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Flow Control Division  
Automation Business Unit

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### ESP3 Electronic Servo Positioner

Automax electric actuators with servo control are factory adjusted for 90 degree operation and shipped in the full clockwise (CW) position as viewed from the motor side.

**WARNING (SEE NOTE 6 ON PAGE 4)**  
DO NOT CONNECT SHORT CIRCUIT TO MOTOR LEADS WHILE MOTOR IS CONNECTED TO ESP3 - SERIOUS DAMAGE WILL RESULT AND WARRANTY VOIDED.

#### Specifications

Power Requirement*	110-125V, 50/60 Hz 5W @ 115 VAC
Temperature**	-40°F (-40°C) to 160°F (70°C)
Approvals	UL recognized CSA certified
Range Of Adjustability	30° to 180° rotational span

\* Options availability for 240 VAC or 12/24 VDC applications.

\*\* Options available for high humidity/outdoor use.

#### Servo Control Input Options

- Connect input signal to TB1 terminals marked +IN and -IN (4-20mA configuration is supplied as standard).

Type of Input	Signal	Board Adjustment
CURRENT (250 Ohm Shunt)	4 to 20 mA <sub>dc</sub>	Input Jumper JP1 to the left
	1 to 5 mA <sub>dc</sub>	Input Jumper JP1 to the right
	10 to 50 mA <sub>dc</sub>	Requires special board. Consult factory.
VOLTAGE	0 to 5 V <sub>dc</sub>	Input Jumper Removed
	2 to 10 V <sub>dc</sub>	Input Jumper Removed
	1 to 10 V <sub>dc</sub>	Input Jumper Removed
RESISTIVE (see notes on p.2)	1.5 to 135 Ohm	Requires special board. Consult factory.
	1.5 to 1000 Ohm	Input Jumper Removed

#### Direct or Reverse Acting

Make sure valve and actuator rotate in the same direction and are in the same position, i.e. valve full CW, actuator full CW.

- Standard units are direct acting:
  - Low input (e.g. 4 mA) = CW
  - High input (e.g. 20 mA) = CCW
- To make reverse acting, place jumpers JP2 and JP3 to 'R' positions on ESP3 and proceed with Valve Alignment and Servo Calibration. For reverse action with ESP3 Transmitter, see notes on page 2.

#### Valve Alignment and Servo Calibration

*Note:* Standard units are calibrated for 0 to 90 degree operation. Units may be recalibrated for 180 degree operation.

- Connect 115Vac/60hz power to terminals marked L1, N, and GND. Power should be fused with an in-line 5 amp slow-blow fuse. ESP3 may be run on 50hz, but actuator may be affected. See specific actuator I.O.M.
- Safety overtravel switches disconnect the motor if the actuator overtravels approximately 5 degrees past the full CW or CCW position. On valves with mechanical stops, the safety overtravel switches need to be set so that the motor will not disconnect prior to hitting a mechanical valve stop. See notes 3 and 6 under "Trouble Shooting" on page 4 before adjustment.
- Minimum Position Adjustment:
  - For Direct Acting: Apply minimum input signal to ESP3 terminals +IN and -IN and adjust zero 'Z' potentiometer until actuator stops at full CW position and CW LED turns off. Turn the 'Z' adjustment CW to move actuator CW.
  - For Reverse Acting: Apply minimum input signal to ESP3 terminals +IN and -IN and adjust zero 'Z' potentiometer until actuator stops at full CCW position and CCW LED turns off. Turn the 'Z' potentiometer CCW to move actuator CW.
- The voltage at test point 'A' referenced to test point 'G' should be approximately 0.75 V<sub>dc</sub>. If not, see note #4 under "Trouble Shooting".
- Maximum Position Adjustment:
  - For Direct Acting: Apply maximum input signal to ESP3 and adjust span 'S' potentiometer until actuator stops at full CW position and CW LED turns off.
  - For Reverse Acting: Apply maximum input signal to ESP3 and adjust span 'S' potentiometer until actuator stops at full CCW position and CCW LED turns off.
- Due to Zero-Span interaction, repeat steps 3 and 5 until actuator positions repeat at both ends of travel (usually 2 to 3 times).

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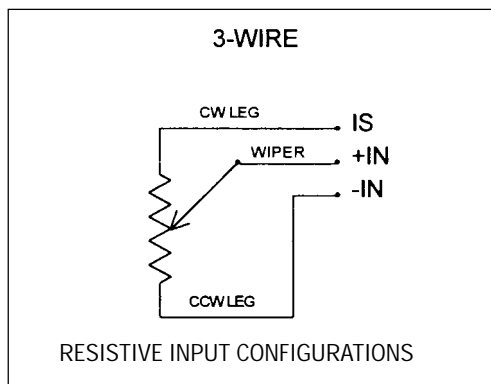
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### Resistive Inputs (optional)

**3 wire:** Clockwise rotation of input potentiometer increases signal (increase resistance). Connect potentiometer's clockwise lead to terminal marked IS. Connect counter-clockwise lead to terminal marked -IN. Connect potentiometer's wiper lead to terminal marked +IN. Remove JP1 input select jumper.

*Note:* If clockwise rotation of potentiometer does not rotate actuator in an increasing signal direction, reverse potentiometer leg leads.



### Heater & Thermostat (optional)

- 115 Vac heater and thermostat are connected to TB1 terminals L1 and N on the ESP3 servo board (see Wiring Diagram on page 3).

### ESP3 Transmitter (optional)

*Note:* If the ESP3 Transmitter is used, the servo calibration (p.1) must be completed with the 4-20mA transmitter installed. Servo calibration should be performed before transmitter calibration.

- Connect 4-20mA output leads to transmitter terminals marked '+' and '-'.
- Place transmitter JP1 jumpers to positions 1-3 and 2-4 for 90 degree operation, or positions 1-2 and 3-4 for actuators calibrated for 180 degree operation.
- Drive actuator to the full CCW position and adjust 'S' span adjustment for 20mA output.
- Drive actuator to the CW position and adjust 'Z' zero adjustment for 4mA output.
- Repeat steps 3 and 4 until the desired output is achieved in both positions.
- Standard ESP3 transmitters are direct acting. A low output signal indicates CW position and high output signal indicates CCW position. For reverse acting see below.
- The transmitter is self powered and optically isolated from the AC motor drive circuits.

### Important Notes About Reverse Acting ESP3 with Transmitter

*Note:* Reverse acting transmitter means a 4mA output for full CCW, and a 20mA output for full CW position.

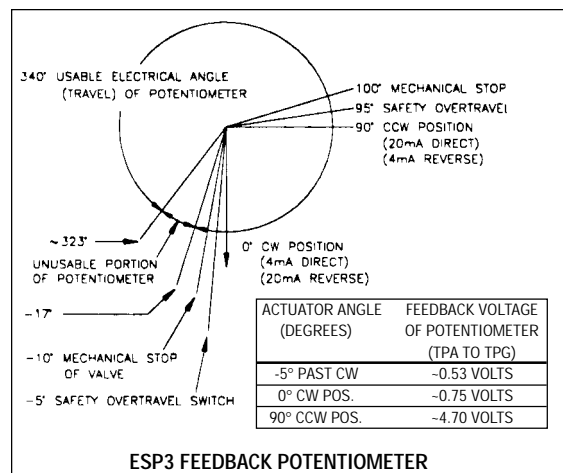
- The BLUE and GREEN feedback potentiometer wires have been reversed on TB1 (see chart below).
- The feedback potentiometer voltages as measured from test points 'A' to 'G' on the ESP3 card are as follows:  

CCW	~ 0.75 Vdc
CW	~ 4.70 Vdc
- JP2 and JP3 (Direct / Reverse acting jumpers) are to be on 'D' Direct (left two posts).
- The RED and BLACK motor drive leads on TB2 have been reversed (see chart below).
- The drive LED's will now indicate the opposite of the actual drive travel.

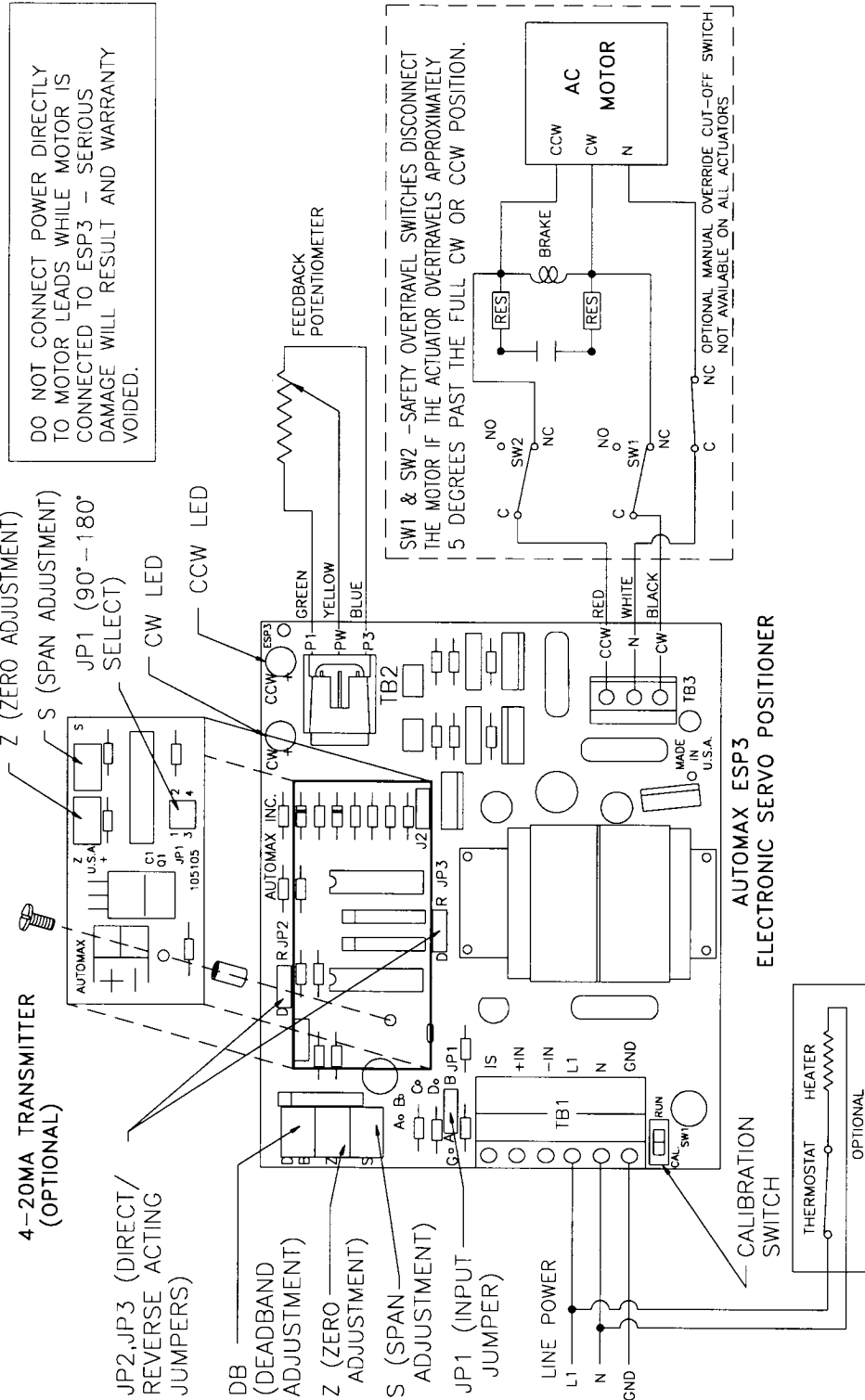
Wire	Reverse Transmitter Position	Standard Transmitter Position
BLUE (Feedback Pot.)	P1	P3
GREEN (Feedback Pot.)	P3	P1
RED (Motor Drive)	CW	CCW
BLACK (Motor Drive)	CCW	CW

### Performance Data (Centura/ESP3)

	CE2ATA	CE4ATA	CE7ATA	CE1ATA
LINEARITY	+/-1%	+/-1%	+/-1%	+/-1%
RESOLUTION	2.0°	1.8°	1.8°	1.5°
DEADBAND	+/-0.8%	+/-0.7%	+/-0.5%	+/-0.3%
HYSTERESIS	+/-1.0%	+/-0.8%	+/-0.5%	+/-0.5%



### ESP3 WIRING DIAGRAM



## Trouble Shooting

1. Actuator does not respond to the input signal.
  - A. Verify the proper input configuration and signal polarity connections. Measure voltage from test point 'D' to test point 'G' should be in the range 1-5 Vdc. *Note:* Signal input circuits have reverse polarity protection, but will not respond to reverse polarity signals.
  - B. Verify the proper power connections. Refer to the schematic on page 3.
2. Actuator does not travel when CW or CCW LED is lighted.
  - A. The calibration switch SW1 should be to the right in the RUN position.
  - B. Check the safety overtravel cams and overtravel switches, and adjust as needed (see note 3).
  - C. If actuator exceeds full CW or CCW positions, check the feedback potentiometer voltage (see note 4).
3. Safety overtravel switches need adjustment. *Note:* On valves with mechanical stops, the safety overtravel switches *must* be set so that the motor will disconnect prior to hitting the mechanical valve stops.
  - A. Disconnect wires from terminal block TB3 on ESP3 drive actuator CW until approx. 5 degrees past the standard full CW position by applying 115Vac power to the black and white motor leads or by using a wrench to turn the manual override shaft. Adjust CW cam until switch trips.
  - B. While setting CW safety overtravel switch, ensure a voltage between 0.20Vdc and 0.53Vdc is measured from test point 'A' to test point 'G' when switch is tripped. Otherwise see note 4 in this section.
  - C. Drive the actuator CCW until approximately 5 degrees past the standard full CCW position by applying 115Vac power to the red and white motor leads. Adjust CCW cam until switch trips.
4. With the actuator in full CW position, the feedback potentiometer voltage should read approximately 0.75Vdc from test point 'A' to test point 'G'. If the feedback pot is not set correctly, the "dead spot" at the end of the pot's rotation may cause over/under travel or oscillations.
  - A. With the actuator in the full CW position, move the switch SW1 to the calibrate (left) position.
  - B. Loosen potentiometer drive gear and rotate potentiometer until approximately 0.75Vdc is measured between test points 'A' and 'G', and then retighten drive gear.
  - C. Move calibration switch SW1 to the run (right) position, and recalibrate ESP3 zero and span adjustments, starting with Step 3 on page 1.
5. Actuator is oscillating or is not responsive to small input changes.
  - A. Drive actuator to mid position and turn DB CCW until both LEDs energize then immediately turn CW until both LEDs de-energize. Turn adjustment CW an additional 1/4 turn and operate actuator over full range in small increments to check operation. Voltage from test point 'B' to 'G' should measure approximately 0.10Vdc.
  - B. In high temperature and/or high cycle environments, the thermal protection circuit in the drive motor may be activated, causing the motor to shut down until it cools. Reduce environment temperature and/or cycle frequency.
6. There is difficulty calibrating the actuator for the correct range of operation.
  - A. The zero 'Z' and span 'S' pots are 30 turn pots, protected from overtravel. Turn both pots CW until you hear clicking. Then turn them back CCW 15 turns to the center of their ranges. Recalibrate starting from step 3 on page 1.
7. Special precautions for operating the ESP3.
  - A. It is always necessary to limit actuator from repeated safety overtravel switch trippage.
  - B. Always remove AC power to actuator prior to removing input signal and apply signal prior to AC power to actuator.
8. Remote mounting of ESP3 card, control signal causes inaccurate control, or long lines to transmitter cause inaccurate control/output readings.
  - A. Long input/output wire lines may add resistance which may affect performance characteristics. Use connecting wires having less than 10 ohms of resistance.
  - B. All signal carrying lines should be shielded, especially if power lines are run in the same conduit.

## Technical Assistance

If technical assistance is required, please have the following information ready before calling:

- A. Actuator model number.
- B. Actuator serial number.
- C. Actuator sales order number.
- D. Input signal configuration being used.