



**Process Instrumentation**

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# **Oil and Gas Product Application Notes**



**Production  
and Distribution**

**T**his guide presents typical instrumentation used in new oil and gas production applications or to improve performance and lower operating costs in existing fields.

## Wellhead Automation

### Primary Recovery - Free Flowing Well

This type of well uses the natural pressure from the earth to force the oil or gas from the reservoir to the surface. A throttling valve located at the wellhead reduces pressure and regulates the flow of product to the collection site. To maintain safety and integrity of the well, SOR pressure switches monitor tubing, casing or flowline pressures so high or low pressure conditions are identified early. The well can be shut-in until corrective measures are taken if problems are indicated. SOR pressure switches are also used to monitor hydraulic line pressure to ensure proper operation of hydraulically actuated throttling valves.

Continuous monitoring with SOR pressure transmitters provides a means for automatic throttling valve adjustment in response to changing well conditions or production requirements for greater operating efficiencies. Pressure transmitters also allow for early identification of developing problems for improved system reliability.

### Primary Recovery - Pump Jack Well

When the energy in a reservoir declines to a point where the well will no longer flow freely, artificial methods are used to lift the hydrocarbons to the surface. Wells can be shut-in if problems identified by monitoring wellhead pressure are managed early, reducing or eliminating the time and expense of costly swabbing units or workovers.

Continuous output can be monitored to identify potential problems associated with producing and shut-in pressures. Decline curve analysis can be performed remotely with the rate data collected via a SOR transmitter. Well performance (pumping unit strokes/minute) can also be monitored and adjusted in conjunction with changing well conditions.

### Typical Instrumentation

Indicate high/low tubing, casing and flowline pressure conditions	PS1	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• High overpressure capability</li> </ul>
Monitor hydraulic line pressures	PS2	Sub Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• Compact size</li> <li>• Tamperproof capability</li> </ul>
Automatic throttling valve adjustment and system reliability monitor	PT1	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> </ul>

### Typical Instrumentation

Indicate high/low tubing and flowline pressure conditions	PS3	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> </ul>
Monitor tubing and flowline pressure conditions	PT2	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> </ul>



## Secondary and Enhanced Oil Recovery (EOR)

As reservoir pressures decline, conventional production methods become less efficient. If determined to be economical, secondary (waterflood) and EOR (thermal, gas miscible, chemical) methods of production are used and continuous monitoring of the wellhead is common.

Continuous wellhead monitoring checks the ability of the reservoir to effectively handle the injected medium. Injection pressures that are too high could cause tubular fatigue and rupture problems. Also, injecting above the reservoir's fracture gradient reduces the sweep efficiency of a waterflood and increases production overhead costs. SOR pressure transmitters, level switches and level transmitters are used to monitor conditions that indicate efficient extraction.

## Compressor Skids

As natural gas reservoir pressures decrease or loading occurs, conventional production methods become less efficient. If determined to be economical, compressor skids are used at the wellhead to increase production. Mechanical and analog instruments are commonly selected for their lower cost, compact size and ability to respond quickly to critical process conditions (e.g. surge detection).

SOR switches or transmitters monitor suction and discharge pressures, inlet and outlet temperatures and lubrication systems for safe, efficient operation. The transmitter zero and span adjustments are easily made tamperproof to limit access to authorized personnel.

### Typical Instrumentation

Monitor water line injection pressure	PT3	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> <li>• High overpressure capability</li> </ul>
Indicate oil/water interface	LS1	Single Point RF Switch	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• Easy calibration</li> <li>• Wide dynamic range capability</li> </ul>
Monitor downhole water levels	LT1	Submersible, Hydrostatic Pressure	<ul style="list-style-type: none"> <li>• Intrinsically safe</li> <li>• Compact</li> <li>• Low maintenance</li> </ul>

### Typical Instrumentation

Indicate high/low process conditions and initiate control functions	PS12	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> <li>• Compact for high-density mounting</li> </ul>
	TS3	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Direct or remote mounted designs</li> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> <li>• Compact for high-density mounting</li> </ul>
Monitor critical process conditions	PT12	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> <li>• Compact for high-density mounting</li> <li>• Tamperproof capability</li> </ul>
	TT4	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Integral RTD design</li> <li>• In-service calibration</li> <li>• Compact for high-density mounting</li> <li>• Tamperproof capability</li> </ul>

## Flowline Monitoring

Hydrocarbons are transported from the wellhead through flowlines to storage facilities. SOR pressure switches are used to verify the system delivery operation. Increased line pressures, due to obstructions such as paraffin build-up, would gradually reduce the overall well performance. Low pressures may indicate a rupture or leakage in the flowline that requires immediate attention to minimize the environmental impact.

Continuous flowline monitoring with SOR pressure transmitters enables early identification of developing problems for improved system reliability. Data developed over time can be used to establish preventive maintenance schedules to lower operating costs and improve performance.

### Typical Instrumentation

Indicate high/low flowline pressure conditions	PS4	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>Corrosion resistant</li> <li>In-service set point adjustment</li> </ul>
Monitor flowline pressure conditions for trend analysis	PT4	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>Low power design</li> <li>In-service calibration</li> </ul>

## Satellite Gas Processing

A limited amount of gas processing may occur at individual wellheads or at a local collection site serving multiple wells. Typically, this on-site processing includes systems for removing sand, water or gaseous contaminants (e.g. a scrubber to remove high concentrations of hydrogen sulfide in “sour” gas) prior to feeding into large pipelines for transportation to central processing stations.

SOR pressure and temperature switches are required for applications associated with pressure relief valves, flare gas burn-off, chemical injection systems, piping systems, thermal processing systems, etc. Level switches are used in point level applications such as condensate drains, chemical storage tanks, particulate level, multiple liquid interface and applications subject to “probe loading.” SOR instruments constructed to NACE requirements are designed specifically for these demanding applications.

### Typical Instrumentation

Indicate high/low process conditions and initiate control functions	PS5	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>Corrosion resistant</li> <li>In-service set point adjustment</li> </ul>
	TS1	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>Direct or remote mounted designs</li> <li>Corrosion resistant</li> <li>In-service set point adjustment</li> </ul>
Indicate high/low level conditions and initiate control functions	LS2	Single Point Ultrasonic Switch	<ul style="list-style-type: none"> <li>Low cost</li> <li>Easy installation</li> <li>Reliable operation</li> </ul>
Indicate high/low level conditions and initiate control functions for difficult interface and particulate applications	LS3	Single Point RF Switch	<ul style="list-style-type: none"> <li>Low cost</li> <li>Easy installation</li> <li>Multiple probe configurations</li> <li>Immunity to “probe loading”</li> </ul>
Monitor process conditions to initiate control functions and provide data acquisition	PT5	Mini-Hermet-Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>Loop powered</li> <li>In-service calibration</li> </ul>
	TT1	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>Integral RTD design</li> <li>Loop powered</li> <li>In-service calibration</li> </ul>
	LT2	RF Transmitter	<ul style="list-style-type: none"> <li>Loop powered</li> <li>Multiple probe configurations</li> </ul>



## Gas Flow Monitoring

Production from remote gas wells is fed into pipelines for transportation to central processing stations. Monitoring individual well production rates requires precise mass flow measurement, in addition to flowline monitoring for safety concerns.

For accurate mass flow calculations associated with custody transfer, typical monitoring stations have an orifice plate with a differential pressure transmitter for flow measurement, a pressure transmitter to monitor flowline integrity and measure static pressure, and a temperature transmitter. Zero and span adjustments on controls are easily made tamperproof to limit access to authorized personnel.

### Typical Instrumentation

Monitor flowline integrity and static pressure	PT6	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> </ul>
Monitor process media temperature	TT2	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Integral RTD design</li> <li>• In-service calibration</li> </ul>
Flow monitoring using calibrated orifice plates	DP1	SORtrans HART® Smart	<ul style="list-style-type: none"> <li>• Explosion proof</li> <li>• In-service programming</li> <li>• High accuracy</li> <li>• 30:1 turndown</li> </ul>

## Low Power Data Acquisition

Many oil and gas production sites are located in remote areas not served by conventional electric power plants. Solar power cells with battery backup are a reliable and inexpensive alternative to running electric power lines to these sites. A Remote Terminal Unit (RTU) gathers safety, well integrity and performance data from local instrumentation for transmission to a central monitoring facility via microwave radio. SOR switches and transmitters are designed for efficient, reliable operation in these low power applications.

### Typical Instrumentation

Indicate high/low pressure conditions and initiate control functions	PS6	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> <li>• Gold contacts for low power switching</li> </ul>
Monitor tubing, casing, flowline and compressor suction/discharge pressures; automatic throttling valve adjustments	PT7	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> </ul>

## Flowline Header Monitoring

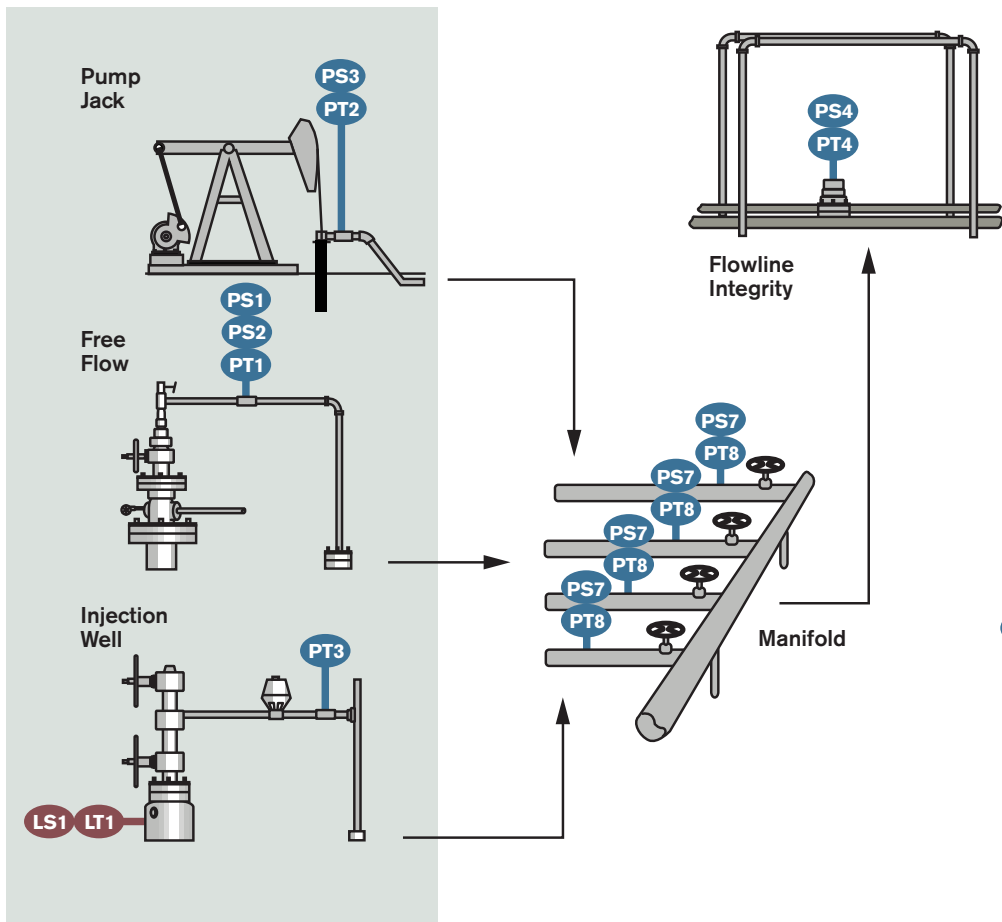
At satellite collection facilities, flowlines from multiple oil wells are fed into a common header that delivers product to an oil/water separator for on-site processing. To identify line rupture, leakage or blockage problems indicated by high or low pressures, SOR pressure switches monitor flowline pressures at each input to verify the downstream operation of the delivery system.

Continuous monitoring with SOR pressure transmitters enables early identification of developing problems for improved system reliability. Continuous outputs can be analyzed to guard against backflows and unbalanced manifold conditions for maximum efficiency.

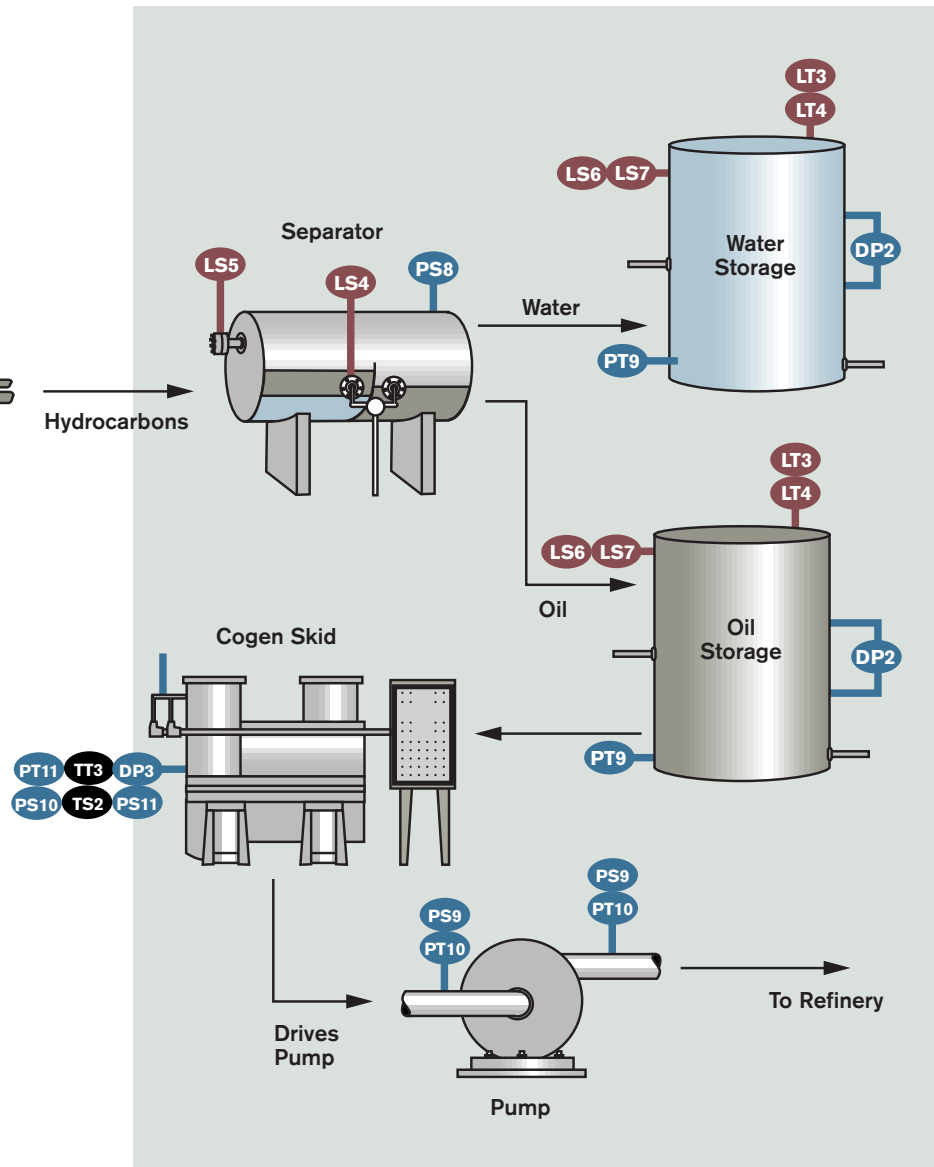
### Typical Instrumentation

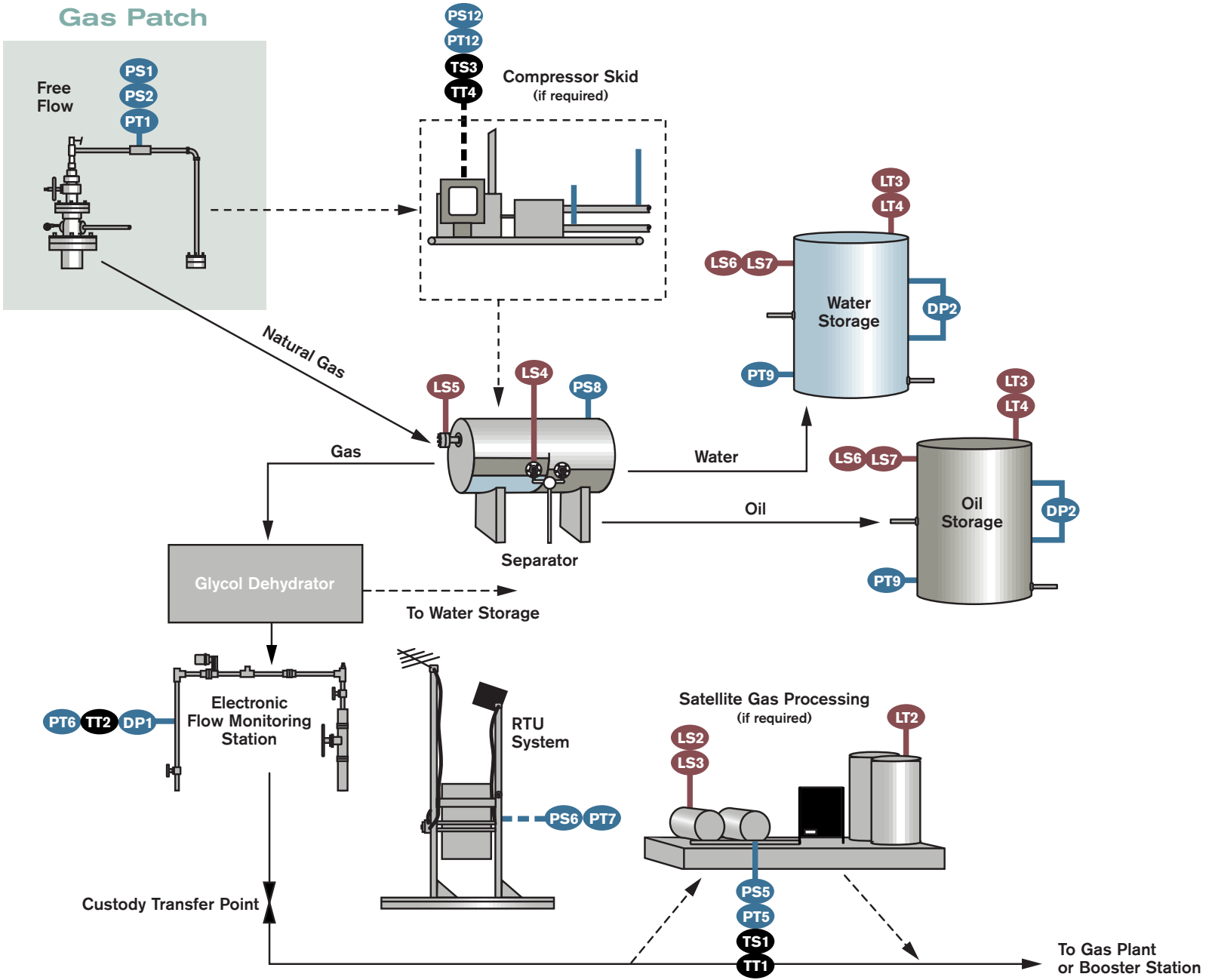
Indicate high/low flowline pressure conditions	PS7	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> <li>• Compact for high-density mounting</li> </ul>
Monitor flowline pressure conditions	PT8	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> <li>• Compact for high-density mounting</li> </ul>

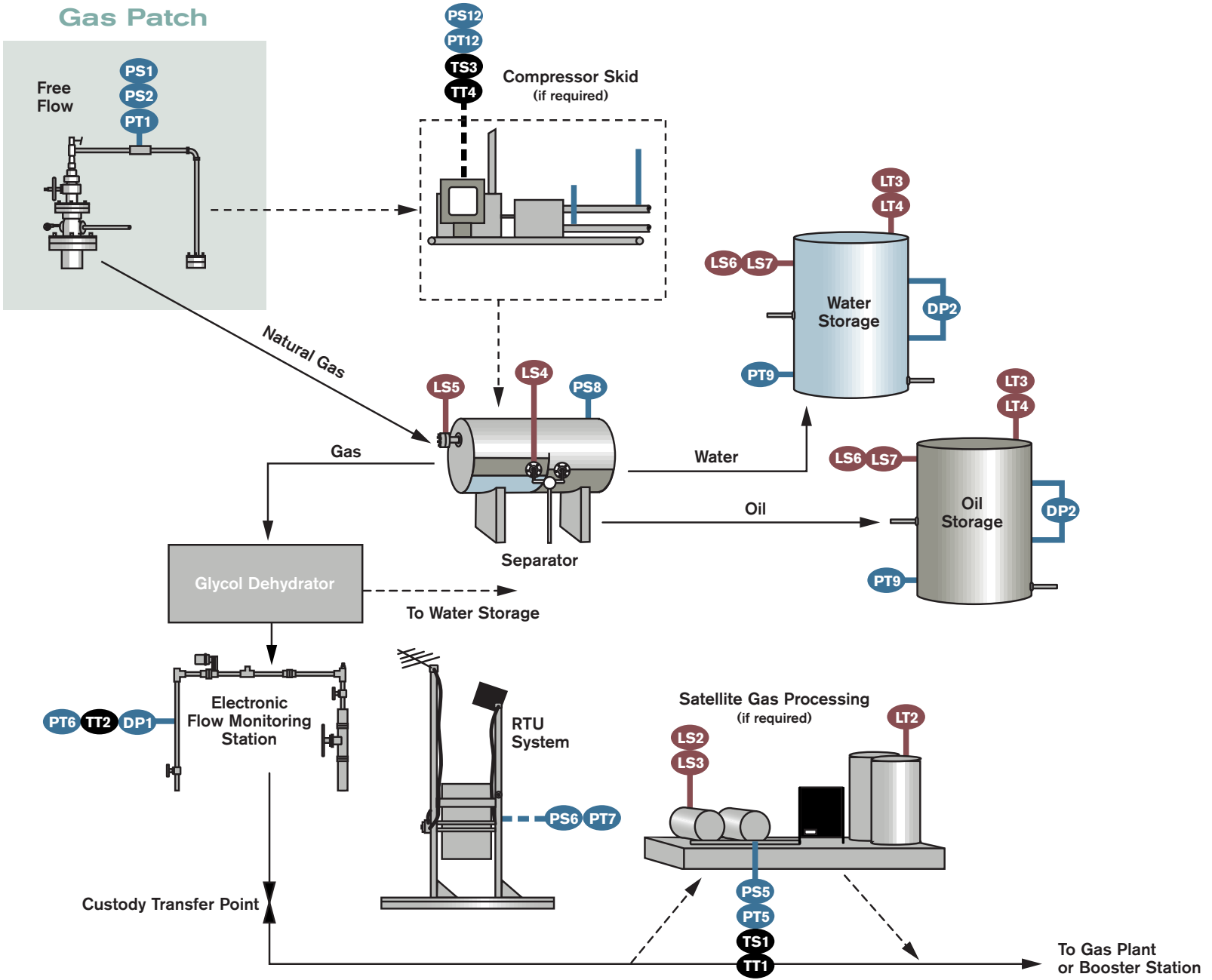
### Patch



### Satellite Processing









## Pump Monitoring

Pumps are incorporated in many processes to move fluids from one location to another. Varying in size, principle of operation and critical control function, their suction and discharge pressures are commonly monitored to ensure system safety and performance. To avoid expensive maintenance (resulting from pump cavitation) and productivity loss, SOR pressure switches guard against the absence of process due to line ruptures or blockages. For applications subject to high cycle rates (e.g. reciprocating pumps), pivot seal designs provide exceptional reliability and long life.

Continuous monitoring with SOR pressure transmitters enables early identification of developing problems for improved system reliability. Data collected over time can be used to establish preventive maintenance schedules for lower operating costs and improved performance.

### Typical Instrumentation

Indicate high/low pressure conditions and initiate control functions	PS9	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> <li>• Compact size</li> <li>• High cycle rate design</li> </ul>
Monitor pump suction/discharge pressures	PT10	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> <li>• Compact size</li> </ul>

## Cogeneration

Gas turbine generators are often installed at remote oil and gas production sites not served by conventional electric power plants. Using waste hydrocarbon or production gas for fuel, a jet turbine generates the power required to operate pumps, compressors, valve operators, control circuits, etc., including those in the cogeneration package.

SOR pressure, differential pressure and temperature switches or transmitters monitor fuel, combustion, exhaust, cooling and lubricating systems for safe, efficient operation. The transmitter zero and span adjustments are easily made tamperproof to limit access to authorized personnel.

### Typical Instrumentation

Indicate high/low process conditions and initiate control functions	PS10	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> </ul>
	TS2	Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Direct or remote mounted designs</li> <li>• Corrosion resistant</li> <li>• In-service set point adjustment</li> </ul>
	PS11	Sub Mini-Hermet - Hermetically Sealed, Explosion Proof	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• Compact size</li> <li>• Tamperproof capability</li> </ul>
Monitor critical process conditions	PT11	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Low power design</li> <li>• In-service calibration</li> <li>• Tamperproof capability</li> </ul>
	TT3	Mini-Hermet - Explosion Proof, Adjustable	<ul style="list-style-type: none"> <li>• Integral RTD design</li> <li>• In-service calibration</li> <li>• Tamperproof capability</li> </ul>
	DP3	SORtrans HART® Smart	<ul style="list-style-type: none"> <li>• Explosion proof</li> <li>• In-service programming</li> <li>• High accuracy</li> <li>• Tamperproof capability</li> </ul>

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*This brochure is intended to provide suggestions for the general application of certain types of instruments. Since each application has unique characteristics, it is recommended that you consult SOR to discuss the specific details of your application to ensure the correct instrument is selected.*



## **Process Instrumentation**

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