Honeywell

Models M640, M740, M940

Actionator Motors Product Manual

61-86-25-02
11/92

Honeywell

Actionator Motors
Models M640, M740, M940

Product Manual

TABLE OF CONTENTS

Industrial Automation and Control Division, 1100 Virginia Drive, Fort Washington, PA 19034

Honeywell

Actionator Motors
Models M640, M740, M940

Specification

Function

The Actionator motors position dampers, butterfly valves, slip stem valves, or any device requiring rotary or linear motion.

Optional auxiliary equipment can be used to provide position feedback or supply power to other devices. Refer to Table 1.

The M640A, B, and D motors are used with either a two-position controller with maintained contacts, or a floating controller. Each motor has a crankarm with adjustable throw and position.

The M740A and B motors will accept a 4-20 mA signal from a proportional controller. These motors will position the final control device at any point between full open or full closed, as determined by the controller signal.

The M740 motor Hard Manual feature allows the customer to override the motor position to fully open or fully close the valve or damper when required.

The M940A and B Actionator Motors provide position proportional control of valves and other devices.

The M640B, 740B, 940B motors can be used to operate slip-stem valves of the direct acting, reverse acting or three-way types using suitable linkage.

The M640D motor provides unidirectional travel with adjustable stops, factory-set at 180°.

The M940 models may be used with the external electronic motor positioner model R7195. Refer to document number 81-99-25-02.

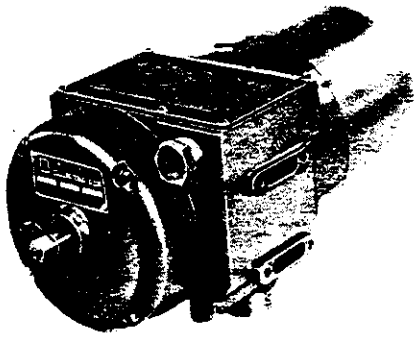


Figure 1—Model M640A and D, M940A Actionator Motor

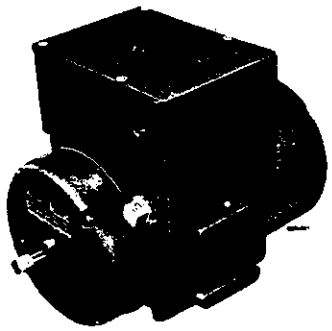


Figure 2—Model 740A Actionator Motor

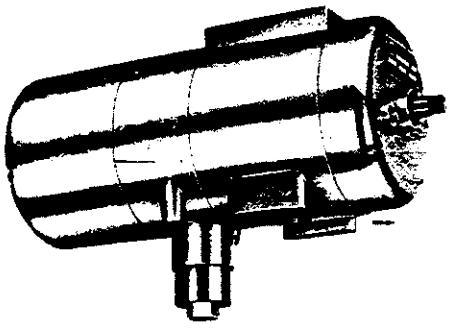


Figure 3—Model M640B, M940B Actionator Motors

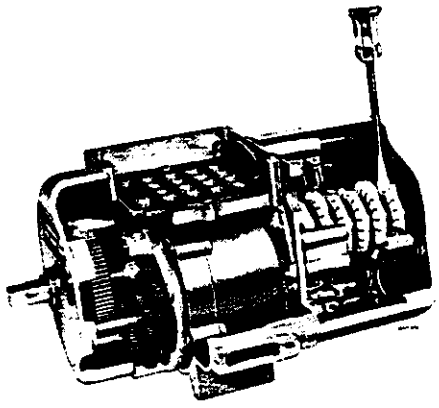


Figure 4—M640 Motor Cutaway View of Internal Parts

Description

Refer to Figures 1-4. A sealed, die-cast aluminum case provides excellent durability. The motor shaft is sealed with an "O" ring made of oil-resistant Buna-N. It is splash-proof and can be hosed down during a cleaning operation if the drain holes are plugged. These motors meet U.L. and C.S.A. type 4 enclosure ratings, when both drain holes are plugged.

Easily accessible switches and adjustments simplify installation and field adjustment. Cam position is easily changed by inserting a screwdriver into one of many slots on the cam and applying slight bias force. Figure 4 shows the simplicity of cam adjustment.

An internal disc brake stops and holds the load in any position. If power is removed from the motor, the brake will maintain the motor position until power is restored.

An adjustable crankarm is included with each motor for connecting the motor shaft to a ball joint and push rod.

The lifter assembly included on M640B, M740B and M940B motors has an adjustable eccentric and an internal strain relief spring to provide strain relief at both ends of the stoke.

The motors are available with timing and torque ratings shown in Table 1.

Options

Auxiliary Switches and Slidewires for M640 Actionator Motors

Auxiliary switches and slidewires provide additional switching functions for M640A motors that have a complete wire harness. Refer to Table 2 for models marked with an asterisk (*).

With the addition of an auxiliary slidewire, any M640A motor can be converted to an M940A. Auxiliary switches and slidewires cannot be added to other motors without changing the terminal board.

Auxiliary switches and slidewires can be combined to provide:

- from one to five auxiliary switches
- one balancing slidewire with up to four auxiliary switches
- one balancing slidewire with one retransmitting slidewire and up to three auxiliary switches

The following assembly numbers contain the auxiliary functions shown. Each assembly contains all the necessary hardware including cams, wipers, spacers, screws, and a wrench.

Assembly 7640MA — One auxiliary switch†
Assembly 7640MB — Two auxiliary switches*
Assembly 7640MC — One 135-ohm slidewire*
Assembly 7640MD — One 1000-ohm slidewire*
Assembly 7640ME — One 500-ohm slidewire*
110126A — Crankarm with adjustable throw and position
24400144-001 — Adaptor kit to mount R7195 to M940/M640

*Order special hub assembly (part number 132986C) with two wipers to mount two slidewires in the same motor.
†Order an extra spacer (part number 132985) and two 4-40 NC screws., 1-5/8 inches long (part number 80248BB), to mount five auxiliary switches in the same motor.

Accessories

Yoke Assembly
Used to mount M640B, M740B, M940B on V5011 and V5013 valves.

Valves
Valve bodies and linkages must be ordered separately.

Dampers
Damper crank, push rod, and ball joint connected to the motor crankarm operate damper in combination with a slip-stem valve.

TABLE 1 — Timings and Torque Ratings Available

Motor Shaft Timing*		Motor Shaft Torque				Lifter Assembly Stem Force†			
in seconds for 180° rotation (in seconds for 150° rotation)		at 90% rated voltage		at 100% rated voltage		at 90% rated voltage		at 100% rated voltage	
60 Hz	50 Hz	lb-in	N•m‡	lb-in	N•m‡	lb	N•m	lb	N•m
7.5 (6.25)	9 (7.5)	45	5.08	70	7.85	100	444.8	140	622.7
15 (12.5)	18 (15)	90	10.2	140	15.8	200	889.6	280	1245.4
30 (25)	36 (30)	180	20.3	280	31.6	300	1334.4	300	1334.4
60 (50)	72 (60)	300	33.9	300	33.0	300	1334.4	300	1334.4
120 (100)	144 (120)	300	33.9	300	33.9	300	1334.4	300	1334.4

*Based on 180° rotation without a load at rated voltage, proportional style has 150°
†Stem force ratings determined with no load on motor shaft
‡Newton-Metre.

Specifications

Operating Conditions

Operating Temperature	−29 to +65°C (−20 to +150°F)
Power Consumption	*M640, M940:* 23 watts *M740:* 40 VA

Performance

Maximum Load Perpendicular to Motor Shaft	90.7 Kg (200 lb)
Motor Shaft Rotation	*M640A:* Adjustable from 10 to 350°, reversible *M740A, M940A:* Adjustable from 10 to 150°, reversible *M640B, M740B, M940B:* Adjustable stroke from 0.64 to 3.81 cm (0.25 to 1.5 inches), reversible *M640D:* Adjustable position, 180° stroke, unidirectional
Auxiliary Switch Rating	7.4 maximum resistive; 120 or 240 Vac (on each switch); 1/3 Hp at 120 or 240 Vac. 1/2 amp at 120 Vdc; 1/4 amp at 240 Vdc

Design

Input Range (M740A, B only)	4-20 mA (factory adjusted) (deadband adjusted to 1%) *Guaranteed fully closed:* 4.0 mA *Guaranteed start to open:* 4.3 mA *Guaranteed fully open:* 20.0 mA *Guaranteed start to close:* 19.7 mA
Input Impedance (M740A,B only)	75 ohms Floating
Adjustments (M740A, B only)	*Zero adjustment:* 0.8 mA to 16.8 mA *Span adjustment:* 2.0 mA to 20.0 mA *Deadband adjustment:* 1% to 5%
Repositions (M740A, B only)	**Deadband setting** — **Repositions** 1% — 100 5% — 20
Slidewire Resistance	135 or 1000 ohms
Motor Shaft Mounting Surface	12.7 mm long by 12.7 mm square (1/2 inch long by 1/2 inch square) Refer to Figures 5 and 6.
Dimensions	Refer to Figures 5 and 6.
Weight	M640A 11.95 lbs. (5.4 kg) M640B 19.0 lbs. (8.6 kg) M740A 14.3 lbs. (6.5 kg) M740B 21.3 lbs. (9.7 kg) M940A 12.4 lbs. (5.6 kg) M940B 19.4 lbs. (8.8 kg)
Accessories (Standard)	1. Crank arm for mounting on square end of motor shaft with a starting angle adjustable in 22-1/2° steps and with a ball joint radius adjustable from 39.7 mm (1.6 inches) to 68.2 mm (2.7 inches) 2. Plug for unused conduit opening in the event that only one of the two opening is used.
Approval Bodies	*Underwriters Laboratories:* File E84572, Guide XAPX *Canadian Standards Association:* File Number LR 47125. All 120 and 240 volt models are U.L. and C.S.A. certified for type 4 enclosures. To comply, motors are supplied with both drain holes sealed with self-tapping screws. The lowest level drain screw may be removed, if venting or draining is desired; but U.L. and C.S.A. enclosure standards are not maintained when drain holes are left open.

TABLE 2 - M640, M740, M940 Actionator Motors

M640 Models/M740 Models

Model Number	Voltage	Timing (Seconds)	Auxiliary Equipment
M640A 1121*	120V	7.5	——
M640A 1022 M640A 1139*	120V	15	——
M640A 1196*	240V	15	——
M640A 1048 M640A 1204*	120V	15	2 SPDT 1 SPDT
M640A 1055 M640A 1147*	120V	30	——
M640A 1246	120V	30	2 SPDT
M640A 1063	120V	30	1 SPDT
M640A 1170*	240V	30	——
M640A 1089 M640A 1154*	120V	60	——
M640A 1188*	240V	60	——
M640A 1162*	120V	120	——
M640A 1253** M640A 1279	120V 220V	15 60	2 SPDT ——
M640B 1054*	120V	30	——
M640B 1062*	120V	60	——
M640D 1003	120V	15	
M640D 1011	120V	15	2 SPDT in Tandem
M740A 1004	120V	15	——
M740A 1012	120V	30	——
M740A 1038	120V	60	——
M740A 1053	120V	120	——
M740A 1020	120V	30	2 SPDT
M740A 1046	120V	60	2 SPDT
M740A 1061	120V	60	One 135Ω Retransmitting Slidewire
M740A 1079	120V	15	2 SPDT
M740A 1087	120V	30	3 SPDT
M740A 1095	220V	60	2 SPDT
M740A 1103	120V	60	2 SPDT, One 1000 Ω Retransmitting Slidewire
M740A 1137	120V	7.5	——
M740B 1003	120V	60	——
M740B 1011	120V	30	——
M740B 1029	120V	15	——
M740B 1037	120V	7.5	2 SPDT
M740B 1045	120V	15	2 SPDT
M740B 1060	120V	60	2 SPDT
M740B 1078	120V	120	2 SPDT

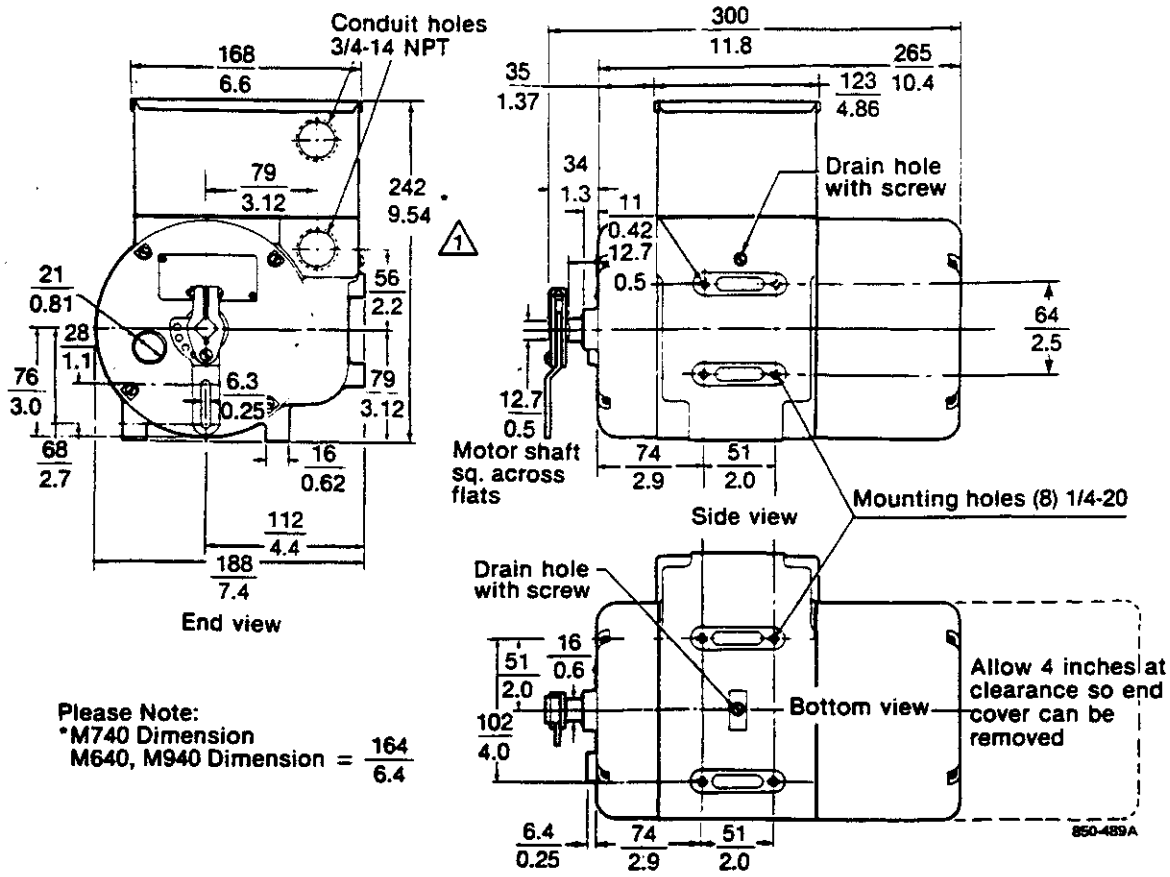
TABLE 2 - M640, M740, M940 Actionator Motors (continued)

M940 Models

Model Number		Voltage	Timing (Seconds)	Auxiliary Equipment
M940A	1000	120V	15	——
M940A	1018	240V	15	——
M940A	1026	120V	30	——
M940A	1042	220V	30	
M940A	1059	120V	30	2 SPDT
M940A	1158	120V	30	1 SPDT
M940A	1067	120V	60	——
M940A	1075	240V	60	——
M940A	1083	220V	60	——
M940A	1091	120V	60	One 1000Ω Balance Slidewire
M940A	1109	120V	120	——
M940A	1125	120V	60	One 135Ω Retransmitting Slidewire
M940A	1133	120V	60	1 SPDT
M940A	1190	120V	60	One 135Ω Retransmitting Slidewire and 1 SPDT
M940A	1141	120V	120	2 SPDT
M940A	1216	220V	60	2 SPDT One 1000Ω Retransmitting Slidewire
M940A	1240	120V	60	2 SPDT
M940A	1265	120V	15	2 SPDT One 135Ω Retransmitting Slidewire
M940A	1273	120V	30	2 SPDT One 135Ω Retransmitting Slidewire
M940B	1009	120V	15	——
M940B	1058	120V	15	One 135Ω Retransmitting Slidewire and One 1000Ω Balance Slidewire
M940B	1074	120V	60	2 SPDT
M940B	1017	120V	30	——
M940B	1025	120V	60	——
M940B	1041	120V	60	One 135Ω Retransmitting Slidewire
M940B	1082	220V	60	One 135Ω Retransmitting Slidewire

*Wired for field addition of auxiliary switches, balancing and retransmitting slidewire.
**Auxiliary switch cams are momentary make at the switch point rather than continuous make through the remaining motor stroke.

Dimensions: millimetres / inches

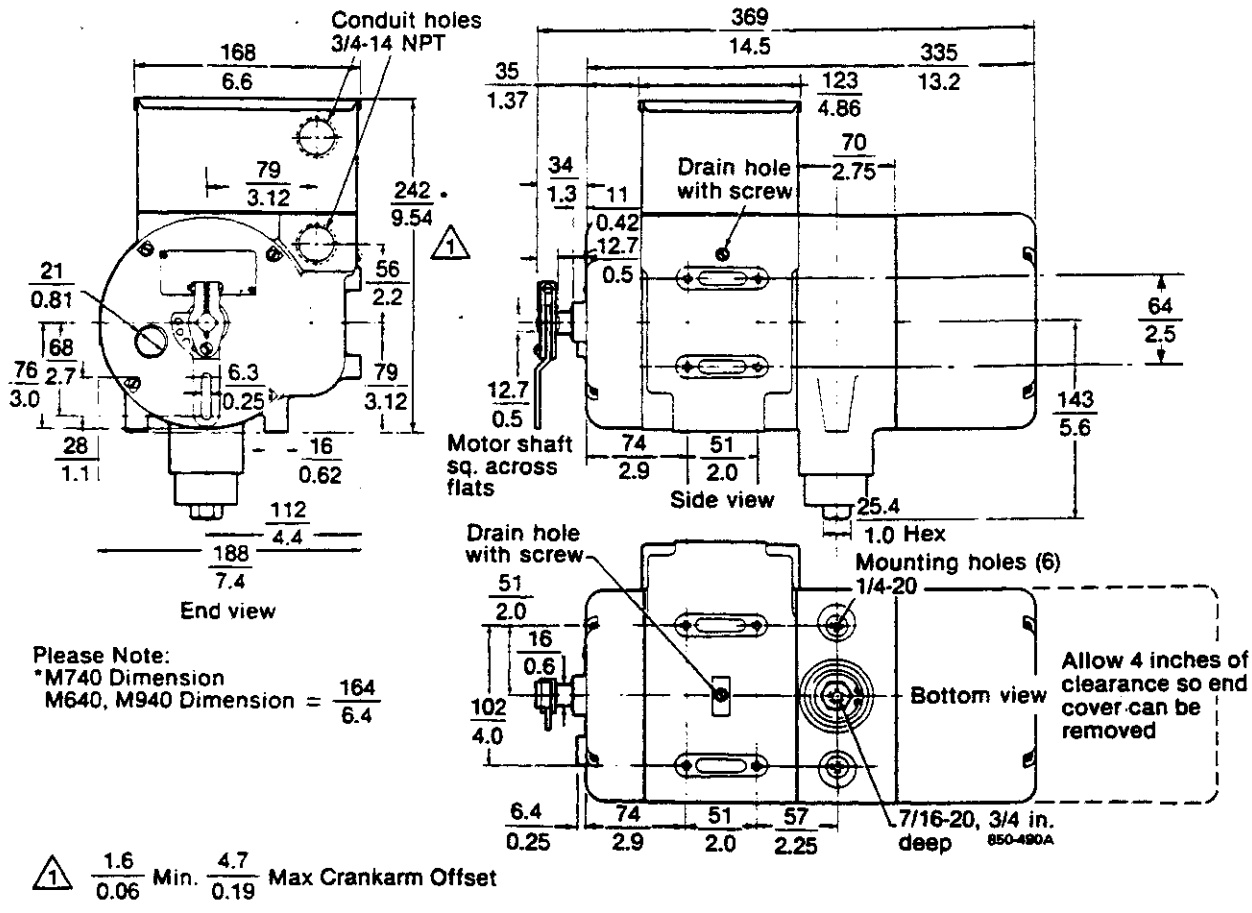


Please Note:
*M740 Dimension
M640, M940 Dimension = 164 / 6.4

△1 1.6 / 0.06 Min. 4.7 / 0.19 Max Crankarm Offset

Figure 5—Motor dimensions — M640A, M740A, M940A

Dimensions: millimetres / inches



Please Note:
*M740 Dimension
M640, M940 Dimension = 164 / 6.4

⚠1 1.6 / 0.06 Min. 4.7 / 0.19 Max Crankarm Offset

Figure 6—Motor dimensions — M640B, M740B, M940B

Ordering Information

When ordering, specify:
Complete Model Number (Refer to Table 1)
Options if desired:
a. Assembly number of auxiliary switches and slidewires for M640 motors. (Select from listing under "Options".)
b. Slidewire resistance for M940 motor.
c. Other option accessories.

Order from

Honeywell
1885 Douglas Drive North
Minneapolis, Minnesota 55422

(In Canada —
Honeywell Limited
155 Gordon Baker Road
Willowdale Ontario M2H 3N7)

For more information, contact the nearest Honeywell sales office or Honeywell, Industrial Controls Division, 1100 Virginia Drive, Fort Washington, PA 19034.

Specifications are subject to change without notice

Actionator Motors
Models M640, M740, M940

Installation Data

Installation

Models M640A, M640D, M740A, and M940A

General

1. Determine the orientation of the motor before mounting. Figure 1 shows the locations of the drain holes. U.L. and C.S.A. type 4 enclosure ratings will be maintained when both drain holes are plugged with self-tapping screws. Remove the lowest drain hole screw only if drainage or venting is required.
2. Leave clearance around the motor for adjusting and servicing.
3. Mount the motor so the motor shaft is horizontal.

Mounting on Dampers

Use integral mounting bosses to mount the motor either externally on the duct wall or other suitable mounting surface, or internally on a mounting bracket furnished on Honeywell dampers as specified.

For external mounting, connect the motor crankarm to the damper-shaft extension using balljoints, a pushrod, and a damper crankarm. For heavy duty use of the actionator motors use a steel mounting plate (Honeywell part number 49097). Refer to Figures 1 and 3 for roughing in dimensions.

Mounting on Valves

Use Honeywell's Q100C linkage to use motors with V51 butterfly valves. See linkage and valve instruction for mounting details.

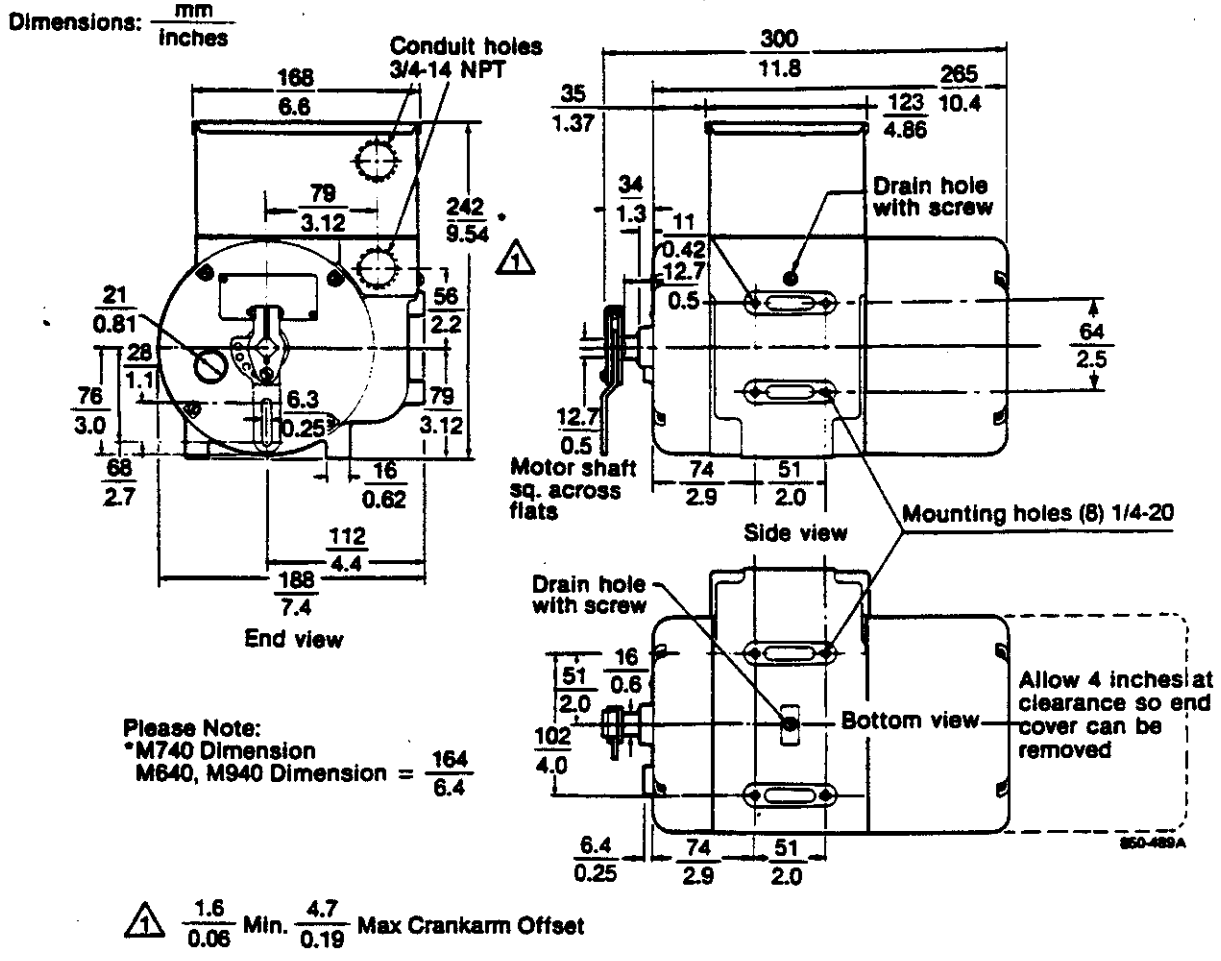


Figure 1—Dimensions to nearest millimetre (Models M640A, M640D, M740A, M940A)

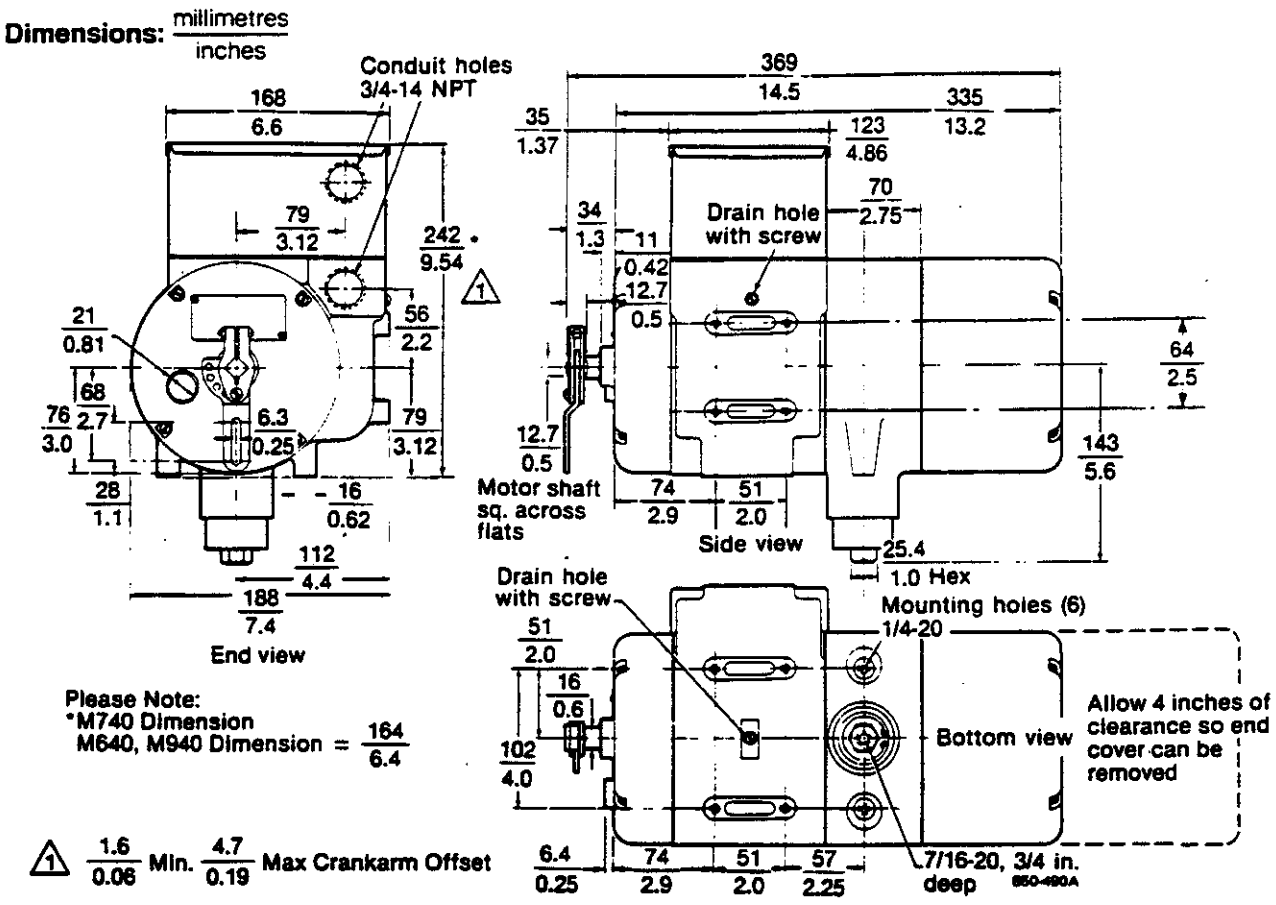


Figure 2—Dimensions to nearest millimetre (M640B, M740B, M940B)

Models M640B, M740B, M940B

General

Dimensions for these models are shown in Figure 2. During installation the motor should be energized through momentary contact switches. Connection of the motor coils through the terminals indicated below will determine the direction of motor shaft rotation and the position of the valve lifter (direction viewed from shaft end):

Motor shaft rotation clockwise, lifter down. Hot terminal 1, common terminal 2. Motor shaft rotation counterclockwise, lifter up. Hot terminal 3, common terminal 2.

Models M740B Only

The direction of motor travel for the M740B motor is determined by connecting line voltage to the circuit. With no input connections to terminals B, R, and W the motor will run to the counterclockwise limit. Applying a short to terminals B and W causes the motor to run to the clockwise limit.

CAUTION: Whenever the motor yoke, and valve are assembled and power is used to drive the motor to make adjustments, do not drive the strain relief mechanism over 1.6 mm (0.06 in.) in either direction on over-travel; otherwise, serious damage may result to the drive-cam and stroke-adjustment mechanism inside the lifter assembly.

These models are furnished with a crankarm assembly which may not be needed and can be discarded.

Adjustments must be made in the following order:

Adjust Lifter Travel

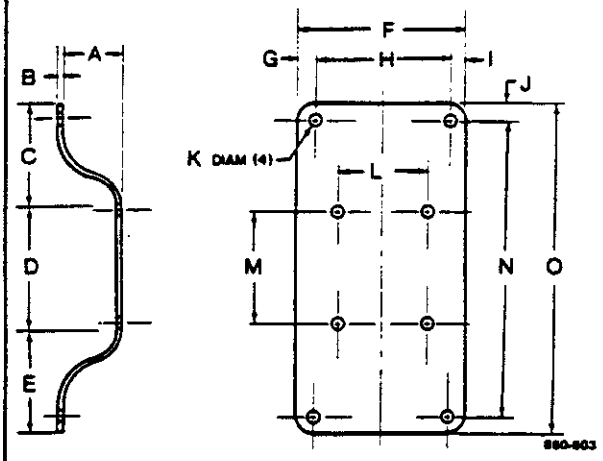
These models are shipped with the stroke set for 6.3 mm (0.25 inches) minimum travel and must be adjusted to match the lift of the particular valve used. Table 1 lists lifter travel along with the motor adjustment, Dimension "A", which must be made. For a particular valve stem lift, refer to the lifter travel column of Table 1, noting Dimension "A". This dimension is measured on the motor from the bottom of the motor housing to the bottom of the lifter shaft (Figure 4) when the lifter is at the lower extremity of its downward stroke.

Dimension "A" is for single-seated and double-seated, two-way valves and allows a 1.5 mm (0.06 inches) strain relief at the end of the stroke.

TABLE 1 - Adjustments to Provide Required Lifter Travel

Lifter Travel		Dimension "A"	
mm	inches	mm	inches
12.7	0.5	29.3	1.16
14.2	0.56	30.1	1.19
15.8	0.63	30.9	1.22
19.0	0.75	32.5	1.28
25.4	1.0	35.1	1.41
31.7	1.25	38.8	1.53
38.1	1.5	42.0	1.66

On three-way valves, Dimension "A" should be increased 0.7 mm (0.03 inches) to give 1.5 mm (0.06 inches) strain-relief at both ends of the stroke. It is possible on three-way valves, because of tolerance build-up, that only 0.7 mm (0.03 inches) strain relief may be available at both ends of the 38.1 mm (1.5 inch) stroke.



	Metric (mm)	English (Inch)		Metric (mm)	English (Inch)
A	34.9	1.375	I	9.5	0.375
B	2.3	0.094	J	9.5	0.375
C	58.7	2.313	K	6.3	0.250
D	69.8	2.750	L	50.8	2.000
E	58.7	2.313	M	63.5	2.500
F	95.2	3.750	N	168.2	6.625
G	9.5	0.375	O	187.3	7.375
H	76.2	3.000			

Figure 3—Dimensions – Steel Mounting Plate for Actionator Motors (Part Number 49097)

NOTE: The motor shaft rotation is factory set (M640B—160°, M740B, M940B—150°). This adjustment should never be changed if the following adjustments are to provide the correct travel of the lifter assembly.

1. Remove the cap screw (Figure 6) from the top of the motor housing.
2. With power on, drive the motor lifter shaft (Figure 5) until the two adjustment screws are in line with the adjustment slot, visible through the cap screw hole (Figure 6) in the top of the motor. At this point the adjustable eccentric cam will have driven the lifter shaft to the lower extremity of its travel.
3. Using a 7/32 inch Allen wrench, loosen the outer locking screw.

CAUTION: Do not loosen the locking screw any further than absolutely necessary as this will disturb final adjustments which must be made later.

4. Using a 1/8 inch Allen wrench, turn the inner adjusting screw in the direction required to adjust Dimension "A" (Figure 4) as needed to provide the lifter travel desired. A scale should be used to measure this adjustment. Clockwise rotation of the adjusting screw will increase Dimension "A" and lengthen the lifter travel. Counterclockwise rotation will decrease Dimension "A" and shorten the lifter travel.

NOTE: The 20 thread per inch screw used in the adjustable eccentric means one counterclockwise revolution of the adjustment screw decreases the travel approximately 2.54 mm (0.10 inch).

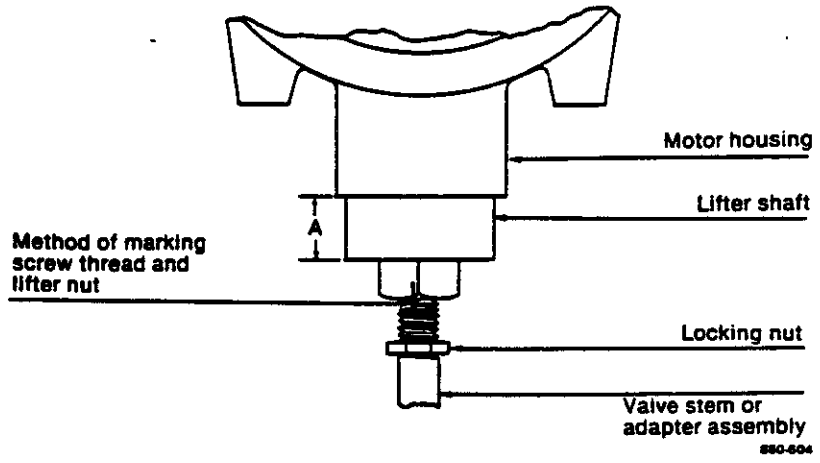


Figure 4—Illustration showing connection of valve stem or adaptor assembly to actionator lifter assembly

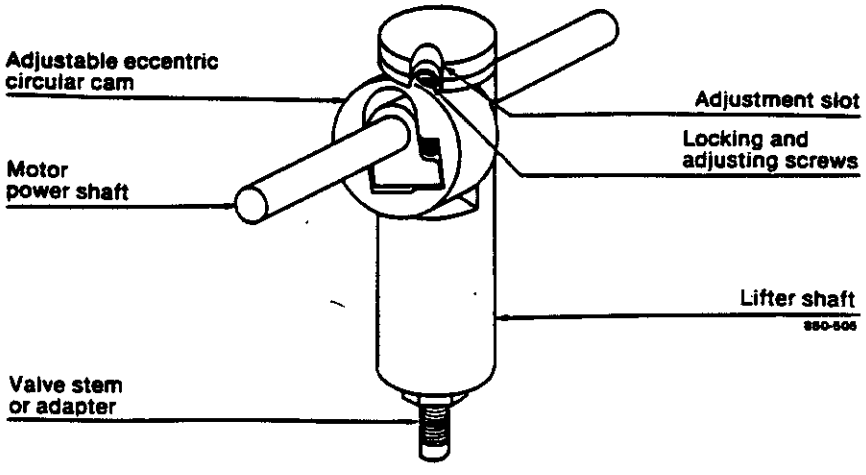
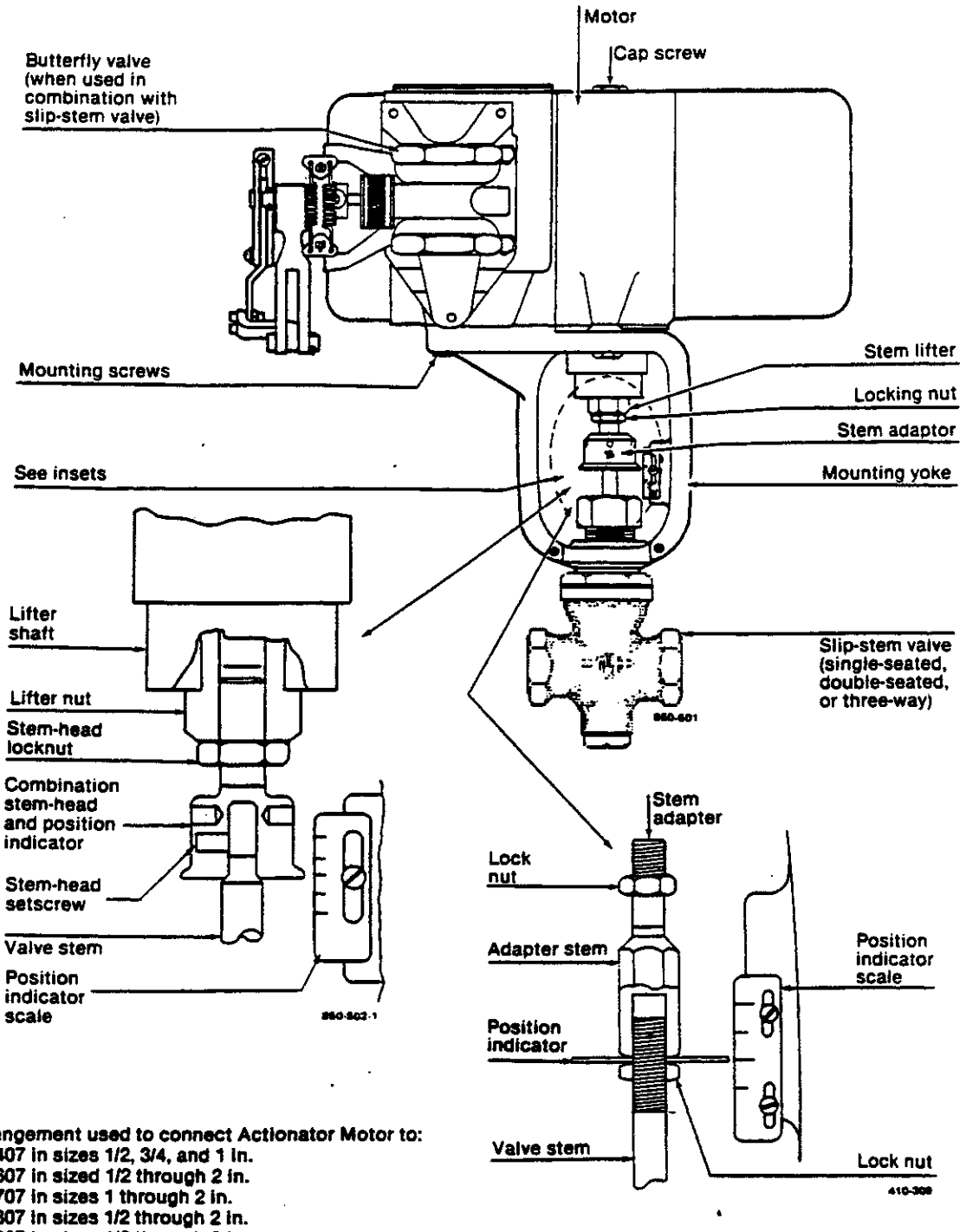


Figure 5—Illustration of lifter mechanism of circular cam, adjusting screws and lifter



This arrangement used to connect Actionator Motor to:
Series 1407 in sizes 1/2, 3/4, and 1 in.
Series 1607 in sized 1/2 through 2 in.
Series 4707 in sizes 1 through 2 in.
Series 4807 in sizes 1/2 through 2 in.
Series 4907 in sizes 1/2 through 2 in.
Series 8107 in sizes 2-1/2 through 6 in.
Series 9107 in sizes 1 through 2 in.
Series 9207 in sizes 1 through 2 in.
V5011A in sizes 1/2 through 3 in. (bronze bodies)
V5011A insizes 2-1/2 through 5 in. (iron bodies)
V5013A in sizes 1/2 through 2 in. (bronze bodies)
V5013A in sizes 2-1/2 through 5 in. (iron bodies)
INSET A

This arrangement used to connect Actionator Motor to:
Series 1607 in sizes 2-1/2, 3 and 4 in.
Series 9207 in sizes 2-1/2, 3 and 4 in.
INSET B

Figure 6—Illustration of M640B, 740B, and 940B Actionator Motor mounted to Yoke and Valve body with inserts showing variations in adaptors for different valves. A V51 Butterfly Valve is also shown mounted to the motor.

5. Check the actual lifter travel adjustment as follows:
   a. Using a scale, note the measurement of Dimension "A", Figure 4.
   b. Using power, run the lifter fully into the motor and again note the measurement of Dimension "A". To ensure tight closure, the difference between these two readings should be equal to:
      1. The valve lift plus 1.5 mm (0.6 inches) for two-way, single-seated and double-seated valves.
      2. The valve lift plus 3.2 mm; (0.13 inches) for three-way valves.
6. If the actual lifter travel does not follow the valve stroke as noted above, return to Step 4 and continue adjusting Dimension "A" until actual operation of the motor provides the required travel.
7. Leave the cap screw off and the locking screw loose for final adjustments.

Mount the Motor to the Valves

NOTE: Two drain holes are provided in the motor housing for ventilation and drainage purposes (Figures 1 and 2).

A self-tapping screw is not supplied for the lower drain hole.

After deciding location of the motor, determine which drain hole will be at the bottom of the motor housing and remove the screw from this hole only if drainage is required. A mounting yoke must connect the motor to the valve body (Figure 6). For most applications the Actionator, yoke, and valve body may be either field or factory assembled (specified when ordering the motor). However, if field mounting is required, the yoke may be ordered separately for the particular valve body (along with the necessary mounting screws, locking nuts, and stem adaptor assembly). The yoke should be connected firmly to the valve bonnet according to the directions furnished with the yoke.

Using 1/4–20 mounting screws (Figure 6) and locking washers, mount the motor firmly to the yoke. To mount the motor it may be necessary to run the stem lifter back into the motor, or to screw the valve stem or adaptor assembly into the lifter to clear the stem. If so, refer to the beginning of this section for terminal connections required to drive the lifter up.

The lower end of the lifter assembly (Figure 6) is provided with a 7/16–20 threaded hole to receive the male threads of the valve stem or stem adaptor. The stem should be threaded up as far as possible, and the locking nut should be left turned down on the stem in the position shown in Figure 4 so final adjustments may be made.

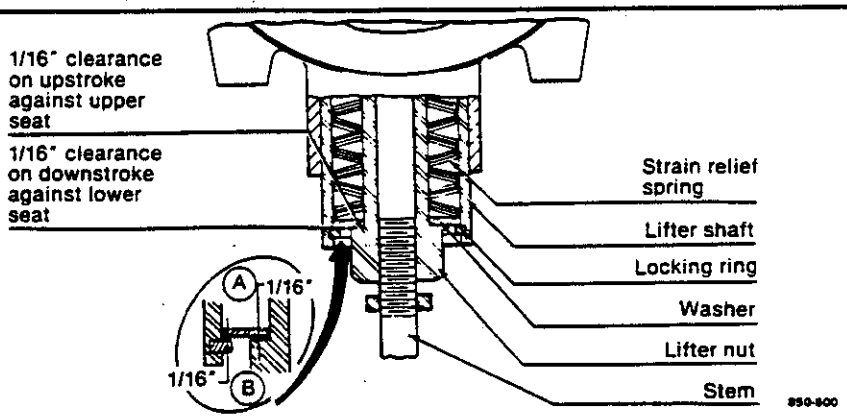


Figure 7—Internal view of lifter shaft assembly showing clearances needed for proper adjustment of strain-relief mechanism.

Final Adjustments for Tight Close-Off

Final adjustments of the stem connection and lifter travel are necessary for tight close-off and to ensure the eccentric is positioned properly with respect to the lifter shaft (Figure 5).

The method for final adjustment will vary depending on whether a straight-through or a three-way valve is used. Single-seated and double-seated direct acting straight-through valves use the same procedure. The procedures which follow provide a method for maintaining 1.5 mm (0.06 inches) override or slightly less on the correct closure. Any greater override could result in jamming and damage to the motor. Do the adjustments under "Adjusting Lifter Travel" in this section first.

In making final adjustments, refer to the beginning of this section for terminal connections required to drive the stem lifter in and out.

Method For Adjusting Two-way Valves

1. With the valve lifter shaft in the downward position, twist the valve stem until the valve seats with hand tightness.
2. Using a colored pencil, mark the position of the stem thread where it enters the nut in the bottom of the lifter assembly. See Figure 4.
3. Using power, back the lifter and stem off the seat (single-seated) or seats (double-seated).
4. Twist the stem out of the lifter 1-1/4 turns by hand with the aid of the mark made in step 2. This should provide 1.5 mm (0.06 inches) (or slightly less) override against the strain-release spring on the down stroke of the motor.
5. Energize the motor and drive the lifter out of the motor to its extreme downward position.
6. Check that the valve is seating properly. See Figure 7. The lifter shaft should drive the strain-relief spring down until approximately 1.5 mm (0.06 inches) (or slightly less) clearance (Note B, Figure 7) is visible between the lock ring and washer.
7. Re-energize the motor until the lifter reaches the top of its stroke and check as follows to ensure that the lifter travel is correct.
   a. Using the mark made in step 2, note the exact number of turns of the stem (Figure 4) required to raise the plug or disc holder to the upper surface of the valve body. If this number is approximately one turn, the lifter travel adjustment made on the motor is correct. Turn the stem back down by hand the same amount as noted above, then proceed to step 8.
   b. If the instroke of the lifter has caused the plug or disc holder to jam against the upper surface, or to approach within less than one turn of the upper surface of the valve body as noted previously (step 7a), the lifter travel adjustment is too large. Using power, back the lifter away from the upper surface and turn the stem back into the lifter. With a 1/8 inch Allen wrench, twist the Allen screw (Figure 5) one-half turn counterclockwise reducing the lifter travel, and then return to step 1. Repeat this procedure, gradually reducing the travel until the correct adjustment is noted as in step 7a, then proceed.

8. Lock the lifter in position by tightening the locking nut (Figure 4) against the nut on the lower end of the lifter assembly.
9. Using a 7/32 inch Allen wrench, tighten the other locking screw (Figure 5). Replace the cap screw (Figure 6) on the adjusting hole.

   NOTE: At no time should the locking screw ever be loosened any further than absolutely necessary if these adjustments are to be correct.

Method for Adjusting Three-way Valves

1. With the valve lifter shaft fully out, twist the valve stem out (Figure 4) until the valve seats with hand tightness.
2. Using a colored pencil, mark the position of the stem thread where it enters the nut in the bottom of the lifter assembly (Figure 4).
3. Energize the motor until the lifter moves up slightly.
4. Twist the valve stem out of the lifter 1-1/4 turns with the aid of the mark made in step 2. This should provide a 1.5 mm (0.06 inch) or slightly less override against the strain-relief spring both on the downstroke as well as on the upstroke of the motor as provided by "Adjusting Lifter Travel" in this section.
5. Energize the motor and drive the lifter shaft to its extreme downward position.
6. Check that the valve is seating properly against the lower seat (Figure 7). The lifter shaft should drive the strain-relief spring down until approximately 1.5 mm (0.06 inches) or slightly less clearance (Note B, Figure 7) is visible between the locking ring and washer.
7. Energize the motor and drive the lifter shaft to its extreme upper position.
8. Check that the valve is seating properly against its upper seat (Figure 7). The lifter shaft and locking ring should drive the strain-relief spring up until approximately 1.5 mm (0.06 inch) or slightly less clearance (Note A, Figure 7) is visible between the locking ring and lifter nut.
9. a. If the visual checks noted in steps 5 through 8 above provide the correct seating and override, proceed immediately to step 10.

   b. If the usual checks in steps 5 through 8 above do not provide the proper seating and override against the strain-relief, further adjustments of the lifter travel will be required. Refer to the procedure at the end of this section before proceeding to stop 10.
10. After proper lifter travel has been achieved (as noted in steps 6 and 9a), lock the lifter in position by tightening the locking nut (Figure 4) against the nut on the lower end of the lifter assembly.
11. Using a 7/32 inch Allen wrench, tighten the outer locking screw (Figure 5). Replace the cap screw (Figure 6) on the adjusting hole.

    NOTE: At no time should the locking screw ever be loosened any further than absolutely necessary if these adjustments are to be correct.

The following steps are to be used only if improper seating and override is noted under step 9b.

This procedure will correct the lifter travel adjustment to ensure tight valve closure, and to provide 1.5 mm (0.06 in) or slightly less override on the strain relief spring at both ends of the stroke while the motor is actually installed on the yoke and valve body.

1. With the valve lifter shaft fully out, twist the valve stem until the valve seats with hand tightness (Figure 4).
2. Using a colored pencil, mark the position of the stem thread where it enters the nut in the bottom of the lifter assembly (Figure 4).
3. Energize the motor until the lifter moves up about 6.3 mm (0.25 in) from the stroke bottom.
4. Twist the valve stem out of the lifter 3-1/2 turns with the aid of the mark made in step 2.
5. Re-energize the motor until the lifter reaches the top of its stroke.
   a. Twist the valve stem into the lifter until the valve seats with hand tightness on the upper seat. Using the mark made in step 2, note the number of turns required to seat the valve. If this number is 1 ± 1/8 turn, the lifter travel adjustment is correct. Return to step 10.
   b. If the number of turns noted in step 5a is greater than 1-1/8 turns, the lifter travel adjustment is too small. Using power, drive the lifter away from the upper seat. Then twist the stem several turns back into the lifter. Using a 1/8 inch Allen wrench, twist the Allen screw (Figure 5) 1/2 turn clockwise, increasing the travel, and then return to step 1 in this section. Repeat this procedure, gradually increasing the travel until the correct adjustment is noted as in step 5a. Return to step 10.
   c. If the valve seats tight on the instroke of the lifter, the lifter travel adjustment is too large. Using power, back the lifter off the upper seat and twist the stem several turns back into the lifter. Using a 1/8 inch Allen wrench, twist the Allen screw (Figure 5) 1/2 turn counterclockwise reducing the travel, and then return to step 1 in this section. Repeat this procedure gradually decreasing the travel until the correct adjustment is noted as in step 5a. Then return to step 10.

Mounting Crankarm Assembly (Figure 8)

1. Fit the crankarm assembly over the motor shaft and tighten screw (Y).
2. If closer adjustment is necessary, first install the crankarm assembly so that it is past the desired starting point in a clockwise direction, then remove screw (X) and lockwasher, turn the crankarm counterclockwise to the desired starting point (in 22.5° steps), and replace screw (X) and lockwasher.

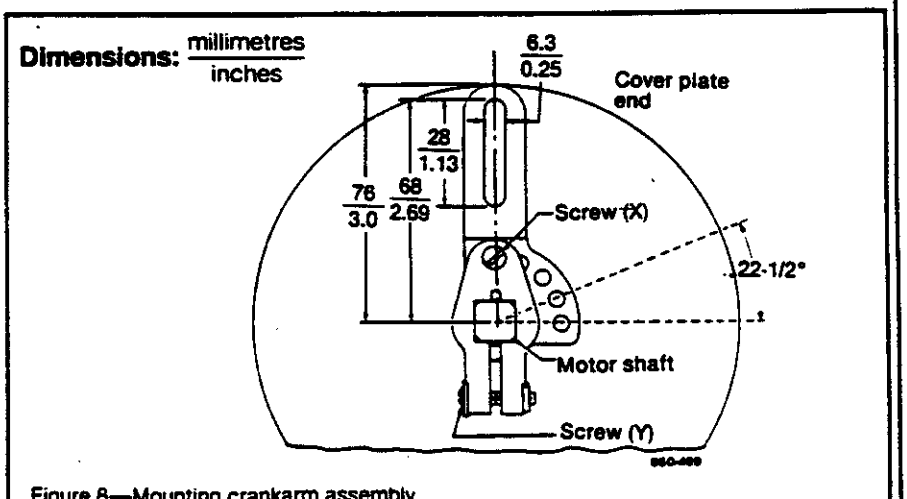
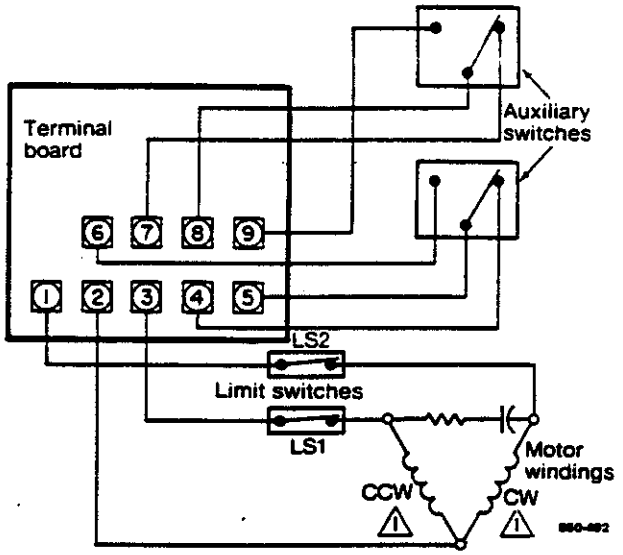


Figure 8—Mounting crankarm assembly



1 Direction of rotation as viewed from output end of motor

Figure 9—M640A, B internal wiring (two auxiliary switch model shown)

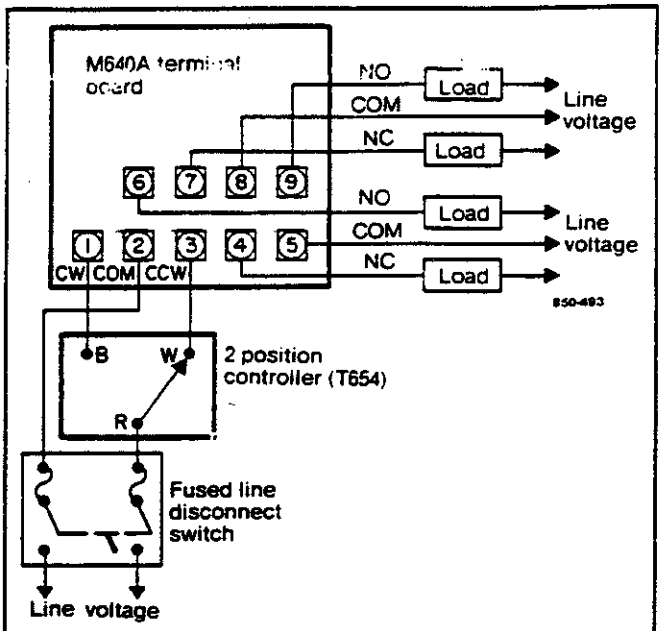


Figure 10—M640 typcial field wiring (two auxiliary switch model shown)

Installing Butterfly Valves

In addition to a slip-stem valve, each M640B, M740B, or M940B motor may be fitted with a V51 Butterfly valve as shown in Figure 6. A linkage must be ordered separately for this installation. Complete mounting procedures are available in document number 60-2102 furnished with the Butterfly valve.

Final Adjustments for all Valves

Using power, run the valve to both the upward limit and the downward limit and check all adjustments. Tighten all nuts, bolts, and locking nuts.

Wiring

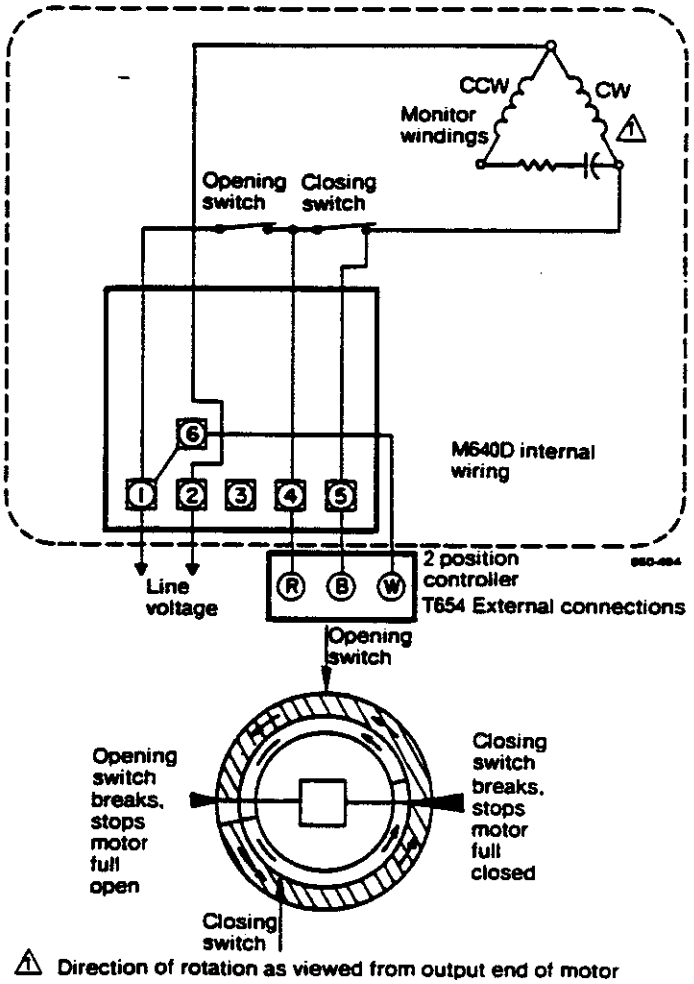
NOTE: All wiring must comply with local electrical codes, ordinances, and regulations regarding wire size, type of insulation, and enclosure. Provide disconnect means and over-current protection as required.

M640A, B Actionator Motor

Figure 9 shows the internal wiring of an M640A, B Actionator motor with two auxiliary switches. Figure 10 shows typical wiring connections to the M640A, B Actionator motor terminal board. The motor may contain up to 18 terminals depending on the number of auxiliary switches and slidewires; but will not contain more than are required.

M640D Actionator Motor

Figure 11 illustrates the internal wiring of the M640D motor. Terminals 4, 5, and 6 connect to the controller.



1 Direction of rotation as viewed from output end of motor

Figure 11—M640D wiring connections and operation.

M740A, B Actionator Motors

Figure 12 shows the internal wiring of the M740A, B Actionator motors.

Zero and Span Adjustment

Refer to Section 61-86-09-01 for Split Range Capability.

1. Adjust the zero adjust potentiometer P3 (the pot closest to the quick-connect terminals) fully clockwise (maximum zero), and the span adjust potentiometer P1 fully counterclockwise (minimum span).
2. Set the controller to the current value at which it is desired to drive the motor just away from the closed position. Motor should be closed.
3. Turn the zero adjust pot P3 slowly counterclockwise until the motor just drives away from the closed position. This is defined to be the "zero."
4. Set the controller to the current value at which it is desired to drive the motor just away from its full open position. Motor should be open.
5. Turn the span adjust pot P1 slowly clockwise until the motor just drives away from the full open position. The difference between this current value and the zero of (3) is defined to be the "span."
6. Recheck the zero and readjust the zero adjust pot P3 as necessary. Turning P3 clockwise will increase the zero value.
7. Recheck the span and readjust the span adjust pot P1 as necessary. Turning P1 clockwise will increase the span.

Split Range and Parallel Operation

The M740A motors may be used in split range applications by connecting the 4-20 mA controller signal to the inputs of the motor connected in series as shown in Figure 13. Since the input resistance to the M740A is 75 ohms, an R7355 DialaTrol controller can drive up to eight M740 motors. The R7355 controller can drive loads up to 650 ohms. Each motor may then be calibrated anywhere within its calibration range. For example, both motors can operate in parallel calibrated to 4-20 mA or one unit can be calibrated to start to open at 4 mA and be fully open at 12 mA and the second motor can be calibrated to start to open at 12 mA and be fully open at 20 mA.

Procedure

Two Motors in Series — Figure 13

1. Apply 4 mA to the two motors in series.
2. Adjust the zero adjustment potentiometer so that motor #1 just starts to open.
3. Apply 12 mA to the motors.
4. Adjust the span adjustment potentiometer of motor #1 until motor just starts to close.
5. Adjust zero adjustment on motor #2 until motor just starts to open.
6. Apply 20 mA to the motors.
7. Adjust the span adjustment on motor #2 until motor just starts to close.

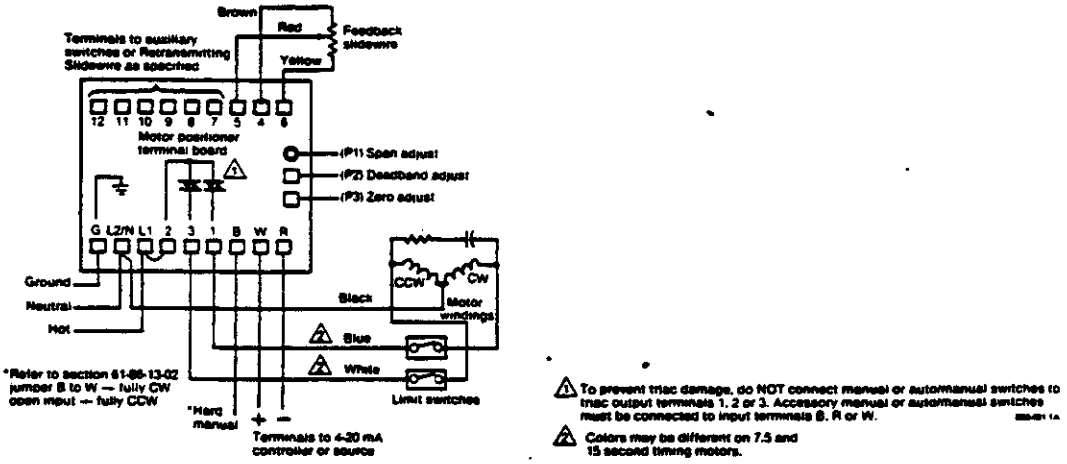


Figure 12—Internal Wiring Diagram, M740A, B

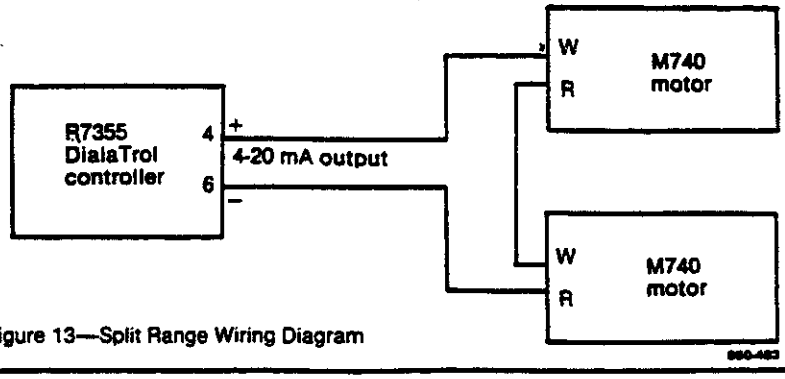


Figure 13—Split Range Wiring Diagram

M940A, B Actionator Motors

Figure 14 shows the internal wiring of the M940A, B Actionator motor. Figure 15 illustrates connection to an R7352 DialaTrol Temperature Controller. Other suitable controllers may be used. As viewed from the output end of the motor, the connection shown provides counterclockwise motor shaft rotation on a rise in temperature at the sensor, and will drive the lifter to it downward. To reverse the direction of rotation on this cycle, reverse both the 1 and 3 as well as 4 and 6 connections at the motor.

Auxiliary Functions

Wiring of auxiliary switches and slidewires follows a definite pattern. Terminals 1, 2, and 3 are for controller and power source connections. Each following numerical sequence of three terminals (i.e. terminals 4, 5, and 6; terminal 7, 8, and 9; etc.) is attached to a separate auxiliary function with exception to the M740 and M940 motors Terminals 4, 5, and 6 of these motors are internally connected to the balancing slidewire. The first terminal of each group of three terminals is always connected to the normally closed contact, the second terminal to the common switch terminal, and the third terminal to the normally open contact of each auxiliary switch.

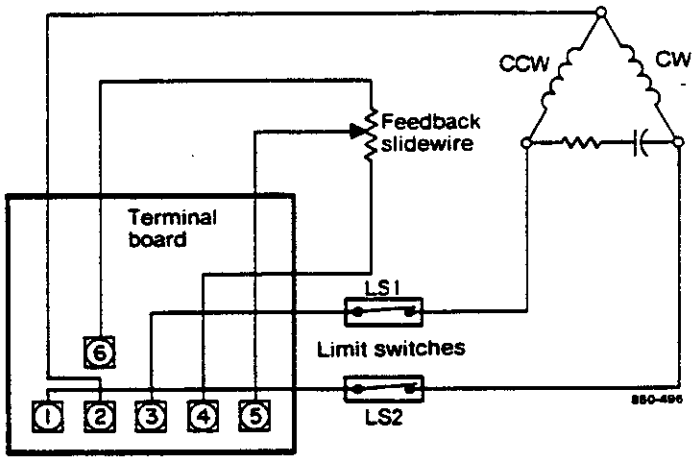


Figure 14—M940 internal wiring

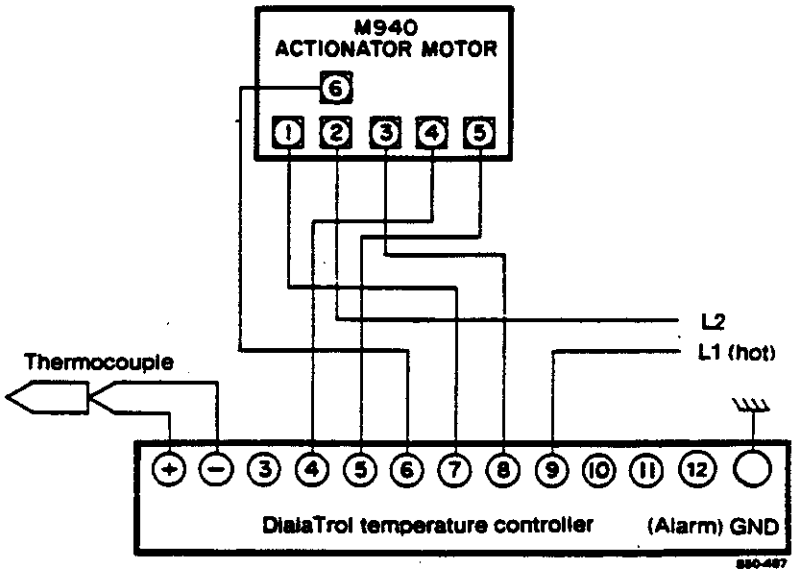


Figure 15—M940 connections to DialaTrol controller

Actionator Motors
Models M640, M740, M940

Technical Data

Theory of Operation

In the following description, the direction of the motor shaft rotation referred to is that of an observer viewing the end of the motor from which the motor shaft extends. The auxiliary switches and slidewires are mounted in the opposite end of the motor. An internal brake stops the motor and holds the load in a stationary position anytime the motor is de-energized.

M640A, B Motors

Refer to Figures 1 and 2. With the controller contacts made "R" to "W" and the motor shaft at its counterclockwise (ccw) limit, the motor is de-energized, and limit switch LS1 is open. When the controller contacts make "R" to "B", the motor shaft starts to rotate clockwise (cw) making limit switch LS1 and driving the lifter assembly up for the model M640B. If the controller is furnished with maintained (2 position) contacts, the motor shaft will rotate to the full cw limit, break limit switch LS2, and the motor will be de-energized. If the controller is furnished with floating contacts with a neutral position, the motor may be de-energized at any time, stopping the motor shaft at intermediate positions between the limits.

When the controller contacts again make "R" to "W", the direction of motor shaft travel and lifter assembly is reversed.

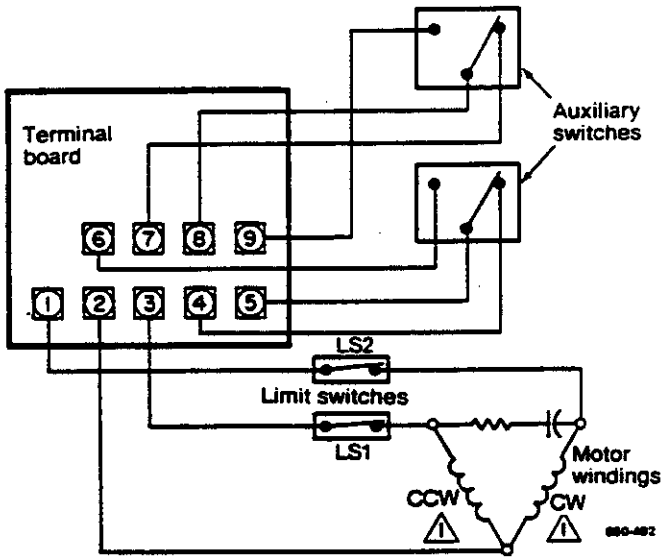


Figure 1—M640A, B Internal Wiring (Two Auxiliary Switch Model Shown)

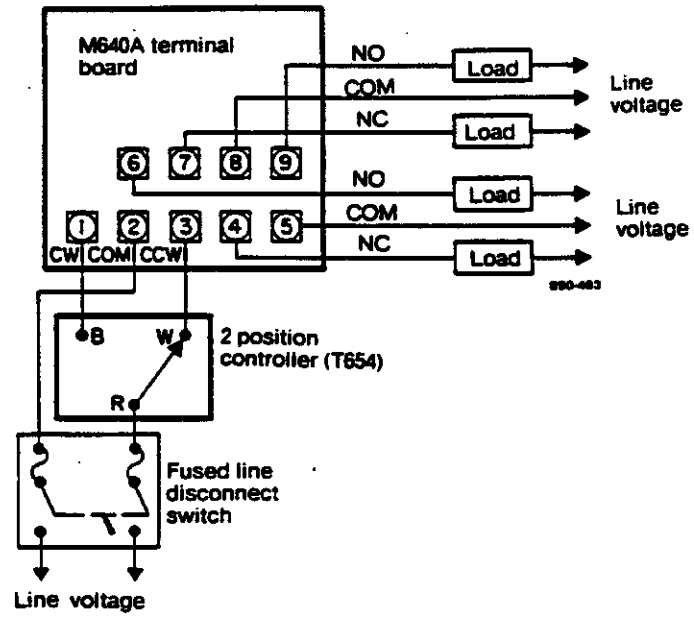


Figure 2—M640 Typical Hookup (Two Auxiliary Switch Model Shown)

M640D Motor

The M640D motor is one-directional (it does not reverse rotation with a reversal in control action). Figure 3 illustrates the internal wiring and external connections. The smaller insert of Figure 3 describes limit switch action for one complete cycle. When the two-position controller detects a sufficient fall in temperature in a heating application, the switch portion between the "R" and "B" terminals will close. The motor then rotates for 180° or until the opening switch breaks (stops are adjustable, factory set at 180°), and stops in full open position. A subsequent rise in temperature causes the controller to close the switch between the "R" and "W" terminals when the motor will start to rotate (in the same direction) for 180°, or until the closing switch breaks. The motor thus stops in the closed position and completes one cycle.

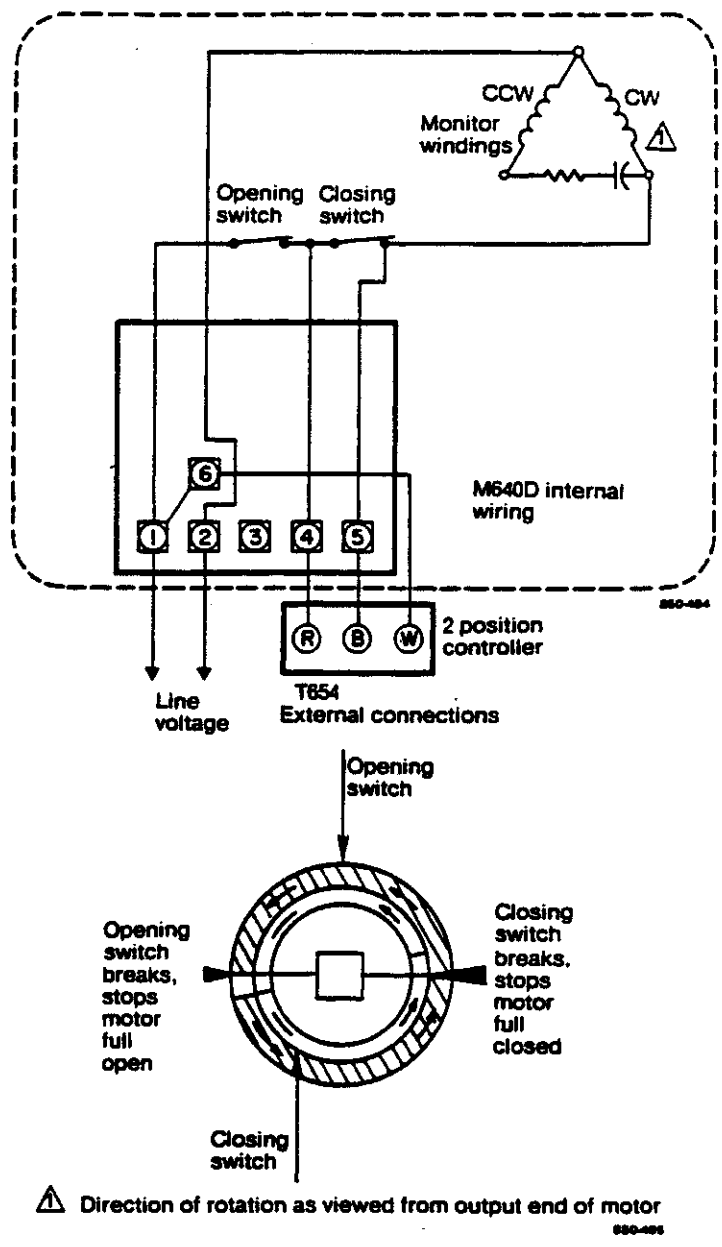


Figure 3—M640D Wiring Connections and Operation

M740A, B Motors

Refer to Figures 4 and 5. When the temperature at the sensor is above the proportional range of the proportioning controller, the controller will transmit a signal of less than 4 ma. The motor positioner circuit will drive the motor to its counterclockwise limit. Limit switch LS1 opens and for model M740B, the lifter shaft is down. The wiper on the motor balancing slidewire is at the extreme ccw position. For a heating application the motor is closed. When the temperature of the sensor falls into the range of the controller, the controller will transmit a signal within its operating span (4-20 mA). The bridge in the motor positioner becomes unbalanced causing the clockwise (cw) motor coils to energize through limit switch LS2. The motor shaft starts to rotate cw (motor opening, and for the model M740B the lifter shaft moving up), limit switch LS1 closes, and the wiper on the motor balancing slidewire starts to move. The motor shaft and balancing slidewire wiper continue to rotate until the bridge in the Motor Positioner is rebalanced. When the bridge becomes balanced, a neutral position is assumed through the effect of the amplifier. The motor is de-energized and stops with the motor shaft and slidewire wiper in a position proportional to the existing load demand at the temperature sensor.

Should the temperature at the sensor fall below the proportioning range of controller, the controller will transmit a signal greater than its operating span (20 mA). This unbalances the bridge in the motor positioner causing it to energize the clockwise motor winding. Limit switch LS2 opens. The motor is then open, and for model M740B the lifter shaft is fully up.

Direction of motor travel is reversed when motor winding connections to terminals 1 and 3 are interchanged and feedback potentiometer connections to terminals 4 and 6 are interchanged.

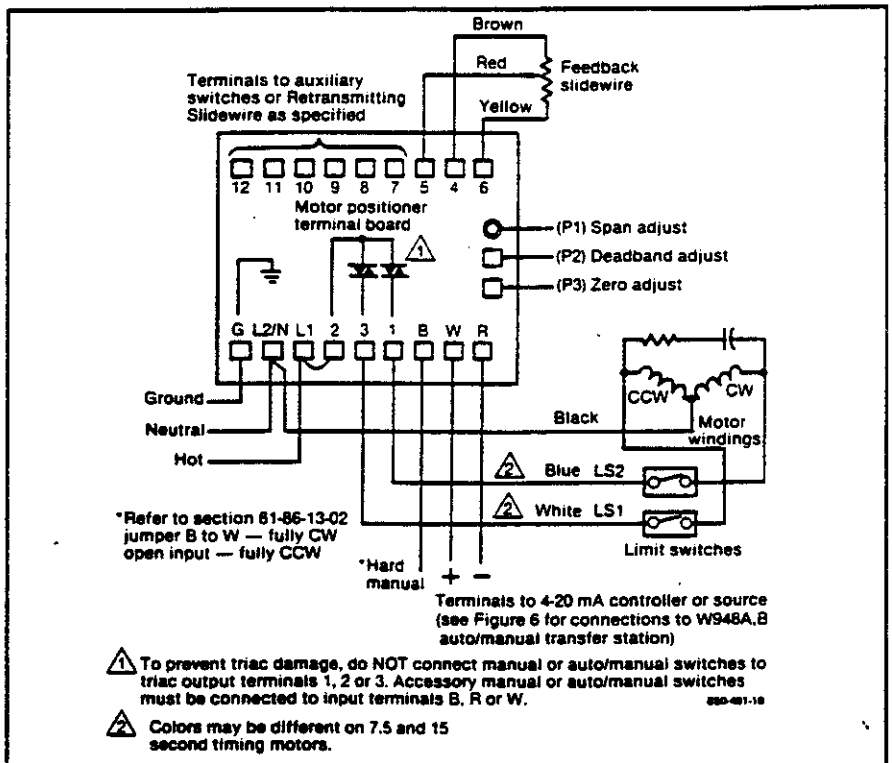


Figure 4—M740 Internal Wiring

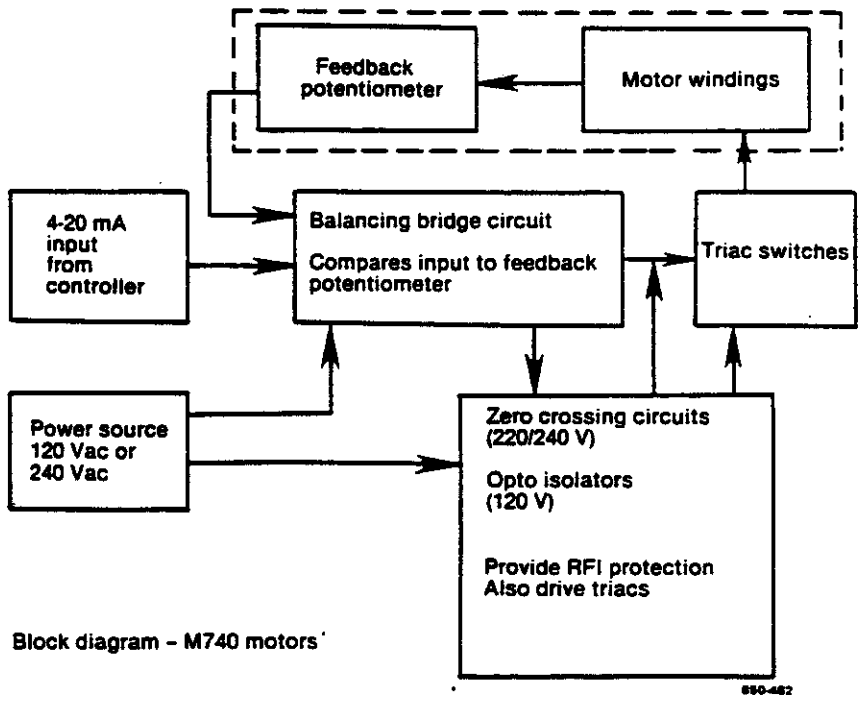


Figure 5—M740 Block Diagram of Motor Positioner Operation

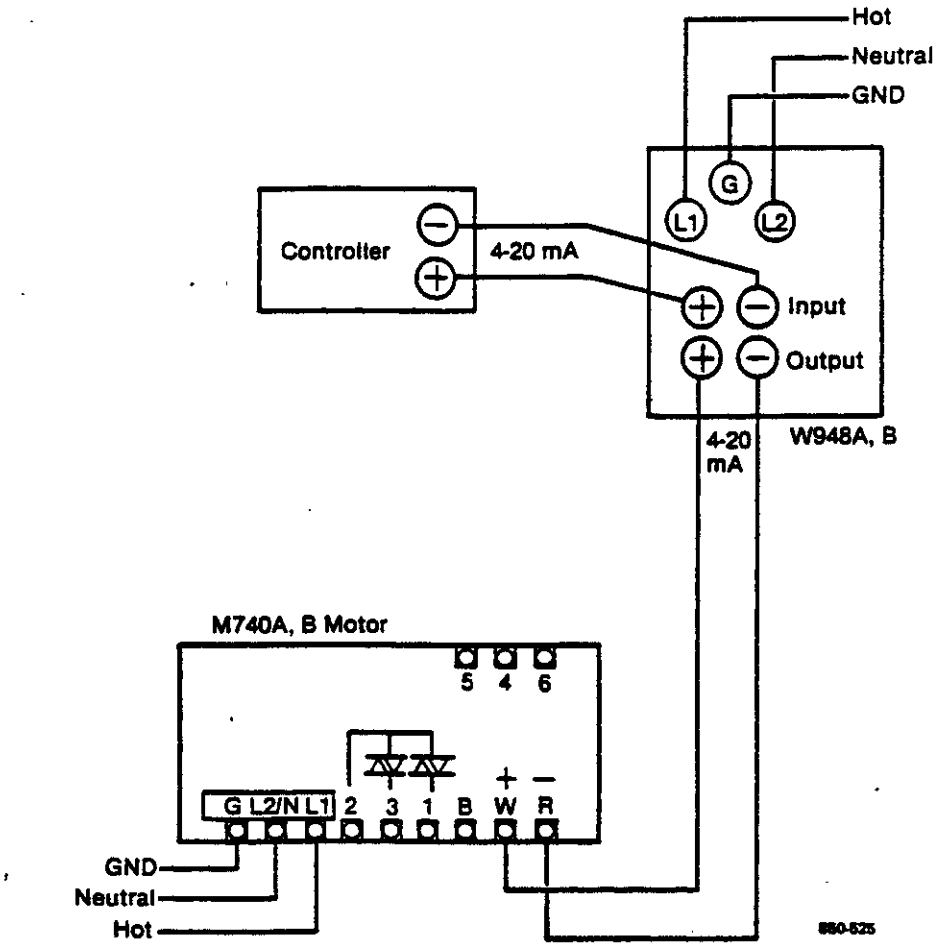


Figure 6 — M740A, B Connections to W948A, B Auto/Manual Transfer Station

M940A, B Motors

Refer to Figures 7 and 8. With the temperature at the sensor above the proportional range of the controller, the motor shaft will be at the counterclockwise (ccw) limit, with limit switch LS1 open and for model M940B, the lifter shaft is down. The wiper on the motor balancing slidewire is at the extreme ccw position. For a heating application the motor is closed. When the temperature of the sensor falls into the range of the controller, the bridge becomes unbalanced through an amplifier in the controller and the clockwise (cw) motor coils are energized through limit switch LS2. The motor shaft starts to rotate cw (motor opening, and for the model M940B the lifter shaft moves up), limit switch LS1 closes, and the wiper on the motor balancing slidewire wiper starts to move. The motor shaft and balancing slidewire wiper continue to rotate until the bridge in the controller is rebalanced. When the bridge becomes balanced, a neutral position is assumed through the effect of the amplifier. The motor is de-energized and stops with the motor shaft and slidewire wiper in a position proportional to the existing load demand at the temperature sensor.

Should the temperature at the sensor fall below the proportional range of the controller, the amplifier in the controller energizes the cw motor coils, the motor shaft rotates to the full cw limit, and limit switch LS2 opens. The motor is then open, and for model M940B the lifter shaft is fully up.

On a subsequent rise in temperature at the sensor, the foregoing sequence is reversed.

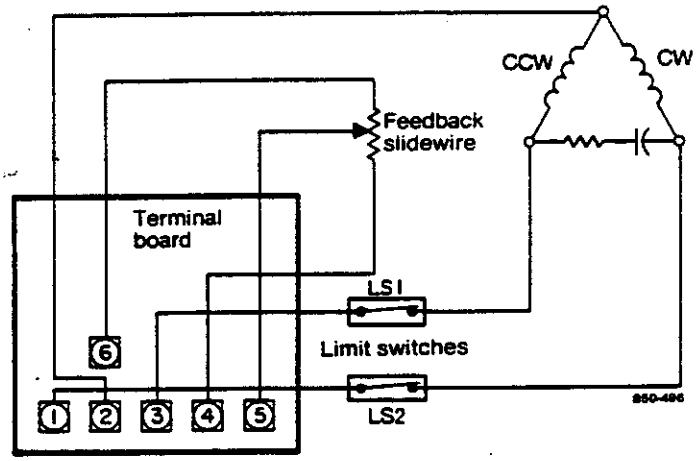


Figure 7—M940 Internal Wiring

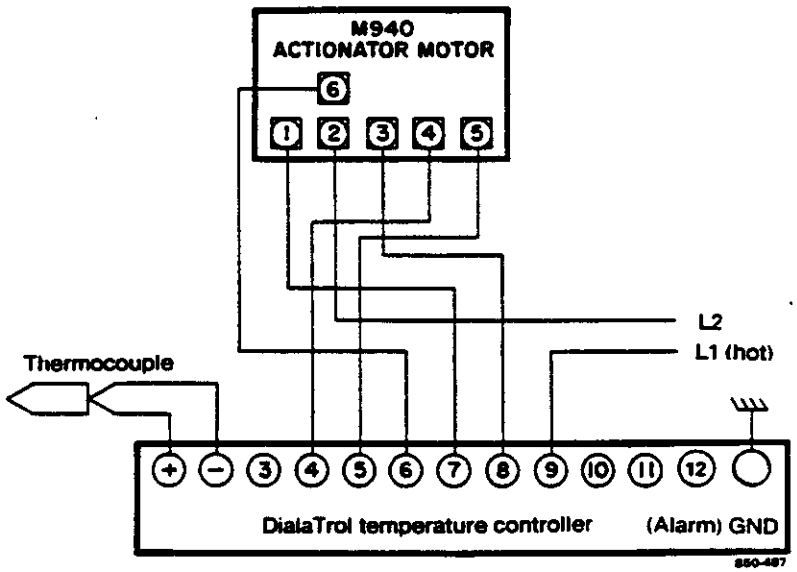


Figure 8—M940B Connection to the R7352 DialaTrol Temperature Controller

Actionator Motors
Models M640, M740, M940

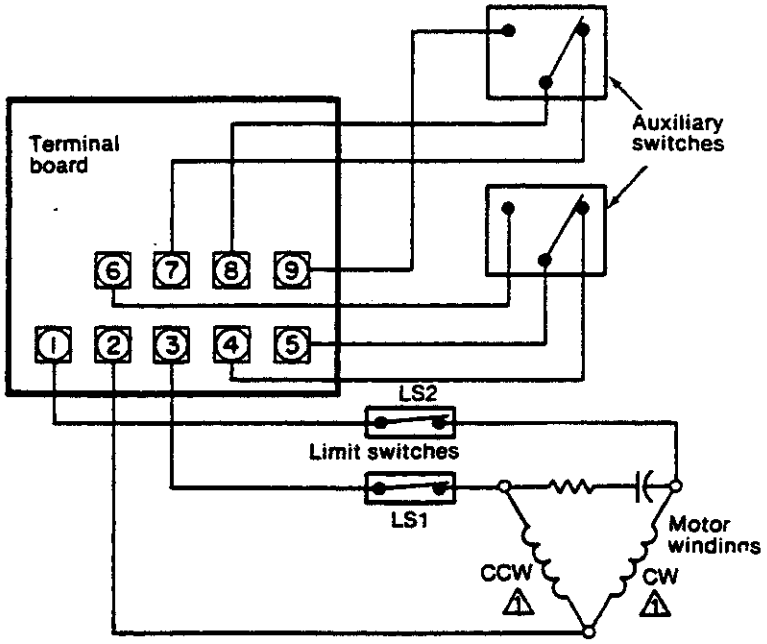
Service Data

Model 640 Motor Adjustments
Limit Switch Adjustment:

1. Disconnect leads from terminals 1, 2, and 3 of the motor. Refer to Figure 1.
2. Remove the two screws from the end cover and remove the cover.
3. The stroke of the reversible model M640A motor is changed by inserting a screwdriver into one of the slots on the cam and applying slight bias force. Figure 4 illustrates a screwdriver in one of these slots. This view shows changing a wiper cam, but the same principle applies for the limit switch cams which are the two innermost cams on the motor shaft.
4. To change the counterclockwise limit:
   a. Apply voltage to terminals 2 and 3.
   b. Drive the motor full counterclockwise and note which cam breaks the counterclockwise switch.
   c. Remove power from terminal 3 and rotate the cam assembly to the desired operating point with the screwdriver.
5. To change the clockwise limit:
   a. Apply voltage to terminals 1 and 2.
   b. Drive the motor full clockwise and note which cam breaks the clockwise switch.
   c. Remove power from terminal 2 and rotate the cam assembly to the desired operating point with the screwdriver.
6. Reconnect the leadwires to terminals 1, 2, and 3 on the motor. Apply power and check motor operation.

The M640D unidirectional motor is set for 180° stroke. If an application requires a stroke other than 180°, follow procedure similar to that for the reversible model M640, except apply voltage to terminal 3 just until the applicable switch breaks the circuit.

Auxiliary Switch Adjustment
Refer to page 3 of this document.



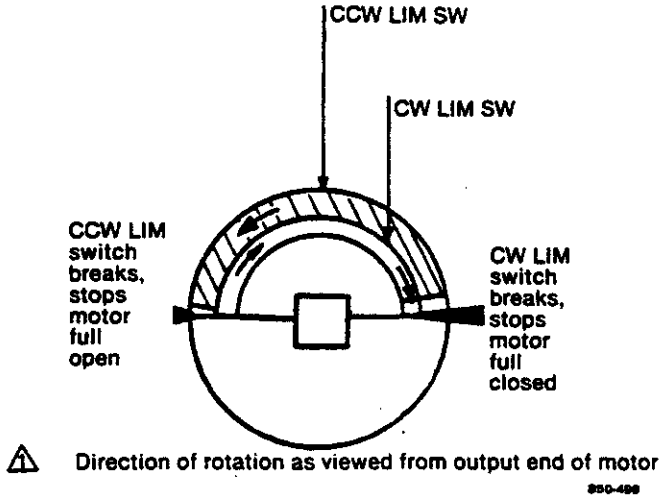


Figure 1—M640A internal wiring diagram, (two auxiliary switch model shown)

Model 740 Motor Adjustments

Limit Switch Adjustment

The M740 Actionator motors are factory set so the motor shaft will rotate through 150° between limits. Because of the motor balancing slidewire, the motor stroke may be shortened from 150°, but not increased. Shortening the motor stroke will reduce the sector covered by the wiper on the balancing slidewire as well as the retransmitting slidewire (if so equipped). This reduced sector will result in decreased proportional band. Do not allow the wiper to travel beyond the rotational limits of the slidewire on either side, even when the stroke is reduced. Rotation beyond these limits will damage the wiper.

To shorten the rotation on the M740 Actionator motor:

1. Disconnect the leads from terminals L1, L2, and G of the motor.
2. Remove the two screws securing the end cover and remove the cover.
3. Shorten rotation in the clockwise direction as follows:
   a. Make connections to L1, L2, and Ground and turn on power.
   b. Apply short between terminals B and W to drive motor shaft to the clockwise limit.
   c. Remove power and note which cam breaks the clockwise limit switch.
   d. Remove short between B and W and apply power to the unit to drive the cam away from the switch by at least the number of degrees the stroke is to be shortened.
   e. Move the Cam clockwise the desired number of degrees rotation.
   f. Re-connect the short between B and W. Re-apply power to check rotation in the clockwise direction.
4. Shorten rotation in the counterclockwise direction as follows:
   a. Make connections to L1, L2, and GND and turn on power.
   b. Allow motor shaft to drive to the counter clockwise limit.
   c. Remove power and note which cam breaks the counterclockwise limit switches.
   d. Connect short between terminals B and W and apply power to the unit to drive the cam away from the switch by at least the number of degrees the stroke is to be shortened.
   e. Move the cam counterclockwise the desired number of degrees.
   f. Remove the short between B and W and re-apply power to check the rotation in the counterclockwise direction.
5. Check the adjustments by alternately driving the motor shaft to both limits.

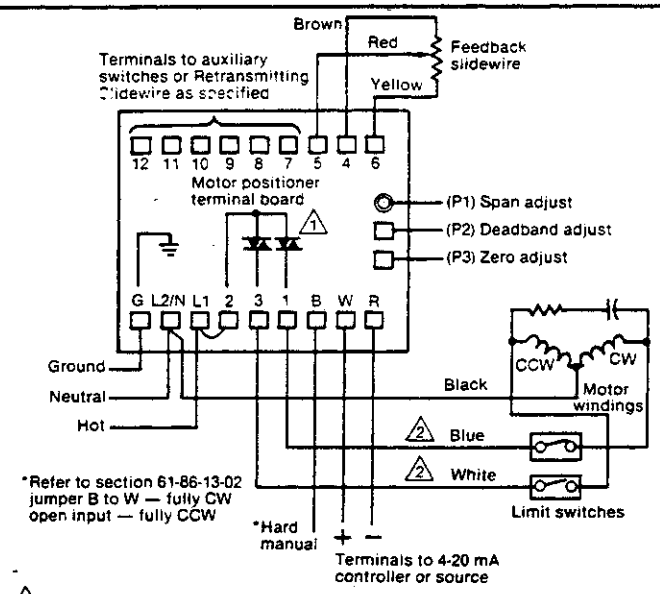


Figure 2—Calibration adjustments

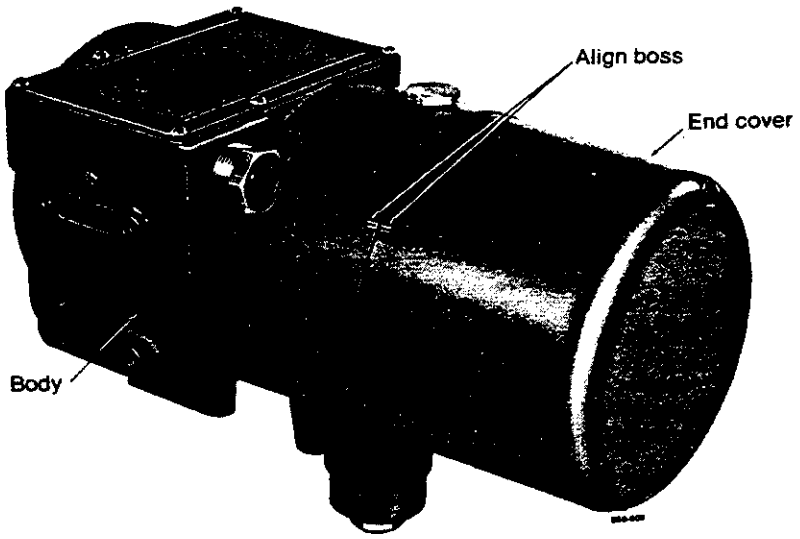


Figure 3—Boss location on the body and end cover (M740 or M940)

6. Reconnect the leadwires and replace the end cover. Align the boss on the end cover with the boss on the motor body. Figure 3 shows the relative position of each boss.

Calibration Check

NOTE: This check is only done if a span other than factory adjusted 4-20 mA span is required or, if it is desired to check the adjustment on the 4-20 mA span.

Span and Zero Check

Refer to Section 61-86-09-01 for Split Range Capability.

1. Adjust the zero adjust potentiometer P3 (the pot closest to the quick-connect terminals) fully clockwise (maximum zero), and the span adjust potentiometer P1 fully counterclockwise (minimum span).
2. Set the controller to the current value at which it is desired to drive the motor just away from the closed position. Motor should be closed.
3. Turn the zero adjust pot P3 slowly counterclockwise until the motor just drives away from the closed position. This is defined to be the "zero."
4. Set the controller to the current value

at which it is desired to drive the motor just away from its full open position. Motor should be open.

5. Turn the span adjust pot P1 slowly clockwise until the motor just drives away from the full open position. The difference between this current value and the zero of (3) is defined to be the "span."
6. Recheck the zero and readjust the zero adjust pot P3 as necessary. Turning P3 clockwise will increase the zero value.
7. Recheck the span and readjust the span adjust pot P1 as necessary. Turning P1 clockwise will increase the span.

Deadband Check — M740 Motors

The deadband adjustment is factory set to midrange or approximately 1-2% deadband. Deadband should never be set narrower than required for good control.. A narrow deadband may cause motor oscillation and result in excessive wear of the motor and associated equipment. Some processes may require deadband adjustment to achieve stable control. Unstable process conditions may be characterized by:

- frequent repositioning (hunting) of the motor
- oscillation of the process variable around the set point.

Check for unstable process conditions during initial start up of the process. If unstable operation occurs, increase the deadband adjustment (P2) clockwise until the cycling rate diminishes.

Hard Manual Check — M740 Motors

Hard Manual allows the customer to override the controller action to fully open or fully close the valve. Open the current input to drive the motor to the fully closed counterclockwise position. Short terminals B to W to drive the motor to the fully open clockwise position.

CAUTION:

To prevent Triac damage do not connect manual or auto/manual switch to triac output terminals 1, 2, 3. Accessory manual or auto/manual switches must be connected to input terminals B, R, or W per Technical Data 61-86-05-01, Figure 6.

Auxiliary Switch Adjustment — M740 Motors

NOTE: Before making any changes in the auxiliary switches, ensure the limit switches operate at the correct points. To adjust an auxiliary switch, follow a procedure similar to that for adjusting limit switches.

1. Connect voltage to terminals L1 and L2.
2. Apply sufficient current from an adjustable current source to W and R terminals, to drive the motor to the desired switch point.
   Example: To provide a switch point at 50% of full stroke, apply 50% of the input span (4-20 mA) (+) start point (4 mA) = 12 mA.
3. Move the auxiliary switch cam until the switch just makes/breaks at this point.
4. Remove the current source from terminals W and R and reconnect to the controller.

Reversing Direction of the M740 A, B Motors

Reverse the direction as follows:

(1) Interchange motor winding connections to terminals 1 and 3.
(2) Interchange feedback potentiometer connections to terminals 4 and 6.

Troubleshooting Procedure — Printed Wiring Board Assembly

Follow this procedure to identify and correct a system related problem.

Motor Check-Out Procedure

(1) Disconnect leads to controller terminals and operating voltage terminals.
(2) Connect an ohmmeter across the feedback potentiometer terminals.
(3) Apply rated voltage across motor winding terminals. Observe gradual increase or decrease in feedback resistance.
(4) Apply rated voltage across the other pair of motor winding terminals. Observe gradual increase or decrease in feedback resistance.

If the motor checks out functioning properly, follow the procedure below:

Troubleshooting the Printed Wiring Board — Refer to Figure 4

(1) Connect operating voltage leads to the appropriate terminals and apply power.
(2) Set the motor at mid-range as follows:
   —Connect input source to terminals W and R.
   —Adjust input source to mid range.
   —Disconnect input leads.
(3) Refer to Figure 4. It is a logic diagram to help you isolate specific component failures on the printed wiring board. These component failures are listed below:
   —shorted triac switches Q3 and Q4
   —Q3 and Q4 break over at less than rated voltage
   —Q3 and Q4 do not fire
   —MOV (CR12) shorts

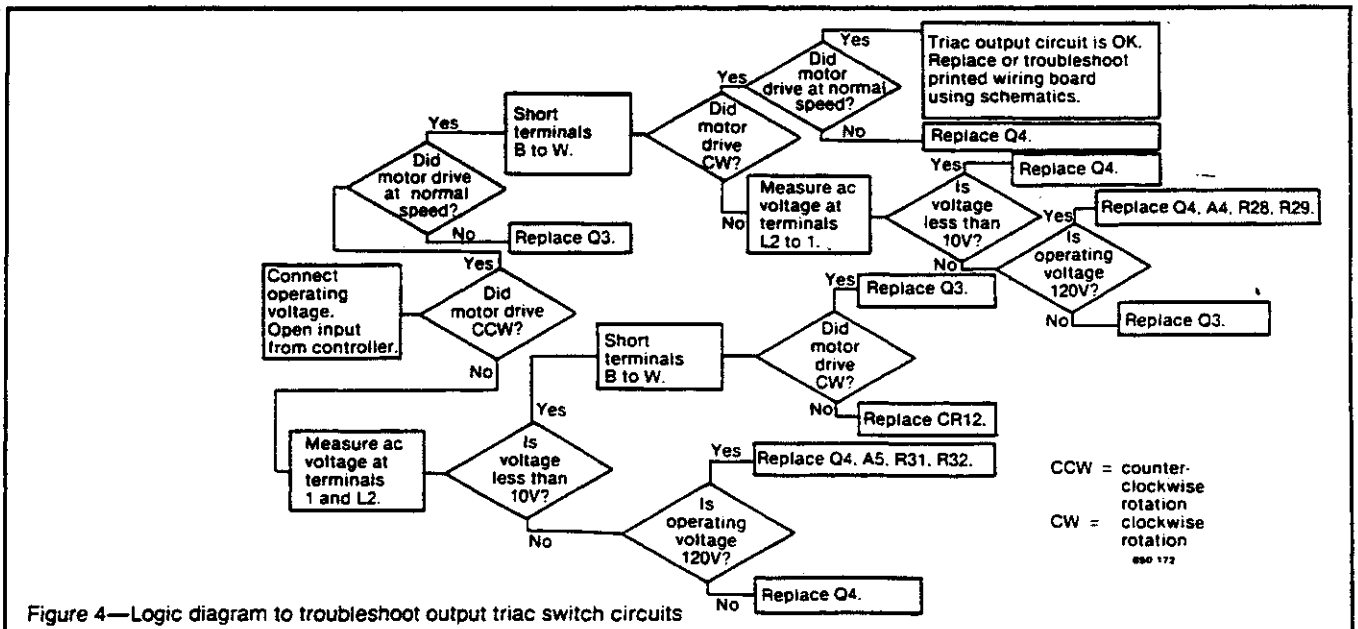


Figure 4—Logic diagram to troubleshoot output triac switch circuits

(4) If the logic diagram doesn't identify your component failure, the failure is not in the output circuit, and the printed wiring board should be replaced or you may use the schematic to troubleshoot the board. Refer to the back of the manual for your schematic for the appropriate operating voltage.

Model M940 Motor Adjustments

Limit Switch Adjustment

The M940 Actionator motors are factory set so the motor shaft will rotate through 150° between limits. Because of the motor balancing slidewire, the motor stroke may be shortened from 150°, but not increased. Shortening the motor stroke will reduce the sector covered by the wiper on the balancing slidewire as well as the retransmitting slidewire (if so equipped). This reduced sector will result in decreased proportional band. Do not allow the wiper to travel beyond the rotational limits of the slidewire on either side, even when the stroke is reduced. Rotation beyond these limits will damage the wiper.

To shorten the rotation on the M940 Actionator motor:

1. Disconnect the leads from terminals 1, 2, and 3 of the motor.
2. Remove the two screws securing the end cover and remove the cover.
3. Shorten rotation in the clockwise direction.
   a. Connect voltage to terminals 1 and 2.
   b. Drive the motor shaft to the clockwise limit, and note which cam breaks the clockwise limiting switch.
   c. Remove the power and move the cam clockwise the desired number of degrees.
   d. Apply power to terminals 3 and 2 to drive the motor back between its limits.
4. Shorten rotation in the counterclockwise direction:
   a. Connect voltage to terminals 2 and 3.
   b. Drive the motor shaft to the counterclockwise limit, and note which cam breaks the counterclockwise limiting switch.
   c. Remove the power from terminals 2 and 3 and move the cam counterclockwise the desired number of degrees.
   d. Apply power to terminals 1 and 2 to drive the motor back between its limits.
5. Check the adjustments by alternately driving the motor shaft to both limits.
6. Reconnect the leadwires and replace the end cover. Align the boss on the end cover with the boss on the motor body tighten screws to 20 inch-lbs. torque. Figure 3 shows the relative position of each boss.

Auxiliary Switch Adjustment Models M640 and M940 Motors

NOTE: Before making any changes in the auxiliary switches, ensure the limit switches operate at the correct points.

To adjust an auxiliary switch, follow a procedure similar to that for adjusting limit switches.

1. Connect voltage to terminal 2 and either terminal 1 or 3.
2. Drive the motor shaft to the position where auxiliary switching is required and note which cam needs adjustment to operate the appropriate switch.
3. Remove power from the terminals and move the cam the desired number of degrees.

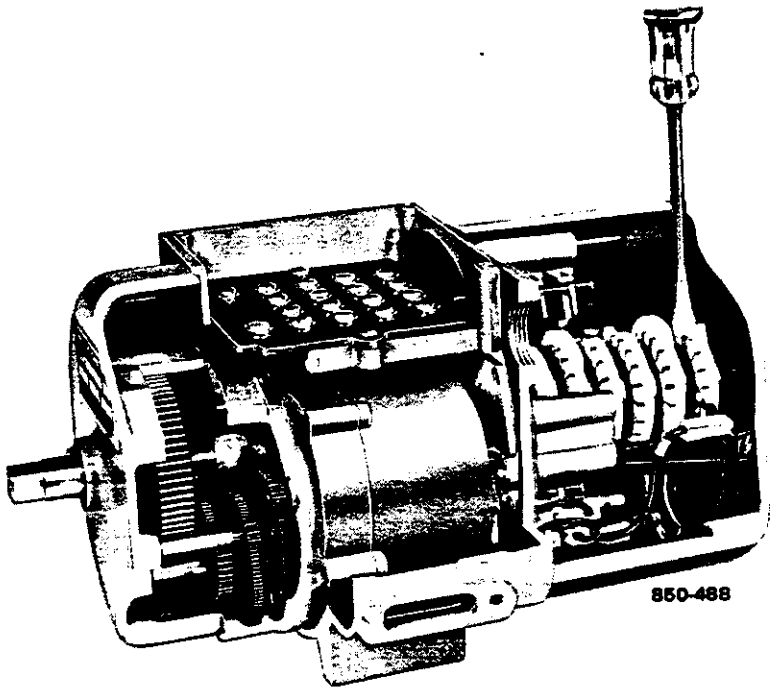


Figure 5—M640 cutaway view of internal parts. (Screwdriver blade shown in cam slot.)

Actionator Motors
Models M640, M740, M940

Parts List

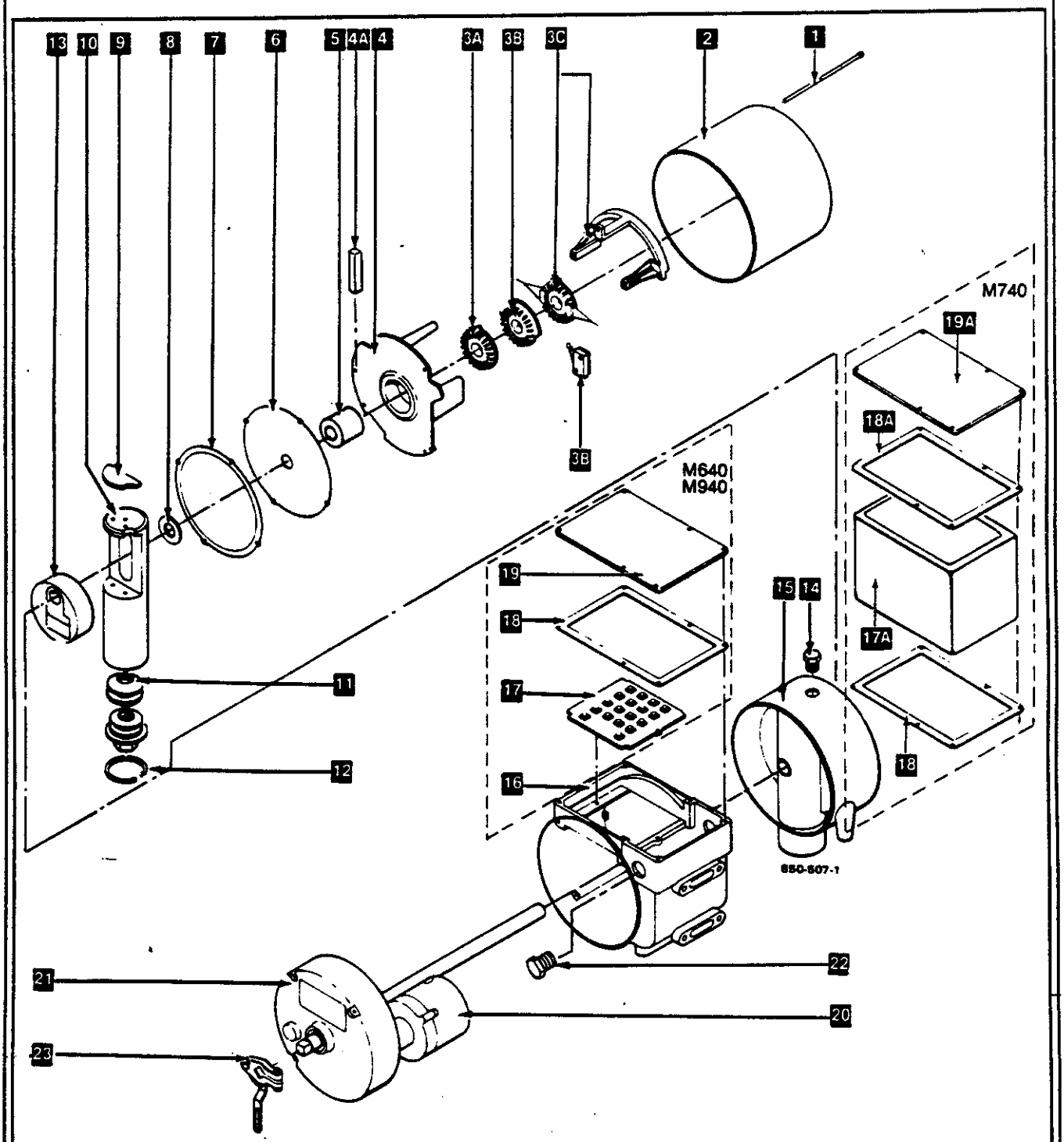


Figure 1—Exploded view of main parts

Main Parts (Refer to Figure 1)

Key	Description	Honeywell Part Numbers	M740 only
1	screw (2) 10—32 UNF—2A, 4-1/2 inches long	133049	
2	end cover	132968	
3	switches, slidewires, and cams. See 3A, 3B, 3C		
3A	limit switch cam (2)	132986A	
3B	one switch and cam assembly	7640MA	
	two switches and cam assemblies with spacer	7640MB	
3C	135 ohm slidewire and wiper assembly	7640MC	
	500 ohm slidewire and wiper assembly	7640ME	
	1000 ohm slidewire and wiper assembly	7640MD	
	M940 wiper assembly for retransmitting slidewire models	132986D	
4	switch plate	132967	
4A	resistor	24001968-004/120V -005/240V -005/220V	
5	switch plate bearing	133052	
6	cam cover	111444	
7	cover gasket	111445	
8	washer, plain, 0.64 ID x 1.19 OD, 0.014 inches thick, phosphor bronze (4)	112300	
9	insert (2)	111460	
10	lifter shaft (only on Models M640B, M740B, M940B)	132999	
11	spring assembly (only on Models M640B, M740B, M940B)	For 15-second timing: 133048B For other timings: 133048A	
12	retainer ring (only on Models M640B, M740B, M940B)	111449	
13	cam assembly (only on Models M640B, M740B, M940B)	133684B	
14	plug (only on Models M640B, M740B, M940B)	111451	
15	lifter housing (only on Models M640B, M740B, M940B)	132973	
16	motor body	132971	
17	terminal board/terminals	See Table 1	
17A	controller	N/A	see Table 1A
17B	screw 4 required	198372CL	
18	terminal cover gasket	132996	
18A	terminal cover gasket	N/A	24001938-001
19	terminal board cover	132998	N/A
19A	terminal board cover	N/A	24001939-001
20	stator-housing assembly	For 120 Volt: 139593B For 220/240 Volt: 139593C	
21	gear train – end bell assembly	See Figure 2	
22	conduit plug	132988	
23	crankarm assembly	110126A	

TABLE 1A — Controller Ass'y Numbers	4-20 mA Input	135Ω Input
Model	**Ass'y Number**	**Ass'y Number**
120V No. AUX. Terminals	24400141-001	24400141-003
240V No. AUX. Terminals	24400141-002	24400141-004
120V 3 AUX. Terminals	24400141-005	24400141-009
240V 3 AUX. Terminals	24400141-006	24400141-010
120V 6 AUX. Terminals	24400141007	24400141-011
240V 6 AUX. Terminals	24400141-008	24400141-012

N/A — Part is not applicable

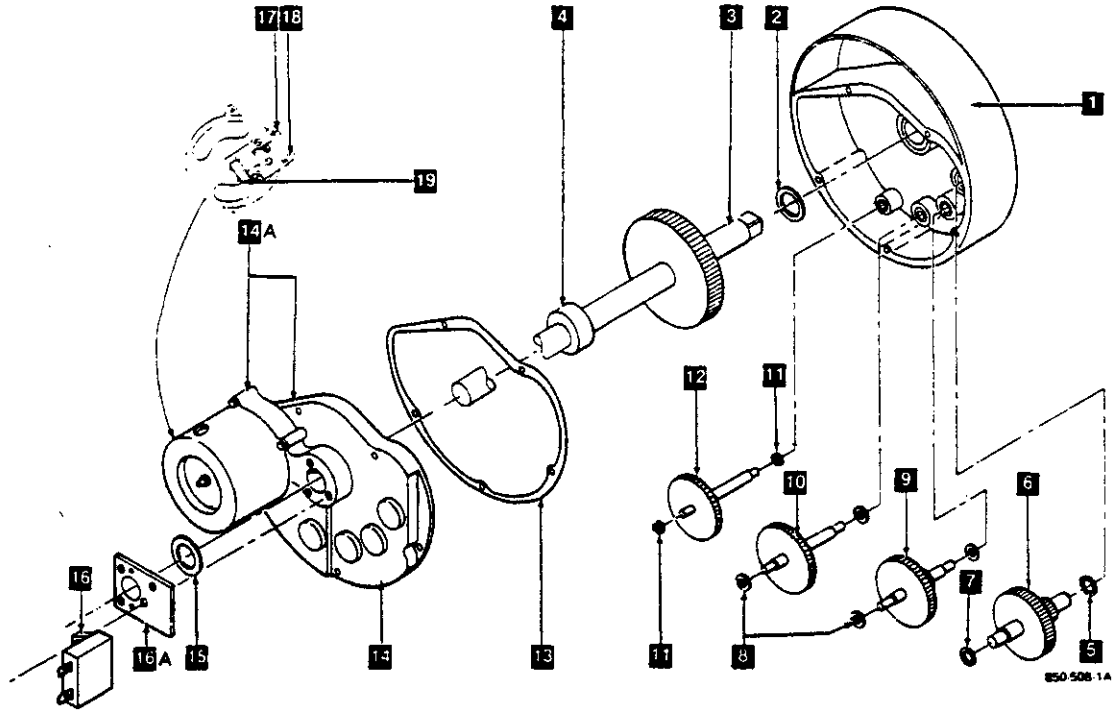


Figure 2 — Exploded view of Gear Tran Housing assembly

TABLE 1 - Terminal Board Numbers

Model	Terminal Board Number
M640A – Standard	132989AAA
M640A – One Auxiliary Switch	132990AAA
M640A – Two Auxiliary Switches	132991AAA
M640A – With Complete Wire Harness	132993AAA
M640B – Standard/with complete wiring harness	132989AAA/132993AAA
M640D — Standard/with 2 Auxiliary Switches	132990AAD/135752AAA
M940A – Standard	132990AAB
M940A – One Auxiliary Switch/with one Auxiliary Switch & Retransmitting Slidewire	132991AAB/132992AAA
M940A – Two Auxiliary Switches/with two Auxiliary Switchh & Retransmitting Slidewire	132992AAA/196058AAA
M940A – With Retransmitting Slidewire	132991AAB
M940B – Standard	132990AAB
M940B – With Retransmitting Slidewire/with two Auxiliary Switch	132991AAB/122992AAA
M940B — With two Auxiliary Switch & Retransmitting S/W/complete harness	196058AAA/132993AAB

Gear Train and Housing Assembly (See Figure 2)

Key	Description	Honeywell Part Numbers M740 only
1	end bell assembly	132979E
2	washer, plain, 0.63 ID × 0.880D × 0.014 thick bronze	107817
3	shaft and gear assembly (model A)	133056A
	shaft and gear assembly (model B)	133057A
4	spacer	190763
5	washer, plain, 0.38 ID × 0.50 OD × 0.14 thick, bronze	See Table 2
6	gear assembly	See Table 2
7	washer, plain, 0.32 ID × 0.50 OD × 0.14 thick, bronze	See Table 2
8	washer, plain, 0.25 ID × 0.44 OD × 0.14 thick, bronze	107814
9	gear assembly	See Table 2
10	gear assembly	See Table 2
11	washer, plain, 0.19 ID × 0.31 OD × 0.14 thick, bronze	107813
12	gear assembly	107835A
13	gasket	107845

Gear Train and Housing Assembly (See Figure 2)

Key	Description	Honeywell Part Numbers	M740 only
12	gear assembly	107835A	
13	gasket	107845	
14	gear housing assembly	133018A	
14A	motor and gear housing assembly (Includes 13 & 15)		
	for 120 volt models	133018E	
	for 220/240 volt models	133018F	—
15	"O" ring, 0.674 ID × 0.103 wall diameter, rubber	104230	
16	capacitor		
	for 120 volt models	4074ELS	
	for 220 volt models	4074ELU	
	for 240 volt models	4074ELW	
16A	mounting bracket	24002059-001	
17	bracket and spring	139873A	

TABLE 2 - Motor Stroke Timing

Key	Description	7.5 Seconds	15 Seconds	30 Seconds	60 Seconds	120 Seconds
5	Washer	—	—	107816	107816	107816
6	Gear Assembly	—	—	107828B	107828B	107828B
7	Washer	—	—	107815	107815	107815
9	Gear Assembly	107820A	107820C	107830A	107830B	107830C
10	Gear Assembly	107833D	107833E	107833D	107833E	107832B

Model M740 Motor Positioner Circuits

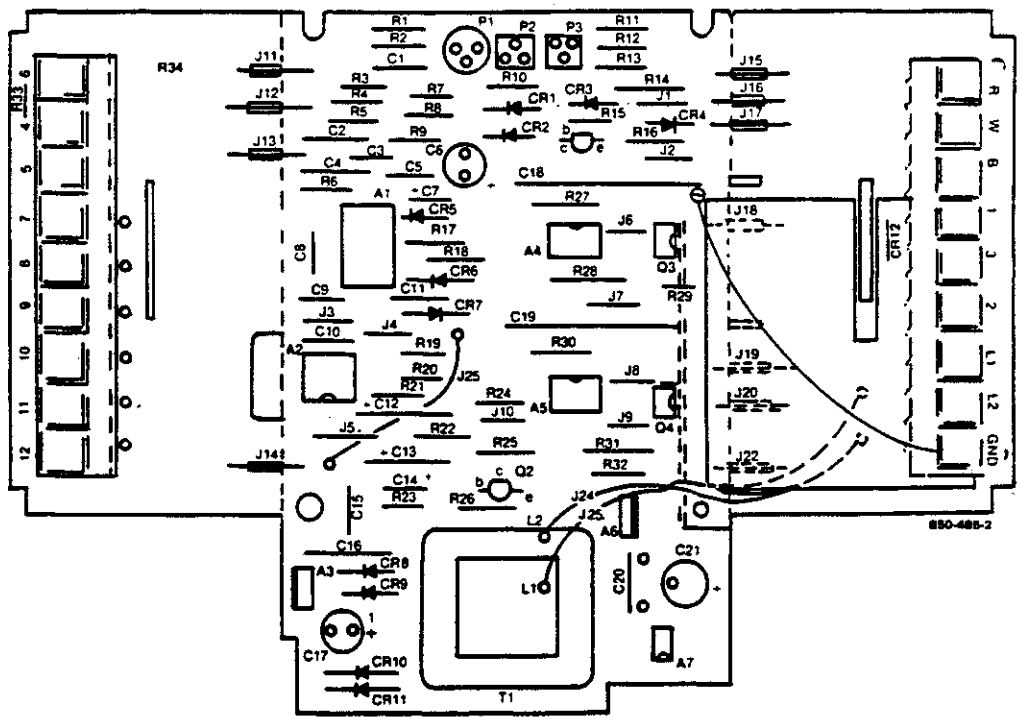


Figure 3—120 V and 220/240V – Printed Wiring Board Assembly

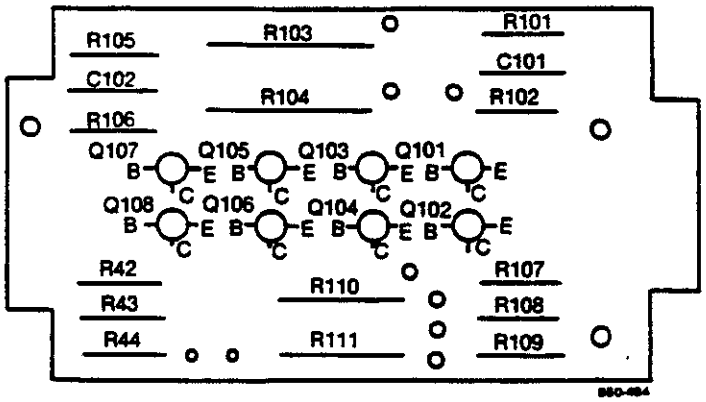


Figure 4—220/240 V – Printed Wiring Board Assembly (Triac Drive)

Refer to Figure 3

Model M740 Motors Only

Input	**4-20 mA**	**135Ω**		
Operating Voltage	**120/240 VAC**	**120/240 VAC**		
Components	**Value**			
Resistors	**(ohms)**			
R1	309	309	±1%	1/8W
R2	jumper	jumper	±1%	1/8W
R3	24.9K	24.9K	±1%	1/8W
R4	10.0K	10.0K	±1%	1/8W
R5	909K	909K	±1%	1/8W
R6	1.54K	1.54K	±1%	1/8W
R7	4.75K	4.75K	±1%	1/8W
R8	430	430	±5%	1/4W
R9	8.25K	8.25K	±1%	1/8W
R10	2K	2K	±5%	1/4W
R11	75	NA	±1%	1/8W
R12	1.5M	1.5M	±1%	1/8W
R13	1.54K	1.54K	±1%	1/8W
R14	jumper	jumper		
R15	N/A	5.6K	±5%	1/4W
R16	N/A	681	±1%	1/4W
R17	2.0K	2.0K	±5%	1/4W
R18	220	NA	± ±5%	1/4W
R19	jumper	4.7	± ±5%	1/4W
R20	N/A	510	±5%	1/4W
R21	910K	910K	±5%	1/4W
R22	510K	510K	±5%	1/4W
R23	10K	NA	±5%	1/4W
R24	820	820	±5%	1/4W
R25	820	820	±5%	1/4W
R26	51K	NA	±5%	1/4W
R27	62	62	±5%	1W
R28	100/NA	100/NA	±5%	1W
R29	470/1.0K	470/1.0K	±5%	1/4W
R30	62	62	±5%	1W
R31	100/NA	100/NA	±5%	1W
R32	470/1.0K	470/1.0K	±5%	1/4W
R33	383*	383*	±1%	1/8W
R34	27K	27K	±5%	1/4W

N/A — Not available for this board assembly

*Shunt for 1000ΩSlidewire

NOTE: All electronic components are commercially available with the exception of custom parts for which part numbers are listed.

Figure 3 Continued — Model M740 Motors Only — Printed Wiring Board Assembly — Operating Voltage = 120 Vac

Input Operating Voltage	4-20 mA 120/240 VAC	135Ω 120/240 VAC	
Capacitors	**(uf)**		**Honeywell Part No.**
C1	.022	.022	24001815-001
C2	.01	.01	24001946-002
C3	.001	.001	24001946-001
C4	.01	.01	24001946-002
C5	.001	.001	24001946-001
C6	47 (16V)	47 (16V)	196845
C7	1 (35V)	1 (35V)	137585
C8	.001	.001	24001946-001
C9	.01	.01	24001946-002
C10	.1	.1	198486
C11	NA	.001	24001946-001
C12	20 (20V)	20 (20V)	137873
C13	20 (20V)	20 (20V)	137873
C14	1 (35V)	NA	137585
C15	.01 (1000V)	.01 (1000V)	121955
C16	.1	.1	191594
C17	220 (50V)	220 (50V)	24001926-001
C18	.022 (1000V)	.022 (1000V)	24001915-001
C19	.022 (1000V)	.022 (1000V)	24001915-001
C20	NA/.1	NA/.1	191594 (240V only)
C21	NA/470 (50V)	NA/470 (50V)	24001926-002 (240V only)
Potentiometers	**(ohms)**		**Honeywell Part No.**
P1 (span)	10K	10K	24001667-002
P2 (deadband)	50K	50K	24001630-003
P3 (zero)	2K	2K	24001630-001
Integrated Circuits (chips)			
A1	LM224	LM224	24001920-451
A2	Custom	Custom	220174
A3	MC78M 18 BT	MC78M 18 BT	24001923-451
A4	OPI 3042/4N36	OPI 3042/4N36	24001917-451/24001925-451
A5	OPI 3042/4N36	OPI 3042/4N36	24001917-451/24001925-451
A6	NA/MC78M08	NA/MC78M08	24001924-451 (240V only)
A7	NA/VM68	NA/VM68	190305 (240V only)

N/A — Not available for this board assembly

NOTE: All electronic components are commercially available with the exception of custom parts for which part numbers are listed.

Figure 3 Continued — Model M740 Motors Only — Printed Wiring Board Assembly — Operating Voltage = 120 Vac

Input Operating Voltage	4-20 mA 120/240 VAC	135Ω 120/240 VAC	
Transistors			**Honeywell Part No.**
Q1	NA	2N3644	24001912-001
Q2	2N 3417	NA	130805
Q3 (Triac Switch)	SC 147M/TR0147N	SC147M/TR0147N	24001935-001/24001936-001
Q4 (Triac Switch)	SC 147M/TR0147N	SC147M/TR0147N	24001935-001/24001936-001
Diodes			
CR1	IN 4004	IN 4004	192265
CR2	IN 4004	IN 4004	192265
CR3	NA	IN 914	132576
CR4	NA	IN 4565A	24001913-001
CR5	IN 914	IN 914	132576
CR6	IN 4004	IN 4004	192265
CR7	IN 4004	IN 4004	192265
CR8	IN 4004	IN 4004	192265
CR9	IN 4004	IN 4004	192265
CR10	IN 4004	IN 4004	192265
CR11	IN 4004	IN 4004	192265
CR12	V275LA/V510LA	V275LA/V510LA	24001966-001/24001966-002
Transformer			
T1	120V/220-240V	120V/220-240V	24001919-001/24001919-002

N/A — Not available for this board assembly

NOTE: All electronic components are commercially available with the exception of custom parts for which part numbers are listed.

Figure 4

Printed Wiring Board Assembly - Triac Drive

Operating Voltage = 220/240 VAC

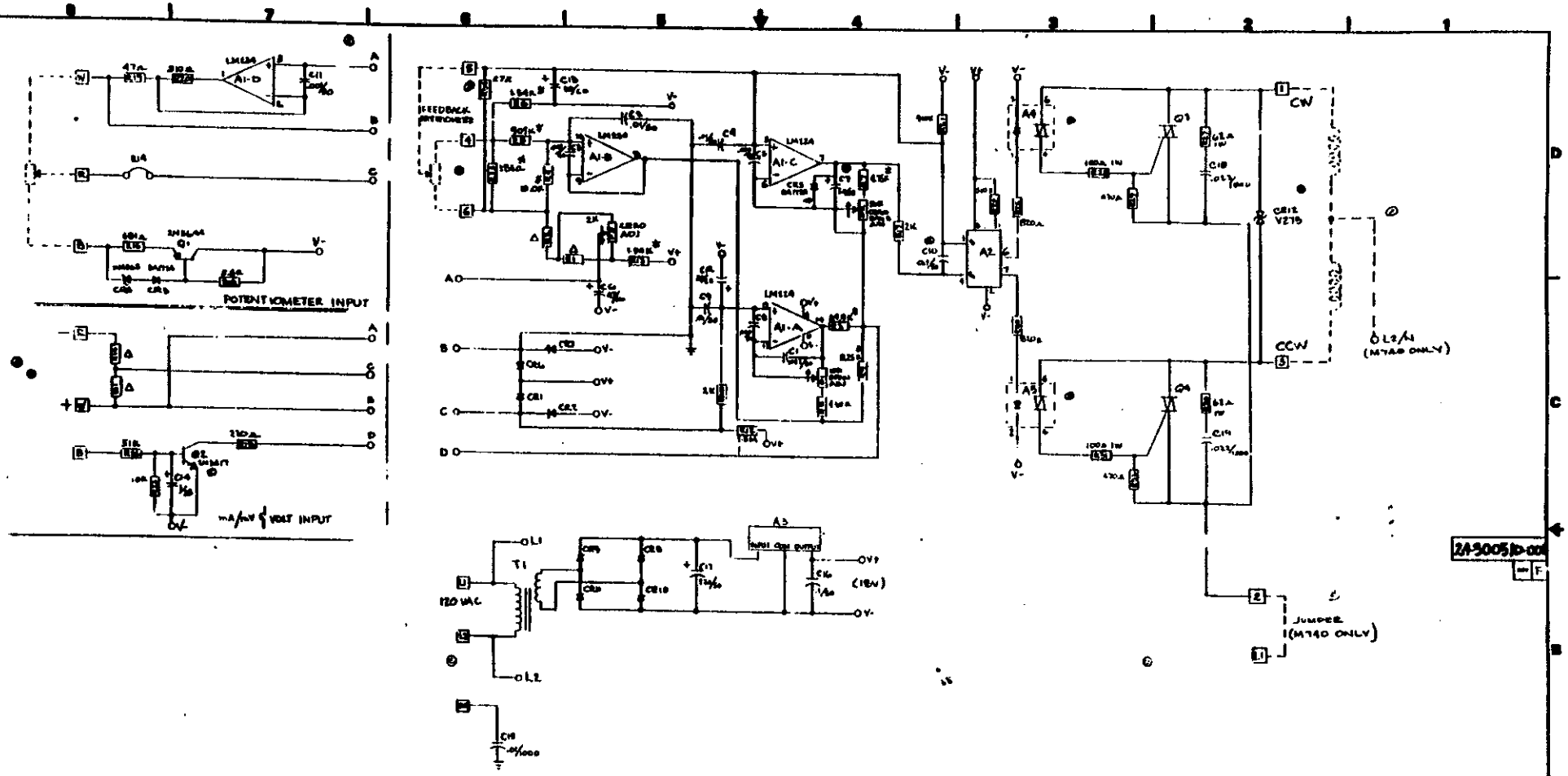
Components	Value		
Resistors	**(ohms)**		
R101	16K	±5%	1/4W
R102	27K	±5%	1/4W
R103	1.0M	±10%	2W
R104	1.0M	±10%	2W
R105	16K	±5%	1/4W
R106	27K	±5%	1/4W
R107	33K	±5%	1/4W
R108	3.6K	±5%	1/4W
R109	390K	±5%	1/4W
R110	62	±5%	1W
R111	62	±5%	1W
R112	33K	±5%	1/4W
R113	3.6K	±5%	1/4W
R114	390K	±5%	1/4W
Capacitors	**(uf)**		
C101	.01	24001946-002	
C102	.01	24001946-002	
Transistors			
Q101	2N3417	130805	
Q102	2N3644	24001912-001	
Q103	2N3417	130805	
Q104	2N3417	130805	
Q105	2N3417	130805	
Q106	2N3644	24001912-001	
Q107	2N3417	130805	
Q108	2N3417	130805	

NOTE: All electronic components are commerically available with the exception of custom parts for which part numbers are listed.

Ordering Information

Order from

1. Your local Honeywell Branch office, or
2. Honeywell Inc.
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422
   (In Canada, Honeywell Limited
   155 Gordon Baker Road
   Willowdale, Ontario M2H 3N7



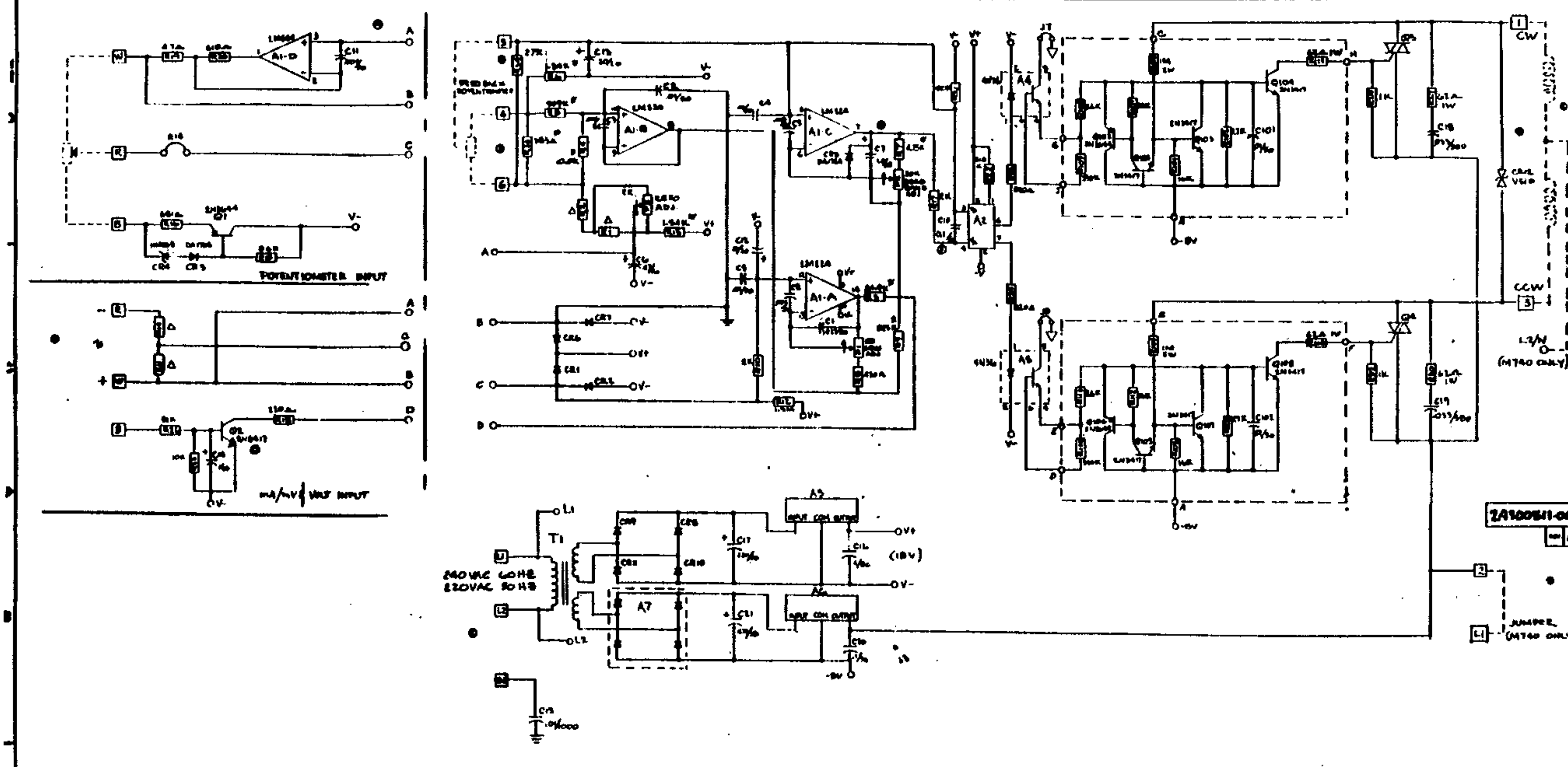
INPUT	R1	R2	R11	R14
4-20mA	249Ω 1%	JUMPER	75Ω 1%	JUMPER
10-50mA	249Ω 1%	JUMPER	80.6Ω 1%	JUMPER
1-5mA	249Ω 1%	JUMPER	301Ω 1%	JUMPER
1-5 VOLT	249Ω 1%	JUMPER	1.54kΩ 1%	887Ω
0-5mA	249Ω 1%	JUMPER	—	JUMPER
1-7mA	340Ω 1%	1184Ω 1%	301Ω 1%	JUMPER

Δ INDICATES PART THAT VARIES WITH INPUT, SEE TAB
△ INDICATES FEILD WIRING TERMINAL
◇ INDICATES 1% RESISTOR
ALL RESISTORS ¼W, ±5% UNLESS OTHERWISE INDICATED

Honeywell

120VAC

D 24500510-001



INPUT		R1	R2	R11	R16
4-20mA		309Ω*	JUMPER	75Ω*	JUMPER
10-50mV		309Ω*	JUMPER	30.1Ω*	JUMPER
1-5mA		309Ω*	JUMPER	301Ω*	JUMPER
1-5 VOLT		309Ω*	JUMPER	1.54K*	3.57K
135Ω		309Ω*	JUMPER	—	JUMPER
3-7mA		340Ω*	110Ω*	301Ω*	JUMPER

4. Δ INDICATES PART THAT VARIES WITH INPUT, SEE TAB
3. ☐ INDICATES FIELD WIRING TERMINAL.
2. K INDICATES ±1% RESISTOR
1. ALL RESISTORS 1/4W, ±5% UNLESS OTHERWISE INDICATED

Honeywell

220/240VAC

D 2A300511-001