

P3015 LEVEL CONTROL APPARATUS 3 TERM ELECTRONIC

INTRODUCTION

Effective operation of industrial processes usually requires a capability to maintain a process variable such as flow, level, temperature, etc., at a required value.

Cussons P3015 Level 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 to a vessel and thus control the water level in the vessel. 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, including optional computer control and data logging using an IBM PC/XT or other compatible computer and also control from an optional programmable logic control module.

EXPERIMENTAL CAPABILITY

The range of investigations which may be carried out are:

- ◆ Manual (or open loop) on-off control.
- ◆ Manual proportional control.
- ◆ Automatic (or closed loop) on-off control.
- ◆ Determination of the characteristics of a first order and second order level system.
- ◆ Demonstration and calibration of controller proportional action and integral action.
- ◆ Demonstration of integral saturation.

- ◆ Response of first order flow and second order systems to closed loop control.

Single Term – (proportional).

Two Term – (proportional plus integral and proportional plus derivative).

Three Term – (proportional plus integral plus derivative).

- ◆ Remote logic control from Cussons P3030 Programmable Logic Control Module.

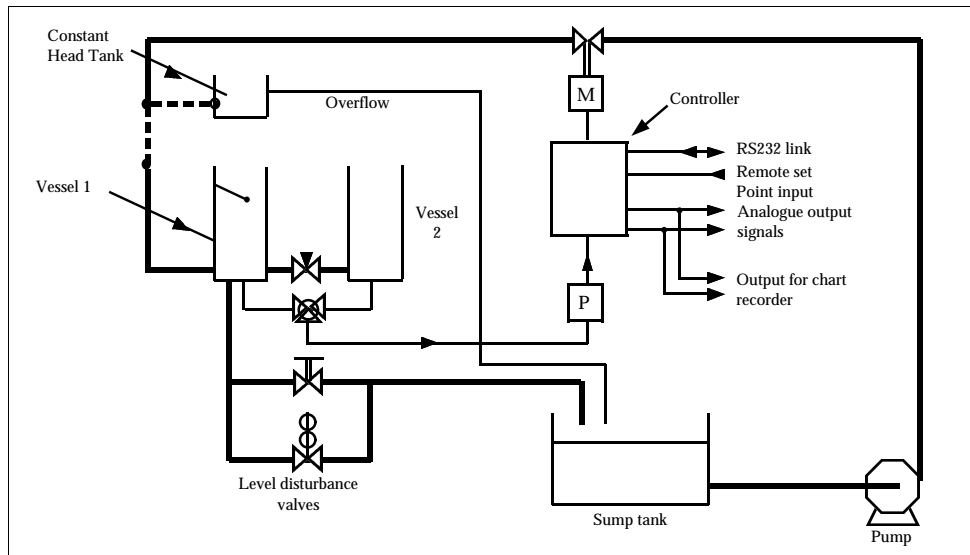
- ◆ Remote control and data logging using Cussons P3025 Software and Interface with an IBM PC/XT.

DESCRIPTION

This bench top unit comprises a process model, a water circulation system, and a process control system.

The process model is made up of two water vessels, vertically mounted on a common base assembly and connected via an interconnecting pipe and valve allowing first and second order systems to be investigated. The first vessel is supplied complete with a constant head tank which fits on top of the vessel. Inlet connections to both the vessel and the constant head tank are of the self sealing quick connect type.

Water is supplied to the first vessel from a sump tank by a centrifugal pump with the flow being controlled by an electrically operated modulating valve. A “high level” float switch is also incorporated in the first vessel to provide on/off control of the centrifugal pump. Flow out of the vessel back to the sump tank is controlled via a hand-operated valve and a solenoid valve so that a variety of steady state and transient conditions may be produced.



The water level in the vessels is measured by a level transducer, switched via a ball valve to either vessel, which produces an input signal (directly proportional to vessel water level) to a three term electronic controller which controls the flow of water to the process model by controlling the electrically operated modulating valve. The proportional, integral and derivative terms of the controller are independently adjustable. The flow of water to the process model may also be adjusted with the controller switched to manual mode. The controller is an advanced programmable microprocessor based instrument incorporating RS232C communications interface, external set point input, and retransmission of both 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 program 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.

Provision is made for the addition of a flow measurement station and additional electronic controller to provide experiments in the control of inter-active loops and for cascaded flow-level control.

TENDER SPECIFICATION

The apparatus comprises a welded steel frame and backplate housing the following:

1. Water flow circuit consisting of a sump tank; centrifugal pump; electrically operated modulating control valve; process model incorporating dual interconnecting water vessels made from clear acrylic material with one vessel fitted with a "high level" float switch, self sealing quick connect water inlet and constant head tank; process

disturbance facility comprising manual and solenoid valves; level transducer and ball valve for vessel selection.

2. A control unit comprising a steel instrumentation enclosure housing a 3 term digital microprocessor controller. Pushbutton switches for the mains power supply, the centrifugal pump and the level disturbance solenoid valve. The microprocessor based instrument has the facility for providing closed loop automatic control or manual control. The microprocessor controller also incorporates an RS232 serial interface, analogue outputs are provided of 0-10V for measured variable and for valve position which can both be fed into the optional chart recorder. The control unit incorporates both computer and programmable logic control communications sockets.
3. Provision should be made for the incorporation of a flow measurement module and second controller for cascaded flow-level control experiments.

P3017 Cussons Flow Control Module for use with P3015.

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 Datalogging Interface for use with an IBM PC/XT/AT or compatible.

P3030 Cussons Programmable Logic Module.

P3040 Cussons Additional Controller for use with P3017.

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