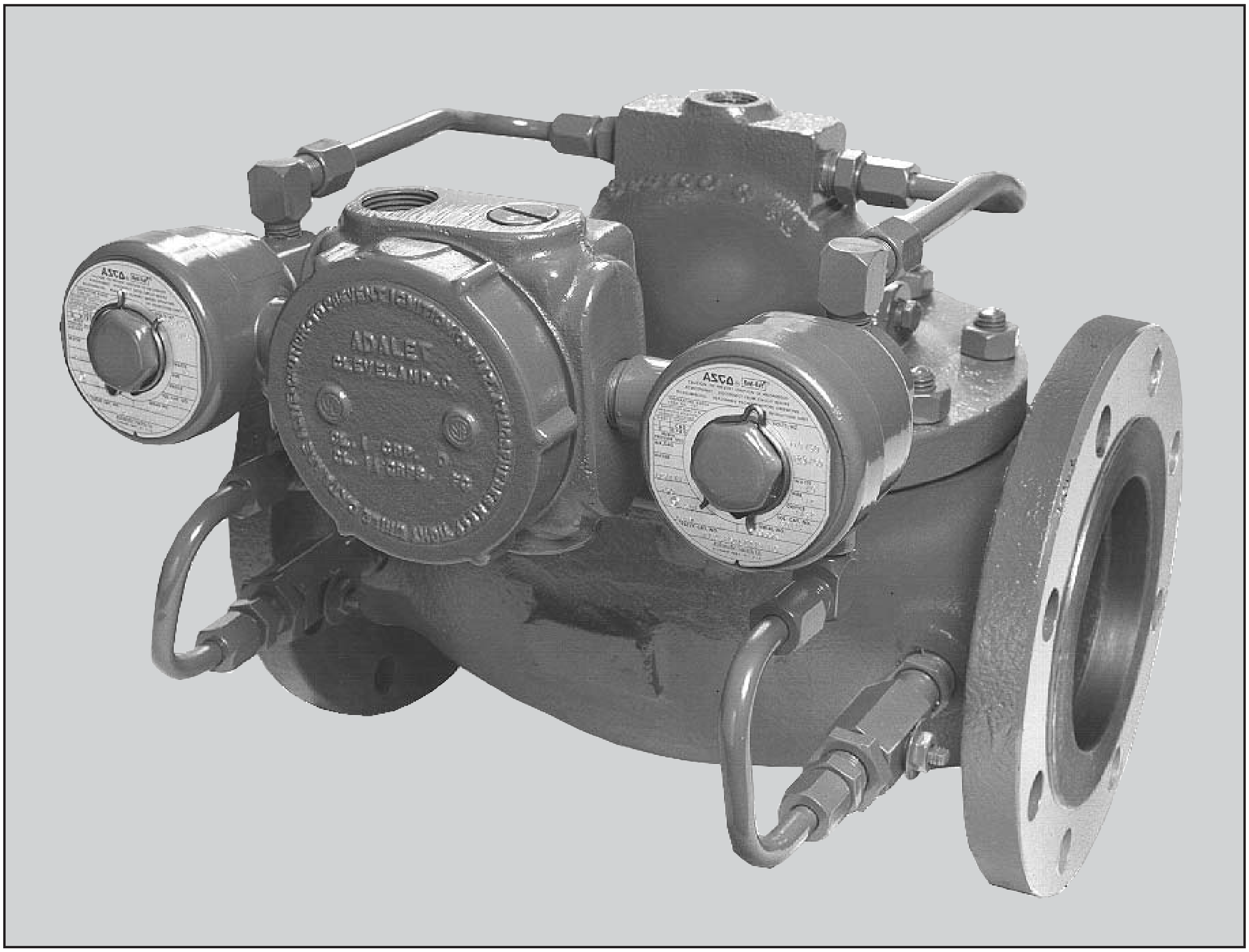
FMC Technologies

Smith Meter™ Valves

Smith Meter™ Model 210 Digital Electro-Hydraulic Set Stop

Installation/Operation

Issue/Rev. 0.2 (1/03) Bulletin MN03010



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The Smith Meter™ Model 210 Digital Control Valves are hydraulically-operated, diaphragm-controlled valves, typically used in conjunction with either an AccuLoad, MiniLoad, or a Model SS1 Controller with Preset Counter.

Receipt of Equipment

When the equipment is received, the outside packing case should be checked immediately for any shipping damage. Carefully remove the unit from its packing case and inspect for damaged or missing parts. If damage has occurred during shipment or parts are missing, the local carrier should be notified immediately and a written report should be submitted to the Customer Service Department, FMC Technologies Measurement Solutions, Inc., P.O. Box 10428, Erie, Pennsylvania 16514-0428. Prior to installation the unit should be stored in its original packing case and protected from adverse weather conditions and abuse.

Standard explosion proof solenoids are:

UL listed and CSA certified for use in Class I, Groups C and D, Division 1.

Class II, Groups E, F, and G, Division 1 hazardous locations.

Installation

Insure the valve is installed with flow in the correct direction. The intended flow direction is indicated on the side of the valve body.

These products have been designed for petroleum applications, where corrosion/erosion is normally minimum. The design of the pressure containing housings have adequate material allowance for typical petroleum applications. Consult the factory for other applications or for the actual material allowances.

Electrical

Wiring is covered in the appropriate controller manual:

MN03008 Model SS1 Controller (1/O)

MN06037 AccuLoad II (I)

MN06108 AccuLoad III (I)

MN06005 MiniLoad (I)

Principle

The Smith Meter™ Model 210 Valve (Figure 1) fundamentally consists of a Smith Meter™ 200 Series Valve with two solenoid controls. A valve response control device, typically a ball valve, is located between each solenoid and its respective upstream or downstream port. This device is used to fine tune the opening/closing rates of the valve, as well as provide control loop isolation for easier control loop service. Adjustment of these devices controls the flow rate to and from the cover chamber permitting valve adjustments based on product viscosity and pressures.

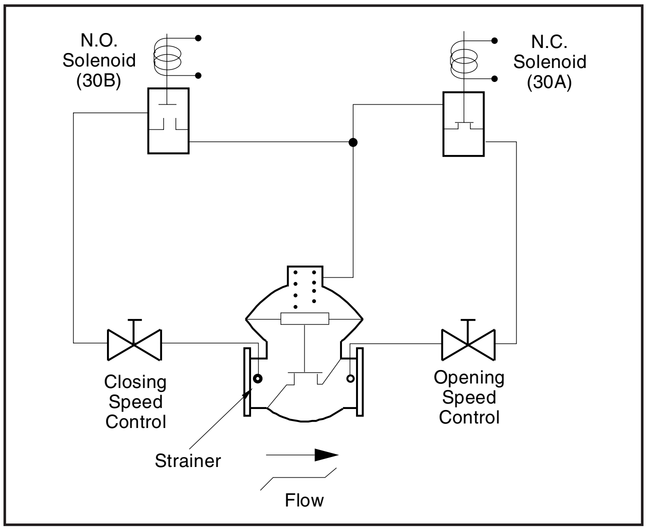
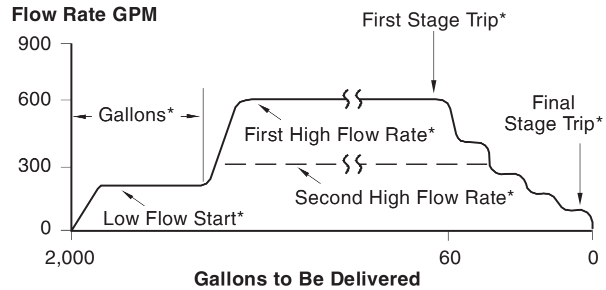


Figure 1 — Model 210 Valve Schematic

The normally open (N.O.) and normally closed (N.C.) solenoids, located in the upstream and downstream portions of the control loop, respectively, control the operation of the valve. When both solenoids are energized, high upstream pressure is blocked from reaching the main valve cover, the pressure in the cover vents to downstream (lower pressure), and the valve opens. Conversely, when both solenoids are deenergized, the downstream control loop is blocked and high upstream pressure closes the valve.

During flow, when the N.O. solenoid is energized while the N.C. solenoid is deenergized, pressure is trapped in the cover causing the valve poppet to be hydraulically locked in a fixed open position. Therefore, a constant flow rate is maintained. When operating conditions change causing a change in flow rate for that fixed valve opening, the flow controller (e.g., SS1, MiniLoad, or AccuLoad) signals the appropriate solenoid to open or close momentarily, changing the valve open position, thereby readjusting the flow rate to its set value.

When the set flow rate changes (e.g., from low flow start to high flow limit, or during multi-step valve shutdown), the appropriate solenoids are signalled to open and/or close until the flow rate adjusts to the new set value. When the product delivered reaches a predetermined (field adjustable first stage trip) value in the controller, valve closure is initiated. The flow controller signals the 210 Valve to ramp down the flow in a multi-step manner, thus preventing line shock.



**Field programmable.*

Caution: There must be sufficient pump capacity to achieve the flow rate set into the SS1, AccuLoad, or MiniLoad or the valve may close slowly resulting in a spill.

Figure 2 — Typical Load Cycle

When the preset quantity is nearly reached (1-2 gallons remaining), a final trip point (field adjustable in controller) signals the valve to close completely assuring accurate delivery of the preset quantity. Figure 2 shows a typical truck loading flow rate sequence.

Start-Up and Field Adjustments

Upon initial system start-up, using the 210 Valve, it is recommended that the following steps be followed sequentially to insure a stable and properly operating system:

Step 1: First, all air must be vented from the cover chamber of the main valve. Otherwise, the valve may be unstable or sluggish. This is done by pressurizing the system and loosening the highest vent plug in the valve cover until all air is expelled. Valves installed in horizontal lines usually automatically expel all of the air from the cover chamber after just a few full actuations of the valve.

Step 2: Be certain the flow rate limit is properly set in the controller (e.g., SS1, AccuLoad, MiniLoad, etc.) so the meter is protected from over-speeding and the valve is modulating (i.e., controlling flow rate).

Step 3: Before energizing the solenoids to open the valve, completely close the downstream solenoid control loop isolation ball valve. This prevents the 210 Valve from opening. Also, adjust the upstream solenoid control loop isolation ball valve about 1/4 - 1/2 open.

Step 4: With no other loading position from the pump open (highest valve inlet pressure) preset a small volume and energize the valve solenoids as normally would be done to initiate flow.

Step 5: Slowly open the downstream ball valve until the main valve opens slowly but smoothly and maintains flow stability (solenoids not "clicking" excessively).

Step 6: Allow a normal preset shutdown, observing the valve closing speed and flow stability during the multi-stage shutdown.

Step 7: If the shutdown speed and flow stability are acceptable, go to the next step. If either is unacceptable, adjust the upstream ball valve (further closed for slower valve shutdown and better flow stability, or further open for faster valve shutdown). Preset small batches each time, repeating Steps 5 and 6 until satisfactory valve performance is obtained.

Step 8: Preset a small batch and after high flow is reached, initiate an emergency stop ('E' Stop). Record the volume throughput after initiation of the 'E' Stop and observe whether there was excessive line shock. If line shock was excessive, close the upstream solenoid isolation ball valve a little further to slow the valve closure rate. Repeat this step until excessive line shock is eliminated.

Step 9: If possible, with all other loading positions from the pump open (lowest valve inlet pressure), preset a small batch and run. If opening speed is not acceptable, open the downstream batch and observe normal valve opening and closing performance, as done in Steps 6 and 7 (See Note A).

If opening speed is not acceptable, open the downstream solenoid isolation ball valve a little further. Repeat this step until acceptable opening speed is obtained.

Step 10: If closing speed is unacceptable, adjust the first stage trip value in the preset counter to a value sufficient to assure reaching final step flow prior to the final stage trip on the preset counter (See Note B).

Step 11: Conduct an 'E' Stop test as in Step 8. If the volume throughput after initiation of 'E' Stop is greater than the volume left in the tank or compartment after a high level sensor initiates an 'E' Stop (typically about twenty (20) gallons for a gasoline transport), a decision must be made whether to speed up the valve closure and accept some line shock at high valve inlet pressure (i.e., one load position operating), or accept a slower than ideal valve closure on 'E' Stop at low valve inlet pressure (i.e., all load positions operating).

Step 12: If a modulating pressure pilot was supplied on the valve, it should have been factory set for the specified control pressure (e.g., 64A pilot set at 35 psi maximum valve outlet pressure or 23 BP pilot set at 15 psi minimum valve inlet pressure). Open the isolation ball valve(s) on the pressure pilot loop, causing the pressure pilot (e.g., Model 64A) to control the valve by adjusting manual valves in the system. Slowly close the isolation ball valve upstream of the pressure pilot until stable (no flow surging) 210 Valve operation is obtained. Using a pressure gauge, check to be sure the pressure pilot is set to control at the desired pressure. Adjust it as required.

Notes:

A. *If it is not possible to conduct Steps 9, 10, and 11 with all load positions operating, compromise by having as many load positions as possible operating. Then throttle the flow ahead of the meter with a manual valve until the 210 Valve is not limiting flow i.e., not modulating). This occurs when the flow rate is less than the high flow rate limit (set into the controller) by more than the flow control "band width" (e.g., 22 gallons for the SS1 Controller).*

B. *The pump should be wired to remain on for at least five (5) seconds after 'E' Stop is initiated to assist in valve closure.*

C. *If the ratio between the highest and the lowest 210 Valve inlet pressure at high flow (ie., one versus all positions operating from that pump) is greater than 2:1, it may not be possible to obtain satisfactory valve performance under all operating conditions. If the inlet pressure variation is extreme, no compromise ball valve settings may be possible. The system will then have to be changed, either by adding pumping capacity, adding a pressure reducing valve in the common line from the pump to the loading positions, or by replacing the 210 Valves with air-operated 215 Valves, etc.*

D. *If it becomes necessary to use the control loop ball valves for pilot isolation (i.e., in order to repair or replace a pilot without draining down the system), be sure to mark their "control position" precisely to permit easy resetting after the repair is complete.*

Section 3 — Troubleshooting Guide

Problem	Cause	Remedy
1) Low or no flow.	No pump pressure.	Start pump
	Upstream block valve closed.	Open valve.
	Improper wiring.	Check wiring.
	Downstream 03A Ball Valve on 210 Valve closed.	Open 03A Valve.
	AccuLoad or SS1 Controller fuse blown.	Replace fuse.
	Broken 210 Valve diaphragm.	Check diaphragm.
	Improper fluid connection to truck.	Open dry break coupling.
	AccuLoad or SS1 Controller relay failed.	Test board.*
	Line strainer clogged.	Visually check.
	Preset Counter switch not working.	Visually check.
	N.C. Solenoid failed closed.	Test and replace.
2) Improper or erratic high flow.	Fluid pressure oscillating.	Stabilize system.
	Improper pressure regulator pilot settings.	Adjust settings.
	AccuLoad or SS1 Controller Hi Flow setting incorrect.	Correct setting.
	Wiring connections loose.	Repair as required.
	SS1 optical switch intermittent.	Reposition slotted disk in SS1*.
	Solenoid wiring reversed.	Correct No. 3 & 4 connection.
3) Excessive high flow.	Manual override valve open.	Close valve.
	Improper wiring.	Check wiring.
	N.O. Solenoid failed to open.	Test and replace.
	N.C. Solenoid failed to close.	Test and replace.
	Contamination in 210 pilot loop.	Clean or replace.
	AccuLoad or SS1 Controller Hi Flow setting incorrect.	Correct setting.
	Pulse transmitter or SS1 slotted disk loose on shaft.	Reposition and tighten.*
4) Valve shuts down early.	Final zero adjustment too early.	Readjust 'Zero' on Preset Counter.+
	N.O. Solenoid leaking	Test and replace.
	AccuLoad or SS1 board defective.	Test and replace.
	Leaking diaphragm.	Replace diaphragm.

Section 3 — Troubleshooting Guide (continued)

Problem	Cause	Remedy
5) Valve shuts down late.	Upstream 03A Ball Valve nearly closed.	Open 30A Valve further.
	Improper switch settings on high flow.	Adjust Preset Counter trip.+
	First trip too late on Preset Counter.	Adjust Preset Counter trip.+
	Final zero adjusting too late.	Readjust 'Zero' on Preset Counter.+
6) Valve fails to shut off.	Manual override valve open.	Close valve.
	Upstream 03A Ball Valve closed.	Open 03A Valve.
	N.O. Solenoid failed to open.	Test and replace.
	N.C. Solenoid failed to close.	Test and replace.
	Final trip failed on Preset Counter.	Replace or repair switch.+
	AccuLoad or SS1 board defective.	Test and replace.*
	Valve strainer clogged.	Check strainer.
7) Line shock on shutdown.	210 Valve closing too fast.	Gradually close upstream 03A Valve.
8) Downstream system pressure too high.	210 Valve leaking.	Repair as required.

* See SS1 Installation/Operation (Buulletin MN03008), AccuLoad Installation/Operation (Bulletin MN06108), or MiniLoad Service (MN06007).
+ See Veeder-Root Installation, Operation, and Service Manual 789 meter presets (Number 251278) or Smith 300B Series Preset Installation, Operation, and Service Manual (Bulletin MN01012).

Section 4 — Related Publications

The following literature can be obtained from FMC Technologies Measurement Solutions, Inc. Literature Fulfillment at johno@gohrs.com or online at www.fmctechnologies.com/measurementsolutions. When requesting literature from Literature Fulfillment, please reference the appropriate bulletin number and title.

Model 210 Digital Electro-Hydraulic Set Stop Valve Specifications .... Bulletin SS03009

Revisions included in MN03010 Issue/Rev. 0.2 (1/03):
Page 2: Added corrosion/erosion note.
Page 3: Highlighted Start-Up section and added caution note to Figures 1 and 2.
Page 4: Step Number 9 revised verbage.

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