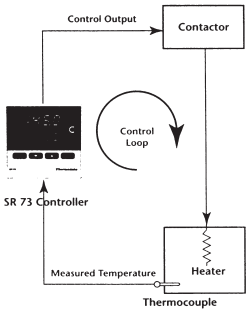
Temperature Control Terms

CONTROL PRINCIPLES

Temperature controllers are far from complicated or difficult to set-up and to operate. However, an understanding of PID controllers and the terms used will greatly help with the selection of a suitable instrument for your process.



THE CONTROL LOOP

The control loop shown in the diagram consists of the following:

- The temperature controller
- A temperature sensor
- An output device

The desired temperature is simply set using push buttons on the front of the controller. This desired temperature or Set-point is then compared with the measured temperature and the resultant error signal used to change the amount of heat being added to or taken from the process.

INPUT SENSORS

Automatic controllers require an input sensor as a means of measuring the process. In temperature applications this is, in most cases, either a thermocouple or resistance thermometer (RTD). Which sensor to use will depend upon the temperature and the process environment.

In many process control applications signal conditioners are used to convert the sensor signal into a 4-20mA signal. Most controllers are able to accommodate these signals and simply scale the input signal to the desired display range.

OUTPUT DEVICES

An automatic controller must have a means of varying the heating power most controllers provide for the following outputs:

- Relay: used to operate a contactor or solenoid valve.
- Solid state relay (SSR): A logic signal from the controller is used to switch the relay and has the benefit of fast switching and no maintenance.
- DC milliamps or volts: used to position motor actuators and to drive thyristor devices for the control of single and three phase heating systems.

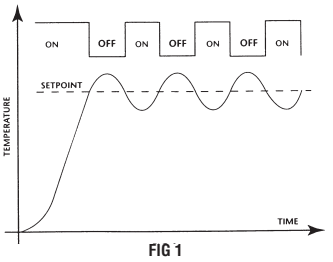


FIG 1

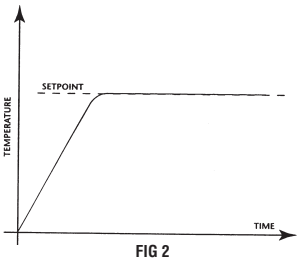


FIG 2

ON-OFF CONTROL – FIG 1

With on-off control the heating is either off (above set-point) or on (below set-point). The temperature difference between the off and on state will largely depend upon the thermal characteristics of the heating system and the sensor response times. To prevent continual excursions through off and on at set-point, a small differential called hysteresis is applied. This requires the measured value to exceed the set-point by a certain amount before the output turns on again. This hysteresis is adjustable via the controllers, a typical value being 1°C. On-off control is satisfactory for low accuracy, non critical heating applications and is recommended when the controller is used as an over temperature cut-out.

PID CONTROL – FIG 2

For many industrial applications the on-off mode does not provide the required "straight-line" control, essential for example in plastics and metal treatment. For accurate and stable control, instruments employing PID algorithms are used.

PID control is also called "Three term control", the terms being:

- P = Proportional
- I = Integral
- D = Derivative

Automatic tuning will calculate the PID settings accurately, enabling you to match the controller characteristics to the process in order to obtain "straight line" control. Automatic tuning ensures stable, "straight line" control at set-point with no overshoot or undershoot.

ADDITIONAL FEATURES

Some controllers offer many additional features such as:

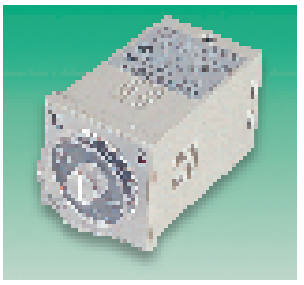
- Auto/Manual control
- Event outputs
- Configurable alarm outputs
- Remote Set-point
- Set-point programming
- Digital communications

PLC1X

Temperature/Process Controllers

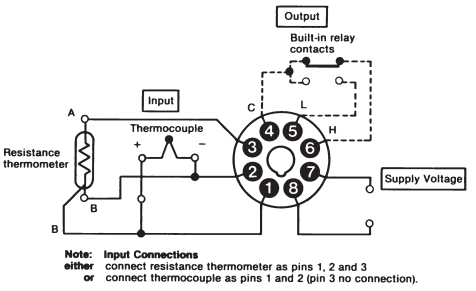
On/Off Control – 'E5C'

OMRON



H = 48, W = 48, D = 85.8,
Panel cut-out = 45 45

- Temperature controllers for On/Off control via type K & PT100 sensors
- Operation of output relay and LED indicator occurs simultaneously with power supply connection
- When preset temperatue is achieved, cooling cycle commences by reset of output relay and LED indicator is extinguished
- If thermocouple open circuits, controller automatically enters safer cooling mode
- Controllers are cold junction compensated. Panel mounting bracket supplied



Note: Input Connections
either connect resistance thermometer as pins 1, 2 and 3
or connect thermocouple as pins 1 and 2 (pin 3 no connection).

Setting accuracy	±2%	Operating voltages	110V ac, 240V ac 50/60Hz
Output contact	SPCO	Operating voltage range	85% to 110%
Contact rating	3A @ 240V ac (res.)		

	Temperature Range	Scale Division
Platinum resistance input sensor:	0°C to 100°C	2°C
Type K thermocouple sensor:	0°C to 200°C, 0°C to 400°C	5°C

PLC2X

Temperature Range	Operating Voltage	Order Code	Price Each 1+	5+	10+	25+
Platinum Resistance Controllers						
0°C to 100°C	110V ac	**175-522**				
0°C to 100°C	240V ac	**170-914**				
Type K Thermocouple Controllers						
0°C to 200°C	240V ac	**175-521**				
0°C to 400°C	110V ac	**175-523**				
0°C to 400°C	240V ac	**170-560**				
Sockets			**1+**	**5+**	**10+**	
DIN rail/surface		**330-954.**				
Chassis		**330-966.**				

Universal Digital Controller

Honeywell

¼ DIN

H = 96, W = 96, D = 55
Panel Cutout = 92 92mm

- Highly visible 3 digit display(s)
- Dual display option available-shows PV and SP
- Essential parameters configurable through front dial
- Range and control are configured using the software package
- **IP54/NEMA 3** front face rating
- ON/OFF or PID control methods available
- Dual display model has one alarm relay output
- Rugged 10A relay output

The UDC100 universal digital controller is a microprocessor-based ¼ DIN low cost temperature controller. Highly simplistic operation, combined with user-friendly set up via the front dial, makes the controller ideal for food processing, small industrial furnaces etc.

Accuracy:	±0.5% of span ±1LSD	Operating voltage:	115/230Vac
Sampling rate:	4 times/sec	Analogue Input:	Thermocouple J, K
Operating temp:	0 to 60°C		

PLC209

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