What is a Pneumatic Controller?

Definition

A controller is a comparative device that receives an input signal from a measured process variable, compares this value with that of a predetermined control point value (set point), and determines the appropriate amount of output signal required by the final control element to provide corrective action within a control loop.

A Pneumatic Controller is a mechanical device designed to measure temperature or pressure and transmit a corrective air signal to the final control element.

Principles of Operation

The Trerice Pneumatic Controller operates through a coordination of its thermal or pressure sensing system and its air signal relay system. The controller's sensing bulb or pressure connection, installed within the process application, senses change within the measured variable and relays this information (input signal) to the controller. The controller mechanically compares the signal against a predetermined set point and sends a corrective air signal to a pneumatic control valve, which modulates process flow, thereby returning the application to the desired condition.

All Trerice Pneumatic Controllers are designed to control the temperature or pressure of general industrial equipment and should be carefully selected to meet the demands of the particular application. The information contained within this catalog is offered only as a guide to assist in making the proper selection. Selection of the proper controller is the sole responsibility of the user. Improper application may cause process failure, resulting in possible personal injury or property damage.

Selecting a Pneumatic Controller

Control Function

Trerice Pneumatic Controllers can be specified for either on/off or proportional control. Processes which are characterized by stable load conditions can be controlled using on/off control with a "quick-opening" control valve, providing a full corrective response to a minimal change in the measured variable. Applications with unstable load conditions, or those requiring precise control, are best maintained using proportional control and an equal percentage valve trim design, which gives a corrective response that is proportionate to the change in the measured variable.

- **Proportional (P)** – Proportional control reacts to the size of the deviation from set point when sending a corrective signal. The size of the corrective signal can be adjusted in relation to the size of the error by changing the width of the proportional band. A narrow proportional band will cause a large corrective action in relation to a given amount of error, while a wider proportional band will cause a smaller corrective action in relation to the same amount of error.
- **On/Off (I/0)** – On/Off control recognizes only that a deviation exists. Any deviation between the set point and measured process variable will produce a full corrective signal.

Range and Set Point

Temperature ranges from -100°F through 600°F and pressure ranges from 30 psi through 1000 psi are available. The set point is the actual temperature or pressure required within the process. A set point indicator (adjusted via an external knob) and a process temperature or pressure indicator are read against the range plate. The controller is equipped with two internal pressure gauges to indicate the air supply pressure and the pneumatic output signal pressure.

What is a Pneumatic Controller?

continued

Action

Trerice Pneumatic Controllers can be furnished in either direct or reverse action. A direct acting controller will increase the output signal as the input (temperature or pressure) of the application increases. A reverse acting controller will reduce the output signal as the input of the application increases. The action must be specified when ordering, but can be easily reversed in the field.

Actuation Systems

The Trerice Pneumatic Temperature Controller is available in three types of thermal actuation: Vapor, Liquid or Mercury, and can be specified with various capillary and sensing bulb materials, coverings, and connections to meet the requirements of any application.

- **Vapor Actuation** – Vapor actuation is recommended for use on applications where cost is a consideration, sensing bulb size is not critical, and the required accuracy ratings are of a commercial grade. This system's accuracy is **not** affected by ambient temperature changes along the capillary system, or by capillary length. Vapor systems have a progressive, nonlinear indicating scale; therefore, the range should be selected so the control point falls within the upper half of the range. Vapor actuation is not recommended for control at ambient temperatures.
- **Liquid Actuation** – Liquid actuation is desirable when controlling within ambient and cross ambient conditions. This system is also suitable for low temperature demands. It is furnished with a small sensing bulb and a linear scale. Consult factory for capillary systems in excess of 20 feet in length.
- **Mercury Actuation** – Mercury actuation is recommended for applications requiring extreme accuracy and control. This system features a linear scale and can be used for controlling high temperature applications. Consult factory for capillary systems in excess of 50 feet in length.

CAUTION: Temperature indication error will be introduced whenever the capillary tubing is exposed to ambient temperatures above or below 75°F. The following formula MUST be considered when specifying liquid actuation:

Where: S = thermometer range span in °F
L = capillary length in feet
T = capillary temperature variation from 75°F

Error = 0.000082 x S x L x T

Example: S = 210 (30 to 240°F)
L = 20
T = 10 (85°F)

Error = 0.000082 x 210 x 20 x 10 = 3.4°

CAUTION: Temperature indication error will be introduced whenever the capillary tubing is exposed to ambient temperatures above or below 75°F. The following formula MUST be considered when specifying liquid actuation without compensated capillary tubing:

Where: S = thermometer range span in °F
L = capillary length in feet
T = capillary temperature variation from 75°F

Error = 0.000015 x S x L x T

Example: S = 210 (30 to 240°F)
L = 20
T = 10 (85°F)

Error = 0.000015 x 210 x 20 x 10 = 0.6°

The Trerice Pneumatic Pressure Controller is furnished with a ⅛ NPT female connection port for sensing process pressure via a user-supplied feedback line.

Thermowell

For applications in which the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the sensing bulb. A thermowell will also facilitate the removal of the sensing bulb from the operating process. Thermowells are available in a variety of lengths, connections, and materials.

Air Filter/Regulator

The Trerice No. TA987 Air Filter/Regulator is recommended for filtering and regulating the pressure of plant compressed air and delivering clean, dry air at the proper pressure to pneumatic control devices.

Clean, filtered supply air is required by all pneumatic control systems and control devices.