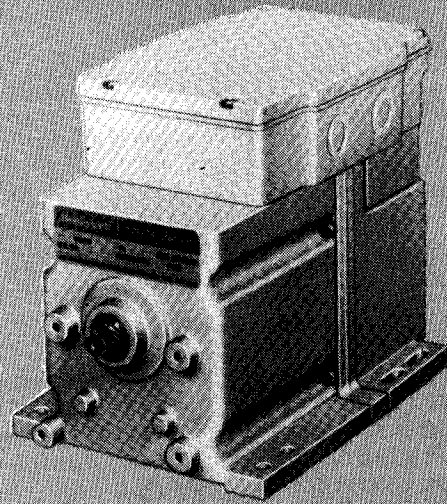


Honeywell

M9185 AND M9186 ARE PROPORTIONING SPRING-RETURN MOTORS USED TO OPERATE DAMPERS AND VALVES.

- Replaces M945A,D,F and M955 motors.
- M9182, M9185 motors rated for 60 lb.-in. torque. M9183, M9186 motors rated for 50 lb.-in. torque.
- Oil immersed motor and gear train for reliable performance and long life.
- Wiring box provides NEMA 3 weather protection.
- Actuator motor and circuitry operate from 24 volts AC. Models available with factory mounted transformer, or an internal transformer can be field added.
- Quick-connect terminals standard - screw terminal adapter available.
- Adapter bracket for matching shaft height of older motors is standard with replacement motors.
- Field adjustable stroke (90° to 160°) models available.
- Nominal timing of 30 seconds for 90° and 60 seconds for 160° stroke.
- Available accessories include valve and damper linkages, explosion proof housing, and auxiliary switches.
- Integral auxiliary switches are available factory mounted, or can be field added to TRADELINE models.
- Field addable interface modules can be mounted in wiring box to upgrade actuator to Series 70 (electronic) control.
- M9183, M9186 are normally open.
- TRADELINE spring return motors may operate valve linkage from the power end or auxiliary end shaft for normally closed and normally open valve applications.

MODUTROL IV MOTORS



**M9185; M9182;
M9186; M9183**

SPECIFICATIONS

TRADELINE MODELS

TRADELINE MODELS are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. TRADELINE model specifications are the same as those of standard models unless specified otherwise. TRADELINE model is M9185D1004.

STANDARD MODELS

<p>Control Type —————</p> <p>91 is Series 90</p> <p>Power Rating —————</p> <p>8 is high power: 60 lb.-in. torque for N.C. motors 50 lb.-in. torque for N.O. motors</p> <p>Output Drive —————</p> <p>5 is spring return normally closed, dual-ended shaft 6 is spring return normally open, dual-ended shaft 2 is spring return normally closed, single-ended shaft 3 is spring return normally open, single-ended shaft</p>	<p>M9185A,C,D,E M9186G</p>	<p>Suffix Letter</p> <p>A: Fixed stroke (90° or 160°) No auxiliary switches</p> <p>C: Fixed stroke (90° or 160°) 2 auxiliary switches</p> <p>D: Adjustable stroke (90° to 160°) No auxiliary switches</p> <p>E: Adjustable stroke (90° to 160°) 1 auxiliary switch</p> <p>G: Fixed stroke (90° or 160°) No auxiliary switches, electrically normally open (motor drives open, clockwise, when powered and control wiring not connected).</p>
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ELECTRICAL RATINGS:

	VOLTAGE (V @ 50/60 Hz)	CURRENT DRAW (A)	POWER CONSUMPTION (W)
Without Transformer	24	1.0	23
With Internal Transformer	120	0.28	28
	208	0.16	28
	240	0.14	28

CONTROLLER TYPE:

Series 90 Control Circuit-135 ohm series 90 proportioning controller. Series 90 high or low limit controller with manual minimum position potentiometer (with a combined total resistance of up to 500 ohms) may also be used in the control circuit,

MOTOR ROTATION:

M9185 motors spring counterclockwise (as viewed from power end) to a closed position on power interruption. M9186 Motors spring clockwise to an

open position on power interruption.

STROKE:

Fixed stroke models, 90° or 160°. Adjustable stroke models may be set between 90° and 160°.

TIMING: Nominal 30 seconds for 90° stroke and 60 seconds for 160° stroke.

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR AUTHORIZED DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER.

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL RESIDENTIAL AND BUILDING CONTROLS SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY).
2. RESIDENTIAL AND BUILDING CONTROLS CUSTOMER SERVICE
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MINNESOTA 55422-4386 (612) 542-7500
(IN CANADA—HONEYWELL LIMITED/HONEYWELL LIMITEE, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9) INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

TORQUE: 60 lb.-in. [6.8 N-m] for N.C. motors.
 50 lb.-in. [5.6 N-m] for N.O. motors.

DEAD WEIGHT LOAD ON SHAFT:
 Power or Auxiliary End—200 lb [90.8kg] maximum.
 Maximum Combined Load—300 lb. [136 kg].
 Auxiliary shaft not included on M9182, M9183 motors.

AMBIENT TEMPERATURE RATINGS:
 Maximum—150° F [66° C] @ 25% duty cycle.
 Minimum—minus 40° F [-40° C].

CRANKSHAFT: 3/8 inch (9.5 mm) square.
 M9185, M9186 have double-ended shafts.
 M9182, M9183 have single-ended shafts.

DIMENSIONS: See Fig. 1.

UNDERWRITERS LABORATORIES INC. LISTED
 File No. E4436, Guide No. XAPX.

CANADIAN STANDARDS ASSOCIATION CERTIFIED:
 GENERAL LISTING FILE NO. LR1620, GUIDE 400-E.

AUXILIARY SWITCH RATINGS (AMPERES):

ONE CONTACT ^a	120 V	240 V
Full Load	7.2	3.6
Locked Rotor	43.2	21.6

^a40 VA pilot duty, 120/240 Vac on opposite contact.

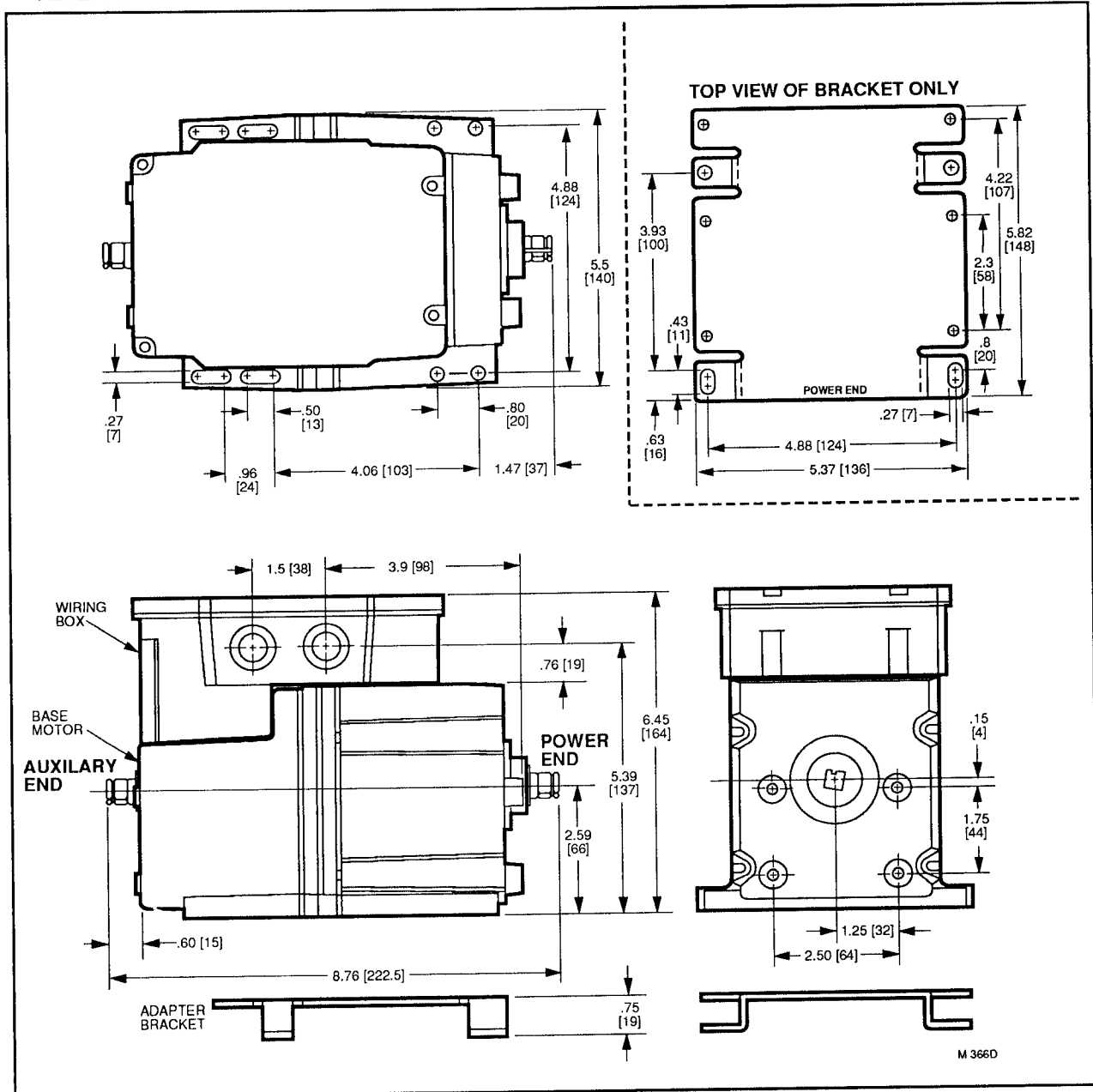
ACCESSORIES:

ES650117 Explosion-proof Housing—Encloses motor for use in explosive atmospheres. Not for use with Q601, Q618, and Q455 Linkages. Order separately from Nelson Electric Co. Requires Honeywell 7617DM Coupling.

Q607 External Auxiliary Switch—Controls auxiliary equipment as a function of motor position.

Internal Auxiliary Switch Kits—Can be field-installed on TRADELINE Models.

220736A—One-switch kit.



- 220736B—Two-switch kit.
- Q605 Damper Linkage—Connects motor to damper. INCLUDES MOTOR CRANK ARM.
- Q618 Linkage—Connects Modutrol motor to water or steam valve.
- Q601 Bracket and Linkage Assembly—Connects Modutrol motor to water or steam valve.
- Q100A,B Linkage—Connects Modutrol motor to butterfly valve. Requires adapter bracket packed with motor.
- Q209E,F Potentiometer—Limits minimum position of motor.
- Q68 Dual Control Potentiometer—Controls 1 through 9 additional motors.
- Q181 Auxiliary Potentiometer—Controls 1 or 2 additional motors.
- 221455A Motor Crank Arm—Infinitely adjustable crank arm. Approximately 0.75 inches shorter than the 4074ELY crank arm, can rotate through downward position and clear base of motor without requiring use of adapter bracket.
- 220741A Screw Terminal Adapter—Converts the standard quick-connect terminals to screws terminals.
- Transformers—Mounted internally, provide 24 Vac power to motor
- 198162JA—24 Vac; 50/60 Hz (for electrical isolation).
- 198162EA—120 Vac; 50/60 Hz.

- 198162GA—220 Vac; 50/60 Hz.
- 198162AA—120/208/240 Vac; 50/60 Hz.
- Q7130A—Interface Module with selectable voltage ranges (4-7 Vdc, 6-9 Vdc, and 10.5-13.5 Vdc). Adapts motor to M71XX function.
- Q7230A—Interface Module, selectable voltage or current control, with adjustable null and span. Adapts motor to M72XX function; 4 to 20 mA or 2 to 10 Vdc.
- Q7330A—Interface Module, for W936 economizer applications. Adapts motor to M73XX function.
- Q7630A—Interface Module, 14-17 Vdc control with minimum position capability. Adapts motor to M76XX function.
- 7617ADW Crank Arm—.75 inches shorter than 7616 BR crank arm.
- 4074BYK—Control up to 6 M91XX motors in unison from one Series 90 controller.
- 4074EAU—Drive 2 or 3 M91XX motors from a W973 Single-zone Logic Panel and W7100 Discharge Air Controller.
- 4074EDC—Drive one M91XX motor from a 4-20 mA Controller.
- 4074EED—Drive up to 4 M91XX motors from a 4-20 mA Controller.
- 221508A Resistor Board—Plugs onto quick-connects in wiring box of M91XX motor. Can be used in place of 4074BYK, EAU, EDC, or EED resistor kits (functions described above).

INSTALLATION

WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

1. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage.
2. Never turn the motor shaft by hand or with a wrench—this will damage the motor.
3. Always conduct a thorough checkout when installation is complete.

LOCATION

Install the Modutrol motor in any location except where acid fumes or other deteriorating vapors might attack the metal parts, or in atmospheres of escaping gas or explosive vapors. Motors are rated for ambient temperatures between -40° and 150° F (-40° C and 66° C).

In excessive salt environments, mounting base and screws should be zinc or cadmium plated, not stainless steel or brass: Use the 220738A adapter bracket for mounting on these surfaces.

Allow enough clearance for installing accessories and servicing the motor when selecting a location. See Fig. 1. If located outdoors install upright and use liquid-tight con-

duit connectors with wiring box to provide NEMA 3 weather protection.

MOUNTING

Always install motors with the shaft horizontal.

Mounting flanges extending from the bottom of the motor housing are drilled for 1/4 inch (6.4 mm) zinc plated machine screws or bolts.

M9185 motors are shipped from the factory in closed position (at the limit of counterclockwise rotation as viewed from the power end of the motor, as shown in Fig. 2). M9186 motors are shipped in the open (clockwise) position.

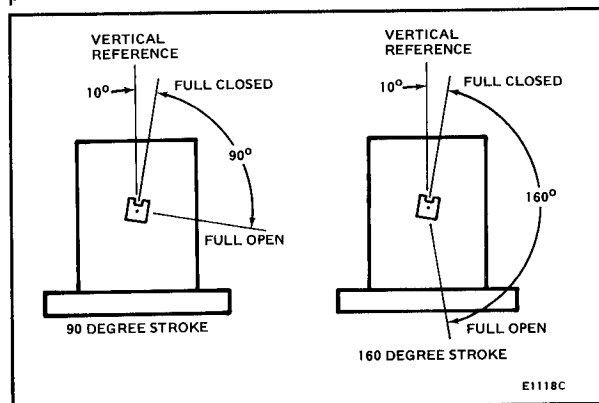


FIG. 2—LIMITS OF MOTOR SHAFT ROTATION VIEWED FROM POWER END.

ADAPTER BRACKET

The 220738A Adapter Bracket, positioned between the motor and the equipment, raises the shaft height of the motor by 0.75 inch to match that of the former Modutrol

motor. This is required on all valve linkage applications, Q607 External Auxiliary Switch applications and some damper linkage applications (either to provide clearance for the crank arm to rotate through the downward position, or to allow the damper linkage to reach the shaft).

To mount the motor with the bracket:

1. Mount the bracket to the equipment with existing or standard bolts.
2. Mount the motor to the bracket using the bolts

provided to the threaded holes in the bracket. See Fig. 3.

For valve linkage applications, the bracket should first be mounted to the linkage. The bracket then provides a convenient base on which the motor can be positioned. After the motor shaft is aligned to the linkage it can then be attached to the bracket with the 4 bolts provided. These bolts go through the outer set of slots on the motor flange and into the outer threaded holes of the bracket. (Fig. 4)

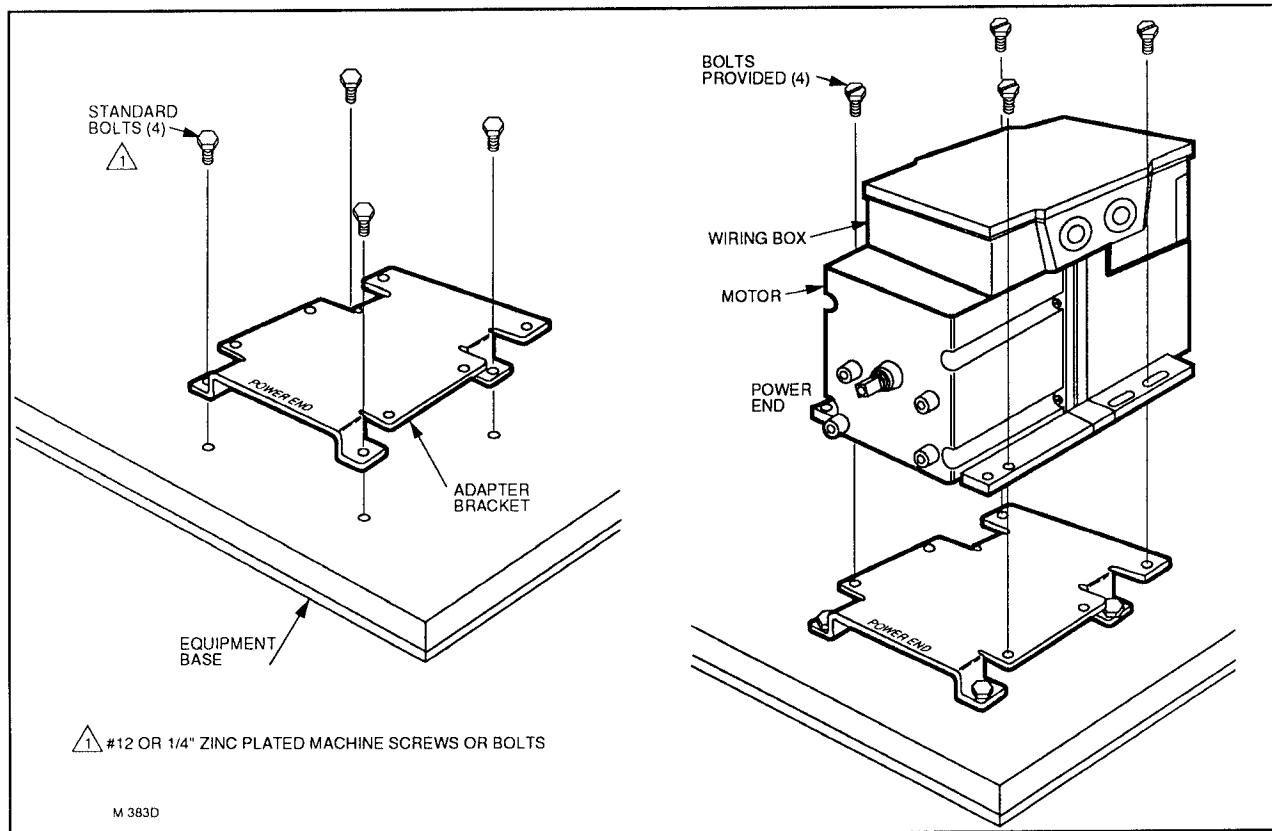


FIG. 3—MOUNTING MOTOR WITH ADAPTER.

DAMPER LINKAGES

A 220738A Adapter Bracket is packed with replacement motors. Use of this bracket is optional for many damper applications. The bracket might be needed in damper applications requiring the crank arm to rotate through the bottom plane of the actuator. If the bracket is not used in a replacement application, the damper linkage will have to be adjusted to the new shaft position.

The motor comes without a crank arm. The crank arm is included in the Q605 linkage or may be ordered separately (see Accessories).

For detailed instructions on the assembly of specific linkages, refer to the instruction sheet packed with each linkage. In general, however, check the following points of operation when installing a motor and linkage.

1. Linkages for dampers should be adjusted so that the damper moves through only the maximum required distance when the motor moves through its full stroke.
2. With modulating control, maximum damper opening should be no more than 60°. Little additional airflow is provided beyond this point.
3. The motor must be stopped at the end of its stroke by the limit switch and must not be stalled by the damper or valve. The motor will be damaged if it is not permitted to

complete its full stroke.

4. Do not exceed the motor ratings in any installation.
5. Do not turn motor shaft manually or with a wrench—this will damage the motor.

VALVE LINKAGES

The 220738A Adapter Bracket must be used with the Q100, Q601 and Q618 linkages in all valve applications. Follow the instructions shown in Fig. 4 for the adapter. Either power or auxiliary end of TRADELINE spring return motors may be used to drive valve linkages.

WIRING

Disconnect power supply before wiring to prevent electrical shock or equipment damage. All wiring must agree with applicable codes, ordinances, and regulations.

A transformer is required to supply 24 Vac power to the motor. Make sure that the power requirements stamped on the motor correspond to the characteristics of the power supply.

Fig. 5 shows terminals and adjustments. Fig. 6 and 7 show internal schematics. Fig. 8 shows auxiliary switch connections. Fig. 9-14 show connections for various system applications. Figs. 15-16 show connections for unison control, and Fig. 18 shows connection for operation from a

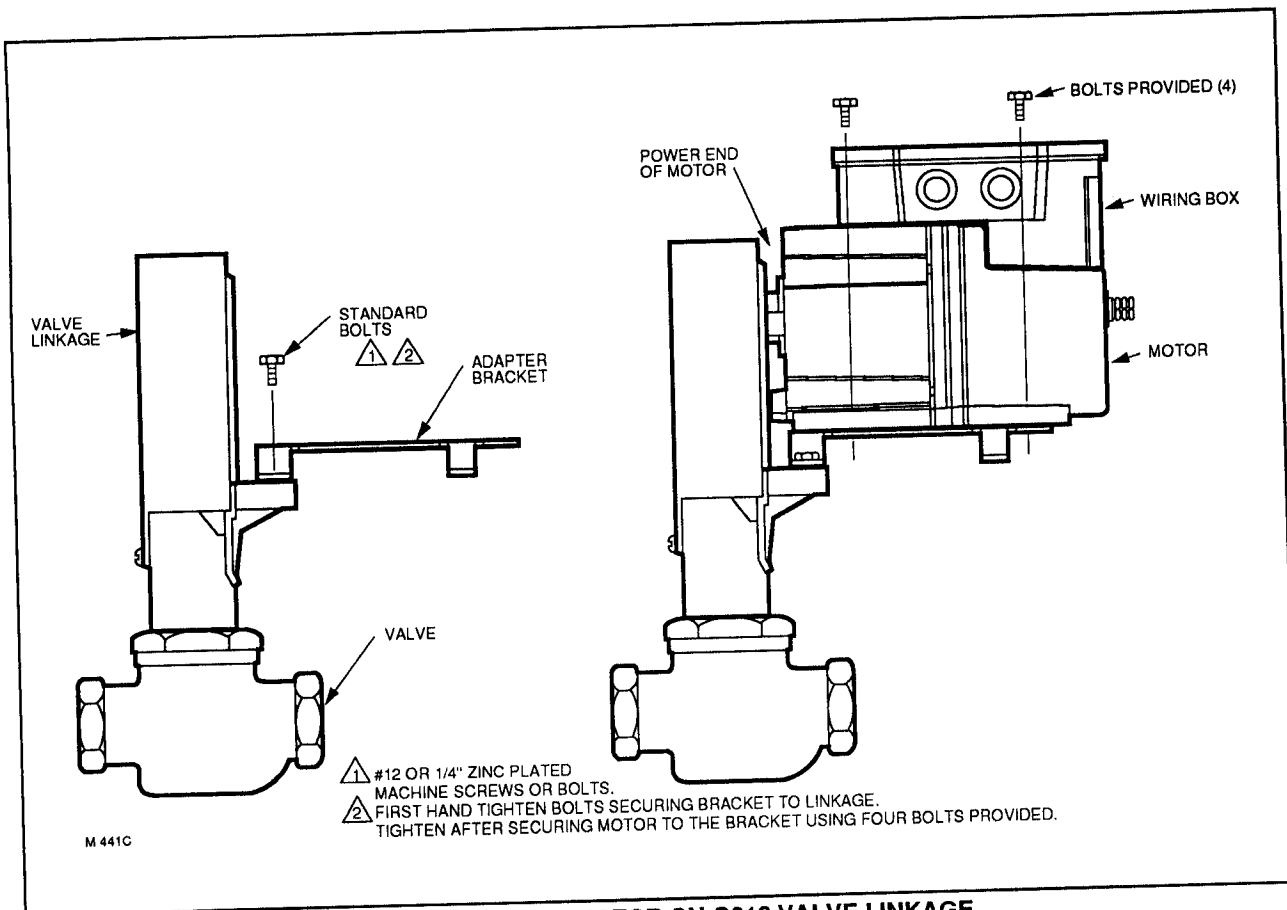


FIG. 4—MOUNTING MOTOR ON Q618 VALVE LINKAGE.

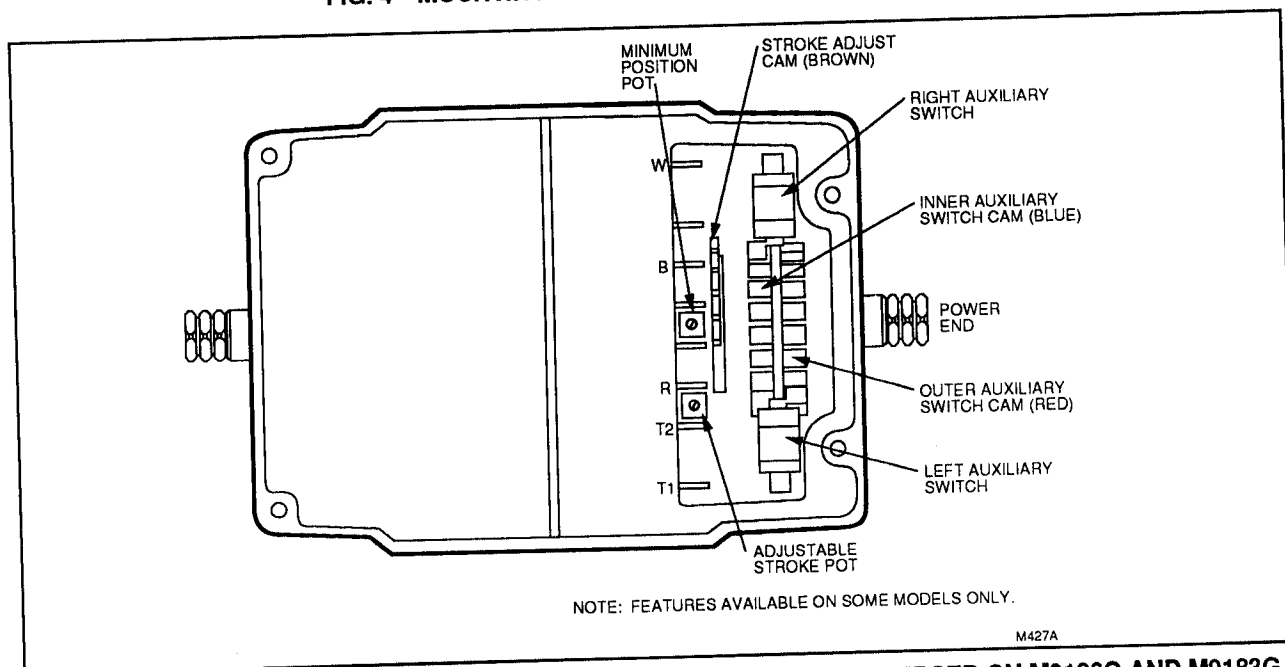


FIG. 5—TERMINALS AND ADJUSTMENTS. TERMINALS W AND B ARE REVERSED ON M9186G AND M9183G.

4-20 mA controller.

Access to the wiring compartment is gained by removing the 4 screws in the top of the wiring box and lifting off the cover.

WIRING BOX

When used with liquid-tight conduit connectors, the wir-

ing box provides NEMA 3 weather protection for the motor. The box also provides knock-outs for wiring conduits and encloses terminals. The wiring box, standard with replacement motors, is required for housing an internal transformer or internal auxiliary switches or Series 70 Interface Modules.

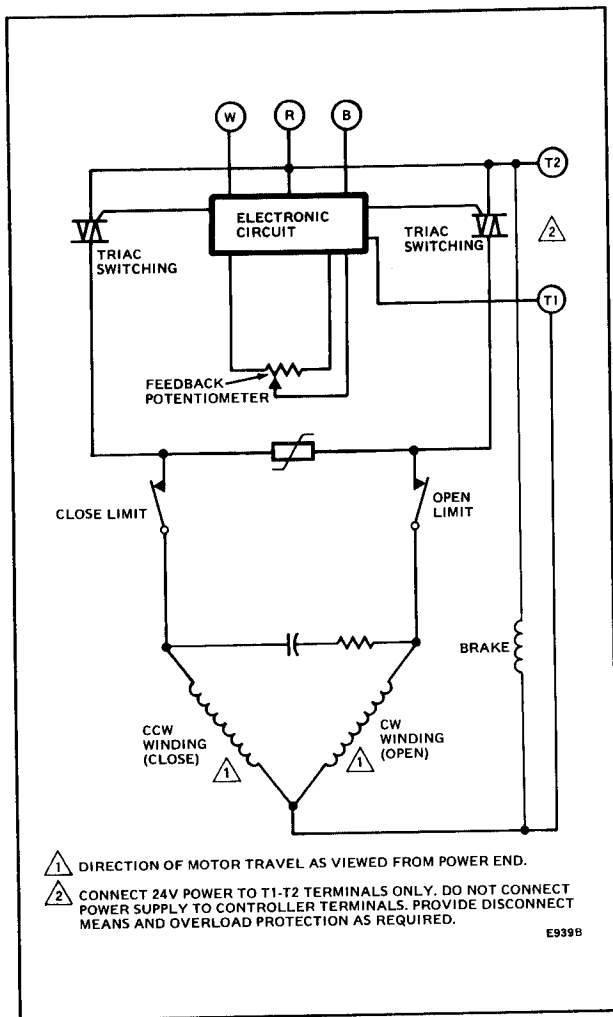


FIG. 6—INTERNAL WIRING, FIXED STROKE M9185/M9186 MODUTROL MOTORS.

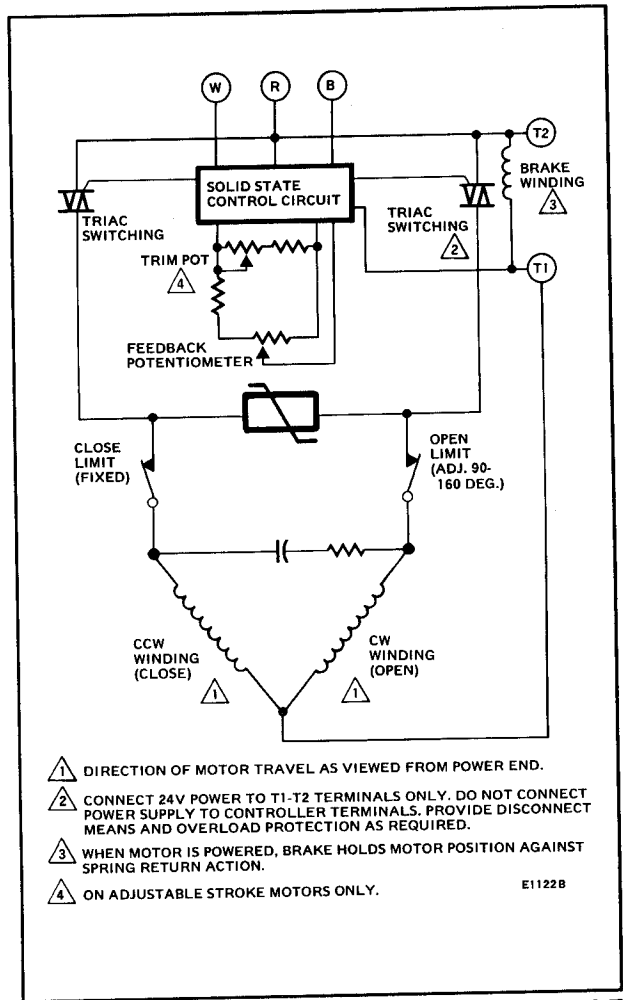


FIG. 7—INTERNAL WIRING OF ADJUSTABLE STROKE M9185/M9186 MODUTROL MOTORS.

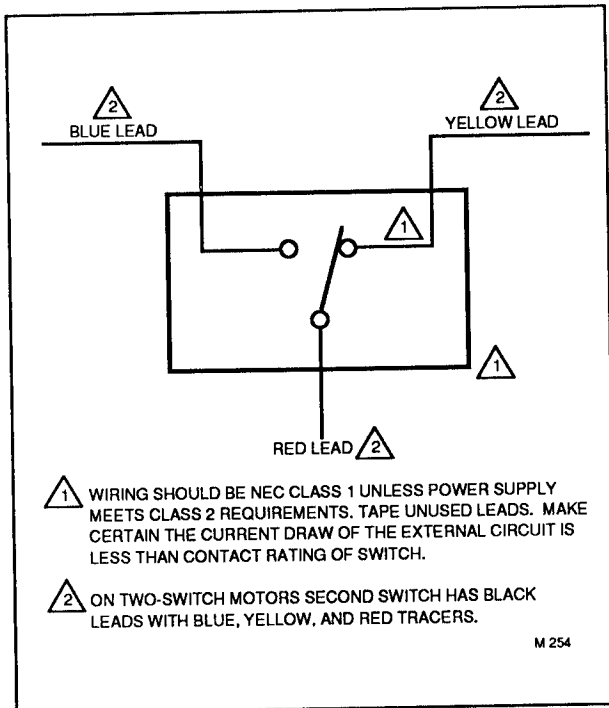


FIG. 8—AUXILIARY SWITCH CONNECTIONS.

CONNECTION DIAGRAMS

These motors are designed for use in Series 90 proportioning control circuits employing a 135 ohm Series 90 controller. Series 90 high or low limit controls or manual position potentiometers may be used in the control circuit. The standard Series 90 controller has R, W, and B terminals. As the controller reduces the R to W resistance, the motor will drive closed (CCW as viewed from the power end).

These motors may also be used on low voltage series 60 circuits. When the controller makes R-W on a temperature rise in a heating application, the motor will drive to the full closed position. The 150 ohm, 1/2 watt carbon resistor included in 4074BYK Resistor Kit (order separately) must be connected between the B and W terminals of the motor (see Fig. 19). Once the motor is energized in a series 60 circuit it will move to the rotational limit. Do not use Series 90 motors with series 60 floating controllers.

The M9185/M9186 motors may also be used on low voltage series 80 circuits. When the thermostat or controller switch makes, the motor will drive to the open position (see Fig. 17). When thermostat or controller is satisfied, it breaks power circuit, and motor spring returns to full closed position. Jumper the R-B terminals on the motor and connect the 150 ohm, 1/2 watt carbon resistor (included in 4074BYK Resistor Kit) between B and W terminals of the motor.

CAUTION

M9185/M9186 Modutrol Motors with the electronic balancing relay are designed to ignore the presence of electrical pickup (unwanted input signals) and will work with standard wiring used with other non solid state Modutrol motors. However, there may be rare cases in which very large pickup is present, such that motor performance becomes erratic. This may happen when the series 90 controller wires are run near wires carrying large electrical currents (large electric motors). Reroute series 90 controller wires away from these conductors, or use twisted cable (Belden type 8443-3 wire, or equivalent) to ensure proper control. If shielded cable is used, the shield must not be grounded.

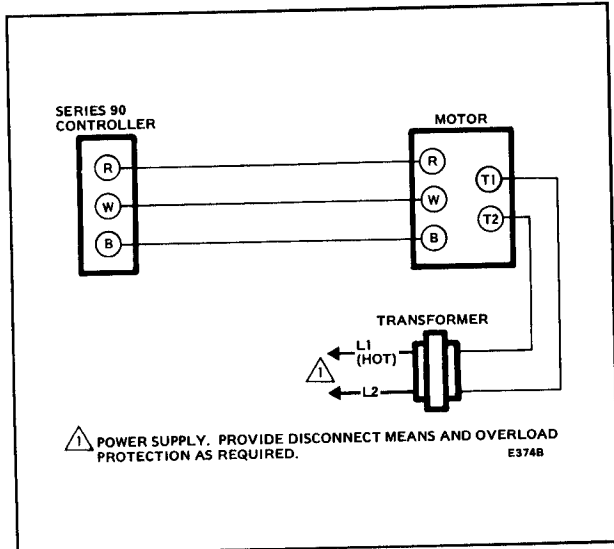


FIG. 9—M9185 OR M9186 MOTOR USED WITH A SERIES 90 CONTROLLER.

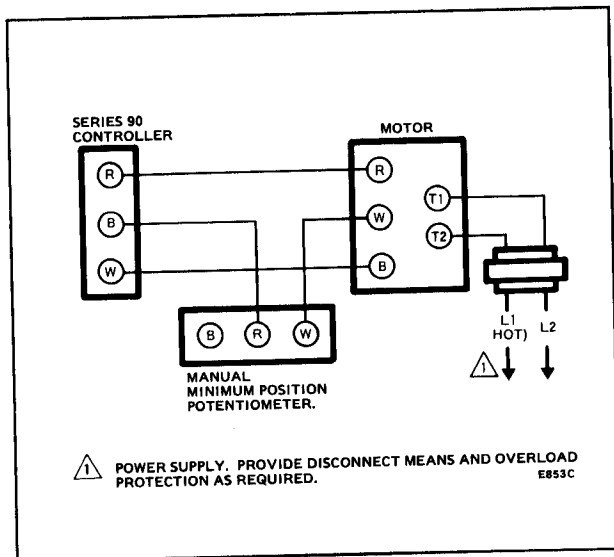


FIG. 10—TYPICAL HOOKUP FOR M9185 MOTOR WHEN MANUAL POTENTIOMETER IS USED TO LIMIT MINIMUM POSITION OF MOTOR. MOTOR CLOSSES COMPLETELY ON LOSS OF POWER.

NOTE: In most applications, a single 135 ohm potentiometer in the limit controller provides only 50% operation of a valve or damper. For those applications where the limit controller must be able to operate the valve or damper to 100% of its capacity, it must have either one 270 ohm potentiometer or 2-series-connected potentiometers with combined total resistance up to 280 ohms. If a 2-potentiometer limit controller is used, it should be wired into the circuit as shown in Fig. 11. In general, a 2-position controller, or a controller with a narrow throttling range, should not be used as a high or low limit in a series 90 circuit as this will usually cause rapid cycling (hunting) of the motor.

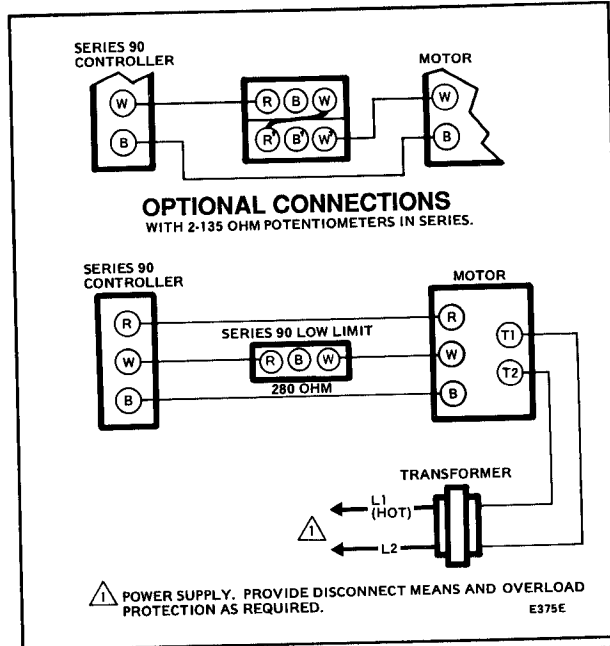


FIG. 11—M9185 OR M9186 MOTOR USED WITH MODULATING LOW LIMIT.

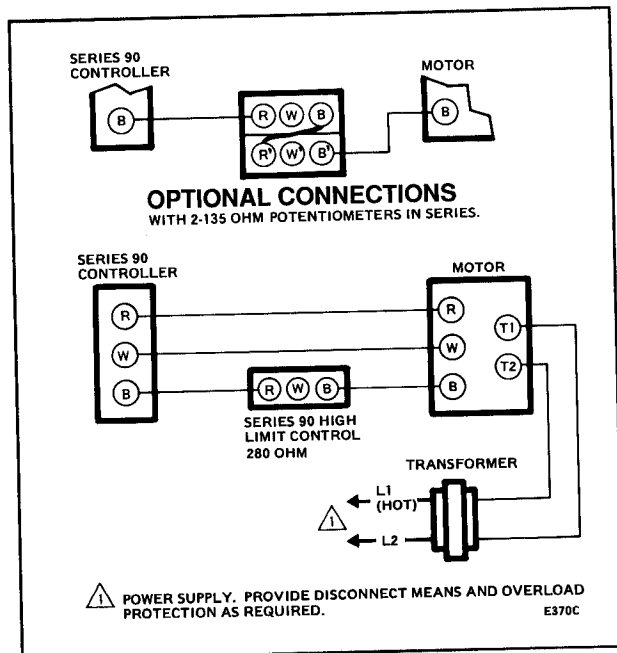


FIG. 12—M9185/M9186 MOTOR USED WITH A SERIES 90 CONTROLLER AND A SERIES 90 HIGH LIMIT.

IMPORTANT

1. Unison control of multiple Modutrol motors is for series 90 motors with solid state balance relays only.
2. Use the same stroke on all motors connected in parallel.
3. When individual motor transformers are used, they must have the same characteristics and they must all be powered by a single branch circuit.
4. All motors must be in phase when using common transformer supply. Connect same transformer lead to T1 on each motor; connect the other transformer lead to T2 on each motor.
5. M9185/M9186 motors cannot be wired in parallel with electromechanical balance relay modutrol motors.
6. Do not disconnect any parallel motor, or remaining motors will not operate properly.

Up to 6 M9185/M9186 motors may be operated from one Series 90 controller by placing the proper value resistor across the W-B terminals of the controller. 4074BYK Resistor Kit contains 5 specially labeled resistors for this purpose. See Table 1. The 221508A Resistor Board can also be used, and does not require a screw terminal kit.

1. Select the proper resistor for the number of motors used.
2. Install 220741A Screw Terminal Adapter if not already in place.
3. Connect selected resistor across W and B terminals as in Figure 15.

Up to 4 M9185/M9186 motors may be operated in unison from the W973 Single Zone Logic Panel or W7100 Discharge Air Controller when the proper value resistor is placed across the R and B terminals. The 4074EAU Resistor Kit (order separately) contains 2 resistors for this purpose. Use the 1300 ohm resistor when 2 motors are paralleled and the 910 ohm resistor when 3 motors are paralleled. If 4 motors are to be connected in parallel, use

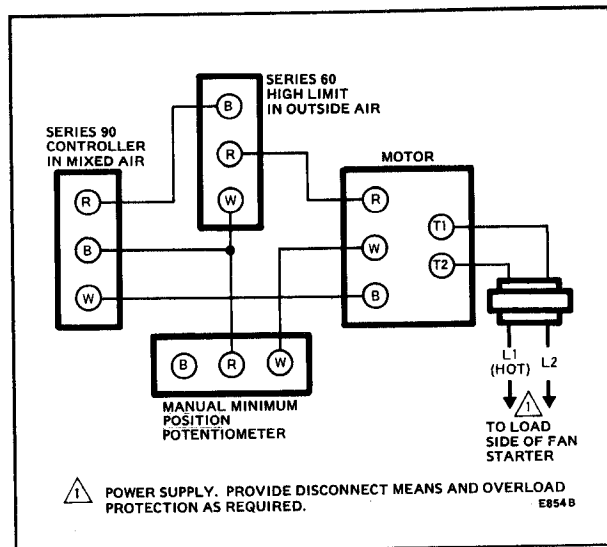


FIG. 13—TYPICAL VENTILATING SYSTEM HOOKUP USING SPDT HIGH LIMIT AND MANUAL POTENTIOMETER TO LIMIT MINIMUM POSITION OF MOTOR.

TABLE 1—4074BYK RESISTORS (1% METAL FILM, 1/8 WATT).

NO. MOTORS	RESISTOR NO.	RESISTANCE (ohms)
2	802139BEAA	140.0
3	802139HBFH	71.5
4	802139EHFH	47.5
5	802139DFHH	35.7
6	802139CJAH	28.0
Two-position ^a	100100BFB	150.0

^a5% Composition 1/2 Watt.

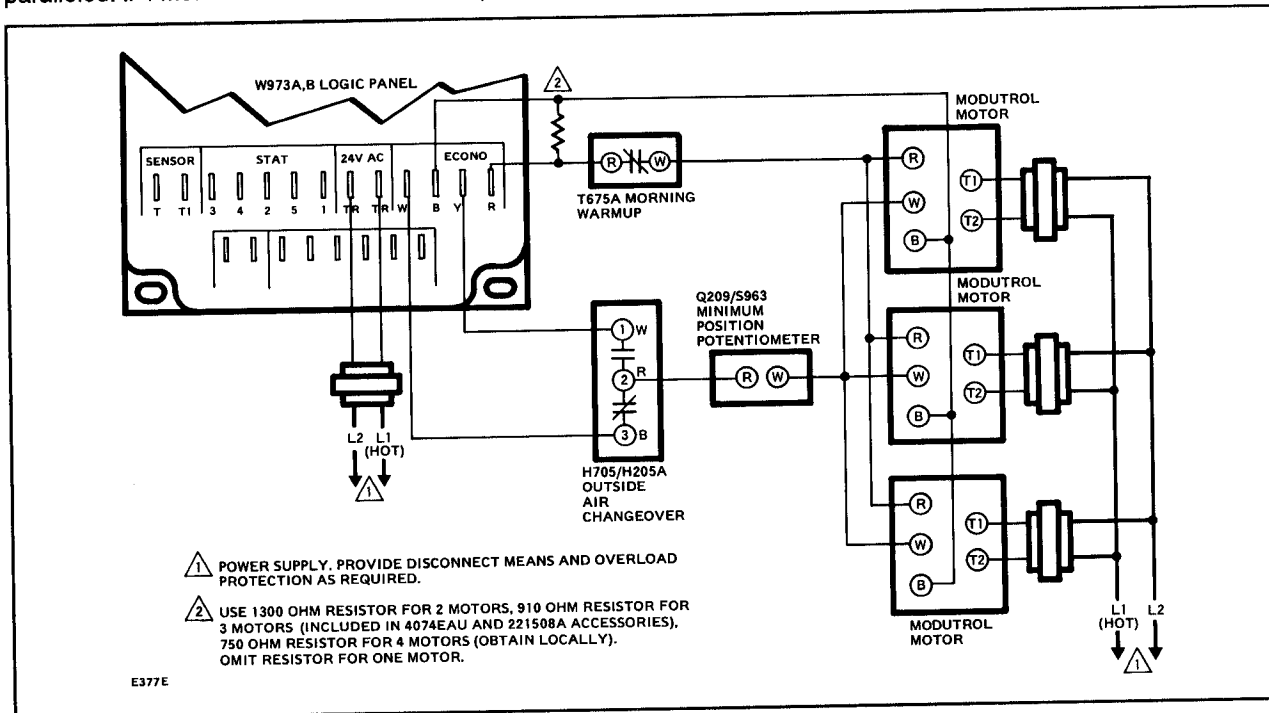


FIG. 14—UNISON CONTROL OF M9185 MOTORS USING ONE MINIMUM POSITION POTENTIOMETER AND A W973 SINGLE ZONE LOGIC PANEL SYSTEM IN AN ECONOMIZER APPLICATION.

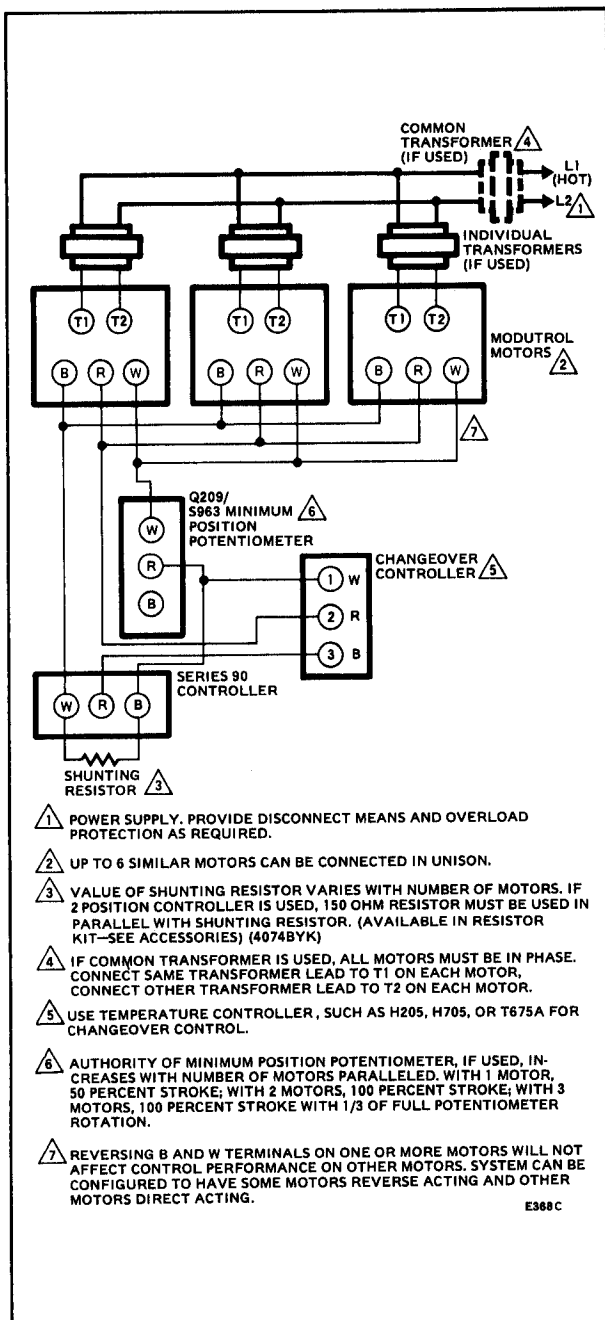


FIG. 15—UNISON CONTROL OF M9185 MOTORS. USING ONE MINIMUM POSITION POTENTIOMETER FOR ALL MOTORS. SYSTEM IS SHOWN CONNECTED FOR COOLING; FOR HEATING REVERSE THE W AND B LEADS AT THE CONTROLLER.

a 768 ohm, 1/4 watt, 5% carbon resistor (not included in the resistor kit). Figure 14 illustrates the connections required for unison operation of 3 motors from the W973 logic panel.

The M9185/M9186 can be used with some Honeywell Industrial Control Products such as the Dialatrol/Dialapak, which has a 4-20 mA control output. It is necessary to use a resistor kit (4074EDC) to interface the 4-20 mA signal source. Up to 4 motors can be controlled from a 4-20 mA source by using 4074EED (see Fig. 18).

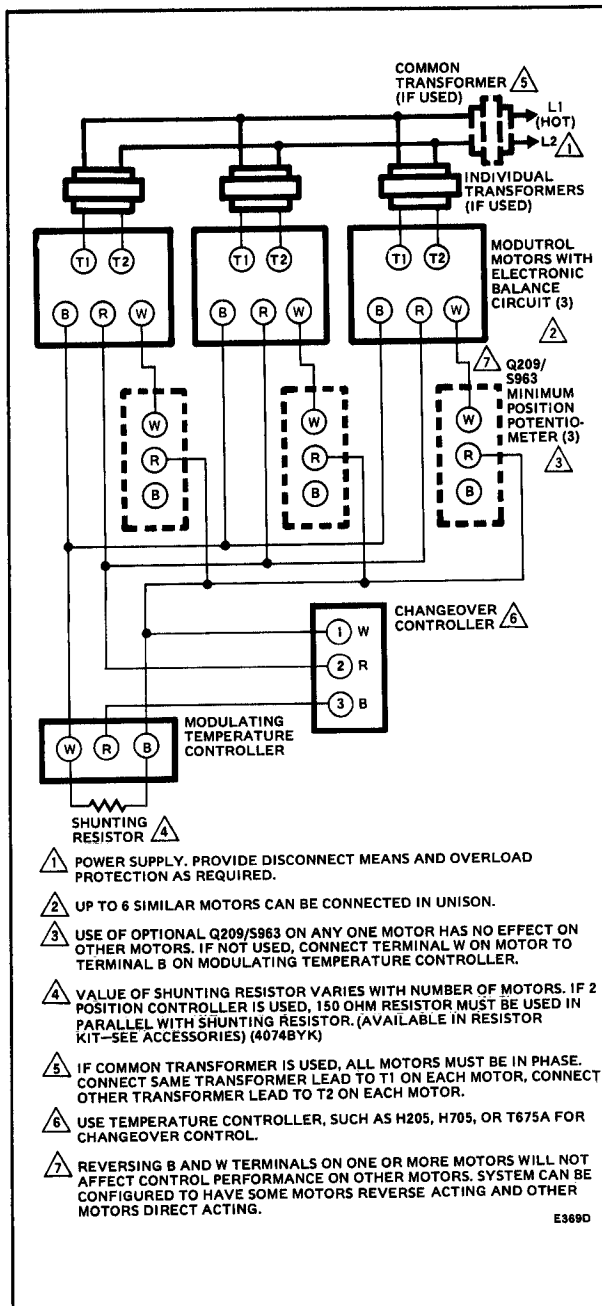


FIG. 16—UNISON CONTROL OF M9185 MOTORS FOR VENTILATION CONTROL USING INDIVIDUAL MINIMUM POSITION POTENTIOMETERS. SYSTEM IS SHOWN CONNECTED FOR COOLING; FOR HEATING REVERSE THE W AND B LEADS AT THE CONTROLLER.

The Q7230A Interface Module or 221508A Resistor Board can also be used to connect to a 4-20 mA signal source.

IMPORTANT

After the valve or damper linkage is connected to the motor, it may be necessary to interchange the blue and yellow connections at the motor terminals to obtain the proper action of the valve or damper on a temperature increase or decrease at the controller.

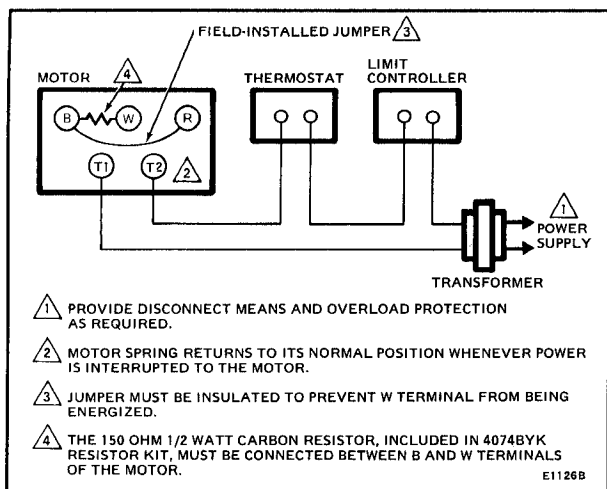


FIG. 17—M9185/M9186 USED IN LOW VOLTAGE SERIES 80 CIRCUITS.

**4074EED RESISTOR SELECTION CHART FOR
4-20 mA**

TOTAL NUMBER OF MOTORS	MINIMUM OUTPUT VOLTAGE REQUIRED (Vdc) ^b	RESISTOR (A)	
		(Ohms)	Part No.
1	1.7	237	802139CDHA
2	2.0	150	802139BFAA
3	2.3	124	802139BCEA
4	2.7	113	802139BBDA
5	3.0	105 ^a	—
6	3.3	97.6 ^a	—

^a Not part of this kit, obtain separately.

^b These values represent the controller open circuit output voltage required to drive the motors.

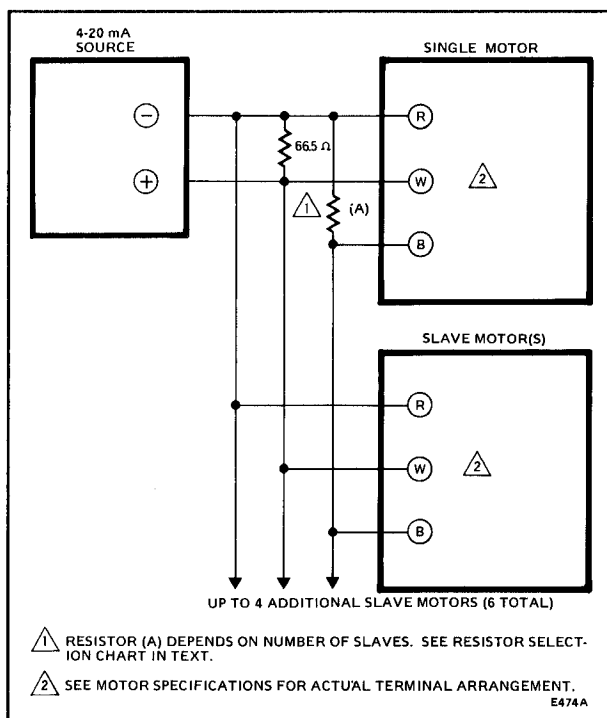


FIG. 18—RESISTOR CONNECTIONS FOR SINGLE OR UNISON CONTROL OF M9185 MOTOR OPERATING FROM 4-20 m-A SINGLE SOURCE.

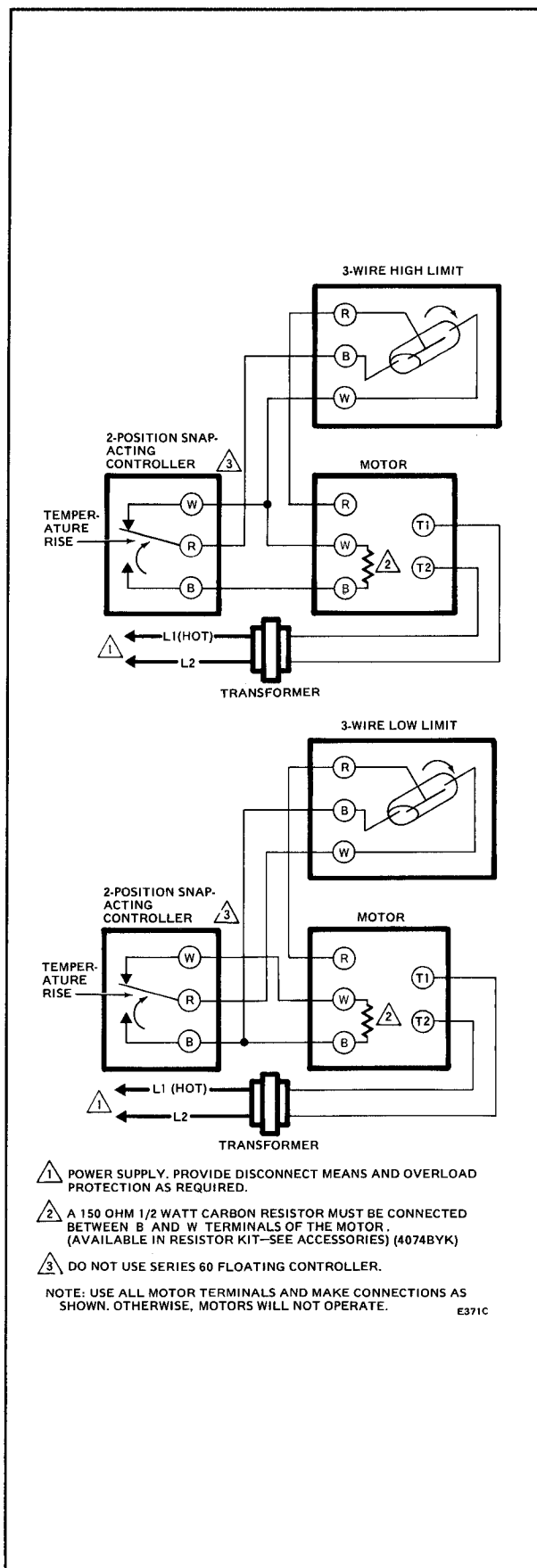


FIG. 19—M9185 MOTOR USED WITH A 2-POSITION CONTROLLER AND HIGH OR LOW LIMIT CONTROLLER IN LOW VOLTAGE SERIES 60 CIRCUIT (heating application).

SETTINGS AND ADJUSTMENTS

STROKE ADJUSTMENT (for M9185D,E)

TRADELIN Motors are shipped with the stroke adjusted for 160° operation. It is necessary to use 160° stroke when controlling Honeywell V5011 two-way and V5013 three-way valves. The stroke may be field adjusted for any stroke between 90° and 160°. In order to set stroke, both

mechanical and electrical adjustments are required. The mechanical adjustment (cam) establishes the full open position of the motor shaft. The electrical adjustment (stroke adjust potentiometer) provides sufficient resistance change to ensure that the cam will actuate the limit switch.

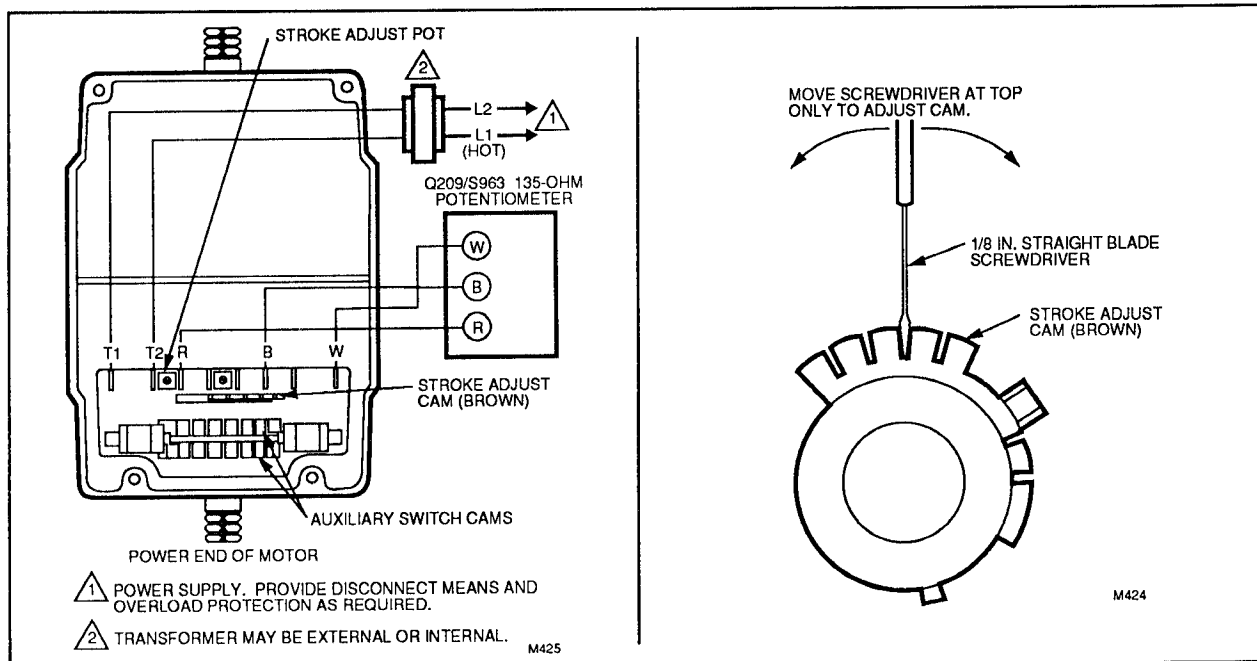


FIG. 20—STROKE ADJUSTMENT SETUP.

CAUTION

Detach linkage from motor before adjusting stroke.

IMPORTANT

Set cams by moving top of screwdriver only. Pressing screwdriver against sides of cam slots or use of excessive force could cause damage.

BEFORE SETTING STROKE:

1. Remove cover from Wiring box.
2. Disconnect controller from motor.

To set 160° stroke (Fig. 18)

1. Turn motor's stroke adjust potentiometer fully clockwise.
2. Drive motor to midposition. This can be done by jumpering B-R-W or with a 135 ohm potentiometer (Q209 or S963) connected to the motor R,B,W terminals.
3. Insert 1/8" [3 mm] screwdriver blade into a slot on the brown cam (inner cam) and move screwdriver handle to the left to rotate cam counterclockwise to the stop.

To Set 90° Stroke

1. Drive motor to midposition. This can be done by jumpering B-R-W or with a 135 ohm potentiometer (Q209 or S963) connected to the motor R,B,W terminals.
2. Insert 1/8" [3 mm] screwdriver blade into a slot on the brown cam (inner cam) and move screwdriver handle to the right to rotate cam clockwise to the stop.
3. Turn motor's stroke adjust potentiometer fully counterclockwise.

To set stroke between 90° and 160°

1. Connect R,B,W terminals of 135 ohm potentiometer (Q209 or S963) to matching terminals on motor.
2. Turn motor's stroke adjust potentiometer fully clockwise.
3. Drive motor to midposition by adjusting the 135 ohm potentiometer.
4. Insert 1/8" [3 mm] screwdriver blade into the brown cam slot (inner cam) and move screwdriver handle to the right to rotate cam clockwise to the stop.
5. Adjust the 135 ohm potentiometer to drive the motor full open (clockwise as viewed from the power end). The motor should now be in the 90° position.
6. Insert 1/8" [3 mm] screwdriver blade into the brown cam slot (inner cam) and move screwdriver handle slowly to the left to rotate cam counterclockwise allowing the motor to reposition after each move of the cam. Repeat this procedure until the motor reaches the desired full open position. (Each click of the cam provides a 2° rotation.)
7. If the motor turns past the desired position, DO NOT MOVE THE CAM. Drive the motor to midposition using the 135 ohm potentiometer, then move the cam clockwise to the stop and repeat steps 5 and 6.
8. When the desired position is reached in step 6, set the electrical stroke limit. This is done by turning the motor's stroke adjust pot slowly counterclockwise until the motor starts to move. Stop and then turn the pot 1/8" turn clockwise. This last adjustment ensures total motor movement over the full range of the 135 ohm controller.
9. Check that the electrical stroke is set properly by opening the W lead. The motor should not move.

AUXILIARY SWITCHES

The auxiliary switches in M9185 motors are actuated by adjustable cams. These cams can be set to actuate the switches at any angle within the stroke of the motor. Also, switch differentials of 1° or 10° can be selected.

TRADELINE motors are shipped with auxiliary switch cams which permit acceptance of internal switch kits (220736A,B). Refer to installation sheet of 220736A,B to install kit.

M9185 motors with factory added auxiliary switches are shipped in the closed position (counterclockwise ↺, as viewed from power end) with auxiliary cams set to actuate switches 30° from the closed position, and to provide 1° differential. With motor in closed (full counterclockwise ↺) position, auxiliary switch breaks R-B (Fig. 8).

CAUTION

Disconnect all power to auxiliary switches before adjusting.

AUXILIARY SWITCH SETTING PROCEDURE

1. Remove top cover from motor to gain access to motor terminals and auxiliary cams. Disconnect controller.
2. Motor position can be adjusted by using a 135 ohm potentiometer or by jumpering R to B or R to W. To use a 135 ohm potentiometer, connect as shown in Fig. 21.
3. Drive motor to the position where auxiliary equip-

ment is to be switched by adjusting the 135 ohm potentiometer, or by jumpering R to B to drive open and R to W to drive closed.

4. For switch differential of 1°, check continuity of auxiliary switch R-B contacts and rotate cam as follows.
 - a. If contacts are open, rotate cam clockwise ↻ until R-B contacts close.
 - b. If contacts are closed, rotate cam counterclockwise ↺ until R-B contacts open.
5. For switch differential of 10° rotate cam approximately 180° so that slow-rise portion of cam actuates switch, then check continuity of auxiliary R-B and rotate cam as follows:
 - a. If contacts are open, rotate cam counterclockwise ↺ until R-B contacts close.
 - b. If contacts are closed, rotate cam clockwise ↻ until R-B contacts open.
 - c. Final adjustment in the proper direction should be made to obtain contact make or break at the desired position.
6. Check for proper differential and switching of auxiliary equipment by driving motor through full stroke in both directions.
7. Disconnect jumper, reconnect controller, replace top cover of motor.

NOTE: If differential is changed from 1° to 10° the switching action is reversed, thus: switch contacts R-B make and R-W break on a counterclockwise ↺ (closed) rotation.

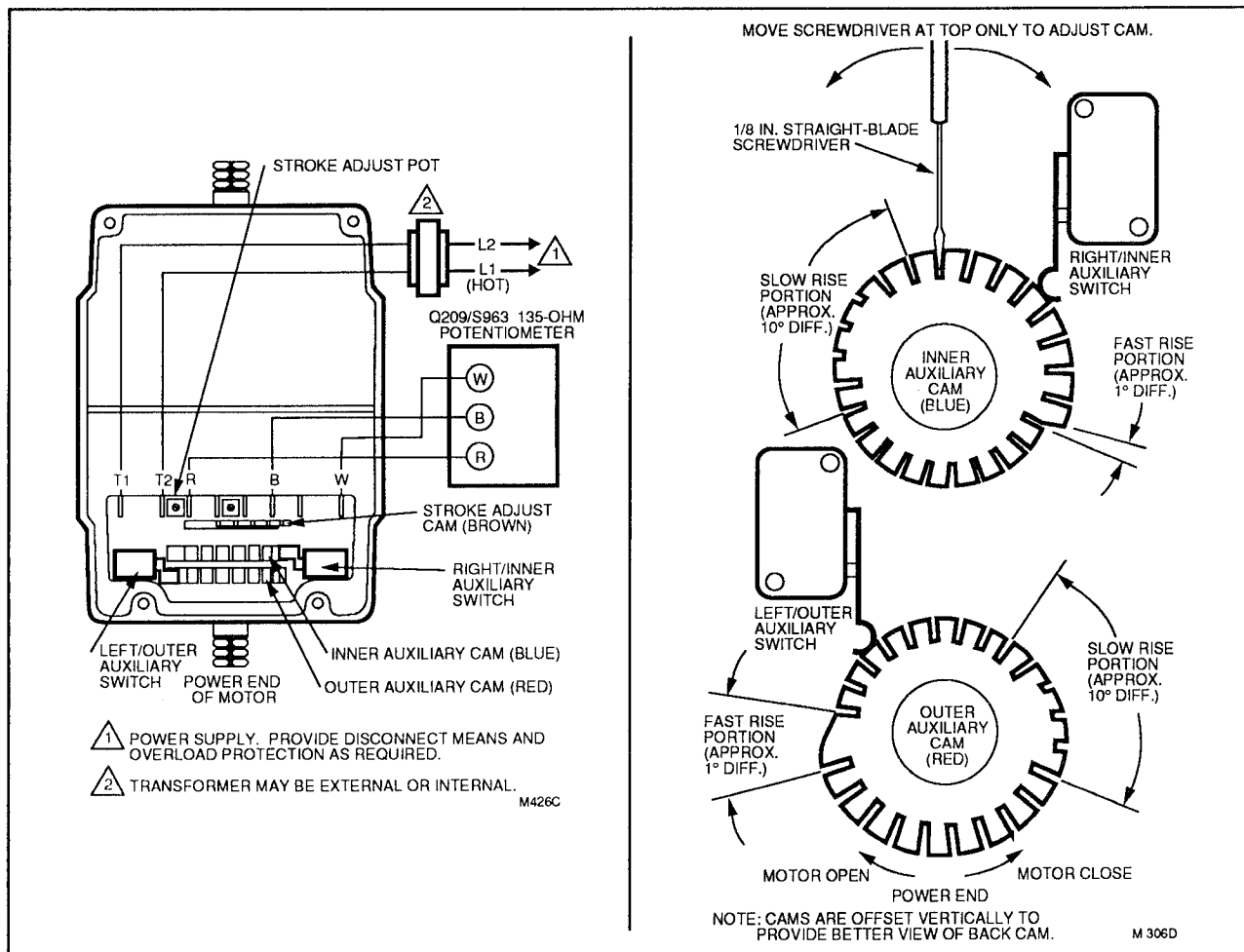




FIG. 21—AUXILIARY SWITCH ADJUSTMENT.

OPERATION AND CHECKOUT

OPERATION

The potentiometers, one in the controller and one on the motor, along with resistor network, form a bridge circuit. As long as the value of the controlled medium remains at the controller set point, the circuit is balanced, and the motor does not run.

When the value of the controlled medium changes, the potentiometer wiper in the controller is moved, which unbalances the bridge circuit. This unbalance is amplified, and energizes Triac switching to run the motor in the direction necessary to correct the change in temperature or pressure. The motor turns the feedback potentiometer to rebalance the circuit and stop the motor.

When power to the motor is interrupted, the motor returns to its normal position; the M9185 returns to the full counterclockwise  (closed) position and the M9186 returns to the full clockwise  (open) position.

CHECKOUT

After installation and linkage adjustment, check the entire motor and control hookup to ensure that:

- The motor operates the damper or valve properly.
- The motor responds properly to the controller.

Inspect the motor, linkage, and valve or damper to see that all mechanical connections are correct and secure. In damper installations, the pushrod should not extend more than a few inches past the ball joints. Check to see that there is adequate clearance for the linkage to move through its stroke without binding or striking other objects.

Check to see that cams operate the auxiliary switches, if used, at the desired point of motor rotation.

SERIES 90 MOTOR OPERATION CHECK WITH MODUTROL MOTOR DISCONNECTED FROM CONTROLLER

STEP	ACTION	RESPONSE	IF NO OR LIMITED RESPONSE
1.	Apply 24 Vac ^a .	None.	—
2.	Short R to W.	Motor drives closed.	Proceed to step 6.
3.	Open terminal W and short B to R.	Motor drives open.	Proceed to Step 6.
4.	Short terminals R to B to W.	Motor must drive to Mid-position.	Proceed to Step 6.
5.	Check voltage between R to B, and between R to W ^b . (Controller must be disconnected.)	17 to 20 Vdc.	No voltage or out of range. Proceed to Step 7.
6.	Motor does not drive.	Motor is defective.	Replace motor.
7.	Voltage out of range.	Motor printed wiring board defective.	Replace motor.
8.	Disconnect 24 Vac.	Spring return motors return to their normal mechanical position.	Spring mechanism defective —Replace motor.

NOTES:

^a Ensure motor transformer is sized properly. If a common transformer is used to power multiple motors, ensure power input is in phase with all motors.

^b Motors may operate in Series 90 or two-position control applications. However, checking voltage between terminals R to B and R to W is necessary to confirm proper operation in electronic (W973, 4 to 20 mA etc.) applications.

NOTES

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