Jordan CONTROLS

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BY: Engineering Dept.

INSTALLATION & OPERATING INSTRUCTIONS FOR MV-1500 SERIES ELECTRIC SLIDING STEM VALVE OPERATORS

Due to wide variations in the terminal numbering of actuator products, actual wiring of this device should follow the print supplied with the unit.

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I. Description

A. General

The MV-1500 series actuator utilizes a three wire 120 or 240V ac permanent split phase, capacitor run motor to operate a rotary spur gear train which is converted to linear motion with a ACME SCREW and NUT combination. The actuator has a maximum stroke of 2.00 inches and a maximum thrust of 2000 pounds. The actuator is permanently lubricated, may be mounted in any position, and is designed to "SOFT SEAT" the valve to which it is mounted. Incorporated in the actuator are two spur gear train assemblies. The first is the power output which consists of either two or three stages of gearing to drive the ACME SCREW. There are two combinations of the two stage gearing and two of the three stage gearing. To identify the gearing we have designated gearing codes of 2A, 2B, 3B, and 3C. The selection of these gears determine both the maximum thrust and the shift rate of the actuator. Along with the power gearing is the feedback gearing which is driven from the ACME SCREW shaft. The feedback gearing determines the maximum stroke of the unit.

Adjustable position end of travel limit switches are driven by the feedback gearing, along with an optional precision potentiometer(s). The switches are set to limit the stroke within the maximum travel range and the optional potentiometer(s) is(are) used to generate a position feedback signal for customer use. A 4 to 20mA transmitter may be supplied for driving a feedback current loop.

B. Specifications

Mode:	MV-1510 MV-1530	120V ac, 60 Hz
	MV-1550 MV-1570	240V ac, 50/60 Hz
Housing:	NEMA 4 AND 7 C, D; 9 E, F, G. Indoors and outdoors	
Stroke:	2.00 in. maximum	
Thrust:	2000 lb. f maximum	
Mass:	35 lbs. (15.9kg) without valve	
Duty Cycle:	MV-1510 MV-1570	Continuous
	MV-1530 MV-1550	Modulating
	(duty cycles are at 100% rated load and 40 C (104 F).	
Ambient:	0 to 65 C (32 to 150 F) -40 to 65 C (-40 to 150 F) w/heater to 85% R.H.	

C. Theory Of Operation

A single phase, reversible, three wire, permanent, split capacitor motor produces torque at the motor pinion gear. This torque is increased (with a corresponding decrease in speed) through two or three stages of spur gearing. The final output shaft is supported with a bronze bushing and thrust needle bearings. This rotary output shaft protrudes thru the gearbox housing and provides an acme power thread.

Running along the thread is a drive nut (manufactured of a low friction, long wearing, self lubricating, plastic material) which allows the high torque, low speed rotary shaft output to be converted to linear thrust and also prevents the unit from backdriving when the motor is de-energized. The drive nut and sleeve are retained from turning by a shoulder screw which projects radially from the nut/sleeve and rides in a precision machined groove. In addition to preventing the drive nut/sleeve from rotating the shoulder screw provides a direct indication of linear movement. The drive nut/sleeve is housed in a cast aluminum housing which provides a means of mating a valve to the actuator. Located in the opposite end of the drive nut/sleeve is a preloaded spring pack and drive nut coupling which is threaded to mate up to the valve stem. The spring pack and drive nut coupling are retained by a snap ring and are protected from contaminants by a seal. This spring provides "soft seating" of the valve. With the valve in the fully closed position the spring is further compressed .030" guaranteeing a positive seating force with the drive nut positioned with reasonable accuracy. The housing features a gasketed "Lexan" window over the position indicator (shoulder screw) and a seal around the O.D. of the drive nut.

Also, a fine pitch gear is affixed to the rotary output shaft which provides feedback indication and limit switches.

II. Installation

A. Wiring and Fusing

All installation wiring shall meet the National Electrical Standards, as well as any state and/or local standards which may apply. Shielded wiring is recommended for feedback wiring. DO NOT connect chassis ground to shield ground. For rest of wiring, refer to Page 14.

Fusing is not provided in the MV-1500 series, and must be installed in line. Fuse to a current value slightly higher than the driven load (slow-blow fuse). Refer to "Start-up & Calibration" to set up MV-1500.

B. Customer Valve Mounting Procedure

NOTE: The MV-1500 series actuator has been preset to your stroke requirement.

1. Run actuator to the full extend (valve closed) position.
2. Insert the valve thru the hole in the linear thrust assembly housing. Drop body nut and packing nut over valve stem but do not thread on.

NOTE: a. most valves are mounted with a body nut supplied with the valve, or
b. some valves will require removal of the stem packing nut to allow removal of the body nut.

3. Run two hex nuts onto the valve stem as far as possible and "jam" together to provide a means of rotating the valve stem.
4. Using an open end wrench begin to carefully thread the valve stem into the drive nut coupling. Thread and tighten valve body nut and packing nut.
5. Continue to thread valve stem into drive nut coupling using and open end wrench on the nut coupling "flats" to resist rotation until the nut coupling is moved toward the actuator .030". Check with straightedge.
6. Run actuator full open and return to the fully closed position. Recheck with straightedge. Readjust and repeat if necessary.

NOTE: *If valve does not open fully, check for proper limit switch settings or valve stem interference. Shorten valve stem if it touches the rotary output shaft when valve approaches the full open position. Adjust limit switches for proper valve stroke length.*

7. Apply thread sealant to valve stem/nut coupling to create water-tight seal. Loosen jam nuts and run up against nut coupling.
8. The valve mounting is now complete and the valve is "soft-seated" at the rated output thrust.
9. Reverse above procedure to remove valve.

C. Start-Up & Calibration

The procedure for calibration is discussed on page 5. If MV-1500 does not respond correctly to a command signal or is erratic, refer to Section III, "Troubleshooting".

III. Trouble Shooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
Valve won't position	1) No power applied to electric actuator. 2) Actuator not aligned with valve stroke. 3) Electric actuator defective. 4) Valve operator assembly jammed or not aligned with electric actuator. 5) Valve jammed. 6) Actuator not properly sized for valve used.	1) Apply power. 2) Do alignment. 3) Repair electric actuator. 4) Align or repair. 5) Repair or replace valve. 6) Recalculate valve thrust required and change actuator to proper gear ratio.
Valve won't seat or drive full close	1) Close position limit not with .030 deflection of valve operator coupling and valve seated. 2) Valve seat defective or dirt in valve. 3) Broken gearing in electric actuator.	1) Adjust. 2) Repair or replace valve. 3) Repair.
Electric motor runs but valve doesn't move	1) Broken gear in electric actuator. 2) Traveling nut in valve operator is bad.	1) Repair. 2) Replace.
Electric actuator will not run with power applied (actuator removed from valve operator assembly)	1) Burnt out motor. 2) Bad motor run capacitor. 3) Gears jammed or broken. 4) Limit switch open. 5) Power applied to both directions at same time electrically stalling motor. 6) Solenoids or lights connected in parallel with motor.	1) Replace motor. 2) Replace capacitor. 3) Repair. 4) Adjust. 5) Correct wiring. 6) Remove (upsets phase shift of motor).
No signal from feedback potentiometer	1) Feedback potentiometer is positioned in dead region. 2) Feedback potentiometer not wired or incorrectly wired. 3) Potentiometer element open or burnt out. 4) Signal monitor device defective.	1) Realign feedback pot out of dead region. 2) Rewire. 3) Replace. 4) Repair or Replace.

IV. Actuator Alignment

A. General (With the drive nut/sleeve removed and all field wires disconnected)

1. Connect an ohm meter across terminals 4 and 5 of the actuator.
2. Trace the wire from actuator terminal 3 to a position limit switch. This switch is the actuator clockwise end of travel switch. When the actuator is mounted on the valve operator assembly this switch will be referred to as the valve "CLOSE" position limit switch.
3. Apply ac power across terminals 1 and 3. The actuator output shaft will rotate clockwise until the switch is tripped. With the ohm meter monitoring terminals 4 and 5, adjust the switch to stop the actuator with approximately 50 ohms at terminals 4 and 5.
4. With a pen or pencil mark the face of the actuator and the output shaft. This will be the starting position to count the number of output shaft turns for a preliminary setting of the counterclockwise or valve "open" position limit switch. At this time it is beneficial to know the stroke length of the stem on the valve to be positioned. The chart on this page can be used to determine the output shaft revolutions for any stroke from 0 thru 2.00 inch.

.025, .044, .069, .089, in/sec Actuator output shaft revolutions	Units. Valve stroke (inches)
0	0
1	.10
2	.20
3	.30
4	.40
5	.50
6	.60
7	.70
8	.80
9	.90
10	1.00
11	1.10
12	1.20
13	1.30
14	1.40
15	1.50
16	1.60
17	1.70
18	1.80
19	1.90
20	2.00

.031 & .055 in/sec Actuator output shaft revolutions	Units Valve stroke (inches)
0	0
1	.12
2	.25
3	.38
4	.50
5	.62
6	.75
7	.88
8	1.00
9	1.12
10	1.25
11	1.38
12	1.50
13	1.62
14	1.75
15	1.88
16	2.00

5. Apply ac power to actuator terminals 1 and 2, count the number of output shaft revolutions and adjust the counterclockwise (open) position limit switch to stop the actuator at the number of revolutions selected. While the actuator is running to this position, the ohm meter monitoring terminals 4 and 5 should show a steady linear increase of resistance. The final resistance read when the limit switch is activated should fall between 650 to 950 ohms for a 1000 ohm feedback potentiometer.

If the resistance does not end up within this range, recheck Step 3. Failure to fall within these ranges could indicate a defective potentiometer, incorrect gearing or improper alignment.

6. Remove ac power from terminals 1 and 2 and apply power across terminals 1 and 3. The actuator output shaft should rotate clockwise until the close switch trips, and the potentiometer resistance across terminals 4 and 5 should again be about 50 ohms. Remove the power from terminal 3 and apply it to terminal 2. With the actuator again running counterclockwise, recount the number of revolutions until the open switch stops the actuator. Leave the actuator in this position and disconnect the power.

B. Alignment - Gearbox to Linear Thrust Assembly

1. Run actuator to full clockwise position (looking at rotary output shaft) - valve closed.
2. Lubricate rotary output shaft threads with AMOCO-RYKON PREMIUM GREASE No. 2.
3. Carefully thread drive nut/sleeve onto screw (be careful not to strip threads in plastic drive nut).
4. Continue to rotate drive nut/sleeve until tapped shoulder screw hole is aligned with closed position on indicator label and install indicator (shoulder screw). Tighten securely.
5. Install "Lexan" inspection window and gasket.
6. Assembly is now complete. Run actuator fully open and return to fully closed to verify proper operation.
7. Install valve per Customer Valve Mounting Procedure.

C. Tandem Pot Alignment (Requires Optional Tandem Potentiometer)

The feedback pot assembly should not need further calibration. If the tandem pot was disassembled, recalibration is necessary.

1. Adjust actuator to fully extend position. Resistance reading for VR-1 should be approximately 50 + 10% ohms across terminals 4 & 5. If not, loosen potentiometer mounting nut and move ONLY THE POT BODY. Tighten the mounting nut and make sure limit switches are still functional.
2. Check resistance reading of VR-2 (top pot). If resistance is approximately 50 ohms, calibration is complete (across terminals 7 & 8).
3. If VR-2 is not near 50 ohms, loosen pot clamp's hex head screw and slowly rotate top pot until approximately 50 ohms is reached. Tighten pot clamp.

D. 4 to 20mA Transmitter Calibration (Requires potentiometer & EC-10649 transmitter)

For the unit to function properly the 4mA end of the feedback potentiometer must be present to 50 ohms. This will insure linearity across the active region of the feedback potentiometer. Both the RANGE and ELEVATION adjustments interact. The ELEVATION sets the 4mA point, and the RANGE sets the 20mA point.

1. Position the actuator to the valve "closed" position.
2. Adjust ELEVATION for 4mA.
3. Position the actuator to the valve "open" position.
4. Adjust RANGE to 20mA.
5. Repeat all steps until no further adjustment is necessary, as RANGE and ELEVATION do interact.
6. To reverse the 4-20mA output, interchange the blue and yellow transmitter wires and adjust ELEVATION with the valve "open" and RANGE with the valve "closed".

V. Replacement Procedures

A. Lubrication

The gearbox and linear thrust assembly are permanently lubricated with AMOCO-RYRON PREMIUM GREASE No. 2. Relubrication is only required if the unit is disassembled for repair, at which time all parts must be completely and thoroughly cleaned.

B. Disassembly for Repair

To disassemble the unit, the following steps must be performed:

1. Disconnect all power.
2. Remove valve from actuator (see Customer Valve Mounting Procedure).

C. Replacing the Feedback Assembly

1. Remove three screws which hold the feedback assembly to the feedback mounting plate.
2. Remove the feedback assembly from the feedback mounting plate by lifting straight out.
3. A gear will be positioned on the shaft of the feedback assembly. It is held in place with two set screws. Note the location of the gear on the shaft.
4. Loosen the set screws, remove the gear, and transfer it to the new feedback assembly; positioning it to the same location as it was on the original feedback assembly.
5. Insert the assembly into the feedback mounting plate being sure the gear is properly meshed with its mating gear.
6. Install the three screws removed in Step 1.
7. Using a 25 watt solder iron, transfer the wires from the original feedback assembly to the new one; one at a time to insure proper wiring.
8. Align the feedback following the alignment procedure.

D. Replacing the Feedback Potentiometer

NOTE: *The potentiometer used with the feedback assembly is a 348 potentiometer with no stops. Incorrect mechanical orientation of the potentiometer shaft or setting of the limit switches can cause the potentiometer shaft to be driven into the "deadband" or "open" zone, causing erratic operation.*

1. Remove three screws which hold the feedback assembly to the feedback mounting plate.
2. Remove the feedback assembly from the housing by lifting straight out. A gear will be positioned on the shaft of the feedback assembly.
3. Noting (or marking) potentiometer wiper position and feedback gear position, remove potentiometer body nut and feedback gear (two set screws).
4. Loosen set screws on each cam (noting color order), and lift potentiometer away for the frame.
5. Using a 25W solder iron, transfer the wires from the old potentiometer to the new one.
6. Reverse procedure on installing new potentiometer into frame.
7. With the preceding procedure accomplished insert the feedback assembly into the feedback mounting plate with the feedback mechanism turned to approximately its mid travel position.
8. Refer to page 5 for final alignment.

E. Replacing Limit Switches

1. Limit switches are held in position with two screws. Remove the screws to replace a switch, and transfer the wires from the old screw to the new one; at time using a 25 watt solder iron.
2. Minor re-alignment of the switch settings may be required, refer to the alignment instructions.

F. Motor Replacement

1. Remove all power from the actuator.
2. Remove the motor mounting screws.
3. Remove the old motor form the housing, leave the wires connected, and install the new motor. Tighten the screws evenly to insure motor alignment with the first stage power gear. If the motor is not mounted straight, bearing binding will occur.
4. Disconnect old motor wires, one at a time, and reconnect new motor wires.
5. Apply power and check for proper rotation and operation.

G. Repairs to Gearbox

The picture on page 9 is only a general location picture and may or may not represent your actuator accurately. Access to the gears is obtained by removal of the three cap screws.

1. Holding the output shaft in place, remove the gear case cover.
2. Replace any worn or broken parts.
3. Bushing replacement is accomplished by using a machinist thread tap and handle, threading into the bushing hole and bottoming the tap, allowing the bushing to walk up the tap.
4. When inserting bushings use a property sized mandrill while pressing the bushing into the housing or cover, sizing the bushing bore at the same time. (Failure to "size" new bushing will hinder the operation of a rebuilt actuator).

G. Repairs to Gearbox cont.

5. With the housing and cover completely cleaned put a few drops of SAE-10 non-detergent oil on each bushing. Do not use detergent oil, as it is not compatible with the combination of stainless steel shafts in bronze bushings.
6. Clean and insert all gears, replace any damaged or worn parts. Be sure all retaining rings are in grooves of shafts.
7. Insert the gears one at a time; starting with the first stage and checking for proper gear mesh.
8. After all gears are inserted into the housing, and checked for proper mesh, coat the gears with AMOCO-RYKO PREMIUM GREASE No. 2 or equivalent. DO NOT pack the gear case - only a light coating is needed.
9. Slide the gear case cover over the output shaft and align it with the housing on the dowel pin. Do not force the cover on. With the cover in place, insert the three cap screws, install field wiring to terminal strip.
10. Apply power to the actuator and check for proper operation.

H. Repair of the Linear Thrust Assembly (with valve removed)

1. Remove "Lexan" inspection window and gasket.
2. Remove indicator (shoulder screw).
3. Unscrew drive nut/sleeve out of housing. Remove seal from housing.
4. Remove seal from drive nut/sleeve.
5. With arbor press (with up to 2000 lb. capacity) or equivalent, press nut coupling until snap ring can be easily removed. Slowly release pressure. Remove springs and spacer (if present). Note position of springs.

   CAUTION: Springs inside drive nut are pre-compressed.

6. Clean and inspect parts. Replace if necessary. Replace all seals and gaskets.
7. Reverse above procedure to reassemble. Relubricate drive nut/housing interface. (AMOCO-RYKON PREMIUM GREASE No. 2)

VI. Suggested Spare Parts

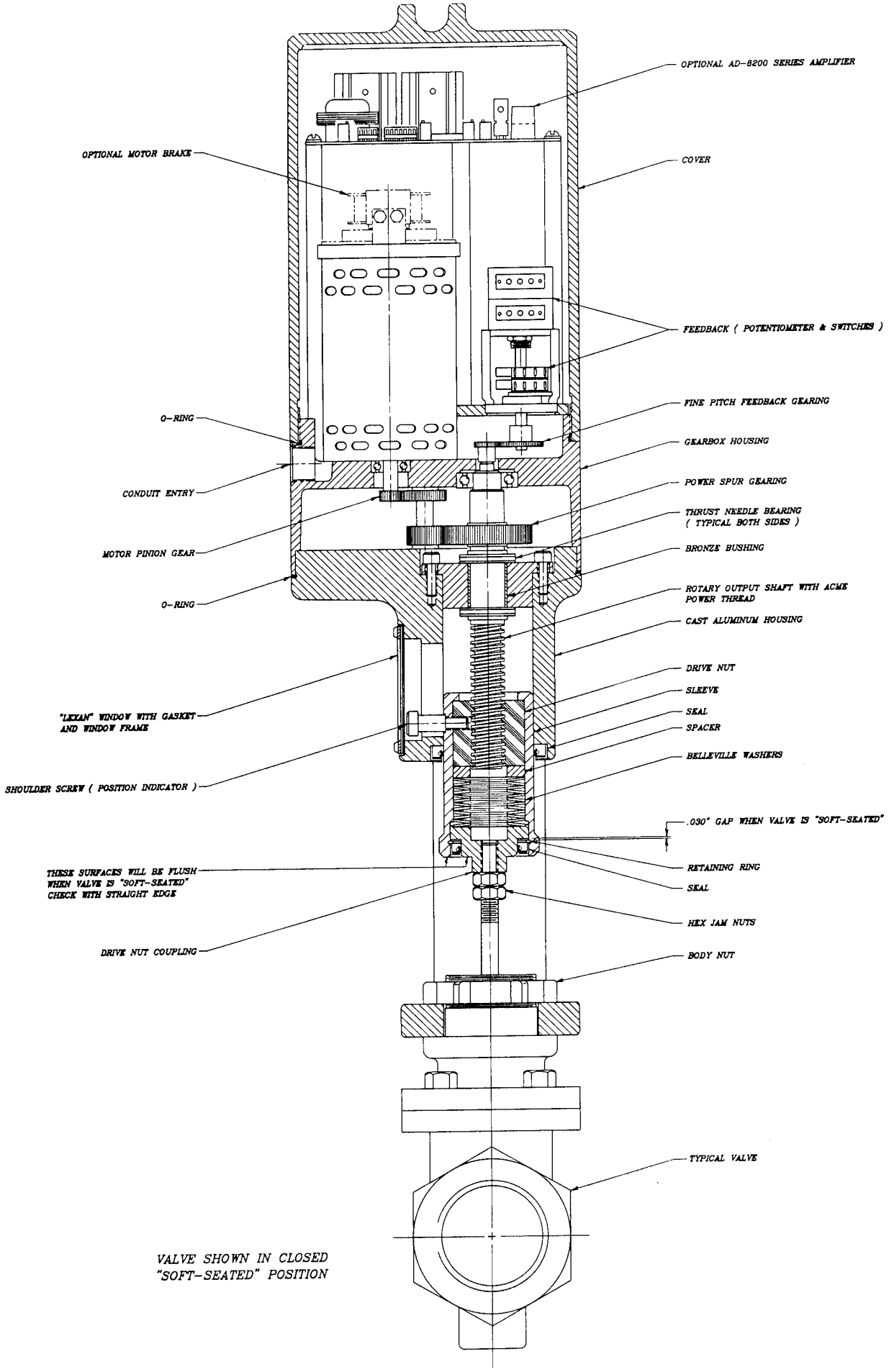
For Electric Actuator

1. motor
2. potentiometer
3. limit switches
4. limit switch actuator
5. power gears
6. feedback gears
7. motor capacitor
8. o-ring
9. bushings
10. seal
11. thrust bearings

For Linear Thrust Assy

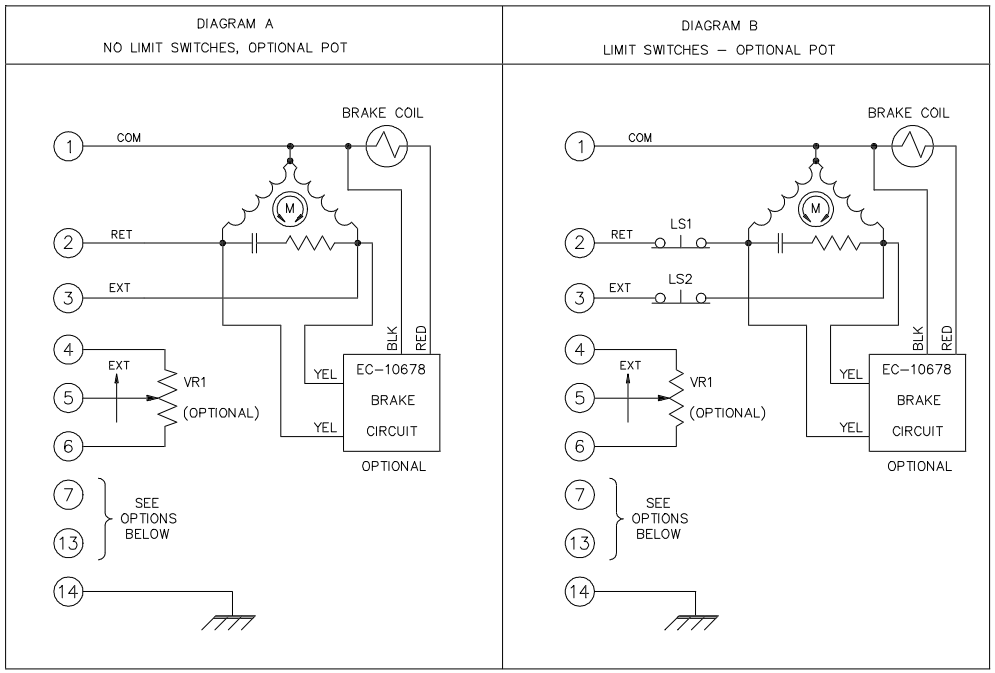
1. drive nut
2. indicator cover gasket
3. drive nut seal
4. drive nut coupling seal

MV-1500 Series Assembly Drawing



Typical MV-1500 Wiring Diagram

BASIC PACKAGE



NOTES:

1) INPUT POWER:
MV–1510: 120Vac MODULATING DUTY
MV–1520: 120Vac INTERMITTENT DUTY
MV–1530: 120Vac MODULATING DUTY
MV–1570: 240Vac MODULATING DUTY

2) ROTATION:
A.C. VOLTAGE APPLIED TO TERMINALS 1 & 3 WILL RESULT IN OUTPUT SHAFT EXTENDING.
A.C. VOLTAGE APPLIED TO TERMINALS 1 & 2 WILL RESULT IN THE OUTPUT SHAFT RETRACTING.

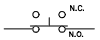
3) GROUND:
GROUND IS IDENTIFIED BY A GREEN SCREW AND WIRE AT TERMINAL 14.

4) POTENTIOMETER:
EXTENSION OF THE OUTPUT SHAFT RESULTS IN DECREASING RESISTANCE AS MEASURED BETWEEN TERMINALS 4 AND 5.

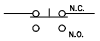
TANDEM POTENTIOMETERS: EXTENSION OF THE ACTUATOR OUTPUT SHAFT RESULTS IN DECREASING RESISTANCE AS MEASURED BETWEEN TERMINALS 4 & 5 (VR1) AND 7 & 8 (VR2).

5) LIMIT SWITCHES:
POSITION LIMIT SWITCH LS1 "TRIPS" AT THE "RET" END OF ACTUATOR OUTPUT SHAFT MOVEMENT. POSITION LIMIT SWITCH LS2 "TRIPS" AT THE "EXT" END OF ACTUATOR MOVEMENT. SWITCHES SHOWN AT MID–TRAVEL (i.e. NOT TRIPPED).

SINGLE TURN FEEDBACK ASSY: LS1 IS OPERATED BY A WHITE COLORED CAM. LS2 IS OPERATED BY A RED COLORED CAM. LS3 AND LS4 ARE OPERATED BY YELLOW COLORED CAMS. LS1 THRU LS4 ARE WIRED TO THE N.O. CONTACTS AS SHOWN.



MULTI–TURN FEEDBACK ASSY: LS1 AND LS2 ARE WIRED USING THE N.C. CONTACTS AS SHOWN.

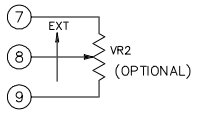
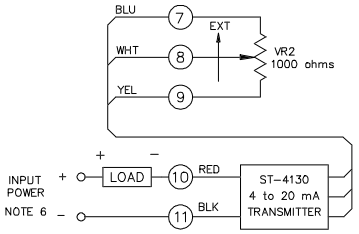
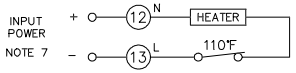
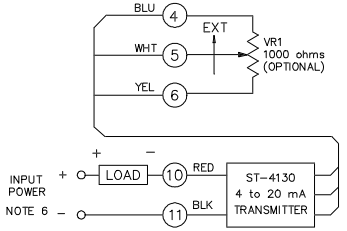
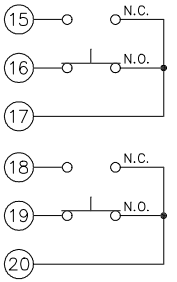


6) TRANSMITTER:
WITH THE OPTIONAL ST–4130, 4–20mA TRANSMITTER WIRED AS SHOWN, THE CURRENT SIGNAL WILL BE DECREASING FOR "EXT" OF THE ACTUATOR OUTPUT SHAFT.

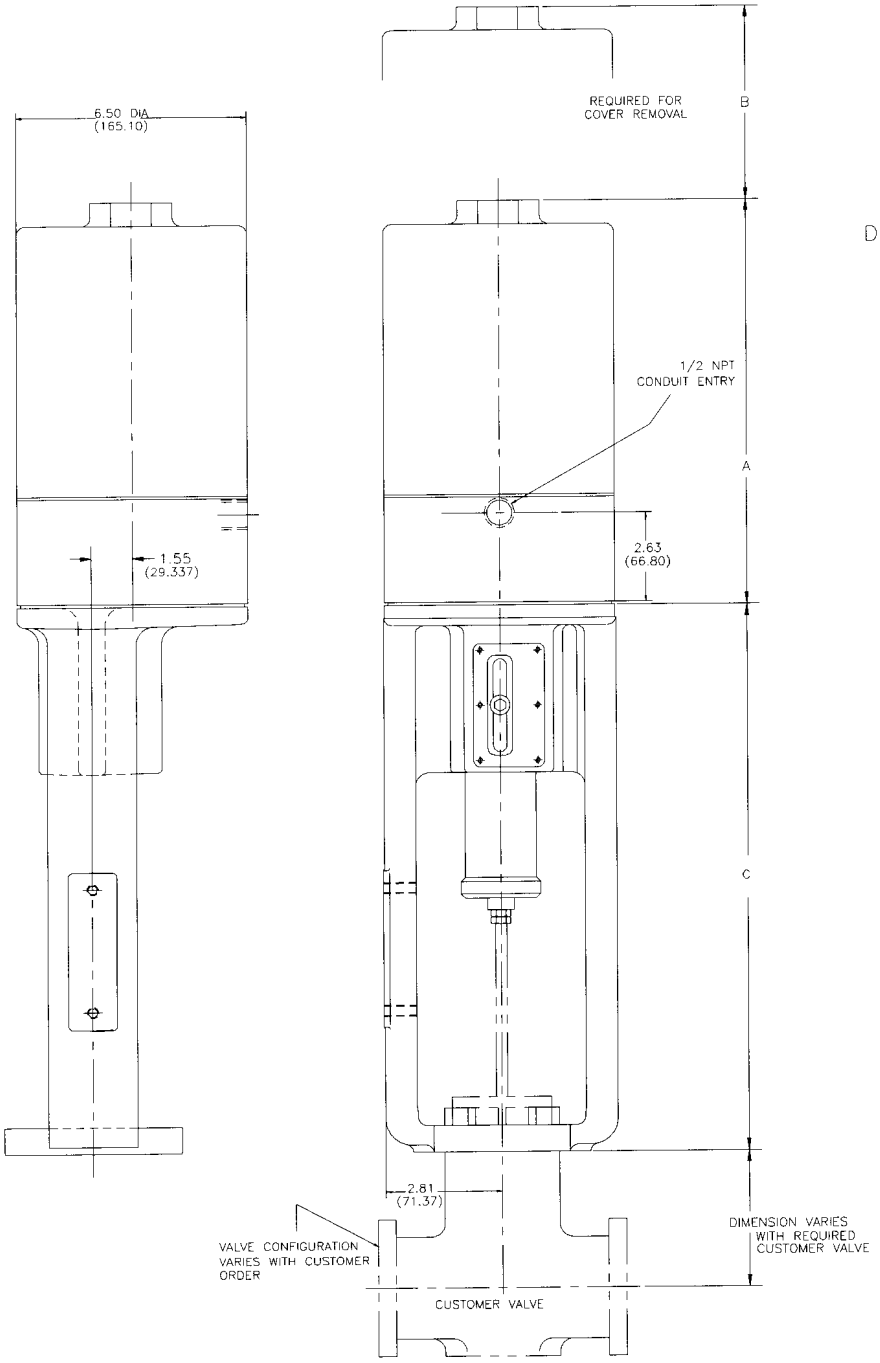
FOR AN INCREASING CURRENT FOR ST–4130 TRANSMITTER INTERCHANGE YELLOW AND BLUE WIRES ON TERMINALS 4 & 6 OR 7 & 9 FOR TANDEM POTS COMING FROM THE TRANSMITTER.

7) HEATER:
INPUT POWER TO TERMINALS 12 & 13 TO BE DETERMINED BY CUSTOMER AT TIME OF ORDER.

8) MOTOR BRAKE:
WHEN AN OPTIONAL MOTOR BRAKE IS SPECIFIED FOR AN SM–1500 ACTUATOR, AN ELECTRO–MECHANICAL BRAKE AND CIRCUIT WILL BE SUPPLIED AND WIRED AS SHOWN. THE BRAKE IS AUTOMATICALLY RELEASED WHENEVER THE MOTOR IS ENERGIZED.

(1) ADDITIONAL POT (TANDEM)	(2) ST–4130, 4–20mA TRANSMITTER W/POT	(3) HEATER & THERMOSWITCH	(4) ST–4130 USING POT IN BASIC PACKAGE	(5) ADDITIONAL LIMIT SWITCHES (SINGLE TURN)
				

MV-1500 Series Installation Drawing



NOTE: This drawing does not illustrate MV-1500 models with the "EL" extended length yoke.

MODEL SERIES	"A"	"B"	"C"		
			STANDARD	LONG	EXTRA LONG
MV-1500	11.50 (292.10)	8.36 (212.34)	10.50 (266.70)	15.55 (394.97)	21.30 (541.02)
MV-1500/AD-8230	13.18 (334.77)	10.04 (255.02)	10.50 (266.70)	15.55 (394.97)	21.30 (541.02)

These dimensions are subject to change without notice and should not be used for preparation of drawings or fabrication of installation mounting.