
Getting Started

Control System Analysis requires a certain amount of preparation before the loops are actually tested with the Protuner™. First, optimizing a control system requires an understanding of the control strategy employed. Secondly, measurements must be accurate and valves must move in response to changes in the controller output. This section presents recommended procedures that should be followed before you start testing a control system.

1. Study the loop drawings to understand the control strategy being employed. Make a sketch of the control system being tested showing the location of all the valves, transmitters, and control loops in the unit operation. **REMEMBER**, you cannot tune and optimize a control system you do not understand.
2. Discuss the system unit operation and the loops you plan to work on with the operators. While some may not always be familiar with in-depth control strategies or inherent design problems, they have learned to overcome the systems limitations using manual control, and kept production running. Operators work with the system on a continuous basis and often can provide valuable insight concerning the systems operating characteristics and problems they may have already identified. Remember, to be successful, you must make the operators part of the optimization team.
3. Inspect the control equipment and the field installations. Physical inspection is an important step in the process.

Transmitter Inspection

Calibration

Check the transmitter calibration reports. If the transmitter has not recently been calibrated it is highly recommended that you get the transmitter calibrated before you begin testing. Keep in mind: You cannot control what you cannot measure.

Damping adjustment

The transmitter damping time constant must be set equal to 1.3 times the controller scan rate to prevent aliasing of high frequency transmitter

noise. See the **Tech Note on Signal Aliasing** for more information on pre-filtering requirements.

Installation and mounting

It is always wise to inspect the physical installation of the transmitter mounting to be sure that it conforms with the manufacturers recommendations. Keep in mind, that all too often, control is an after thought in the design of a system, resulting in installations that do not conform to the manufacturers recommendations. It is amazing some of the installation problems we have found over the years.

For example; insufficient straight runs of pipe for flow meters is common, signal wires badly corroded due to leaky junction boxes, dp transmitters located incorrectly above the pipe on flow meter applications. In one plant, we found a number of newly installed magnetic flow tubes installed in downlines which resulted in air in the line and noisy measurements at low flows. In a number of paper mills, field inspection found magnetic flow meters located just downstream of the chemical addition pumps, resulting in a continuous changing of the electrochemical nature of the fluid and very noisy flow signals. Recently, a dp transmitter used for an open tank level measurement, was found with the plastic shipping plug still in the atmospheric port.

Valve Inspection

Calibration

Calibration of the actuator bench set, I/P transducer, and positioner, requires stroking the valve through its full travel. Therefore, calibration cannot be easily done while the process is running. On the whole, control valves are not calibrated well and are a major source of control problems.

A quick calibration check would be:

1. Place the loop in manual and compare the controller output to the actual valve position.
2. If there is a significant difference, the positioner zero can be adjusted to eliminate the variance.
3. Place the loop back in automatic. When the process stabilizes at setpoint, place the loop in manual and compare the difference between the controller output and the actual valve position.
4. Adjust the positioner span to eliminate the error.

5. Repeat the process until the controller output signal matches the valve position.

Improper calibration of the control valve travel can result in a number of control problems. If the loop is tuned with an incorrect calibration, re-calibration may change the process gain, and thus require changes in the controller tuning parameters.

Improper calibration will result in controller reset windup problems.

As an example, if the valve is at 100% travel at an 80% controller output, a large upset may require the controller output to go to 100% to correct the upset, as the process reaches setpoint, the control action must unwind from 100% to 80% before the valve starts to move, resulting in a large overshoot.

Linkage Inspection

Linkages are often used to connect the actuator to the valve stem and the positioner feedback to the actuator stem. Loose linkages can result in all kinds of cycling problems and should be eliminated. If you find valves, where the linkages are worn and can be shown to be the cause of poor control, a case can be made to replace the valve.

Air Supplies

Check the regulators settings supplying instrument air to the valve actuator and its accessories.

Look for any undersized tubing, pinched lines, and air leaks. In inspecting the air supply systems we have identified and fixed a large number of problems, which if unresolved, would have made optimum control impossible.

As an example, in a paper mill stock blending system we found a number of newly installed ball valves with piston actuators controlling the various stock flows. The air supply to the piston actuators came from the old wall mounted regulators supplying only 20 psi, and not the 80 psi required. During installation, the actuators appeared to work, but under operating conditions they did not have enough force for smooth operation.

In a chemical plant, the advanced control group installed a fussy logic controller in an attempt to control what was thought to be a difficult process. In inspecting the field installation, we found a leaking

diaphragm in the I/P which in manual caused the valve position to drift around. Once the problem was identified and fixed, the control of the loop was quite simple.

In short, get out of the control room and check the equipment, BEFORE you start tuning.