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Product Focus: Process Control and Instrumentation

Process Control and Measurement

Process control and measurement implies continuously changing variable data or control methods in an industrial process. Different from discrete (ON/OFF) states, numeric values over a set range are sensed or transmitted in continuous (flow production) or batch (a set quantity or output) processing. Some of the most common variables used for process control are pressure, flow, level, and temperature.

Pressure Process Control

Pressure sensing devices measure pressure at a specific point in the process, used for monitoring or transmitting the measured value to a control device or system that performs functions such as starting/stopping a pump or opening a valve to regulate the pressure.

Pressure Sensors/Switches: Pressure and vacuum sensors monitor relative system pressure in many process, hydraulic, or pneumatic applications. Pressure switches provide simple setpoint-tripped output signals, while pressure transmitters provide absolute, gauge, or differential analog readings over wide measuring ranges.

Current to Pneumatic (I/P) Transducers: I/P transducers are electro-pneumatic devices that use a 4-20mA input signal and a high-pressure air supply to provide a precisely regulated air pressure output, offering a reliable, repeatable operation of pneumatic valve positioners/actuators, cylinders, web tensioners, clutches, and brakes.

Pressure Gauges: Pressure gauges are simple measurement and display devices for industrial and commercial applications. Mechanical dial pressure gauges use Bourdon tube sensing elements, while digital pressure gauges offer enhanced functionality. Differential gauges measure and display the pressure difference between two points.



Siphons, Snubbers, and Isolation Valves: Siphons protect pressure gauges, transmitters, and switches from the effect of high-temperature media such as steam. Pressure snubbers protect instruments by suppressing the effect of damaging pressure pulsations and spikes. Manual isolation and throttling needle valves isolate instruments from the sensed media, while block and bleed valves isolate instruments with the added ability to bleed off unwanted pressure. Both valves allow for quick and easy removal and maintenance of measurement instruments without shutting down the process.

Potable Water Regulators: Purpose-built water regulators are compact food-grade units that provide economical, high-performance pressure regulation of drinkable water. The highly sensitive diaphragm-operated design delivers accurate downstream pressure, and the molded rubber supply valve provides precise regulation while helping to prevent leakage.

Temperature Process Control

Temperature measuring devices sense temperature at a specific point or area and provide a signal for monitoring or control. Numerous applications rely on temperature control, including HVAC systems, heat-treating applications using ovens/furnaces, packaging devices like shrink wrap machines and glue applicators, plastic extrusion and injection molding machines, and more.

The most common temperature measuring devices are thermocouples and resistance temperature devices (RTD). Both devices provide low-level current outputs which can be connected directly to a temperature input on a controller or to an amplifier for longer distance transmission.

Thermocouple Sensing Elements/Probes: Thermocouples work based on the Seebeck effect, a phenomenon where a small voltage is produced across a junction of two dissimilar metals when exposed to a temperature gradient. The amount of voltage produced within the thermocouple is very small, usually millivolts, and is directly related to the difference in temperature across the junction. There are many types of thermocouples. The most common ones are J, K, and T, which designate a specific temperature range and wire color coding to identify them.

RTD Sensing Elements/Probes: RTDs have an internal resistance that changes with temperature linearly. They are typically made from a very fine wire wrapped around a ceramic or glass core, or are created using thin film technology. Since the resistance in the wire changes with temperature, the temperature can be determined by measuring the voltage drop across the resistance. RTDs come in a variety of types. The most common is the Pt100, which is made from platinum that has been calibrated to be 100 ohms at 0 °C. Platinum is an ideal metal for RTDs because of its stability, resistance to corrosion, and higher melting point. RTDs are great for applications up to around 600 °F.

Infrared Pyrometers: Infrared pyrometers determine the surface temperature of an object by measuring its emitted infrared radiation. These sensors can read the temperature of inaccessible or moving objects without difficulty. An essential feature of infrared temperature sensors is that they allow non-contact sensing, preventing contamination or exposure to hazardous materials.



Temperature Controllers: Temperature process control units read the signal from a temperature device, such as a thermocouple or RTD, and maintain a setpoint via an output signal (relay, voltage pulse, current, or linear voltage) to a controlled device, using modes such as simple ON/OFF, full PID closed-loop control, special Ramp/Soak profiles, or manual operation.

Temperature Switches and Transmitters: Temperature switches provide simple setpoint-tripped discrete output signals; temperature transmitters provide analog readings over wide measuring ranges.

Thermometers: Thermometer gauges provide accurate point-level temperature measurement using a bi-metallic sensing element. Dials with dual scales provide instant readings in both Fahrenheit and Celsius.

Flow Process Control

Flow sensing devices measure the flow rate (volume per unit of time) and consumption (totalized flow) of liquid traveling through a system. These systems utilize pumps and valves to regulate flow and require accurate downstream flow measurements to ensure proper operation.

Mechatronic Flow Switches: Mechatronic liquid flow switches use a spring-supported piston which is lifted by the flowing medium. A discrete output signal is provided based on the position of the piston. The spring forces the piston to its original position with decreasing flow, and the built-in check valve prevents backflow, allowing sensor mounting in any position. Mechatronic flow switches are very reliable. They have a fast response time and a long lifespan.

Mechatronic Flow Transmitters: Mechatronic flow transmitters use a spring-supported piston that is lifted by the flowing medium against the spring resistance. The flow rate is determined by converting the piston position to an analog output signal. The spring resistance forces the piston to return to its original position with decreasing flow, preventing backflow. The transmitters are immune to rapid media temperature changes and are ideal for applications requiring fast response times.



pipe.

Magnetic-Inductive Flow Meters: Magnetic-inductive flow meters use Faraday's law of induction to measure flow rate. Current-carrying coils generate a magnetic field in a measuring pipe. When a conductive media flows through the pipe, its ions are diverted perpendicularly to the magnetic field. The positive and negative charge carriers flow in opposite directions, inducing a voltage that is measured by two electrodes immersed in the media. The induced voltage is directly proportional to the average flow velocity. The volumetric flow rate is calculated using the flow velocity and cross-sectional area of the pipe.



Vortex Flow Sensors: Vortex flow sensors measure the frequency of vortices shed by a bluff body placed in the path of a flowing fluid. The bluff body is a small obstruction that causes the fluid to flow around it in alternating vortices. The frequency of this vortex shedding is directly proportional to the flow rate of the liquid. They are simple in design, have no moving parts that can wear out, and are unaffected by the temperature or pressure of the measured fluid. They have a wide flow range, a low pressure drop, and are typically more cost-effective than other types of flow meters.





Variable Area Mechanical Flow Meters: Variable area mechanical flow meters are designed with a precision molded, sharp-edged orifice within a piston assembly to form an annular opening with a metering cone. Flow passing through the meter creates a pressure differential across the orifice, which causes the piston to move precisely in proportion to the flow rate against the spring. A red indicator attached to the piston moves along a numerical flow scale to show the flow rate.

Differential Pressure Flow Transmitters: Differential pressure transmitters determine flow rate by measuring the difference in pressure across a primary flow element placed in the fluid stream. Primary flow elements such as an annular plot tube, orifice plate, or venturi tube are used to create a physical property accurately related to the flow rate. These devices are known for their high accuracy and precision in flow measurement over a wide range of flow rates and operating conditions.



Level Process Control

Level sensors monitor the level of liquids, pellets, powders, and other similar products in tanks and process systems. The measurement can be used for monitoring purposes or to control a process. Integrated level controllers can sense level and operate alarms, pumps, valves, and other industrial equipment. A variety of sensing technologies are available, including contact and non-contact methods, and you should choose the sensing technology best suited for the material being monitored.

Ultrasonic Level Sensors: Ultrasonic sensors emit a sound impulse and measure the elapsed time of the echo from a detected object or material. These types of sensors can operate as downward facing, non-contact level sensors. Models with discrete outputs will indicate the presence of the material within the sensing range; distance sensing models with analog outputs can indicate the material's relative level within the sensing range.



Pulsed Radar Level Sensors: Downward-looking pulsed radar level sensors emit pulses towards the surface of a liquid and measure the time (time of flight) for the pulses to reflect from the surface and return to the sensor. Since the distance to the liquid surface is proportional to the time of flight, the level can be determined.



Guided Wave Radar Level Sensors: Guid-

ed wave radar level sensors use electromagnetic pulses that travel down a metal probe until they reach the medium, which then reflects the pulse waves back to the probe. The time difference between the transmitted and received pulses is used to compute and display the level with high precision.



Submersible Level Sensors: Submersible sensors provide continuous liquid level measurement by sensing the hydrostatic pressure produced by the height of liquid above the sensor. These sensors typically provide a current output signal corresponding to their specific pressure sensing range.

Differential Pressure Level Sensors: Differential pressure level transmitters measure the difference in pressure between two points in a fluid. This pressure difference is directly proportional to the level of the fluid.





Vibrating Fork Switches: Vibrating fork switches use a harmonic vibrating frequency which is reduced when their forks come into contact with a monitored liquid. The switches use this frequency reduction to determine the presence of the liquid and send a discrete output. These switches provide reliable level detection of dirty liquids that coat, scale, or foam, such as wastewater, diluted caustic soda, and light oils. They can be mounted throughthe-wall or inside a tank as high- or low- level indicators.





Float Level Switches: Low-cost float switches provide single-point monitoring of liquid level in industrial applications. Powerful permanent magnets within the float actuate a highly reliable and repeatable hermetically sealed reed switch as the float rises and lowers with liquid level. A variety of material construction and mounting styles offer compatibility with many liquids, temperature ranges, and system pressures. **Rotating Paddle Level Sensors:** Rotating paddle level switches are point level switches for dry, granular bulk solids. These contact level switches use a motor-driven rotating paddle to detect the level. The paddles freely rotate in the absence of material. When the monitored material covers the paddle blades and impedes their rotation, the switch contacts engage to signal that material is present. They are highly reliable, can operate in harsh environments, and are unaffected by vibration, dust, or moisture.



Capacitive Level Sensors: Capacitive sensors are useful for detecting the level of solids such as plastic pellets or water-based conductive liquids. These switches are contact sensors that detect presence by evaluating the difference in the dielectric values of air (typically) and the measured media. When the media comes into contact with the sensing face, the sensor detects the change in capacitance and provides a discrete output.

Other Process Control Devices

Other devices used in process control systems include displays for monitoring process values, signal conditioners, and process valves.



- **Graphical Panel Meters:** These meters measure voltage, current, or frequency and provide analog meter-style visual readings as well as accurate numeric formats.
- Signal Conditioners / Limit Alarms: Signal conditioners, transmitters, and optical isolators are used in process control systems to solve ground loop problems, isolate noise issues, convert signals to desired levels and types, and to allow longer cable runs. Limit alarms monitor analog inputs and provide low limit, high limit, or other discrete output indications based on the input value.
- **Timer Relays / Counters / Tachometers:** Timer relays provide simple timebased control with multiple modes and adjustable timing ranges, discrete outputs, and a mechanical or electronic display. Multi-function units combine features of a digital counter, timer, and tachometer.
- **Solenoid Process Valves:** Pipeline valves allow ON/OFF flow control and/or mixing and diverting of process media such as air, oil, inert gas, water, and even some caustic materials.
- **Solenoid Separated Process Valves:** Media-separated two-port discrete pipeline valves allow ON/OFF flow control of gases or fluids where the (metal) working components of the valves never come into contact with the process media.
- **Power Monitors:** Power meters are highly accurate devices that measure standard power parameters, plus metering and harmonics.



Looking for knowledge on process control topics such as temperature sensing?

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Review from August 2023 "Good heavy duty temperature probes, large wiring area" Leonard in PENN YAN, NY

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HMI/Operator Interface





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- Marathon single-phase AC motors up to 5hp
- DC motors up to 2hp
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- WEG single-phase AC motors up to 2hp
- WEG three-phase AC motors up to 3hp
- WEG brake motors up to 2hp





Motors and

Motor Controls

- Temperature and process controllers
- Digital and process panel meters
- Temperature sensors and transmitters
- Infrared pyrometers
- Pressure sensors and gauges
- Level sensors and controllers
- Flow sensors and transmitters
- Signal conditioners
- Pipeline valves
- Solenoid /media separated process pipeline valves
- Current to pneumatic (I/P) transducers
- Vibration switches and transmitters
- Trumeter graphical panel meters •
- Cloud data logger with I/O
- · Hour meters and counters

Software

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- Free HMI programming software (download)
- Free AC drive configuration and programming (built-in PLC) software (download)



Safety



- ReeR MOSAIC safety controllers
- IDEM[®] and Dold[®] safety relays
- Speed/Standstill safety relay modules
- WEG safety contactors
- Safety laser scanners
- Magnetic safety switches
- Magnetic coded safety switches
- RFID coded safety switches
- Light curtains from Contrinex, ReeR and Datalogic
- Two-Hand controls
- Trapped key interlocks
- Safety enabling switches
- Safety mats and edges
- Safety bumpers
- Intrinsically safe isolators
 Hazardous location devices
- Safety enabling switches
 - Worm gearboxes
 - Stainless steel worm gearboxes
 - Helical gearboxes
 - Precision gearboxes
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Relays & Timers



- Electro-mechanical relays
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- Slim interface relays
- Power relays
- Solid state relays
- Hazardous location relays
- Timer relays
- Multi-Function Digital Counter / Timer / Tachometers
- Force-guided relays
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- Southwire and Wera nutdrivers
- Sensor tester
- Wera screwdrivers and torque tools
- Wera wrenches, ratchets and sockets
- Southwire and AutomationDirect pliers and stripping tools
- SapiSelco cable ties
- RUKO hole cutting tools
- RUKO grinders and burrs
- Crimping tools from AutomationDirect, Southwire and Z+F,
- Tool cases and bags

Power Transmission



Circuit Protection



Identification

Eaton and Gladiator UL 489 miniature circuit breakers

- AutomationDirect, Gladiator, and Fuji UL 489 molded case circuit breakers
- Eaton and Gladiator UL1077 supplementary protectors
- Edison fuses, fuse holders and fuse blocks
- Socomec, Gladiator® and Bryant® disconnect switches
- Bryant UL 508 manual motor controllers
- Socomec manual transfer switches
- E-T-A, Gladiator, and WAGO electronic circuit protectors
- Merz rotary cam switches
- Code brand scanners, including 1D, 2D and DPM images; scanners can read all common barcodes.
- Contrinex RFID devices use radio frequencies to read and transmit data without the need for line of sight.
- AutomationDirect Standalone RFID R/W units provide fast and long range communication with RFID tags
- Datalogic smart vision sensors make a decision based on a captured image, very useful for applications requiring presence and/or orientation object detection.
- Swivellink mounting systems
- Wenglor vision lighting



Motion Control



Sensors

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- LS Electric[®] servo drives and motors up to 7.5kW
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- CUI Devices® Kit Encoders
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- Photoelectric sensors
- Limit switches
- Precision limit switches
- Inclination sensors
- Laser sensors
- Color and contrast sensors
- Area sensors
- Encoders
- Current and voltage sensors





- Ground fault sensors
- Pressure sensors and gauges
- Temperature sensors, switches, transmitters and thermometers
- Liquid level sensors
- Flow sensors
- Ultrasonic sensors
- Fork sensors
- Linear position sensors
- Vibration sensors
- Position indicators



Pushbuttons, Switches and Lights

- KILLARK[®] hazardous location control stations
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- Fuji[®], Schmersal and Eaton metal/ plastic 22 and 30mm pilot devices
- IP69K-rated pilot devices from Schmersal
- Captron IP69K capacitive pilot devices
- Werma audible and visual signal beacons
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options

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Pneumatics



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- Roxburgh power outlets
- Hammond drive isolation transformers
- Edison[®] power distribution blocks
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- AcuAMP[®] AC current transformers
- Socomec multifunction power meters
- Trumeter graphical panel meters
- Surge protection devices
- Regulators
- Solenoid valves
- Hand valves
- Charles
- Check valves
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- Tubing
- Hose
- Hose clamps

Water (Potable) Components



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