

SHADOW OPERATION AND MAINTENANCE **MANUAL**



_U.S. PATENT 8,069723B2

(313) 867-6686

WWW.SHADOWFEEDWATER.COM

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SHADOW ELECTRIC FEED WATER SYSTEM FORWARD

When properly installed and given reasonable care and maintenance the shadow assembly should operate satisfactorily for many years. Because of the differential pressures expected, abrasive particles in high enough concentrations in the fluid, could damage the valve assembly and shorten the life expectancy of the assembly. Clean fluids are recommended.

1a. Inspection of Equipment

Immediately upon receipt of the shipment, inspect the equipment for damage or missing components. Check the shipping packing list and report any damage or shortage to the local transportation company's agent. Put these instructions in a safe place where they will be available to those who will be using them for installation and service.

1b. Storage

If the shadow assembly is to be stored before use, it should be inspected as described in the above and stored in a dry location. Temperatures should not vary below 50 degrees F., and a maximum of 95 degrees F. Standard shipping containers are not suitable for outdoor storage.

1c. Electrical Wiring

All electrical equipment and wiring conforms to the National Electrical Codes.

1d. Construction Material

While it is reasonable to assume that good judgment has been used in selecting all the materials in the assembly for compatibility with process fluids, actual conditions sometimes vary from original specifications. Typical material selections do not consider all the temperature, pressure and fluid variables. The customers engineer should be consulted for final judgment on the best materials for critical process applications.

PRODUCT INFORMATION AND SPECIFICATIONS

Actuator:

Voltage: 24 volt AC .5 amps
Temperature Range: 40 - 130 degrees Fahrenheit
Approval Rating: UL and CSA Compliant

Probe:

Size NPT: $\frac{3}{4}$ inch
Short Length: 5½ inches
Long Length: 10½ inches
Pressure Range: 250-PSI/406 degrees Fahrenheit

Cable:

Length: 9 feet Coaxial Cable

VALVE:

Material: Stainless Steel – 3 Piece
Pressure Rating: 600-PSI/320 degrees Fahrenheit
Sizes: $\frac{1}{2}$ to 1½ inches NPT
Approvals: CRN No. OC14175.5

Signal Generator:

Voltage: 24 volts DC, 5 amps (internal power by servo)

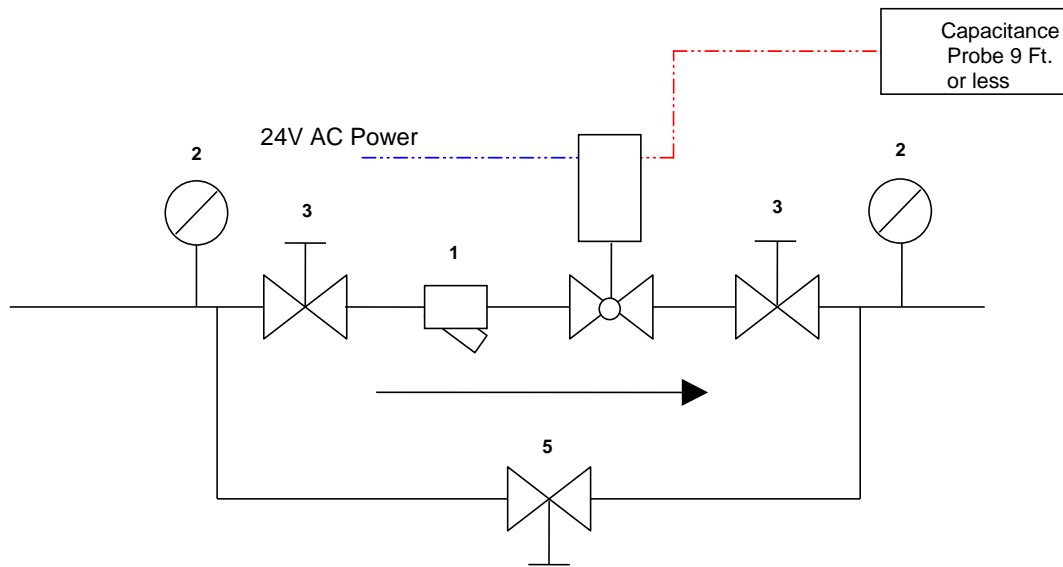
Bracket & Coupling: 304 Stainless Steel

Shipping Weight: 13 LBS for 1 inch Valve Assembly

Shadow Recommended Installation 24 Volt System

Valve Piping:

Pipe the SHADOW **Ball Valve** into a three-valve network. The Recommended Piping Diagram shows a typical isolation and by-pass valve set-up. Note the importance of the pressure gauges and strainer. If the valve must be separated from the actuator to complete this installation procedure, be careful to reassemble the actuator to the valve in exactly the same position. Do not manually open or close the valve when it is detached from the **Actuator**.



- 1) Y Strainer
- 2) Pressure Gauges
- 3) Isolation Valves
- 4) SHADOW Feed Water Valve
- 5) By-Pass Valve

Electrical:

The **Capacitance Probe** coaxial cable must be connected to the SHADOW **Actuator**. The outer shielding of the coaxial cable is connected to the terminal marked "G" on the capacitance signal generator (Figure 1). The center wire on the coaxial cable is connected to the terminal marked "P" on the signal generator. The coaxial cable is low voltage wiring and therefore does not require external protection, such as Greenfield or conduit. The installation contractor must bring a 5 amp

fused disconnect source of 24volt AC (with ground) power the step down transformer to provide 24 Volts AC to the SHADOW **Actuator**. There are two electrical connector blocks inside the SHADOW **Actuator**. Block 1 contains connections numbered 1 through 6. Block 2 contains connections numbered 1 through 8. All the 24volt AC wires are connected to Block 2. The white (L2/N) wire from the 24volt AC source is connected to terminal 1 in Block 2; the black (L1) wire is connected to terminal 2 in Block 2; and the ground wire is connected to terminal 3 in Block 2. **PLEASE NOTE that Block 2 connector, Terminals numbered 1-3 are 24volt AC; Terminals numbered 4-8 are 24-volt.**

FIGURE NO. 1

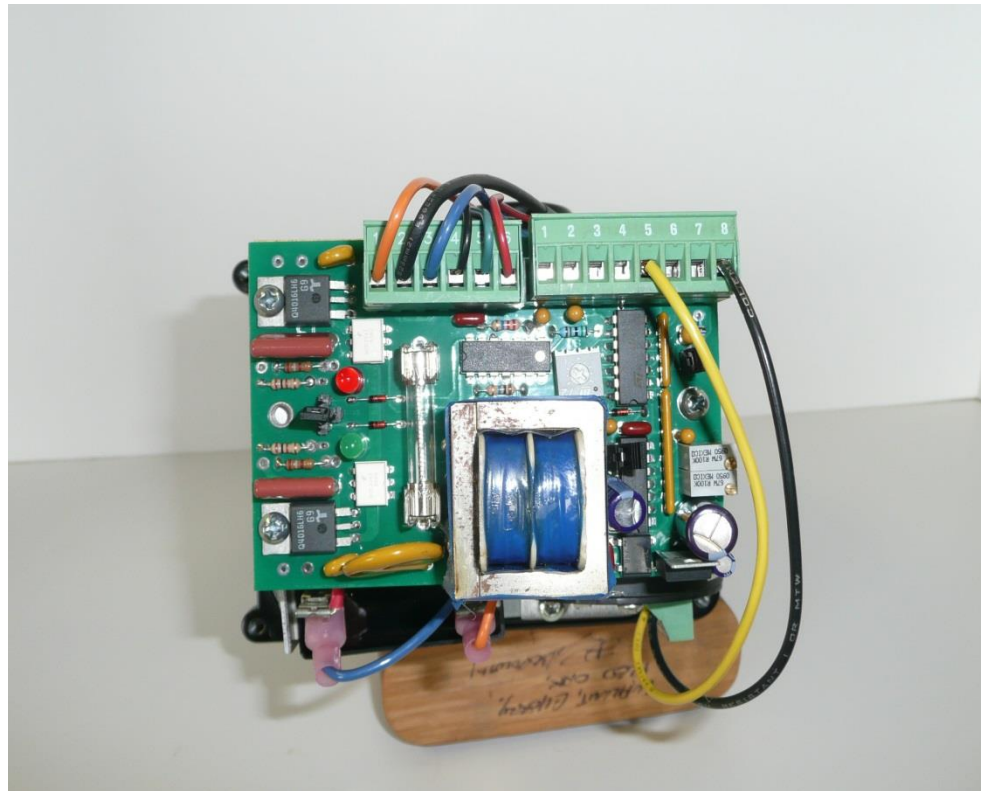
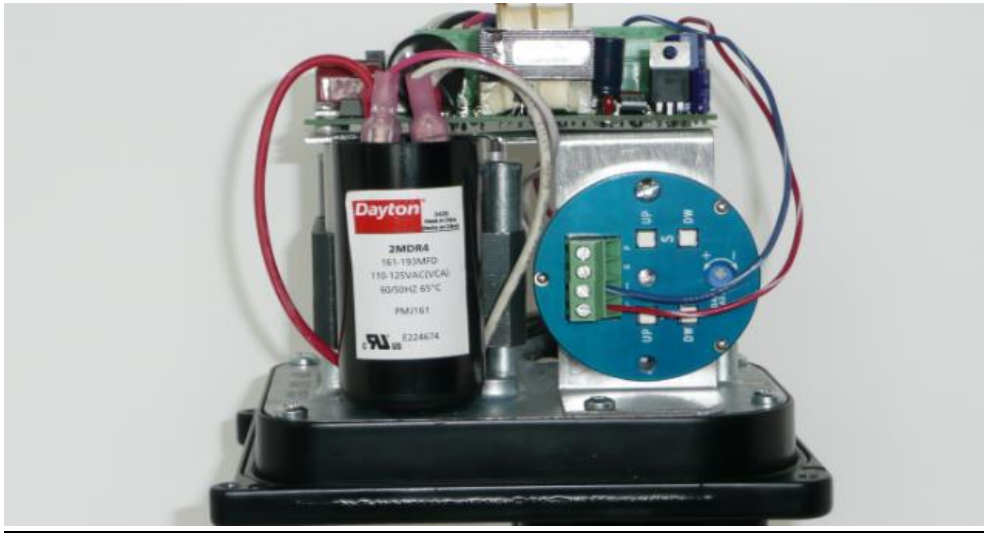


FIGURE NO. 2 SIGNAL GENERATOR



SHADOW SET-UP 24 VOLT AC

The Shadow System will maintain a water level half way between the “high” and “low” settings you calibrate it for. The “Shadow Set-Up” is the procedure that will train the Shadow for your water level settings at the jobsite. Make sure the white part of the probe is in contact with the water while choosing the settings.

Shadow Set-Up for Capacitance Signal Generator

A. Fill the vessel to your “low water” point.

***We suggest setting the water: $\frac{3}{4}$ inch above Primary Low Water Cutoff Point.**

- 1.) Apply Fused (5 Amp) 120-volt power to the step down transformer. (100 VA)
Run power to the 24-volt AC to the Shadow Actuator.
- 2.) Press and hold the “zero” (Z) and “span”(S) DOWN buttons together for 5 seconds.
Press and hold the “zero” (Z) and “span”(S) UP buttons together for 5 seconds.
(Once this operation is done the past program is erased.)
- 3.) Attach your black voltage lead to #4(block 2) and your red voltage lead to #5(block 2).
#5 must also have the (-) wire from the signal generator connected to it.
(See Figure #1, Block 2, numbered 1-8)
- 4.) Set your voltage meter to DC voltage. (Ignore what the valve is doing during the set-up)
Press and hold the “zero” UP button until you read 1.5+ volt DC.
Press and hold the “zero” Down button until you read 1.0+ volt DC.
(Be patient values take time to change)

B. Fill the vessel to your “high water” level.

***We suggest setting the water: 4” above low water point.**

- 1.) Press and hold the “span” UP button until the meter reads 5.0+ volts DC
Capacitance Signal Generator field set-up is finished. Leave the damping screw fully turned clockwise and remove meter.

System is now ready for normal duty. Start up the process (boilers, etc.). In a normal operation this is what to look for:

- With the actuator cover removed, the red and green LED set-up lights go on and off. This process will begin regularly only once a normal water level is reached.
- The actuator motor is NOT HOT to the touch.
- The water level is stable.
- The water level is in the sight glass in the range you set it for.
- The pump discharge pressure is constant.

Figure: 1 (Top view of Actuator)

Block 1 (numbered 1-6)

Block 2 (numbered 1-8)

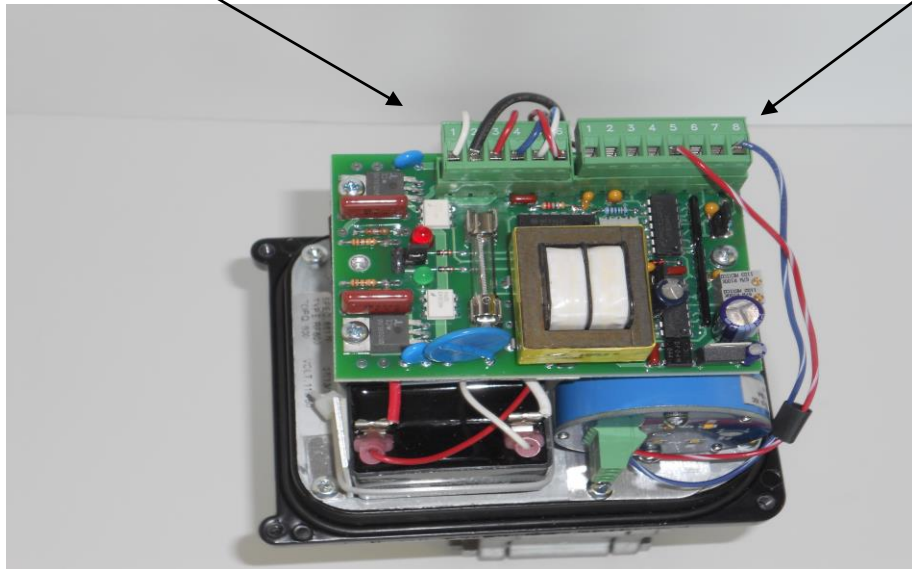
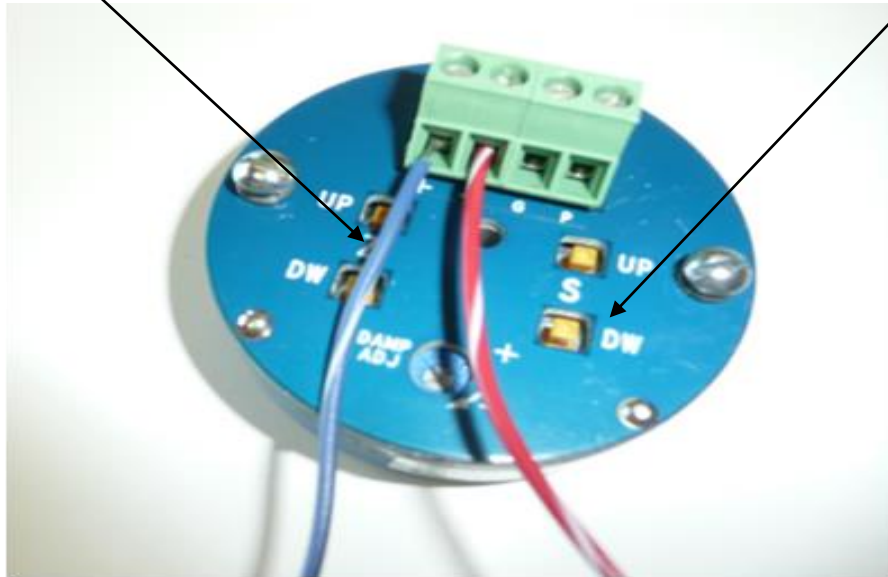


Figure: 2 SIGNAL GENERATOR

(Z) Zero side Buttons

(S) Span side Buttons



Dampening screw is shipped in fully “clockwise” position.

Figure: 3 INSTALLED SIGNAL GENERATOR
(Side view of Actuator)



Figure: 4 Actuator Cover



Figure: 5 Actuator Cover Comes with Temperature Coupon Installed



Temperature Coupon will record the highest temperature reached and is irreversible, if temperature exceeds 145 Degrees Actuator must be returned to factory for recalibration.

Figure: 6 Shadow Step Down Transformer



INSTALLATION TIPS

Issue or Problem Probe Cable Length

1. Cable Too Long for conditions

- a.** Solution: Cable can be shorten without effecting the actuator conditions.

2. Cable too short for conditions

- a.** Cable cannot be lengthened, actuator will not function accurately.
- b.** Solution: Install a 4 x 4 junction box within the parameters of the furnished cable.
- c.** Remove the actuator's signal generator from the actuator assembly, by removing two screws and wires from pin no. 5 and pin no. 8.
- d.** Install the signal generator in the new junction box.
- e.** The Capacitance Probe coaxial cable must be connected to the SHADOW Actuator signal generator. The outer shielding of the coaxial cable is connected to the terminal marked "G" on the capacitance signal generator. The center wire on the coaxial cable is connected to the terminal marked "P" on the signal generator. Reattached the two 24 volt D C signal generator wires from the junction box to the actuator assembly Terminal Block 2. Pin no. 5 connects the negative on the signal generator with a blue/white wire, while the positive connection wire the red/white attaches to Pin no. 8.

3. Actuator Drifting

- a. Check cable pressing on the signal generator “White Buttons”. Remove the white caps from the buttons; they are not required for the actuator to function. Note: Once the caps are removed, use a small ball point pen to adjust changes to the signal generator buttons.

4. Issue: Valve Set Up out of adjustment

A visual inspection shows the original set points have changed. Pull white caps on buttons and re calibrate the Shadow Probe. If the problem still exists, replace the probe and re-calibrate new probe.

5. Issue: Loss of 24 Volt System

Check pin no. 5 and 8 for 24 volt D.C. current. No power to the signal generator, contact factory for replacement parts.

Note: if valve is not traveling then neither the red nor green LED lights should be on.

SHADOW TROUBLE SHOOTING

- A. Before isolating the issues, the burner must be in the OFF position with the 120 volt power still in the ON position to the Shadow Actuator.
- B. Retention the 4 (four) bolts from the valve bracket to the actuator and the 4 (four) nuts and bolts to the actuator valve body.
- C. Check Temperature Coupon located on the inside cover.

TO ISOLATE ISSUE

Step I

Activate Valve as a complete assembly. Check and verify valve opening and closing.

Step II

Check and verify open position of the actuator/ valve.

1. Remove from Block No. 2 the wire from terminal No. 5 while power is activated on the valve. Make sure the wire does not touch any part of the actuator body (24 volt). Turn feed pump ON and verify that the water level in the vessel is increasing. Once verified, turn the pump OFF. The actuator valve goes to a full open position. Note: Be patient the valve opens slowly.
2. Observe while the valve is opening that the green LED light is ON and when the actuator is fully open that the LED Green light is in the OFF. Neither red nor green LED lights are lite.

Check and verify closed position of the actuator valve

1. With the 120 volt still powered with terminal No. 5 disconnected, add a jumper wire between terminal No. 6 to Terminal No. 7. This will allow the actuator go to a fully closed position. Again be patient the actuator will be closing slowly. Observe while the valve is closing that the RED LED light is ON and when the actuator is fully closed that the LED RED light is in the OFF. Neither red nor green LED lights are lite. Turn pump ON and verify that the vessel water remains constant without any upward flow movement. Once this is verified the pump may be turned OFF.
2. Reinstall wire to Terminal No. 5 and remove jumper wire from terminal No. 6 and No. 7.

CHECKING OUT PROBE, SIGNAL GENERATOR,

DEAD BAND AND CABLE

Checking Probe

1. Check and verify visually that the probe does not have any stress cracks.
2. Check and verify that the probe is free from debris and any fouling.
3. Check and verify proper tension between the two probe nuts.

Check Low Water Setting PART A

1. Install DC Volt Meter connecting the Positive Pin to Block No. 2 terminal No. 5 and the Negative Pin to terminal No. 4. Note: terminal No. 5 still has the wire connected to the block.
2. Adjust vessel low water height "(Low Water height, which was used in at the original set up)". This should be 1.0 Volt DC + or - .3 volts DC.

Check High Water Setting PART B

1. Install DC Volt Meter connecting the Positive Pin to Block No. 2 terminal No. 5 and the Negative Pin to terminal No. 4. Note: terminal No. 5 still has the wire connected to the block.
2. Adjust vessel high water height "(High Water height, which was used in at the original set up)". This should be 5.0 Volt DC + or - .3 volts DC.
3. If A & B are not in range, recalibrate the signal generator. See original instructions in this manual for the proper calibration of the actuator.

Checking the Dead Band

1. With power on the valve at any constant water level, observe the red and green LED lights, these lights should be off. While observing the constant water level, if both lights are flickering, the dead band is too small. To correct this condition adjust the dead band clockwise until the LED lights remain off.

Checking Potentiometers

1. Potentiometers Upper and Lower are factory set. Any adjustments made in the field may cause the actuator to be non-functional and will need to be returned back to the factory for recalibration of the actuator.

ACTUATOR TEMPERATURE COUPON

Checking Temperature Coupon

1. Check the inside cover for the temperature coupon. For the actuator to operate accurately, the temperature must be below 145 degrees F. If the actuator cover is above the 145 degree, the actuator assembly must be returned to the factory for further action.



[Temperature Coupon]

SHADOW VALVE

ELECTRIC MODULATING BOILER FEEDWATER VALVE SYSTEM

24vAC System

