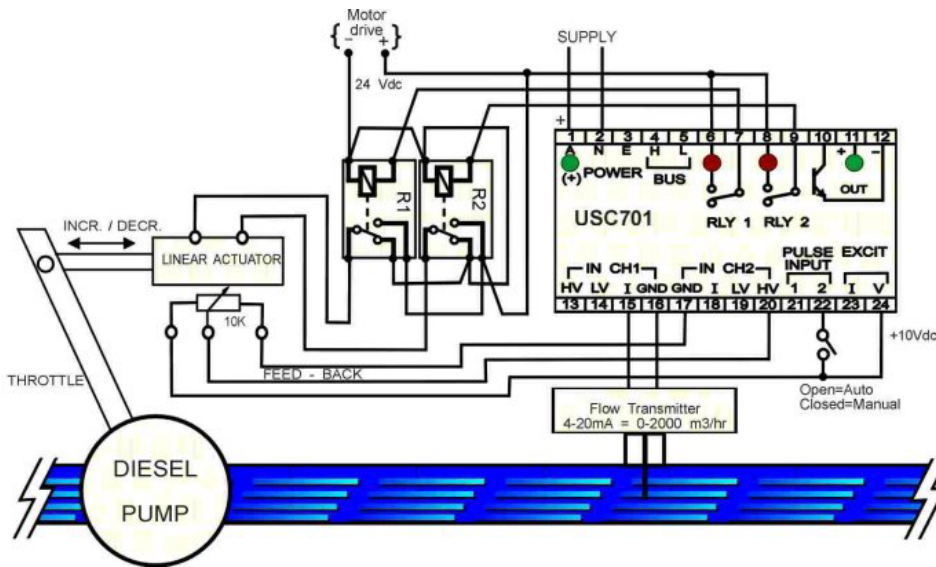


UAP1076, Engine Speed Controller



The desired flow rate is 1040 cubic meters per hour. The flow meter output is 4-20mA represents 0-2000 cubic meters per hour. The engine governor is controlled by a Linak LA12 actuator, which gives an RPM range from 790 to 1760 under load.

Control Program Description

The USC701 application program consists of two cascaded control systems:

- A PID control system that compares the actual water flow in the pipe with the required flow. The PID controlled operates when the Auto switch is activated.
- A three state controller that sets a linear actuator using a 10k potentiometer feedback. When Manual mode the actuator travels to a percent position set by the access module. When in auto mode the PID controller controls the setting for the 3 state controller.

Hot keys

- UP Display flow (CH1)
- DOWN Display set point to control to when in auto mode.
- BACK Display OUT% indicates the required output from the manual or PID control.
- NEXT Display ACTUATOR indicates actuator output position, when operating correctly this will be close to OUT%.
- ENTER Goes to trim menu to adjust required flow rate and Trim menu.

3 State Controller Tuning

1. Leave the main pump engine off and power up the control system including the USC701 and the linear actuator.
2. Program the USC701 with the application UAP1076.
3. Run the linear actuator to minimum speed setting and measure the voltage from the wiper on terminal 20 of the USC701.
4. Move the linear actuator to maximum speed setting and measure the voltage from the wiper on terminal 20 of the USC701.
5. Modify the calibration of USC701 CH2 so that it measures 0-100% for the required actuator movement.
6. Enter 50 in Con_G (Manual) the actuator should move to the middle position.

7. The actuator may hunt backwards and forwards increase the value of Con_d (S3_DB%) until hunting stops.
8. Enter 10 in Con_G (Manual) then enable manual mode, the actuator should move to about 10%.
9. Enter 90 in Con_G (Manual) then enable manual mode, the actuator should move to about 90%.
10. Repeat steps 6 to 9 until best dead band setting is found.

NOTE

If wishing to prevent the actuator from being driven into its stops offset the 0 and 100% positions away from the ends.

To increase relay life the on and off delay times can be increased, this will introduce the need for increased dead band.

PID Tuning

Initial Setting: 'PB (%)'=450, 'I time

S'=50, 'D time S'=0

Set 'PB (%)'

1. Run plant and reduce PB% until control oscillates or increase until control stops oscillating.
2. Once the value for PB% is found where control is on the edge of oscillation then increase by about 20%.
3. Make a step change in the set point move between manual and auto mode and observe that plant oscillation will reduce and stabilise at an acceptable rate. If not repeat steps 2 to 4 until satisfied. The objective is to stop oscillation, the plant will not control on set point at this stage.

Set 'I time S'

4. Reduce 'I time S' until process controls around or close to set point. Do NOT make 'I time S' = 0.
5. Make a step change in the set point or move between auto and manual mode, observe that plant stabilises and then moves back to the set point.

Set 'D time S'

6. Set 'D time S' to approximately $D \cong \frac{1}{4 \times i}$ where 'I time S' = i and 'D time S' = D.
7. Make a step change and observe that plant stabilises and then moves back to the set point.

Notes

'PB (%)'	System Gain
50	2
100	1
200	0.5

The proportional band ('PB (%)') will affect how savage the control action is. If slower more gentle control action is required then higher numbers should be entered into 'PB (%)'.

To prevent long correction times during start up the 'I time S' value is reduced by a factor of 10 during large proportional errors, this can result in too much spring during start up in responsive control systems. Increasing the 'I time S' by as little as 0.5 can overcome this problem.

'USC Config 106' can be used to log readings and graph the results while tuning the system.