Description

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. Trerice offers two different types of controllers:

- An Electronic PID Controller uses electrical signals and digital algorithms to perform its receptive, comparative and corrective functions.
- An Electric Contact Controller is a mechanical device designed to measure temperature and transmit a corrective electrical signal to the final control element by the activation of one or more electrical switches.

Principles of Operation (Electronic PID Controller)

An electronic sensor (thermocouple, RTD or transmitter) installed at the measurement location continuously sends an input signal to the controller. At set intervals the controller compares this signal to a predefined set point. If the input signal deviates from the set point, the controller sends a corrective output signal to the control element. This electric signal must be converted to a pneumatic signal when used with an air operated valve, such as a Trerice Series 910 or 940 Control Valve. The conversion can be made using a Trerice TA901 I/P Transducer, which converts a 4 to 20 mA electric signal to a 3 to 15 psi air signal.

Features (Electronic PID Controller)

An electronic controller is best suited for applications where large load changes are encountered and/or fast response changes are required. Trerice Electronic Controllers have full auto tuning and PID capabilities, and offer a host of available options, including user selectable inputs and ranges, outputs, setback functions, and alarms.

PID Control is a feature of most Trerice Electronic Controllers. PID combines the proportional, integral and derivative functions into a single unit.

- **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.
- **Integral (I)** — Integral control reacts to the length of time that the deviation from set point exists when sending a corrective signal. The longer the error exists, the greater the corrective signal.
- **Derivative (D)** — Derivative control reacts to the speed in which the deviation is changing. The corrective signal will be proportional to the rate of change within the process.

Auto-Tuning

Auto-tuning will automatically select the optimum values for **P**, **I** and **D**, thus eliminating the need for the user to calculate and program these values at system startup. This feature can be overridden when so desired. On some models, the control element can be manually operated.

Selecting an Electronic PID Controller

All Trerice Electronic 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.

Case Size

Case Size selection is determined by both available and designed space, and controller features.Trerice Electronic Controllers are available in the following panel sizes: 96 x 96 mm (1⁄4 DIN), 72 x 72 mm, 48 x 96 mm (1⁄8 DIN), and 48 x 48 mm (1⁄16 DIN). The depth of the unit varies with the model selected.

Input

The Input is the measurement signal received by the controller from the sensor. A variety of input types are available, including thermocouple, RTD, voltage and current.

Control Output

The Control Output is the corrective signal transmitted from the controller to the control element. Various control output types are available, including contact, voltage, current and solid state relay driver.

Analog Output

The Analog Output is an optional secondary signal that transmits the measurement signal from the controller to a remote data acquisition device, such as a recorder, personal computer or display unit.

Alarms

Most models can be ordered with alarms, event outputs, or heater break alarms, which signal an external device to perform a specific task at a predetermined set point.

Setback Function

This feature, optionally available on some models, is designed to provide energy savings in applications where the process is idled at regular intervals through the connection of an external timer or switch.

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Principles of Operation (Electric Contact Controller)

The Trerice Electric Contact Controller operates through a coordination of its thermal sensing system and temperature indicating arm with internal linkage, which activates a preset electrical switch upon contact. The thermal system, installed within the process application, senses change in the measured variable and relays this information (input signal) to the controller through an expansion or contraction of the system fill. The temperature indicating arm moves around the dialface in response to the change in process temperature until such time as the internal linkage touches the preset electric switch. This contact sends a corrective electrical signal, which activates or deactivates external On/Off devices, such as solenoid valves or electric heaters. The subsequent control of these devices will result in an increase or decrease of the application temperature, thereby returning the process to the desired condition.

All Trerice Electric Contact Controllers are designed to control the temperature 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.

CONTROLLERS

Selecting an Electric Contact Controller

Control Function

Trerice Electric Contact Controllers are designed specifically for On/Off control. Processes which are characterized by stable load conditions can be controlled using On/Off control with a solenoid valve, electric heater or other electrically operated device.

- **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.

Switching Point and Temperature Range

Trerice Electric Contact Controllers can be ordered with up to four switches per unit. The switches can be adjusted to any point within the temperature range of the controller. Multiple switch units are particularly useful for operating an alarm or other safety device, in addition to the main control element. A switching point indicator (set via an external knob) and a temperature indicator are read against the range plate. Temperature ranges from -100°F through 700°F are available.

Actuation System

The Trerice Electric Contact Controller is supplied with a liquid thermal actuation system. This actuation is desirable when controlling within ambient and cross ambient conditions. It is also suitable for low temperature demands. It is furnished with a small sensing bulb and a linear scale. These controllers can be specified with various capillary and sensing bulb materials, coverings and connections, to meet the requirements of any application. Consult factory for capillary systems in excess of 20 feet in length.

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.

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 = 0.000018 × S × L × T

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

Error = 0.000018 × 210 × 20 × 10 = 3.4°