Chapter 25  Tank Over Tank

Tank over Tank Level Control Lab

Purpose of the Lab – From experiences in industry, one individual stated that an auto controls course need only teach students to tune outer loops slow and inner loops fast to be successful with instrumentation applications. This stuck with this author and there has always been desire for students to have such an experience with a visual loop within a loop.[6]

Materials – The tank with level control, flow controls, a bilge pump and PLC.

Cost – The cost of these systems is approximately $1500/each. The lab pictured below is nearing completion for implementation in multiple labs. While relatively expensive, large and clumsy, it promises to replace units commercially available in the $30K range/each. The major cost is the plastic of the system – roughly $1000. It provides loop-within-loop control of level control in the upper tank.

Benefit – This lab has been implemented on one system and that system used as a basis for building of eight new systems. Today the controller, flow control elements and level control elements are waiting final mounting on these eight vessels. The design was updated with new flow meters. In the course of the design, two level controllers were tried and failed. The third finally worked. The benefit of trial and error led to a good design that works. The experience of building and programming this lab was of great benefit to the experience base of the staff.
Cytron 20Amp Bi-Directional 6V-30V DC Motor Driver Speed Controller 60A Peak

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$1980

FREE Shipping
Only 14 left in stock - order soon.
These Turbine Flow Sensors below are in process of replacing the Gems sensors above:


Unlike the previous paddle-wheel sensor these use micro-turbines and can measure flows between .26 to 4GPM with flow accuracies of ±3% across its entire flow range. (The existing sensors have an accuracy of ±15%, which is less than ideal.) Gems also makes a .26-6.6GPM variant that may give a little more headroom, but with a significantly lower pulses per gallon number.
We may also be using the following down the road:

Badger Meter Vision series BV2000TRN075B

Catalog:

Their TRN075B is a comparable sensor in terms of flow range, accuracy and fittings with a 1m attached cable pigtail, but comes in at $83.20/ea.
Next, the bilge pump:

Rule 500 GPH Bilge Pump, 24 V Input, Submersible
Compact ultrasonic sensor in straight or right-angle housing.

- Senses from 30 to 300 mm
- Available in analog or discrete models
- Features minimal dead zone and eliminates dead zone if used in retrosonic mode
- Ideal for material handling and packaged goods applications, such as bottling or liquid level detection and control for small containers
- Available in straight or right-angle versions with a wide variety of mounting hardware for enhanced sensing versatility
- Offers programmable background suppression
- Compensates for temperature, for greatest sensing accuracy
- Simplifies setup with push-button and remote TEACH-mode programming
- Shows status during setup and operation, using highly visible LEDs indicators

S18UUAQ BANNER ENGINEERING ULTRASONIC, VOLTAGE QD SENSOR

Price: $285.00
Manufacturer SKU: S18UUAQ
Manufacturer ID: 02790

This item qualifies for FREE SHIPPING over $300!
Availability: Usually Ships in 3 to 5 Business Days
Part Number: S18UUAQ

Qty: 1

ADD TO CART
These hand valves contribute the ‘load’ on the process. As they are opened wide, the bilge pump has difficulty and finally can’t keep up with the outflow: