

P3035

TEMPERATURE CONTROL APPARATUS

3 TERM ELECTRONIC

INTRODUCTION

Cussons P3035 Temperature Control Apparatus is designed to demonstrate the control of temperature in a simulated reactor vessel by controlling the supply of coolant (air) in response to changes in process conditions. The unit provides students with the opportunity of investigating the effects of a change of controller parameters (proportional band, integral and derivative times) on the control capability of the system. Of particular benefit to the student is the fact that the unit is made up of typical items of control equipment currently used in industrial applications, thereby providing an excellent opportunity for familiarisation.

EXPERIMENTAL CAPABILITY

The range of investigations which may be carried out are:

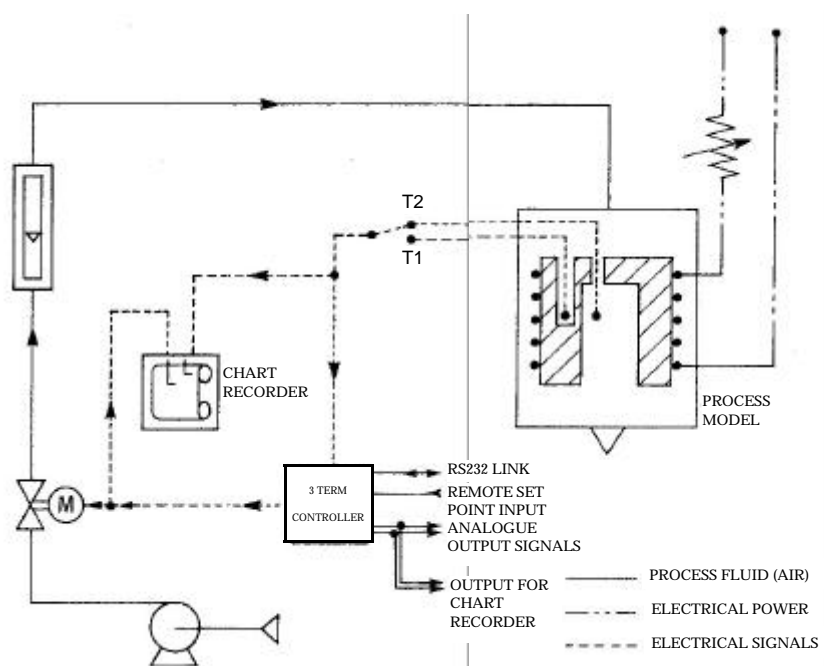
- ◆ Manual (or open loop) on-off control
- ◆ Manual proportional control
- ◆ Determination of the characteristics of a first order and a second order temperature system
- ◆ Demonstration and calibration of controller proportional action and integral action
- ◆ Demonstration of integral saturation
- ◆ Response of a first order and second order temperature systems to closed loop control:
 - Single Term – (proportional)
 - Two Term – (proportional plus integral and proportional plus derivative)
 - Three Term – (proportional plus integral plus derivative)

DESCRIPTION

This bench top unit comprises a process model, an air cooling system, a process control system and a chart recorder.

The process model is a vessel housing a cylindrically wound electrical heater which simulates an exothermic chemical reaction process. The input voltage to the heater can be adjusted manually by means of a multi-position switch working in conjunction with a fine control potentiometer. As such changes to the simulated "heat of reaction" are made, the system has to respond by adjusting the supply of coolant air to maintain the temperature within the reactor vessel at the desired set point.

The cooling system consists of a blower unit, an electronically operated butterfly valve to regulate the flow of air and a variable area flow meter to enable air flow measurement to be made. The coolant air flows into the top of the reactor vessel, around the outside of the heater unit and exits at the bottom of the vessel to be dumped to atmosphere at the rear of the apparatus. Temperature within the reactor vessel is measured by two thermocouples. The first thermocouple is housed within the wall of the heater former (cylindrical in construction with the upper end of the cylinder being closed), while the second is located on the internal wall surface of the heater former. When this latter thermocouple is used, it effectively produces a time lag with respect to the system response to a change of temperature in the reactor vessel. A switch enables either of the two thermocouples to be selected to provide the input signal to a three term electronic controller acting in conjunction with a valve positioner and the butterfly valve adjusts the supply of coolant air to the reactor vessel in response to changes in temperature within the vessel so that the desired temperature can be maintained.



SCHEMATIC DIAGRAM

The proportional, integral and derivative terms of the controller are independently adjustable. The supply of coolant air may also be adjusted by manual control with the controller in manual mode.

The controller is an advanced programmable microprocessor based instrument incorporating RS232C communications interface external setpoint input, and retransmission of the measured variable and control output as analogue signals for data logging. The optional P3030 Programmable Logic Control Module may be used to initiate the controller set point programs as well as command the pump and the disturbance solenoid valve. Other optional equipment available includes P3018 Multi Speed Flat Bed Chart Recorder to record the process variable and the controller output signal, and P3025 Software and Interface for use with an IBM PC/XT/AT or other compatible computer.

TENDER SPECIFICATION

P3035 Temperature Control Apparatus:
3 Term Electronic

Bench Top Temperature Control Apparatus utilising control components typical of current industrial applications.

The apparatus comprises:

1. An air flow circuit consisting of a belt driven blower unit, blower motor, electrically operated air flow valve, variable area flow meter, air flow ducting, and a process model with thermal overload protection, simulating an exothermic chemical reaction process.

2. A control unit comprising a steel instrumentation case housing a three term digital microprocessor controller with adjustable ranges of 0-100%, 0 to 10 minutes, and 0 to 400 seconds on the proportional band, integral time and derivative time respectively; multi-position temperature control switch with fine control potentiometer; thermocouple selection switch; and push-button switches/indicators for the power supply and the blower motor.
3. A welded steel frame and backplate housing the foregoing components.

P3018 Chart Recorder – Bench mounting multi-speed flat bed two channel chart recorder.

P3018/CK Consumables Kit – Comprising kit for chart recorder comprising:

- 10 rolls x 16m chart paper
- 2 red pens and 2 green pens

P3025 Cussons Computer Control Software and Data Logging Interface for use with an IBM PC/XT/AT or compatible.

P3030 Cussons Programmable Logic Module

DIMENSIONS

1075 mm wide x 600 mm deep x 876 mm high

SERVICES

Electrical Supply: Single phase 100/110V 60Hz, or Single phase 220/240V 50Hz