



Equipment Monitoring and Control Products

IPS Tempo™ • IPS APEX™ • IPS Wireless™
IPS Power Monitor™



Experience In Motion

Equipment Monitoring and Control Products

Through the application of advanced technologies, the Flowserve Intelligent Process Solutions (IPS) Family of Products helps customers proactively manage their plant assets to increase plant uptime and reduce equipment life cycle costs. Flowserve offers advanced monitoring solutions – wired and wireless – for permanent and portable data collection and analysis of vital assets. Monitoring and control solutions from Flowserve are engineered specifically to address process and equipment issues. As a result, user interfaces are highly intuitive and information is easy to interpret and immediately actionable.



In addition, Flowserve is on the leading edge of predictive monitoring and diagnostics. Onboard sensors and intelligent algorithms make it possible for plant operators to predict system behavior before failure or disruption, thus protecting their most critical plant assets.

The IPS family of products currently includes:

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Managing Vital Plant Assets and Optimizing Equipment Performance

Flowserve IPS Wireless technology is a cost-effective, reliable and scalable data communication system that enhances customer productivity and profitability. IPS Wireless employs open platform architecture to ensure it will interface and integrate easily with most existing instrumentation, software and controllers. In addition, its omni-directional technology ensures reliable data communication in even the most hard-to-reach locations.

Flowserve IPS APEX is the industry's most sophisticated tool for data acquisition, diagnostics and intelligent control. Embedded with intelligence derived from the extensive equipment expertise only Flowserve can offer, IPS APEX helps users lower life cycle costs by delivering actionable information to optimize process control and equipment operation.

Flowserve IPS Tempo makes intelligent system optimization and the benefits of variable frequency drive (VFD) technology more accessible. Users can program IPS Tempo to respond to process and condition variables to optimize plant output, reduce energy consumption, lower operating costs and protect pump equipment against adverse operating conditions.

Flowserve IPS Power Monitor is designed with features that enable monitoring of critical rotating equipment. It is equipped with a programmable start-up delay and low and high trip points. Proper application can help eliminate expensive repairs and downtime.

The Flowserve IPS Family of Products – Powered by the Technology Advantage™ Platform

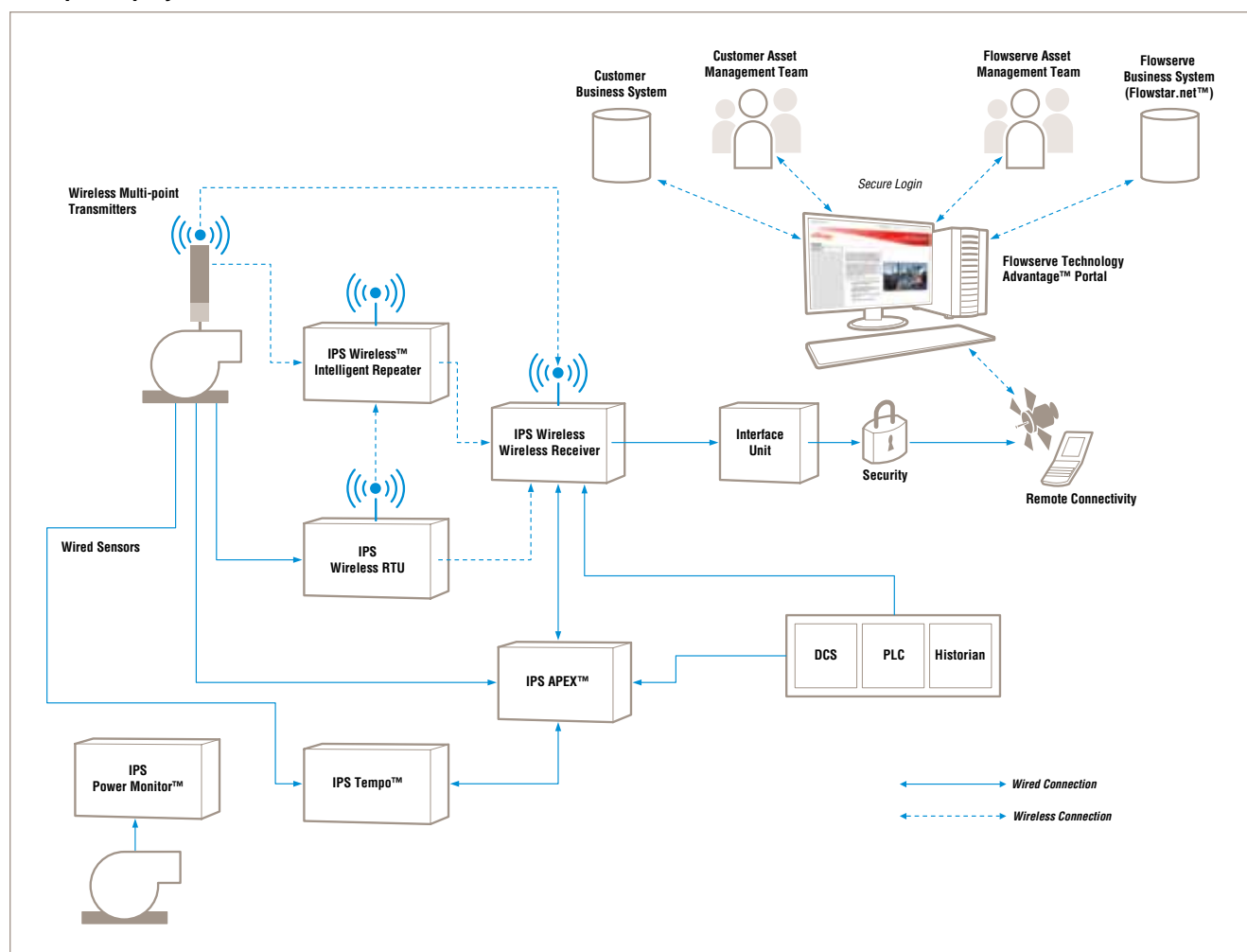
Flowserve has committed to developing a platform of information technology and sensor-based solutions to streamline the collection, storage, interpretation and use of essential plant and equipment data. This suite of technology-enabled capabilities – the Technology Advantage Platform – is unique in industry since all aspects focus on process systems and equipment. A fundamental component of the Technology Advantage Platform is the IPS family of equipment monitoring and control products.

Each of the products within the IPS family can be used independently or collectively to manage critical assets and enhance customer productivity, while reducing downtime and life cycle costs. Flowserve pump and equipment expertise coupled with their leading edge predictive monitoring and diagnostics tools enables customers to realize enhanced system reliability and increased plant availability.

The IPS family of products helps to:

- Collect key system parameters through IPS devices
- Analyze and synthesize the data into actionable information
- Transmit this information to the Asset Management Team through the Technology Advantage Portal so they can act in a timely fashion to address critical process and equipment issues
- Protect process equipment by allowing automated responses to detrimental operating conditions.

Example Deployment of IPS Products



IPS Wireless

Flowserve IPS Wireless technology supplies access to key process and system parameters. This enables plant operators to quickly respond to adverse operating conditions, which enhances productivity and profitability.

The IPS Wireless technology employs unique transmitting units that process sensor signals and wirelessly transmit not just data but actionable information back to plant operators. Plant operators are able to make timely and informed decisions that lower production costs by increasing equipment availability and operational efficiency. The IPS Wireless radio signal transmission is reliable, scalable, secure and interoperable and interfaces with most existing sensor systems found in process plants.

Limitless Applications

Flowserve IPS Wireless technology allows the acquisition of analog and digital data where a wired system would not be economically feasible. It enables the prompt utilization of important equipment and process data, including:

- Flow
- Level
- Gas emissions
- Pressure
- Temperature
- Vibration
- Corrosion
- Power
- Efficiency

Whether for portable or fixed assets or analog or digital instruments, Flowserve has wireless solutions for equipment performance monitoring, process monitoring and asset management.

Features and Benefits

Flexible Operation is achieved by open-platform architecture.

Seamless Integration with existing distributive control and equipment health management systems is possible.

Reliable Data Communication in even the most remote locations is guaranteed through non-line-of-sight technology.

Lower Cost than most other traditional wired systems increases product appeal.

Data Integrity is achieved through secure and reliable packaging and decoding methods.



Cost-Effective Omni-directional Radio Signal Transmission

The IPS Wireless radio signal transmission technology offers greater flexibility at a much lower cost than traditional transceiver or line-of-sight systems. This technology uses a 3D radial field and is not limited to line-of-sight. The “out-of-box” reliability offered by omni-directional signal transmission far surpasses most other traditional line-of-sight radio transmission signals and eliminates the need for RF beam steering, directional antennas and site survey assessments.

This technology utilizes advanced spread spectrum radio signals to reliably transmit equipment operating data from even the most remote and inaccessible plant locations. The Frequency Hopping Spread Spectrum (FHSS) technology combined with error detection and automatic request capability ensures uninterrupted signal and data transmission in the most difficult installation environments. FHSS and omni-directional signal transmission deliver data to the collection point without “signal collision.”

In addition to the flexibility, adaptability and low cost of this technology, IPS Wireless data transmission is decoded in the IPS Gateway prior to interfacing with the user’s Equipment Control System (DCS, PLC or SCADA) so that data integrity and security is ensured. The control system may also have a data historian which will provide back up in the case of data loss.

Sensing and Control Devices

Single-Point Transmitters

IPS Wireless Single-Point Transmitters provide wireless data acquisition and transmission of analog and digital signals in a single self-contained, self-powered unit. Programmable omni-directional radio signal transmission enables intelligence to be placed “at the edge.” The “always-on” status enables transmission rates to vary according to sensor signal values, prolonging battery life.

Receivers

IPS Wireless Receivers communicate from IPS Wireless Single-Point Transmitters and Remote Transmission Units to the customer's data management system. The receivers utilize spread spectrum, frequency hopping, data management technology that allows up to 2500 single-point transmitters to be monitored and can be expanded in multiples of 2500 transmitters.

Remote Transmission Unit (RTU)

The IPS Wireless RTU can be AC-powered or solar-powered with backup battery and allows a flexible number of sensor channels (2, 4, 8, 16, 24, 36). Each channel is equipped with a removable unique conditioning module that can be changed based on the desired sensor. The IPS Wireless RTU uses the same radio transmission technology as battery-powered transmitters, eliminating the need to incorporate separate modems. The IPS Wireless RTU has a self-transmitting range of 1.2 km (0.75 miles), but its effective transmission range can be extended to 11.2 km (7.0 miles) with the addition of a network of multiple repeaters.

Intelligent Repeater

The IPS Wireless Intelligent Repeater extends the transmission range of IPS Wireless Single-Point Transmitters and RTUs. This technology increases the reliability of the signal transmission at a fraction of the cost of traditional “transceiver” or “line-of-sight” systems that require self-healing “mesh technology.”

Remote Start/Stop

Comprised of a local transmission unit and a remote receiving unit, the IPS Wireless Remote Start/Stop device is able to send and receive both analog and digital commands to start/stop pumps and motors and open/close control valves.



Area Classifications

Zone 0 (Class I, Div I, Groups A, B, C, D, E, F, G)	Single-Point Transmitters
Zone 2 (Class I, Div II, Groups A, B, C, D)	Receivers Remote Transmission Unit Intelligent Repeater Remote Start/Stop



IECex ATEX

IPS APEX



The Flowserve IPS APEX makes the benefits of data acquisition, diagnostics and intelligent control more accessible to condition monitoring users. IPS APEX helps users lower life cycle costs by delivering actionable information to optimize process control and equipment operation.

The IPS APEX technology enables high-speed data acquisition of dynamic sensor signals and convergence of multiple data streams into embedded diagnostic and control algorithms. This technology can be incorporated “at the edge” near process system sensors, ensuring that only actionable information is relayed back to users for optimized control and reliability.

Features and Benefits

Sensor Signal Monitoring and Logging are achieved by unique data acquisition methods.

Reliable Detection and Diagnostics are available for mechanical and hydraulic anomalies.

Intelligent Control is made possible through automated control capabilities.

Data Visualization through the Flowserve Technology Advantage Portal provides access to:

- Performance history
- Exception notification
- Reporting

Seamless Integration into distributive control and equipment health management systems is enabled.

Advanced Data Acquisition and Diagnostics

IPS APEX enables data acquisition from virtually any monitoring device. This flexible solution can intelligently diagnose reliability and operational problems while providing outputs to adjust equipment and system parameters.

Real-time Information

IPS APEX enables high-speed processing of sensor signals and real-time diagnostics at the equipment level. The results are channeled to the end user for immediate action as required.

Protection From High-Risk Process Conditions

IPS APEX uses equipment-specific software that helps plant operators proactively diagnose and manage the most common operating problems through the use of:

- Cavitation detection algorithms
- Aeration detection algorithms
- Condition monitoring functions
- Automated control software
- Other diagnostic algorithms per application



Integrated Communications

IPS APEX provides a complete integrated solution for intelligent monitoring, visualization and anomaly notification. IPS APEX can also communicate aggregated real-time information for remote visualization using the local plant network or through the Internet via DSL, cable, satellite or other telecommunications systems.



Design Specifications	
Intelligent Core Processing Unit	Multi-processor architecture with Digital Signal Processor (DSP)
	USB removable memory device for local data storage
	Real-time clock for data time stamping
Onboard Sensor and Control Interface System	Analog input and output for high-speed sampling of sensor signals
	Digital (discrete) inputs and outputs
Communication Interfaces	Wired or wireless
	Ethernet
	Serial multiple communication process
Area Classification	Safe Area

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The Technology Advantage Portal Is at the Center of It All

To run a productive and profitable operation, plant operators need information, not just data. With the IPS family of monitoring and control products, data can be acquired and integrated with the customer's existing data management systems or displayed on a local PC or laptop.

Additionally, Flowserve has developed the Technology Advantage Portal. This data/information aggregation system enables plant managers and operators the ability to:

- View ongoing performance metrics through interpreted visuals
- Monitor real-time equipment performance
- Review historical equipment information

The Technology Advantage Portal also allows customers to:

- Quickly diagnose and solve equipment performance issues from anywhere in the world via its secure remote login capability
- Benchmark asset performance against industry averages
- Create a centralized view of plant asset information regardless of source. This view may include:
 - Installation and operation information
 - Bill of material data including drawings
 - Historical data including parts usage, upgrades and maintenance records

IPS Tempo

The IPS Tempo is a user-friendly, variable frequency drive (VFD) with pre-engineered optimization, protection and control features for pumps. This technology helps reduce energy consumption and protects against adverse operating conditions. The IPS Tempo solution extends equipment life and lowers life cycle costs.

Designed for easy implementation, the unique operator interface module enables typical drive configuration in as little as 10 minutes. When connected to specific sensors, the IPS Tempo can be configured to enable automated process control. It can also sense detrimental operating conditions, such as closed valves, off-curve operation, dry-running and pump cavitation.



Example Applications

- Batch systems
- Rail, truck and barge loading and unloading
- Variable demand pump systems
- Parallel or series pump systems
- Mag drive pump installations
- Boiler feed
- Unstable suction conditions

Condition Monitoring

- Pressure
- Flow
- Temperature
- Tank level
- Power
- Pump/motor vibration
- Any 4-20 mA or 0-10 V signal



Features and Benefits

Industrial Grade VFD with unique pump-specific interface is provided.

Energy Savings typically yield one-year return on investment.

Quick Start Set-up and Configuration is enabled from a numeric keypad.

Pre-engineered Pump Protection Features replace motor starters and current overloads.

Lower Life Cycle Costs are achieved by reduced power consumption, improved reliability and increased seal life.

One Button Pump Rotation Correction and static/rotation tuning.

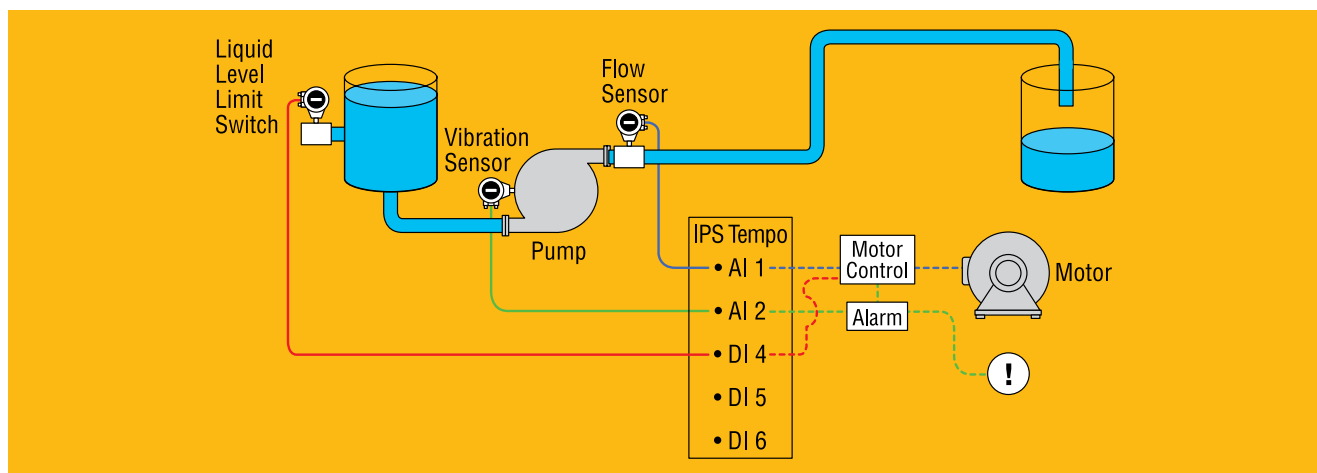
Several Input/Output Options include: two analog inputs and outputs; six digital inputs; and three digital outputs.

Multiple Languages can be displayed, including English, Spanish, Portuguese and French.

Zero-Stacking Bookshelf Design allows multiple drives to be cabinet mounted with zero spacing between drives.

Reflective Wave Drive limits reflective wave (due to long cable lengths) to a maximum of 2.25 times the bus voltage or 1600 V, whichever is less, up to cable lengths of 183 m (600 ft). Peak motor voltage is also limited by the IPS Tempo design.

Network Options include FieldBus, ModBus, DeviceNet, Ethernet and others.



Pre-Engineered Monitors

The Process Variable Monitor is used while operating in process control (PI) mode to detect a process no longer controllable within the set operating limits. This includes changes in process fluid or system characteristics, loss of adequate suction, equipment failure or wear.

The Power Monitor is used in process or speed control mode to detect operation at power levels above or below predetermined normal levels. Min/max allowable power levels are entered for selected speed. IPS Tempo is pre-engineered to vary the acceptable power level as drive speed changes by utilizing appropriate speed affinity laws. Some examples include dry running, low flow, change in fluid characteristics, blocked lines, closed valves, overload conditions, excessive wear, rubbing, etc.

The Condition Monitor is used to detect abnormal process conditions by monitoring a sensor signal on analog input channels and initiating an appropriate selected action from a list of available responses. This could include situations when there is excessive vibration, temperature, pressure or flow variations, or poor lubrication conditions.

The Digital Input Monitor is used in process (PI) or speed control modes to detect and respond to conditions or events indicated by discrete (on-off) switching devices, including limit, level, pressure, temperature, flow and relay switches.

The Auto Set Point Adjustment Monitor enables process control or speed set points to be automatically adjusted in response to a signal from an analog sensor connected to an analog input. A programmable multi-point scaling operation determines the effect of the signal on the process and controls the speed set point. This could be used for load out application optimization, batch control operations or automated cavitation protection.

Environment Specifications	
Enclosure Rating	IP20 / UL Type 1 (NEMA 1)
Temperature	0°C to 40°C (32°F to 104°F)
Humidity	5 – 95%, non-condensing
Elevation	Up to 1000 m (3300 ft) without derating
Area Classification	Safe Area

Power Specifications	
Range	4 - 75 kW (5 - 100 hp) at 240 VAC
	4 - 521 kW (5 - 700 hp) at 480 VAC
	4 - 112 kW (5 - 150 hp) at 600 VAC
Input	200 - 240 VAC, three phase 10%
	380 - 480 VAC, three phase 10%
	500 - 600 VAC, three phase 10%
Output	Adjustable voltage from 0 to 230 V, 400 V, 460 V or 575 V
	Frequency range from 0 - 400 Hz
	Inverter produces pulse width modulated (PWM) waveform using the latest generation IGBTs



IPS Power Monitor

The IPS Power Monitor monitors and displays actual power to the rotating equipment, offering simultaneous protection from underload and overload operating conditions. The IPS Power Monitor helps to eliminate costly downtime and expensive equipment repairs caused by:

- Dry running
- Pump overloads
- Cavitation
- Blocked lines
- Closed suction or discharge valves
- Excessive wear or rubbing



Features and Benefits

Push Buttons display horsepower or kilowatts that are automatically converted with display switching.

Adjustable Low and High Power set points protect rotating equipment from underload and overload operation.

Automatic Shut-down or Alarm Tripping can be achieved before damage occurs.

Adjustable Trip Delay Timers filter out nuisance trips caused by temporary power fluctuations.

Adjustable Start-up Delay Timer is particularly useful in unloading applications.

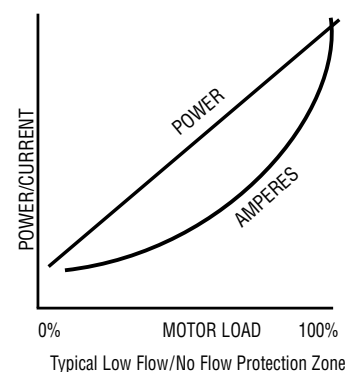
Optional 4 to 20 Milliamp Analog Output is available.

Effective Facilitation of remote displays, operator interface and output to PLC or DCS is possible.

Two Relay Outputs (form C) for low and high power trips. These outputs can be used to shut down equipment or trip alarms.

Versatile Operation is derived from automatic, manual and remote reset options.

Area Classification is defined as Safe Area.



At low loads, motor amperes do not change much with small changes in loads. Small signal changes can cause false trips or allow equipment to operate below the desired minimum operating point.

At low loads, power is linear. Small changes in operating loads provide greater signal changes. The IPS Power Monitor is more sensitive to load changes and offers easier setup, more reliable equipment protection and no false trips.

Services and Solutions for the Global Infrastructure Markets

Flowsolve Services and Solutions focuses on providing customers with uncompromising technical service and engineering support, wherever and whenever needed. Dedicated to delivering the highest quality support, Flowsolve Services and Solutions integrates hydraulic, mechanical and materials engineering knowledge with creative equipment, system and business solutions.

A worldwide network of Quick Response Centers staffed by highly skilled engineers and technicians is available around the clock, seven days a week to respond to customer queries, to evaluate and troubleshoot problems and to provide reliable solutions with quantifiable business results.



Integrated Solutions That Support the Complete Life Cycle

Typically, 90% of the total life cycle cost (LCC) of a flow management system is accumulated after the equipment is purchased and installed. Flowsolve offers a comprehensive suite of services and solutions designed to provide customers with unprecedented value and cost savings throughout the life span of the system.

- **Aftermarket Parts and Services**

- Repair and maintenance
- Replacement parts and components

- **Engineering and Technical Services**

- Engineering support
- Technical assessments
- Equipment performance improvements

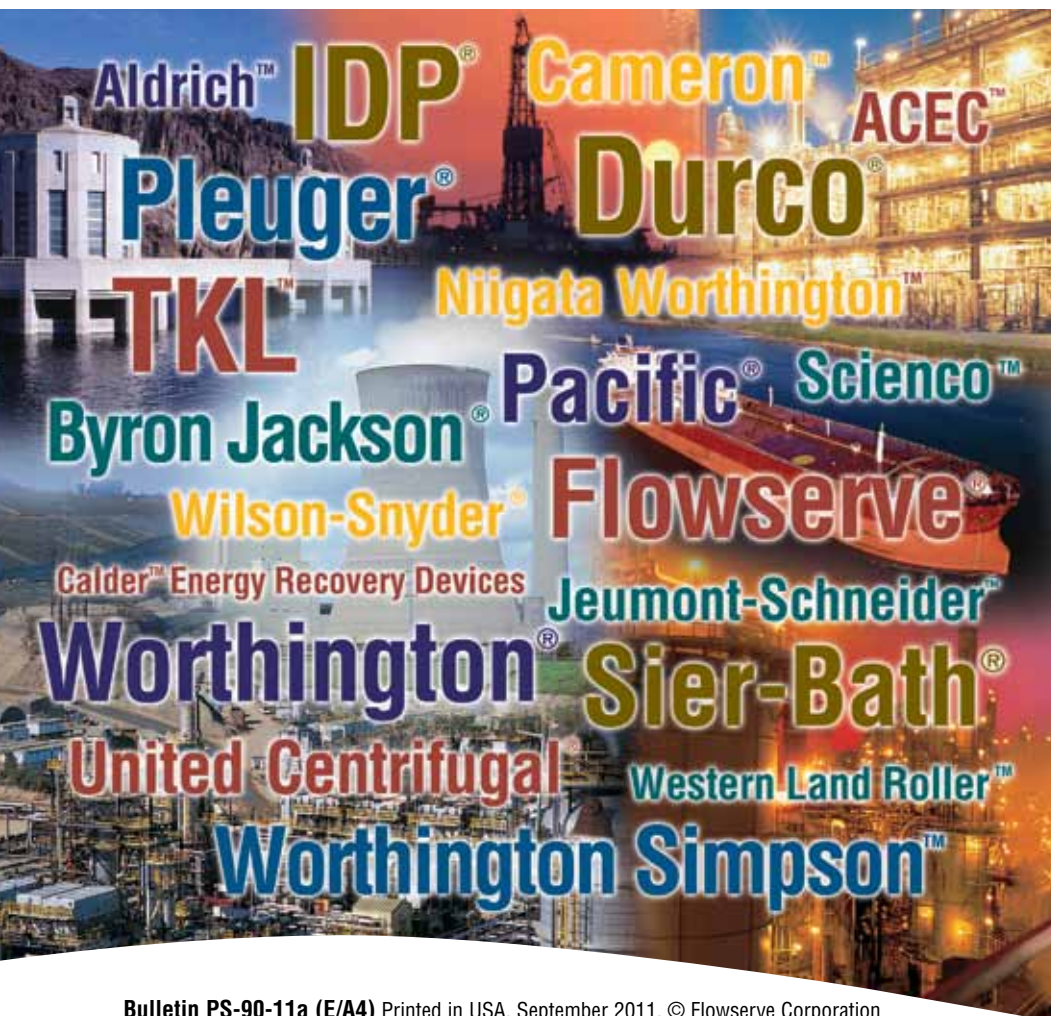
- **Education and Training**

- Customer site
- Learning Resource Center
- Online

- **Asset Management and Optimization**

- Business assessments
- Asset data management
- Asset optimization solutions





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