Feedback Potentiometer and 4-20 mA Position Indicator
For Series 90 Modular Accessory System
Installation, Operation and Maintenance Instructions

INTRODUCTION
Note: For M.A.S. housing assembly, installation, and maintenance instructions, refer to Installation, Operation, and Maintenance manual WCAIM2005.

The Series 90 Modular Accessory System can accept a number of potentiometer options designed to provide feedback representing the position of the M.A.S. Shaft. Units using a feedback potentiometer can provide any one of the following:

<table>
<thead>
<tr>
<th>Output Required</th>
<th>Potentiometer Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0-1000 ohm</td>
<td>Dual</td>
</tr>
<tr>
<td>4-20 mA</td>
<td>Dual</td>
</tr>
</tbody>
</table>

P – Single Potentiometer
D – Dual Potentiometer
4 – 4-20 milliamp Position Indicator

Important: Voltage limit of single or dual potentiometer is 30 volts maximum.

The 4 to 20 milliamp position indicator outputs a signal suitable for a 4 to 20 milliamp DC meter with a 0–100% scale (such as General Electric type GE 185), indicating closed (0 degree, 0%) to open (90 degree, 100%).

It is important to note that a potentiometer can serve only one function at a time. For instance, a single potentiometer could not be wired to provide both a 4-20 milliamp output signal and also provide resistance output.

1. ASSEMBLY
a. With the potentiometer (item 3) mounted to the potentiometer bracket (item 4) and the pinion gear (item 1) loosely fitted to the potentiometer shaft (item 2), mount the potentiometer bracket (item 4), if not already mounted, to the baseplate (item 5) using two #8-32 x 5/8" screws (item 10) provided.

b. Remove the upper snap ring (item 6) from the shaft (item 7). Use care to avoid deforming it permanently.

c. Slide the face gear (item 8) onto the shaft, teeth facing down, and secure with the snap ring (item 9) provided.

Note: For best results, wipe off any lubricant that may be on the shaft before sliding on the face gear.

Caution: Do not overstretch the snap ring — use the minimum opening to allow it to slip over the gear.

d. Replace the upper snap ring (item 6).

e. For all options except non-positioner/controller “4” option, skip steps f and g, and go to Section 2, WIRING. For non-positioner/controller “4” option continue with f.

f. Attach the 4 to 20 milliamp circuit board (item 11) to the board-mounting bracket (item 12) as shown using three of the #4-40 x 3/16" screws (item 13), three #4-40 nuts (item 14), three 1/4" long plastic spacers (item 15), and three 3/16" plastic washers (item 16).

g. Attach the circuit board/bracket assembly to the upper four holes on the baseplate circuit board mounts (item 17) using four #4 x 3/8" self-tapping screws (item 18).
2. WIRING

Note: All wiring is to be run smoothly and neatly and away from any rotating parts, using wire ties if necessary. Use caution to avoid pinching wires and/or solenoid rectifiers between the base and cover flanges.

a. For non-positioner/controller units only, add the second terminal strip in the “secondary” location using the four \#4 x \(\frac{3}{8}\)" self-tapping screws provided. It is possible that a second terminal strip is already present and available for use.

b. Connect the wires to the end terminal strip as shown.

Note: Wiring should be inserted only to mid-point of terminal strip.

c. For any “P” or “D” option, go to section 3, CALIBRATION. For any “4” option, go to section 4, CALIBRATION.
3. CALIBRATION FOR “P” OR “D” (SINGLE OR DUAL POTENTIOMETER) OPTION

Prior to adjusting the potentiometer, the M.A.S. package must be mounted to the actuator, and the baseplate must be installed in the M.A.S. Unit. Adjust the potentiometer pinion gear so that there is approximately \( \frac{3}{16} \) tooth engagement between the face gear and the pinion gear and tighten the pinion gear set screw. The actuator must be in the full-closed position prior to making the potentiometer adjustment. In the case of a double-acting actuator, either temporarily connect air to the appropriate actuator port or use a wrench to move the actuator to the closed position. Unless there is air supplied to a spring-return actuator, it should automatically be in the closed position. Using an ohmmeter, measure the resistance between the purple and the white/black potentiometer leads at the terminal strip. Rotate the face gear to obtain a resistance on the ohmmeter of 80 to 90 ohms.

Note: It is not necessary to loosen or remove face gear snap ring to rotate gear.

Important: The feedback potentiometer is calibrated for only one 90-degree quadrant of valve operation. If the output shaft is repositioned to another 90-degree quadrant, or if the output shaft is rotated a multiple of 360 degrees from its original position, or if the M.A.S. package is removed from the actuator, the feedback potentiometer will no longer be in calibration and must be recalibrated as directed above.

If the dual potentiometer is being installed in a positioner unit (that previously contained a single potentiometer), the positioner will require recalibration.

4. CALIBRATION FOR “4” (4-20 MILLIAMP POSITION INDICATOR) OPTION

a. For Non-Positioner/Controller

[Diagram of circuit board with labels R4, R5, R2, R1, etc.]

Calibrate the potentiometer per Section 3 above.

To obtain proper 4 to 20 milliamp output, the indicator circuit board potentiometers R4 and R5 must be calibrated as follows:

- Connect an ammeter to terminals 4 (positive) and 5 (negative).
- Place the actuator in its closed (full-clockwise) position and adjust R5 (adjacent to the “4” etched on the circuit board) to indicate 4 mA on the meter.
- Place the actuator in its open (full-counterclockwise) position and adjust R4 (adjacent to the number “20” etched on the circuit board) to indicate 20 mA on the meter.

Note: Adjustment of one potentiometer affects the other. Repeat the procedure several times to reach the proper values.

b. For Positioner/Controller

[Diagram of circuit board with labels R1, R2, R3, R4, R5, etc.]

Calibrate the potentiometer per Section 3.

To obtain proper 4 to 20 milliamp output, the indicator circuit board potentiometers “4 mA” (R2) and “20 mA” (R1) must be calibrated as follows:

- Connect an ammeter to terminals 4 (positive) and 5 (negative).
- Place the actuator in its closed (full-clockwise) position and adjust R2 to indicate 4 mA on the meter.
- Place the actuator in its open (full-counterclockwise) position and adjust R1 to indicate 20 mA on the meter.

Note: Adjustment of one potentiometer affects the other. Repeat the procedure several times to reach the proper values.
5. TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause(s)</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates backwards</td>
<td>Green and purple wires reversed</td>
<td>Check wiring per Section 2.</td>
</tr>
<tr>
<td>Reverse-acting actuator</td>
<td></td>
<td>Reverse green and purple wires.</td>
</tr>
<tr>
<td>Indication not consistent</td>
<td>Gears slipping</td>
<td>Check gear tooth engagement (approximately 90°).</td>
</tr>
<tr>
<td></td>
<td>Pinion gear set screw loose</td>
<td>Recalibrate and tighten set screw.</td>
</tr>
<tr>
<td>Indication not correct</td>
<td>Potentiometer needs to be calibrated</td>
<td>Calibrate potentiometer per Section 3.</td>
</tr>
<tr>
<td></td>
<td>M.A.S. shaft turned more than 90 degrees</td>
<td>Recalibrate for new quadrant.</td>
</tr>
<tr>
<td>4-20 mA output not operating properly</td>
<td>Power supply not connected</td>
<td>Check/connect power supply.</td>
</tr>
<tr>
<td></td>
<td>Board not calibrated</td>
<td>Complete calibration procedure per Section 4.</td>
</tr>
<tr>
<td></td>
<td>Wiring not correct</td>
<td>Recheck wiring per Section 2.</td>
</tr>
</tbody>
</table>

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