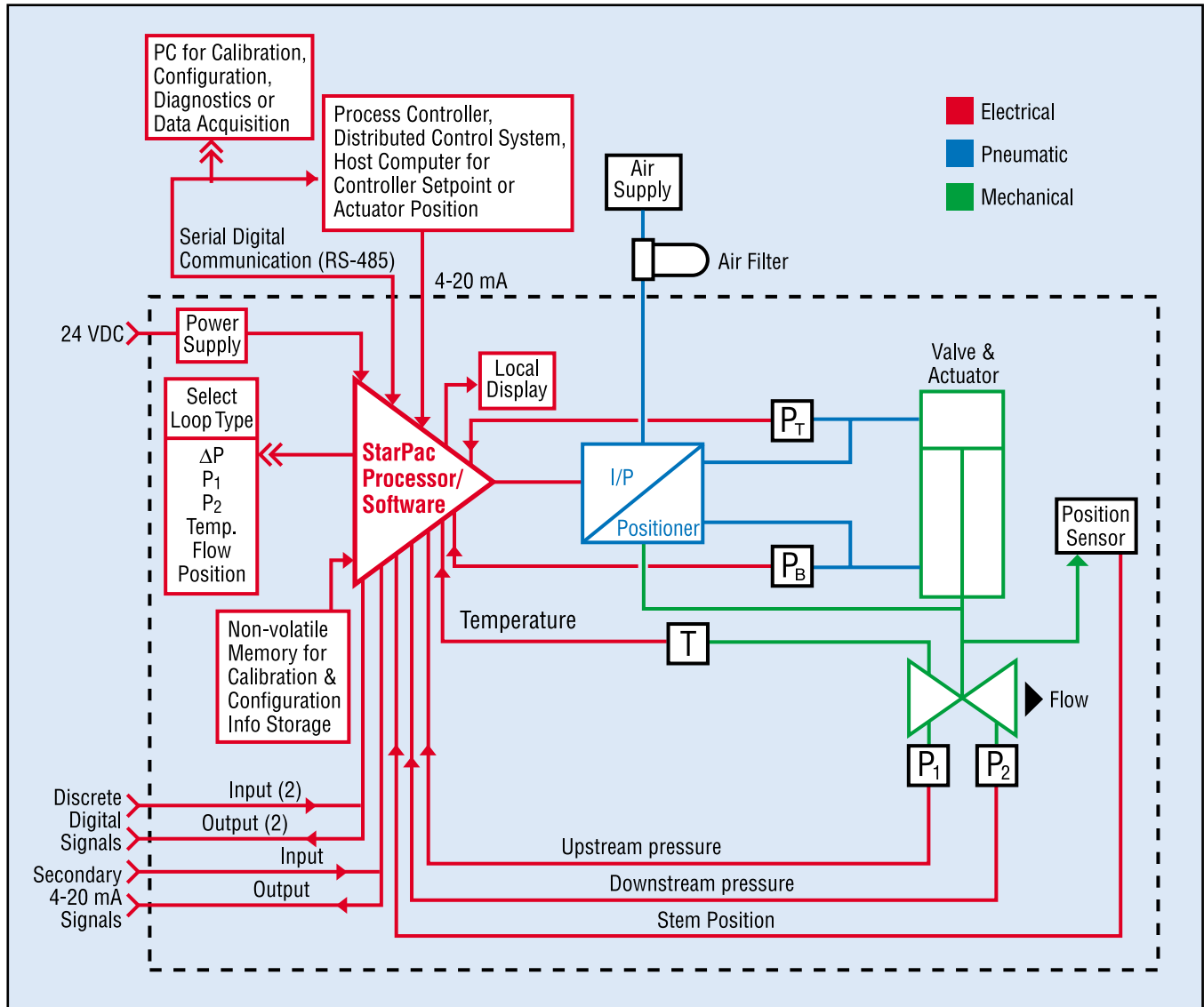## Piping Schematic, Ordering Information

Figure 3: StarPac Intelligent Control System Schematic

Ordering Information

The following information must be provided when ordering a StarPac intelligent system:

1. Control valve specifications: size, body pressure rating, material, etc.

2. Start-up and operating conditions: inlet / outlet pressures, temperature, flow rate, fluid physical properties

3. Maximum operating temperatures and pressures

4. Process control parameters and special software

5. Pressure sensor material and configuration required: Buna-N O-rings and 316 stainless steel sensors are standard, other elastomers and metals are available

6. Electrical classification requirements

7. Piping installation at StarPac system

8. Any special accessories and options required (handwheel, certified drawings, power supplies, RS-485 converter, etc.)

Valtek StarPac Intelligent Control System
Specifications

Flow Accuracy

The standard accuracy of a control loop, based on the StarPac system, to measure and control flow is ±2 percent of full scale flow over the turndown of the control valve, normally 30:1 for a globe valve. This can be improved by using characterized trim or reducing the turndown of the high accuracy range. Pressure accuracy is ±0.25 percent of full scale flow and temperature accuracy is ±2° F (1.1° C).

Performance Specifications

Measurement Repeatability

Flow	0.25% full scale
Pressure (max.)	0.1% full scale
Temperature	1° F (.6° C)
Drift	1% full scale / 6 months
Calibration	Independent zero and span adjustment for all sensors.
Vibration	Up to 2 G's - 30 to 500 Hz

Operating Temperature Range

Ambient	-40 to 170° F (-40 to 76° C)
Process Media	-320 to 1500° F (-195 to 815° C)
Temperature Effect	-40 to -10° F: 0.07% / ° F -10 to 150° F: 0.02% / ° F 150 to 185° F: 0.07% / ° F

Other Features

Totalizer	Totalizes mass flow until reset; available through digital link.
Data Logger	300 most recent samples at user-defined intervals, from 1 second to 3.6 hours.

Table II: Physical Specifications

Pressure Sensors	316L stainless steel, Viton O-ring seal; others on request
Housing	Cast, powder-coated aluminum
Tubing	304 stainless steel
Explosion-proof	Class I, Division I, Groups B-D (FM and CSA, Europe pending)
Non-incendive	Class I, Division II, Groups A-D (FM and CSA, Europe pending)
Environmental	NEMA 4X
Pressure Sensor Over-range	Two times maximum operating pressure with negligible change in output.

Table III: Electrical Specifications

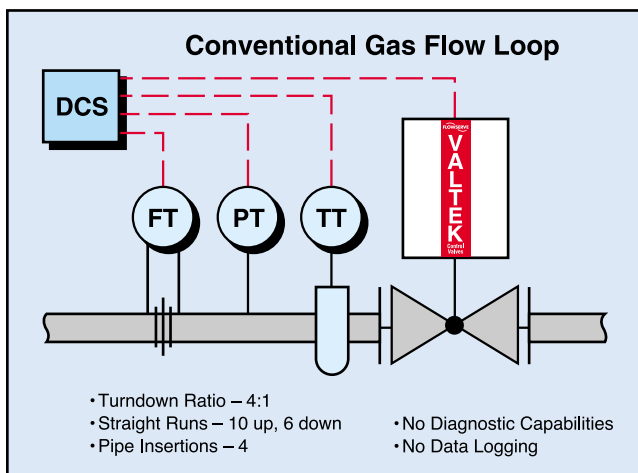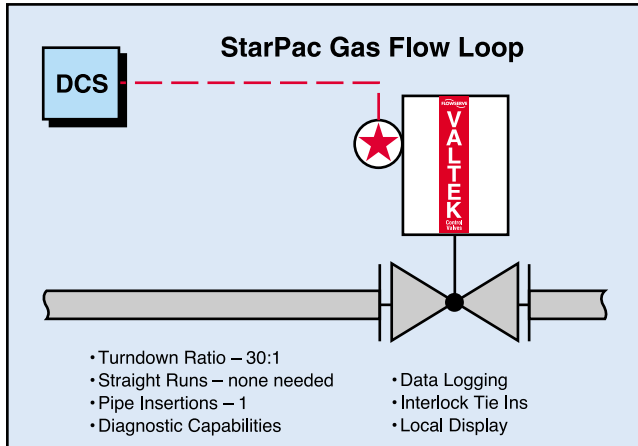|	
Power Supply	Nominal 24 VDC (18-64 VDC allowable) providing 300 mA
Analog Command	4-20 mA, 1000V isolation
Aux. Analog Input	4-20 mA, 1000V isolation
Analog Output	4-20 mA, drive up to 750 Ω
Discrete Inputs (2 channels)	Jumper-selectable input voltages of 120 and 24 V accept either AC or DC signals, pulse width > $1/16$ sec
Discrete Outputs (2)	1 A, 110 VDC or 125 VAC; 350 mA/200 VDC or peak AC
Explosion-proof	Class I, Division I, Groups B-D (FM listed)
Non-incendive	Class I, Division II, Groups A-D (FM and CSA) Ex N IIC
Overload Protection	Min. 500 volt isolation; 24 V power fuse protected
Serial Interface (2)	RS-485 port; Modbus protocol

Table IV: Software Specifications

Computer System	Windows 95 or higher, Pentium processor, 32MB RAM (64 MB prefered)
Drives Required	Hard disk (approximate 30 MB)
StarPacs per link	Up to 31

Table V: Valve Specifications

Body Size	Mark One: $1/2$ to 42-inch ShearStream: 2 to 12-inch MaxFlo: 2 to 12-inch
Pressures	Compatible with selected body

Valtek StarPac Intelligent Control System

StarPac Gas Flow Loop

DCS

• Turndown Ratio – 30:1
• Straight Runs – none needed
• Pipe Insertions – 1
• Diagnostic Capabilities
• Data Logging
• Interlock Tie Ins
• Local Display

Conventional Gas Flow Loop

DCS

FT **PT** **TT**

• Turndown Ratio – 4:1
• Straight Runs – 10 up, 6 down
• Pipe Insertions – 4
• No Diagnostic Capabilities
• No Data Logging

StarPac Control Valve System operating in steel mill

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For more information, contact:

For more information about Flowserve and its products,
contact www.flowserve.com or call USA 972 443 6500

Manufacturing Facilities

1350 N. Mt. Springs Prkwy.
Springville, UT 84663
Phone 801 489 8611
Facsimile 801 489 3719

1300 Parkway View Drive
Pittsburgh, PA 15205 USA
Telephone 412 787 8803
Facsimile 412 787 1944

Manderscheidstr. 19
45141 Essen, Germany
Telephone (49) 2 01 89 19 5
Facsimile (49) 2 01 891 9600

Alläe du Quartz 1
CH-2300 La Chaux-de-Fonds
Switzerland
Telephone (41) 32 925 9700
Facsimile (41) 32 926 5422

Quick Response Centers

5114 Railroad Street
Deer Park, TX 77536 USA
Telephone 281 479 9500
Facsimile 281 479 8511

104 Chelsea Parkway
Boothwyn, PA 19061 USA
Telephone 610 497 8600
Facsimile 610 497 6680

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