Place correct letter in blanks on the right.

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|  |  | **Letter** |
|  | Using \_\_\_\_\_\_ an operator must visually monitor a process and make corrections as needed. |  |
|  | Process of utilizing instruments to measure and control process variables to manufacture products safely and efficiently. |  |
|  | Federal agency that enforces safety and health regulations. |  |
|  | The \_\_\_\_\_\_\_ develops measurement standards. |  |
|  | \_\_\_\_\_\_ are parameters or quantities that we wish to measure and control at the correct limit. |  |
|  | The desired value of a process variable (e.g. fluid level). Value at which PV is maintained. |  |
|  | When the process variable deviates from the set point. |  |
|  | The amount of deviation from the set point. |  |
|  | The difference between the minimum and maximum values of a process variable. |  |
|  | The difference between the maximum and minimum values of a range |  |
|  | The ability of a sensor to provide the same result under the same conditions. |  |
|  | The smallest change in a variable that can be detected by a sensor. |  |
|  | The gradual change in a measurement over time when the process conditions are constant. |  |
|  | The degree to which a measured value matches the actual process value. |  |
|  | The milliamp signal (value) and the corresponding value of the process variable are \_\_\_\_\_\_\_ to one another. |  |
|  | The arrangement of instruments designed to measure and control a process. |  |

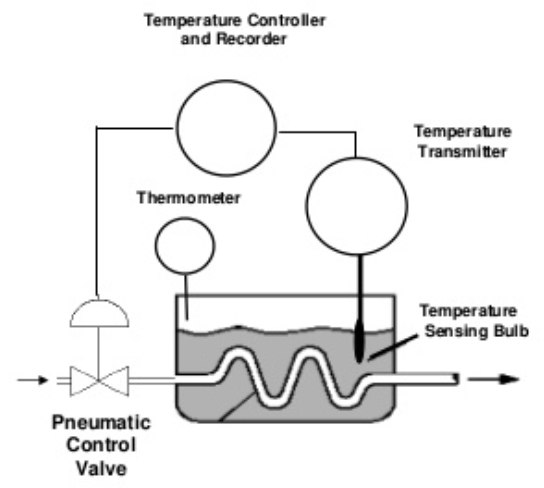
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| 1. Accuracy |
| 1. Drift |
| 1. Error |
| 1. Industrial (Process) Instrumentation |
| 1. Instrument Loop |
| 1. Manual Control |
| 1. National Inst. of Standards and Technology |
| 1. Occupational Safety and Health Administration (OSHA) |
| 1. Process Upset |
| 1. Process Variables |
| 1. Proportional |
| 1. Range |
| 1. Repeatability |
| 1. Sensitivity |
| 1. Set Point |
| 1. Span |

Place correct letter in blanks on the right.

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|  | The \_\_\_\_\_\_ is typically an electrical device (e.g. a level measuring instrument) that measures the process variable and converts the measurement into a value (electrical signal). |  |
|  | The \_\_\_\_\_\_ receives a signal from the primary element (PV), compares it to a set point, and sends a signal (corrective action) to the final element to keep the process variable at the set point. |  |
|  | In order to maintain (control) the process variable set point (e.g. the level in a tank), a \_\_\_\_\_\_\_ must be changed to control the final element (e.g. an actuator controlled valve). |  |
|  | Receives a signal from the control element and adjusts the manipulated variable in order to keep the process set point. |  |
|  | In \_\_\_\_\_\_, the final control element is either on or off depending on whether the process variable is above or below set point. (tends to overshoot or undershoot the set point) |  |
|  | In \_\_\_\_\_\_, the final control element changes proportionally to the amount of deviation from the setpoint. (more precise) |  |
|  | Ensures that the output of the transmitter is proportional to the Process Variable. |  |
|  | Lists instruments used by tag number. |  |
|  | Contain applicable codes, standards, wiring and cable requirements, ventilation requirements, power supply requirements, etc. |  |
|  | Provide information and requirements for proper mounting and connections of a specific instrument. |  |
|  | Identify where an instrument is to be installed. |  |
|  | Detailed drawing of equipment, piping, and instrumentation on a project. |  |
|  | Identify instrumentation location, function, and related instrument loop. |  |
|  | Identify location of instrument when the process is spread across multiple buildings or areas. |  |

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| 1. Area Designation Numbers |
| 1. Calibration |
| 1. Control Element |
| 1. Final Element |
| 1. General Instrumentation Specifications |
| 1. Installation Detail Drawings |
| 1. Instrumentation Index |
| 1. Location Drawings |
| 1. Manipulated Variable |
| 1. On/Off Control |
| 1. Piping and Instrument Drawing (P&ID) |
| 1. Primary Element |
| 1. Proportional Control |
| 1. Tag Numbers |

1. Draw the P&ID symbol for a discrete, field mounted, instrument.
2. Draw P&ID the symbol for a control valve.
3. Draw P&ID the symbol for a ball valve.
4. In the control loop shown, steam is delivered through a pipe to maintain a desired temperature in the tank.



PLC

Temperature Sensor

* 1. Label the primary element, control element and final element.
  2. What is a typical current range for signals in a control loop? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. Describe the manipulated variable under a proportional control scenario.