Digital valve control

How It Works

The implementation of digital valve control capabilities in the Scanner* 3000 flow computer melds aspects of our valve actuation with flow measurement and control technologies. The result is a throttling control capability that can be structured to optimize a facility rather than just a single loop in isolation.

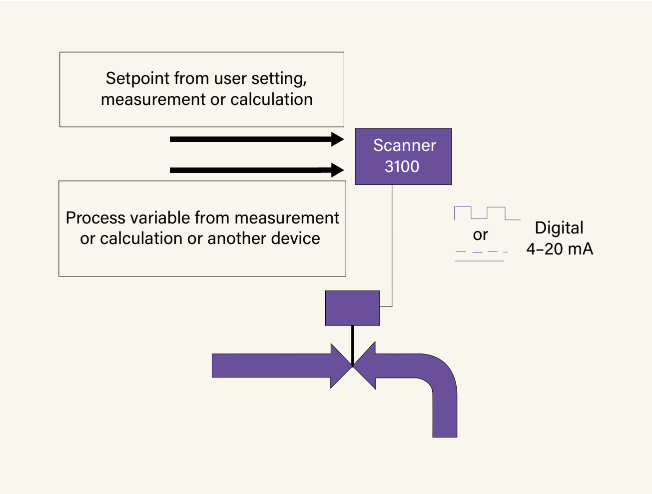
This is accomplished by allowing each of the three controllers within the Scanner 3000 flow computer to acquire either or both the process variables and the setpoints from within a single Scanner 3000 flow computer or from remote Modbus® connected devices. These remote devices include subservient Scanner 2000 flow computers connected to the distributed measurement network by wires or wireless methods.

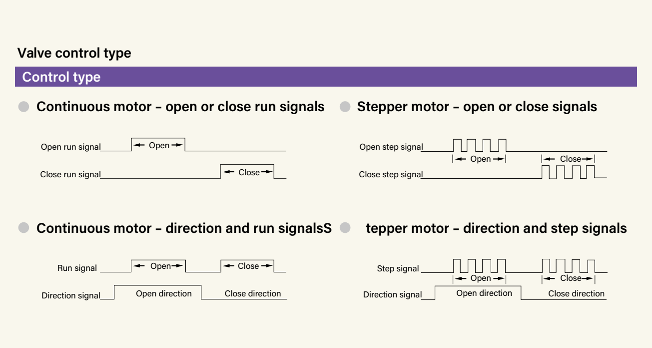
For a facility-wide operation multiple details can be gathered and processed by user programmed logic or computations prior to applying them to the controller.

The Scanner 3000 flow computer features a digital controller that drives status outputs. In contrast to a 4–20-mA output controller, a digital controller conserves power and is better suited to electric valve actuators and applications, where the amount of valve opening does not require constant change. A common application of this is the wellhead choke position.

An additional benefit to the combination of a digital controller and an electric actuator is that sites that do not have a compressed air supply can avoid the use of natural gas as a pneumatic supply and the related implications for greenhouse gas fugitive emissions.

The digital valve controller enables any Scanner 3000 flow computer model to drive a stepper motor regulator, turn on and off a motorized valve or regulator, or open and close solenoid valves controlling instrument air to a pneumatic actuator. The popular use of this feature is to reduce the power consumption in the control system by avoiding the continuous power needed to operate a 4–20-mA loop since power is consumed only when the final control element requires repositioning. The system provides inherent lock-in-last positioning in the event of a power system failure.





The Scanner 3000 flow computer manages the digital valve position using proportional integral derivative (PID) algorithms and either a single process variable or a combination of a process variable and a pressure override variable. It is one of three PID controllers that are standard within the flow computer. All three controllers can be used at the same time. While the digital controller requires two status outputs, each of the analog controllers use a 4–20 mA output. The digital controller can be configured to use up to two inputs to provide confirmation of a fully open or closed valve. Two of the Scanner flow computers' status outputs can drive 0.5 A at up to 30 VDC. Often, these outputs are used with interposing relays to increase the voltage or current capacity to enable the direct control of electric actuators.

Output parameters

The following parameters are provided to configure and optimize the control action:

Scaling

The scaling parameter is the time in seconds required to travel from open to closed (full travel) for continuous motor control types (for example, 100 s). Alternatively, for a stepper actuator, the scaling is the number of pulses required to move the valve full travel (for example, 200 pulses).

Deadband

The deadband parameter is the percentage of full-scale valve travel required before the controller repositions the valve. This feature prevents hunting which would waste power and prematurely cause wear to the actuator and valve.

PID parameters

Process variable

The process variable can come from any measured input or computed value from within the Scanner 3000 flow computer, from a subsidiary Scanner 2000 flow computer, or from a Modbus read source.

Execution period

The execution period is applied only when the data source is from a Modbus device or a subsidiary flow computer. To account for latency in the data acquisition, the execution period is the waiting time before the controller revaluates the measured value.

Setpoint source

The setpoint source can be a manually set user-entered value or can come from a measured input or computed value from within the Scanner 3000 flow computer (including from the programmable controller from a subsidiary Scanner 2000 flow computer or from a Modbus read source).

The units of measure must be the same as the units of measure of the process variable.

Setpoint tolerance

Setpoint tolerance is usually applied only when the setpoint source is other than a user-entered fixed value. It is essential that when the setpoint is calculated, the controller holds the last value until the setpoint has deviated by more than this amount.

Setpoint deadband

The setpoint deadband is usually applied only when the setpoint source is other than a user-entered fixed value. The setpoint deadband holds the last output value until the output change exceeds this amount.

Range low

The range low parameter is the process value when at a minimum of 0%.

Range high

The range high is the process value at a maximum of 100%.

PID settings

+ Gain
+ Integral (reset)
+ Derivative (rate)
+ Automatic and manual

Maintenance model action

When the flow computer enters maintenance mode due to a calibration, the controller can be set to lock the current valve position or move to the fail position of full open or full close.

Pressure override—setting option

Provided the same valve can influence both the primary variable such as flow and a secondary variable such as pressure, the pressure override may be helpful. This feature monitors the second variable and the control action is automatically taken in priority to the primary variable when the pressure exceeds the setpoint. There are separate settings for gain, integral, and derivative for the override controller.