

P3012

FLOW CONTROL APPARATUS

3 TERM PNEUMATIC

INTRODUCTION

The primary objective of a control system is to maintain a process variable such as flow, level, temperature, etc. at a required value. Cussons P3012 Flow Control Apparatus is designed to demonstrate various aspects of control engineering using a flow controlled system to control the flow of water delivered by a centrifugal pump. The unit provides students with the opportunity of investigating the effects of a change of controller parameters (proportional band, integral action and derivative time) 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.

The range of investigations which may be carried out are:

- ◆ Manual (or open loop) two step control
- ◆ Manual proportional control
- ◆ Demonstration of controller proportional action and integral action
- ◆ Demonstration of integral saturation
- ◆ Response of a first order flow system to closed loop proportional control
- ◆ Response of a first order flow system to two term closed loop control (proportional plus integral and proportional plus derivative)
- ◆ Response of a first order system to three term closed loop control (proportional plus integral plus derivative)

DESCRIPTION

The apparatus consists of a water circulation system with a centrifugal pump coupled to a sump tank generating the process variable, namely water flow. The flow rate is measured by an orifice plate assembly, differential pressure transmitter and signal processing unit which produces a linear input signal directly proportional to the flow rate, to a three term pneumatic controller. The latter acting in conjunction with an auto/manual station and a pneumatically operated modulating valve regulates the water flow automatically. The water flow rate may also be adjusted by manual control with the auto/manual station switched to manual mode. The flow rate may be observed directly from a variable area flow meter incorporated in the system.

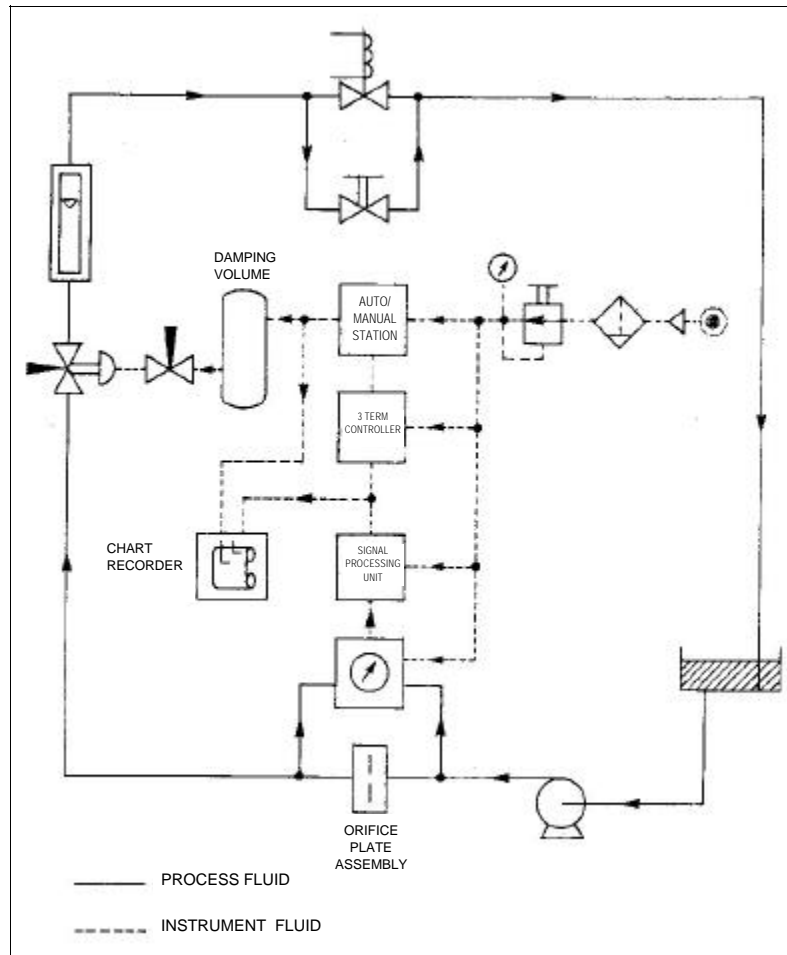
Manual and solenoid valves in the system enable disruptions to the flow to be introduced. The flow rate and controller output values are recorded to a base of time on a two pen vertically mounted chart recorder. The air supply to the apparatus passes through a filter unit prior to distribution via two distribution circuits, one of which is dedicated to the pneumatic control valve. A small, fully automatic air compressor is available as an optional accessory if required.

TENDER SPECIFICATIONS

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

The apparatus comprises:

1. Water flow circuit consisting of a sump tank made from clear acrylic material, centrifugal pump, orifice plate assembly, pneumatic modulating flow control valve, variable area flow meter and a disturbance section comprising manual and solenoid valves.



SCHEMATIC DIAGRAM

2. Pneumatic control loop consisting of a differential pressure transmitter, signal processing unit, three term controller with adjustable ranges of 2-200%, 0 to 40 repeats/min, and 0 to 20 mins on the proportional band, integral action, and derivative time respectively and an auto/manual station. The air distribution line is fitted with an input filter, regulator and pressure gauge.
3. 2-pen vertically mounted pressure recorder.
4. A welded steel frame and backplate housing the foregoing components.

P3006 AIR COMPRESSOR

Fully automatic and compact air compressor with very low operational noise characteristics. Output 4.5m³/h, working pressure 8.5 bar.

SERVICES

Electrical Supply: As above.

DIMENSIONS

360 mm wide, 360 mm deep, 560 mm high

SERVICES

Compressed Air Supply: 3 to 10 bar pressure 1.5m³/h
 Electrical Supply: Single phase 220/240V 50 Hz. The unit can be supplied to operate on an alternative electrical supply upon request at the time of order placing.

P3012/CK CONSUMABLES KIT

Consumable Kit comprising:
 5 rolls x 30 yards chart paper
 2 red pens
 2 blue pens

DIMENSIONS

1075 mm wide, 600 mm deep, 870 mm high

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