

## Glossary

**4 to 20 mA:** A standard analog signal used for the proportional representation of a measurement variable or process condition.

**Absorb:** To take up or receive by chemical or molecular action.

**AC (Alternating Current):** An electric current in which the flow reverses periodically. Compare direct current (DC).

**Accumulator:** See Totalizer

**Accuracy:** The ability of a measurement to match the actual value of the quantity being measured.

**Acid:** A corrosive liquid (usually in a solution) that dissolves metals and other materials. Technically, acidic material produces positive ions in solution. An acid is the opposite of a base and has a pH between 0 to 7. A given amount of an acid added to the same amount of a base neutralizes the base, producing water and a salt. Common vinegar, for example, is a weak solution of acetic acid.

**Active Outputs:** These outputs throttle current in loops powered by the 8900; no external power source is required.

**Adsorption:** The clinging of molecules to the surface of particles; the process by which activated carbon removes contaminants from water.

**Alkali:** A bitter, caustic mineral often found in large beds in the desert. Alkalis are bases; two common examples are lye and ammonia.

**Analog (also analogue):** A type of signal in which data is represented by continuously variable, measurable, physical quantities, such as current or voltage. 4 to 20 mA is a common analog signal, as opposed to Digital.

**Base:** A bitter, caustic liquid. Technically, a basic material produces negative ions in solution. A base is the opposite of an acid and has a pH of 7 to 14. A given amount of a base added to the same amount of an acid neutralizes the acid; water and a salt are produced. Alkalis are bases; ammonia is a common base.

**Batch Control:** The process of dispensing a precise volume of fluid repetitively or in conjunction with another process.

**BCF:** Bead and Crevice Free; a welding technique for plastic pipes that yields a weld surface suitable for high purity application requirements.

**Bi-Directional Flow:** (1) All Signet flow sensors with a frequency output are bi-directional; the sensor will always have an output of "positive" flow no matter which direction the fluid is flowing in the pipe. (2) Flow sensors with 4 to 20mA output can be set for uni- or bi-directional flow. Uni-directional flow indicates one direction of flow only, typically set as 4 mA equal to zero flow and 20 mA equal to the maximum flow rate required. Bi-directional flow indicates flow in both forward and reverse directions. Bi-directional flow can be set-up by making the 4 mA output equal to a negative number (for instance, -5 m/s) and the 20 mA output equal to a positive number (for instance, +5 m/s).

**Blind Transmitter:** Any device having 4 to 20 mA output without also having a local/permanent display.

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**Boolean:** A logic system treating variables through the operators AND, OR, NOT, and XOR, where each operator can have one of two values, true or false.

**Buffer:** Typically a solution used as a calibration standard due to its ability to maintain a stable pH value.

**Calibration:** Systematic adjustment of the display and/or output of a measuring instrument for the purpose of conforming to a standard or actual value.

**Caustic:** any strongly corrosive chemical substance, especially one that attacks organic matter. A caustic alkali is a metal hydroxide, especially that of an alkali metal; caustic soda is sodium hydroxide, and caustic potash is potassium hydroxide. Most inorganic acids, e.g., sulfuric acid, are caustic, especially when concentrated.

**Cavitation:** The formation and collapse of a gas pocket or bubble due to mechanical shearing of a fluid.

**CE:** Conformité Européene. A mark that is affixed to a product to designate that it is in full compliance with all applicable European Union legal requirements.

**Cell Constant:** 1) the distance between the two electrodes of a conductivity cell divided by their cross-sectional area. 2) A value associated with an effective measurement range used in the proper selection of conductivity cells for specific applications.

**Condensation:** The transformation of water vapor to liquid. Also, a chemical reaction in which two or more molecules combine, usually with the expulsion of water or some other substance.

**Conductivity:** The measure of the ability of a fluid to conduct an electrical current. In water, this ability is due to the presence of ionized substances in solution. Conductivity measurements usually include temperature compensation.

**Corrosion:** Material deterioration due to chemical attack.

**Current (loop) Output:** See 4 to 20 mA

**DC (Direct Current):** Electric current in which electrons flow in one direction only. Compare alternating current (AC).

**Dead Band:**

The limits between which the input to an instrument can vary without causing a change to the instrument output.

In relay operation: The difference between the increasing and decreasing readings when the switch is operated between set point and reset point.

See also Hysteresis

**DIN:** Deutsches Institut für Normung e.V.

DIN is a non-governmental organization established to promote the development of standardization and related activities in Germany and related markets with the goal of facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. Through the European standards organizations CEN and CENELEC, DIN also presents the German view in the development of the European standards that are critical to completion of the single European market.

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**DN:** Diametre Nominal; Term used by DIN standards for the inside diameter of pipes.

**Deionization:** A purification process by which ionized particles are removed from water.

**Desalination:** Processes that remove salt from water, such as reverse osmosis, ion exchange, distillation and evaporation.

**Diffusion:** An intermingling of the molecules of liquids or gases.

**Digital:** A type of signal in which data is represented in numerical form. Opposite of Analog.

**Dry Contact Closure:** Relay. The contacts of a mechanical switch.

**DryLoc®:** George Fischer Signet Inc. trade name and patented design for a versatile and robust connector scheme between sensor electronics and electrodes.

**Dual Proportional Control:** See relay control discussion on page 198 (also applies to transistor-type outputs).

**EasyCal:** The calibration routine in Signet pH and ORP systems in which standard buffers or test solutions are automatically recognized by the instrument.

**Efficiency:** For pH and ORP electrodes, the percent of theoretical slope.

**Effluent:** Liquid flowing out of a system, such as a discharge of liquid waste from a factory or water leaving a sewage treatment plant.

**Electrode:** Primary detection device, typically analytical, requiring or benefiting from some secondary conditioning circuitry (e.g., pH and ORP electrodes).  
2) Sensor.

**Emissions:** The potentially disruptive electromagnetic frequencies generated by an electronic device. Various standards defining allowable limits have been established.

**Empty Pipe Detection:** The empty pipe detection in Signet products features a zero flow output when the sensors are not completely wetted. This does not indicate an empty pipe, but rather a pipe that is not completely full.

**EP:** Copolymer of Ethylene and Propylene or terpolymer with butadiene. Typically features good weather and chemical resistance. Typically used with diluted acids and alkalis, detergents, alcohols, steam and silicone oils.

**EPDM:** Ethylene Propylene Copolymer; Same as EP, EPR, and EPM.

**EPM:** Ethylene Propylene Copolymer; Same as EP and EPR, and EPDM.

**EPR:** Ethylene Propylene Copolymer; Same as EP, EPM, and EPDM.

**FFPM :** Also known as FFKM, trade names include or Kalrez (trademark) or Chemraz (registered trademark). Typical applications for this material include highly aggressive chemical processing, semiconductor wafer processing, pharmaceutical, oil and gas recovery, aerospace and petroleum.

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**FM:** Factory Mutual; An organization that sets various product standards, especially related to intrinsic safety and explosion proof. Insurance companies look to see if items such as cooling towers have earned Factory Mutual Approval and typically offer reduced rates for equipment that has been demonstrated as unlikely to burn in a fire.

**FPM:** FPM is an elastomer, better known as Viton. See Viton entry.

**Frequency:** The number of repetitions that occur in one second. Frequency can be used to describe electrical quantities, sound waves, mechanical vibrations, etc. Frequency is measured in units of Hertz (Hz).  
In Signet flow sensors, the output is defined in terms of frequency and used to calculate Flow Rate.

**Hot-Tap:** A mechanical assembly that allows the insertion and removal of a sensor or electrode without the need for system shutdown, and initial installation may be performed under pressurized conditions. Similar to Wet-Tap.

**Hysteresis:** In relay Setpoint programming, the difference between the activation point and the release point. See also Deadband.

**Impedance:** A measure of the apparent resistance posed by an electrical circuit to an alternating current (AC).

**Immunity:** Ability of a device to function without disruption in the presence of electromagnetic interference.

**Insertion Flow Sensor:** A type of flow sensor that installs through a hole in the wall of a pipe and converts a local velocity measurement into a calculation of the flow rate in the pipe. Usually used in comparison to “full bore” or “full line” flow sensor.

**Intrinsically Safe:** Term used to identify any device, instrument or component that will not produce any spark or thermal effects under any conditions that are normal or abnormal that will ignite a specified gas mixture. Electrical and thermal energy limits are at levels incapable of causing ignition. It is common practice to use external barriers with intrinsically safe installations.

**Ion:** An electrically charged atom or group of atoms.

**IP65:** A European standard for the degree of protection provided by enclosures for splash proof and dust-proof rating.

**IP68:** The European standard for degree of protection provided by enclosures for submersible and dust-proof rating.

**IR:** Infrared, refers to a welding technique offered within the range of SYGEF® HP products.

**ISO:** International Organization for Standardization: A voluntary organization that creates international standards, including the standards for computers and communications. The American National Standards Institute, ANSI is a member of ISO. An example of an ISO set of standard codes is the two-character code set to denote countries, e.g., AR = Argentina, AT = Austria, AU = Australia, DE = Germany, SG = Singapore, and US = United States of America. (ISO is not one of the thousands of acronyms used by computer and communications workers! It is actually a pun based on the prefix “iso” which means “same” in Greek.)

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**ISO 14001:** International Organization for Standardization environmental standard.

**ISO 9001:** International Organization for Standardization quality standard.

**Isolated/Isolation:** Electrical separation between two or more circuits used to prevent measuring errors, ground loops, or a shock hazard.

**K-Factor:** In Signet Flow sensors, the number of pulses generated by the sensor for each unit of volume that passes by the sensor. Usually published in pulses per gallon and pulses per liter.

**Linearity:** The extent to which an output (response) is strictly proportional to an input (stimulus).

**Loop:** In electricity, a complete circuit. Usually used in reference to a 4 to 20 mA loop, an output signal used to control valves, actuators etc.

**Loop Impedance:** The maximum allowable total electrical resistance of all devices, including wiring, connected to any electrical loop; expressed in Ohms at a specified voltage level, i.e.;  $600\Omega @ 12 \text{ VDC}$ .

**Loop output:** An analog output signal, usually 4 to 20 mA.

**Loop powered:** In Signet products, any instrument that derives operating power from a 4 to 20 mA loop.

**Magmeter:** Electromagnetic flow meter.

**Metalex™:** Product name of fixed insertion metal paddlewheel flow sensors manufactured by George Fischer Signet Inc.

**Mho:** The unit of conductance such that a constant voltage of one volt between its ends produces a current of one ampere in the conductor.

**Mini-Tap:** Stainless steel installation fittings for use with Metalex flow sensors.

**NEMA 4:** A standard for enclosures maintained by the National Electrical Manufacturers Association; NEMA 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water.

**NEMA 4X:** Same as NEMA 4, with added protection from corrosion.

**NEMA 6:** A standard for enclosures maintained by the National Electrical Manufacturers Association; NEMA 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection in submersible applications.

**NIST:** National Institute of Standards and Technology.

**Non-isolated:** Two or more electrical circuits sharing a common ground. When separated by distance or connected to additional circuitry there is increased probability for measurement errors due to ground loops.

**Ohm:** The unit of measure for electrical resistance. A resistance of 1 ohm will pass 1 ampere of current when a voltage of 1 volt is applied.

**Open Collector Output:** An NPN transistor or FET output generally used to pull a signal from high to low. Device used for frequency, pulse, and alarm outputs.

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**Operating Pressure:** Maximum vapor pressure from process

**Operating Temperature:** The temperature at which a product is capable of operating; usually a minimum and maximum value.

**ORP (Oxidation Reduction Potential):** A method of measuring the degree of completion of a chemical reaction by detecting the ratio of ions in the reduced form to those in the oxidized form as a variation in electrical potential measured by an ORP electrode.

**Paddlewheel:** A type of insertion flow sensor (pioneered by George Fischer Signet Inc.) that utilizes a bladed rotor to engage the fluid flowing in a pipe. The spinning rotor produces a frequency output directly proportional to the fluid velocity.

**Passive Outputs:** These outputs throttle current in loops powered by a supply external to the 8900.

**PBT:** PolyButylene Terephthalate: A semi-crystalline polymer, combining good strength and stiffness with low moisture absorption, exceptional thermal stability, excellent electrical insulation properties, outstanding dimensional stability and resistance to the effects of a wide range of chemicals, solvents, and oils.

**PEEK™:** PolyEtherEtherKetone; an engineering thermoplastic with excellent chemical and water resistance. In Signet products, the yellow housing in ProcessPro field-mount instruments.

**Percent Rejection:** An indicator of RO system efficiency and membrane condition. Defined as one minus the ratio of the conductivity of RO product water to feed water, expressed as a percentage, and representing the extent to which incoming contaminants were rejected by the system.

**pH:** A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale commonly in use ranges from 0 to 14.

**Piezoelectric:** The generation of electricity or of electric polarity in dielectric crystals subjected to mechanical stress, or the generation of stress in such crystals subjected to an applied voltage.

**Polypropylene (PP):** PP is a polymer of ethylene with an isotactic arrangement of methyl groups.

**Preamplifier:** A device used typically to protect the relatively weak output signals of pH and ORP electrodes from the wide variety of electromagnetic interference common in most industrial environments.

**ProcessPro®:** Signet product name for a group of instruments characterized by a basic 4 to 20 mA Loop output, for the measurement of Flow, pH/ORP, Conductivity, Pressure and Temperature.

**Proof Pressure:** Maximum water or hydraulic pressure.

**ProPoint™:** Signet product name for a group of panel mount instruments for the measurement of Flow, Batch, pH/ORP, Conductivity/Resistivity, Salinity and others. Characterized by a unique analog and digital display.

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**Proportional Pulse:** In Signet products, an operating mode for relays and open-collector outputs that varies the frequency of the pulse in direct proportion to input variations.

**PTFE:** Polytetrafluoroethylene, also known as TFE. Trade names include Teflon®, Halon®, Floun® (all registered trademarks).

**Pull-up resistor:** A resistor needed to obtain the high-level voltage signal in a transistor-type output circuit.

**PWM:** Pulse Width Modulation; In Signet products, an operating mode for relays and open-collector outputs characterized by varying the time that a pulse is “on” versus the time it is “off”. Also, a method of digitally encoding analog signal levels.

**Quinhydrone:** A crystalline powder typically added to pH 4 and 7 buffers for the purpose of producing standard solutions used in the calibration of ORP measuring systems.

**RC Filter:** A resistive-capacitive device, often referred to as a “snubber”, designed to protect instrumentation and relay contacts by capturing the voltage spikes resulting from the switching of large inductive loads such as solenoids and motor starters, etc.

**REDOX:** Reduction/Oxidation; Same as ORP.

**Relative Humidity:** The amount of moisture in the air as compared with the maximum amount that the air could contain at the same temperature, expressed as a percentage.

**Relay:** An electromechanical switch.

**Repeatability:** The extent to which an output (response) repeatedly corresponds to identical input (stimulus) during dynamic conditions.

**Resistivity:** The inverse of conductivity (1/conductivity).

**Reverse Osmosis:** a process that allows the removal of particles as small as ions from a solution. The most common use for reverse osmosis is in purifying water. It is used to produce water that meets the most demanding specifications that are currently in place.

**Reynolds Number:** A dimensionless quantity associated with the smoothness of flow of a fluid. At low velocities fluid flow is smooth, or laminar, and the fluid can be pictured as a series of parallel layers, or lamina, moving at different velocities. The fluid friction between these layers gives rise to viscosity. As the fluid flows more rapidly, it reaches a velocity, known as the critical velocity, at which the motion changes from laminar to turbulent, with the formation of eddy currents and vortices that disturb the flow. The formula can be stated as:

$$R = dv/\mu \text{ where } d \text{ is inside diameter, } v \text{ is velocity and } \mu \text{ is viscosity.}$$

In general,

- $R < 2000$  = Laminar Flow
- $R > 2000 < 4500$  = Transitional (Indeterminate)
- $R > 4500$  = Fully Developed & Turbulent  
(most flow sensors operate best in turbulent flow)

**Rotor-X:** Family trade name of the original plastic paddlewheel flow sensors.

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**RS232:** An interface standard between equipment employing serial binary data interchange.

**Ryton:** Trade name for Polyphenylene Sulfide or PPS. Other trade names include Fortron<sup>®</sup>, Tedar<sup>®</sup>, Supec<sup>®</sup>, and Tedur<sup>®</sup> (all registered trademarks)

**S<sup>3</sup>L:** Acronym for Signet Sensor Serial Link; a digital communication method between Signet sensors and host instruments.

**SafeLoc™:** Name coined by George Fischer Signet Inc. to define the unique locking mechanism used in the Signet 3719 pH Wet-tap assembly.

**Salinity:** A measurement of dissolved salt concentration, as in seawater, typically expressed in parts per thousand (ppt).

**Sensor:** 1) A primary detection device typically providing direct input to a measurement instrument (i.e., paddlewheel flow sensor). 2) The combination of an electrode and some secondary conditioning circuitry (i.e., pH electrode and preamplifier). 3) Electrode.

**Signet:** Model name of fluid measurement sensors and instruments marketed under the +GF+ brand.

**Sleeved Rotor:** An accessory rotor featuring a self-lubricating mechanical sleeve that replaces the standard liquid bearing of Rotor-X paddlewheel flow sensors. Sleeved rotors will extend the maintenance interval in applications known to produce premature rotor wear, such as those involving abrasive liquids.

**Specific Gravity:** Ratio of the mass of a body to the mass of an equal body of volume of water at 4°C, or some other specified temperature.

**Suspended Solids:** Particulate suspended (as opposed to being dissolved) and typically creating turbid, cloudy conditions in liquid.

**TDS:** Total dissolved solids.

**Totalizer:** In flow instrumentation, a permanent or resettable counter for volume such as gallons or tens of gallons, etc.

**Transmitter (two-wire):** A device that converts an electrode or sensor input to a 4 to 20 mA output using the same two wires for signal transmission as for system power

**Turndown Ratio:** Dynamic response characteristic. The ratio of a sensor's maximum measurement range to its minimum measurement range.

**Twist-Lock:** Signet quick and easy connector scheme between the 2720 Pre-amplifier and 271X pH and ORP electrodes.

**UHMW Polyethylene:** Ultra High Molecular Weight polyethylene. Very good chemical resistance of corrosives; very good stress cracking resistance (with the exception of strong oxidizing acids at elevated temperatures).

**Ultrasonic:** Designating frequencies of mechanical vibration above the range audible to the human ear, i.e., above 20,000 Hz.

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**Viscosity:** The internal friction of a fluid, caused by molecular attraction, which makes it resist a tendency to flow.

**Viton:** Viton® fluoroelastomer is well known for its excellent heat resistance. It offers excellent resistance to aggressive chemicals.

**Voltage (output):** A standard analog signal (0 to 5 or 0 to 10 VDC for Signet products) used for the proportional representation of a measurement variable or process condition.

**Vortex shedding:** A type of flow measurement device where vortices are formed continuously behind a solid body in a stream, and the frequency of the vortices is proportional to the flow rate.

**Weldolet:** A weld-on branch connection for metal pipe typically used as an installation fitting for insertion-style sensors or electrodes.

**Wet-Tap:** A mechanical assembly that, after initial installation into a non-pressurized system, allows the insertion and removal of a sensor or electrode without the need for system shutdown. Similar to Hot-Tap.

**Window (Relay Module):** An out-of-range alarm scenario that allows a single relay to be triggered by either a high or a low process condition. For example, a relay in window mode can be programmed to trigger if a pH value in a final effluent tank drops below 6.0 or rises above 8.5.