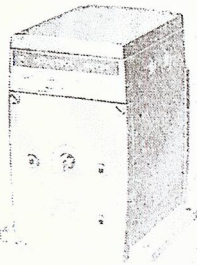


**OBSOLETE**

# M941A,B,C,D MODUTROL MOTORS



REVERSING, PROPORTIONAL MOTORS USED TO DRIVE BURNER FIRING RATE VALVES, DAMPERS OR AUXILIARY EQUIPMENT.

Designed for flame safeguard applications in commercial/industrial oil or gas burner systems. With heavy duty, vibration resistant balancing relay (except M941B). Regulated by 3-wire, proportional controller. Stroke is field adjustable to 90 or 160 degrees. Crankshaft: Double-ended, 3/8 in. [9.5 mm] square. Ambient Temperature Range: Minus 40 to plus 125 F [minus 40 to plus 52 C]. Maximum Dead

Weight Load on Shaft: Power End—200 lb [90.7 kg]; Auxiliary End—100 lb [45.4 kg]. Dimensions: 7-1/2 in. [190.5 mm] high, 5-5/8 in. [142.9 mm] wide, 7-7/16 in. [188.9 mm] deep. Listed by Underwriters Laboratories Inc.—M941A,C,D; Industrial Risk Insurers (formerly FIA) approvable; CSA Certified—M941C,D.

AUXILIARY SWITCH RATINGS (amperes):

M941C—

LOAD	120V AC	240V AC
Full Load	7.2	3.6
Locked Rotor	43.2	21.6

M941D—

LOAD	120V AC	240V AC	277V AC
Full Load	5.8	2.9	—
Locked Rotor	34.8	17.4	—
Resistive	11.0	11.0	11.0

*continued next page*

Weight Load on Shaft: Power End—200 lb [90.7 kg]; Auxiliary End—100 lb [45.4 kg]. Dimensions: 7-1/2 in. [190.5 mm] high, 5-5/8 in. [142.9 mm] wide, 7-7/16 in. [188.9 mm] deep. Listed by Underwriters Laboratories Inc.—M941A,C,D; Industrial Risk Insurers (formerly FIA) approvable; CSA Certified—M941C,D.

Designed for flame safeguard applications in commercial/industrial oil or gas burner systems. With heavy duty, vibration resistant balancing relay (except M941B). Regulated by 3-wire, proportional controller. Stroke is field adjustable to 90 or 160 degrees. Crankshaft: Double-ended, 3/8 in. [9.5 mm] square. Ambient Temperature Range: Minus 40 to plus 125 F [minus 40 to plus 52 C]. Maximum Dead



## firing rate controls

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M941A,B,C,D continued

ELECTRICAL RATING: 24 volts, 50/60 Hz.

POWER CONSUMPTION:

M941A,C,D—21 VA.

M941B—17 VA.

TIMING (NOMINAL)		NORMAL RUNNING TORQUE		BREAK-AWAY TORQUE <sup>a</sup>	
90 DEG. STROKE	160 DEG. STROKE	lb-in.	N-m	lb-in.	N-m
7.5 sec.	15 sec.	37	4.2	75	8.5
15.0 sec.	30 sec.	75	8.5	150	17.0
1/2, 1 min.	1, 2 min.	150	17.0	300	34.0

<sup>a</sup>Maximum torque available to overcome occasional large loads such as a seized damper or valve. MUST NOT BE USED CONTINUOUSLY AT THIS RATING.

REPLACEMENT PARTS:

No parts replaceable.

ACCESSORIES:

Q100A,B Linkage. Connects Modutrol motor to butterfly valve.

Q601E,F,J-M Valve Linkage. Connects Modutrol motor to water or steam valve.

Q605A,B,D,E Damper Linkage. Connects motor to damper (includes motor crank arm).

Q607A,B Auxiliary Switch. Controls auxiliary equipment as a function of motor position.

Q618A Valve Linkage. Connects Modutrol motor to water or steam valve.

S443A Manual Potentiometer. Includes dpdt toggle switch.

7640JS Weatherproofing Kit.

7616BR Motor Crank Arm.

R9107A External Balancing Relay (for M941B).

Cover Transformers. Die-cast aluminum cover with built-in transformer—

130810A—120V ac, 60 Hz.

130810B—120/208/240V ac, 60 Hz.

130810C—220V ac, 50 Hz.

130810D—208/240V ac, 60 Hz.

130810E—208V, 60 Hz.

130810F—240V, 60 Hz.

AT72D Transformer. See page 115.

ORDER NUMBER	DESCRIPTION	TIMING <sup>a</sup>	AUXILIARY SWITCH DIFFERENTIAL	ADDITIONAL FEATURES
M941A1008	With heavy-duty, vibration-resistant balancing relay.	15.0 or 30.0 sec.	—	Shipped in 160 degree position.
M941A1016		30.0 or 60.0 sec.	—	Shipped in 160 degree position.
M941A1024		1.0 or 2.0 min.	—	Shipped in 160 degree position.
M941A1032		30.0 or 60.0 sec.	—	Shipped in 90 degree position.
M941A1040		7.5 or 15.0 sec.	—	Shipped in 160 degree position.
M941A1057		15.0 or 30.0 sec.	—	Shipped in 90 degree position.
M941A1107		7.5 or 15.0 sec.	—	Shipped in 90 degree position.
M941B1007	Requires an R9107 external balancing relay.	30.0 or 60.0 sec.	—	Shipped in 160 degree position.
M941C1006	With 1 cam-adjusted Micro Switch spdt auxiliary switch and heavy-duty, vibration-resistant balancing	15.0 or 30.0 sec.	Fixed at 10 angular degrees.	Shipped in 160 degree position. With tapped shaft.
M941C1014		30.0 or 60.0 sec.		Shipped in 160 degree position.
M941C1022		30.0 or 60.0 sec.		Shipped in 90 degree position.
M941C1022		30.0 or 60.0 sec.		Shipped in 90 degree position. switch set at



	With 1 cam-adjusted Micro Switch spdt auxiliary switch and heavy-duty, vibration-resistant balancing relay.	15.0 or 30.0 sec.	Fixed at 10 angular degrees.	Shipped in 160 degree position. With tapped shaft.
M941C1006		30.0 or 60.0 sec.		Shipped in 160 degree position.
M941C1014		30.0 or 60.0 sec.		Shipped in 90 degree position.
M941C1022		30.0 or 60.0 sec.		Shipped in 90 degree position, switch set at 4 degrees of 90 degree stroke. Includes motor crank arm.
M941C1030		30.0 or 60.0 sec.		Shipped in 90 degree position, switch set at 4 degrees of 90 degree stroke. With tapped shaft.
M941C1063		30.0 or 60.0 sec.		
M941D1005	With 2 cam-adjusted Micro Switch spdt auxiliary switches and heavy-duty, vibration-resistant balancing relay.	30.0 or 60.0 sec.	Adjustable.	Shipped in 90 degree position; 1 switch set at 5 degrees and 1 set at 54 degrees of 90 degree stroke.
M941D1021		15.0 or 30.0 sec.		Shipped in 160 degree position. With tapped shaft.
M941D1039		30.0 or 60.0 sec.		Shipped in 90 degree position; 1 switch set at 5 deg. and 1 set at 54 degrees of 90 degree stroke. With tapped shaft.
M941D1047		30.0 or 60.0 sec.		Shipped in 160 degree position; 1 switch set at 120 degrees from closed position of 160 degree stroke on opening, 1 set at 35 degrees before closed end of 160 degree stroke.

<sup>a</sup>Shorter timing applies when 90 degree stroke is selected.  
Shipped in 90 degree position.

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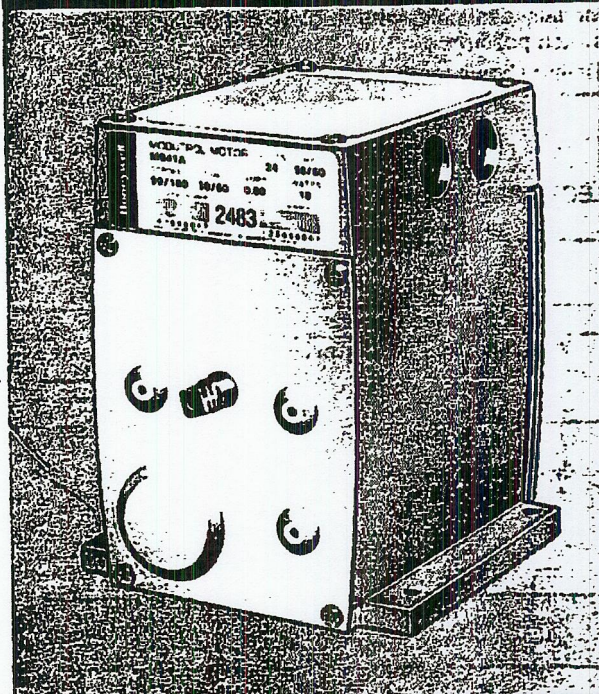


# Honeywell

THE M941 IS A LOW VOLTAGE, REVERSING, PROPORTIONAL MODUTROL MOTOR USED TO DRIVE VALVES, DAMPERS, OR AUXILIARY EQUIPMENT. IT IS ADAPTABLE TO COMMERCIAL OR INDUSTRIAL (OIL OR GAS) BURNER SYSTEMS.

- M941A,C, and D have an electronic, vibration resistant drive circuit.
- M941C has 1 cam-adjusted Micro Switch spdt auxiliary switch.
- M941D has 2 cam-adjusted Micro Switch spdt auxiliary switches.
- Auxiliary switch differential is factory set at 1° (selectable for 10°).
- M941C,D available with auxiliary switches factory adjusted for low or high fire switching.
- Motor stroke is field selectable to 90° or 160°.
- All models require 24 V power supply.
- Die-cast aluminum case.
- Direct drive feedback potentiometer.
- Interchangeable with other modulating motors. Use existing accessories.
- Accessories include weatherproofing kit and internal transformer.

## MODUTROL MOTOR



## M941A,C,D

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# SPECIFICATIONS

**MODELS:** The M941 is a reversible, proportioning motor with feedback potentiometer. For additional model characteristics refer to the table below.

**CRANKSHAFT:** Double ended, 3/8 in. square.  
**STROKE:** Dual—90° and 160° (field selectable).  
**TORQUE (lb.-in.):**

MODEL	TIMING <sup>b</sup> (sec.)	INTERNAL ELECTRONIC DRIVE CIRCUIT	INTERNAL AUXILIARY SWITCH
M941A	15 or 30 30 or 60 60 or 120	Yes	None
M941C	15 or 30 30 or 60	Yes	Spdt(1) <sup>a</sup>
M941D	15 or 30 30 or 60	Yes	Spdt(2) <sup>a</sup>

TIMING (Nominal)		NORMAL RUNNING TORQUE	BREAKAWAY TORQUE <sup>a</sup>
160° STROKE	90° STROKE		
30 sec	15.0 sec	75	150
1,2,4 min	1/2,1,2 min	150	300

<sup>a</sup>Models available with factory-set make and break switch position.  
<sup>b</sup>Timing shown for 90° and 160° respectively.

<sup>a</sup>The maximum torque available to overcome occasional large loads such as a seized damper or valve. **MUST NOT BE USED CONTINUOUSLY AT THIS RATING.**

**DEAD WEIGHT LOAD ON SHAFT:**  
 Power End—200 lb. [91 kg] maximum.  
 Auxiliary End—100 lb. [45 kg] maximum.  
**AMBIENT TEMPERATURE RATINGS:**  
 Maximum—130 F [54 C].  
 Minimum— -40 F [-40 C].

**ELECTRICAL RATINGS:**

M941A,C,D	VOLTAGE (50/60 Hz)	CURRENT DRAW (A)	POWER CONSUMPTION (W)
Without Transformer	24	0.80	18
With Internal Transformer	120 208 240	0.24 0.14 0.12	23

*continued on page 3*

## ORDERING INFORMATION

**WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALE OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY—**

1. Model number, TRADELINE if desired.
2. Voltage and frequency.
3. Timing.
4. Accessories, if desired.

**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 SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY).

**RESIDENTIAL DIVISION CUSTOMER SERVICE  
 HONEYWELL INC., 1885 DOULGAS DRIVE NORTH  
 MINNEAPOLIS, MINNESOTA 55422-4388 (612) 542-7508**

**(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.**

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DIMENSIONS: See Fig. 1.

**AUXILIARY SWITCH RATINGS (A):**

M941D—two spdt, type V3, snap switches.

M941C—one spdt, type V3, snap switch.

ONE CONTACT <sup>a</sup>	120 V	240 V
Full Load	7.2	3.6
Locked Rotor	43.2	21.6

<sup>a</sup>40 VA pilot duty, 120/240 Vac on opposite contact.

**SWITCH OPERATING POINT:** Field adjustable.

**SWITCH DIFFERENTIAL:**

Factory set at 1°, selectable for 10°.

**UNDERWRITERS LABORATORIES, INC. LISTED:**

M941A,C,D. File No. E4436, Guide No. XAPX.

**NOTE:** Only line voltage models and those with auxiliary switches require Underwriters Laboratories, Inc. listing.

**ACCESSORIES:**

**DHE-94 Explosion-proof Housing—**encloses motor for use in explosive atmospheres. Not for use with Q601 and Q455 Linkages. Order separately from Crouse-Hinds Co. Requires Honeywell 7617DM Coupling.

**Transformers—**mounted internally. Include mounting screws and barrier.

7640PK—120 Vac; 50/60 Hz.

7640PL—220 Vac; 50/60 Hz.

7640PN—120/208/240 Vac; 50/60 Hz.

**Q607 Auxiliary Switch—**controls auxiliary equipment as a function of motor position.

**Q605 Damper Linkage—**connects motor to damper; includes motor crank arm.

**Q601 Linkage—**connects motor to water or steam valve.

**Q618 Linkage—**connects Modutrol motor to water or steam valve.

**Q100 Linkage—**connects Modutrol motor to butterfly valve.

**Q181A Auxiliary Potentiometer—**for control of auxiliary motor.

**7640JS Weatherproofing Kit—**weatherproofs the M941 Modutrol Motor.

**7616BR Motor Crank Arm—**included with Q605 but not with motor.

**7640PP Screw Terminal Adapter—**use to convert M941A,C,D quick-connect terminals to screw terminals.

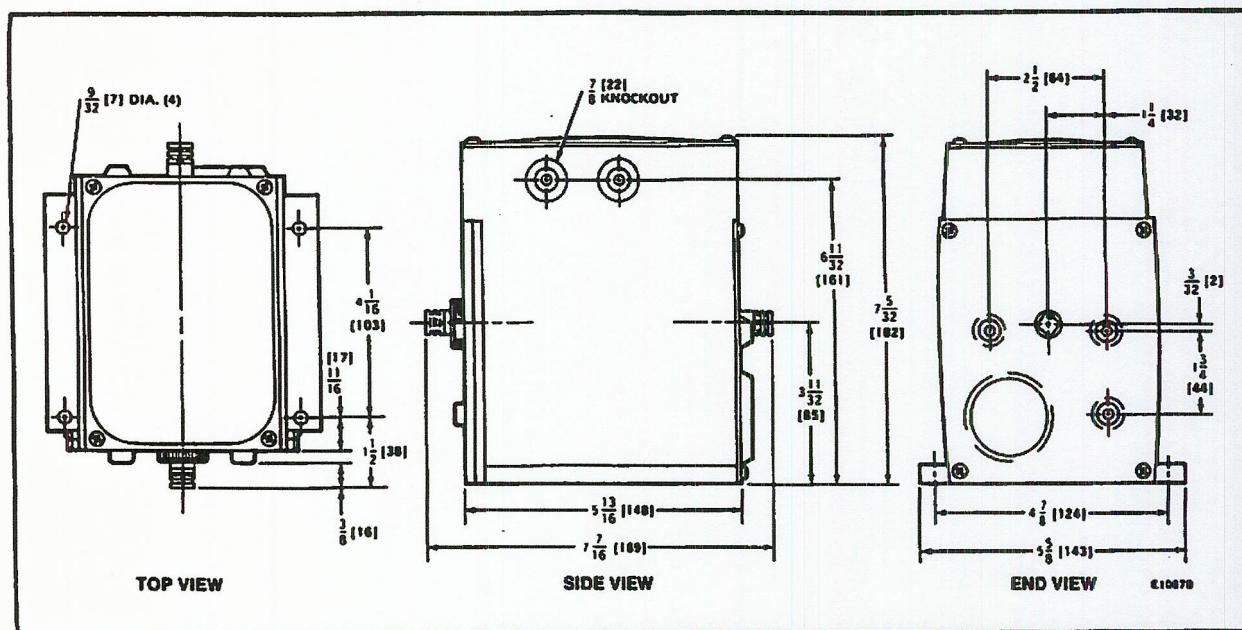


FIG. 1—APPROXIMATE DIMENSIONS OF M941 MOTORS IN in. [mm SHOWN IN BRACKETS].

# 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 electric shock or equipment damage.
2. Do not attempt to turn the motor shaft by hand or with a wrench. Damage to the gear train will result.

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## 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 other explosive vapors. Motors are rated for ambient temperatures between -40 F and 130 F. If located outdoors, use weatherproofing kit; see Accessories section.

Allow enough clearance for installing accessories and servicing the motor when selecting a location. See Fig. 1.

## MOUNTING

Always install the motor with the crankshaft horizontal. Mounting flanges extending from the bottom of the motor housing are drilled for 1/4 in. machine screws or bolts.

All M941 motors are shipped from the factory in the closed position, which is the limit of counterclockwise rotation as viewed from the power end of the motor.

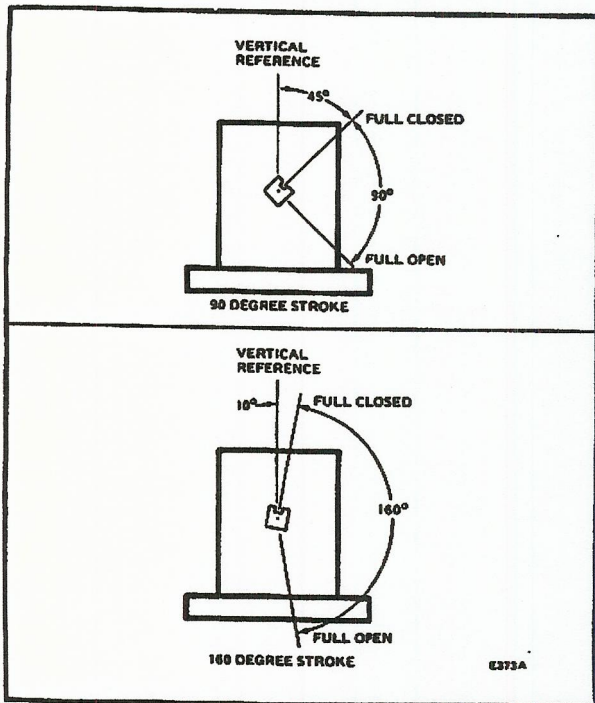


FIG. 2—MOTOR SHAFT POSITION AT ROTATIONAL LIMITS (as viewed from the power end of the motor).

## INSTALLING LINKAGES

The motor comes without a crank arm. The motor 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 valves and louver type dampers should be adjusted so that the damper or valve 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.

## WIRING

Disconnect power supply before wiring to prevent electrical shock or equipment damage.

All wiring must agree with applicable codes, ordinances, and regulations.

Make sure that the voltage and frequency stamped on the motor correspond to the characteristics of the power supply.

Applications using M941B that required external M9107A balance relay should be replaced using M941A,C or D motors and eliminating R9107 relay. In this case, disconnect R9107 and connect series 90 controller directly to motor terminals as shown in Fig. 3.

Figs. 3-4 show internal schematics and terminal connections to the M941 motors.

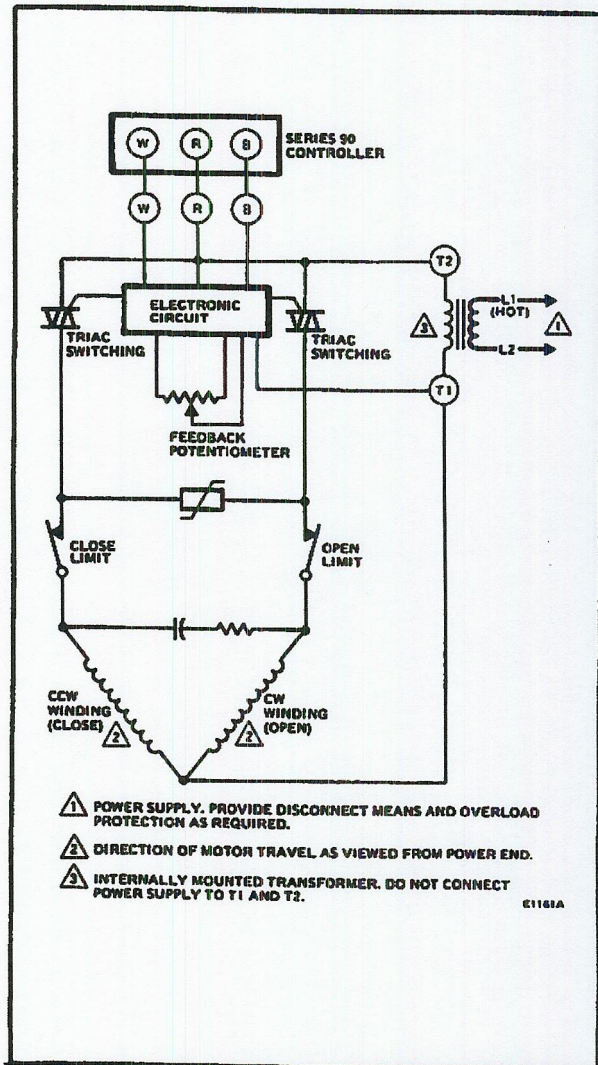


FIG. 3—M941A, C, AND D INTERNAL SCHEMATIC AND BASIC EXTERNAL CONNECTIONS.

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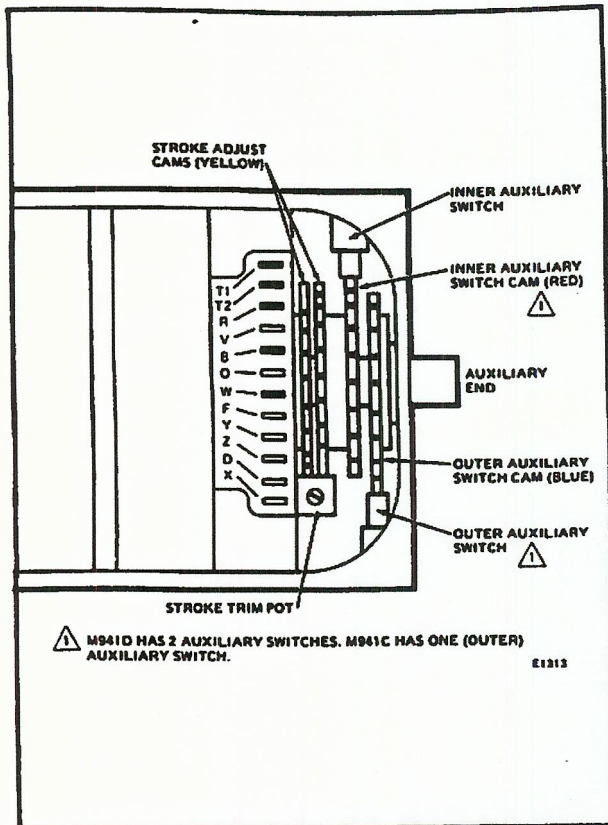


FIG. 4—M941A,C,D TERMINALS AND ADJUSTMENTS.

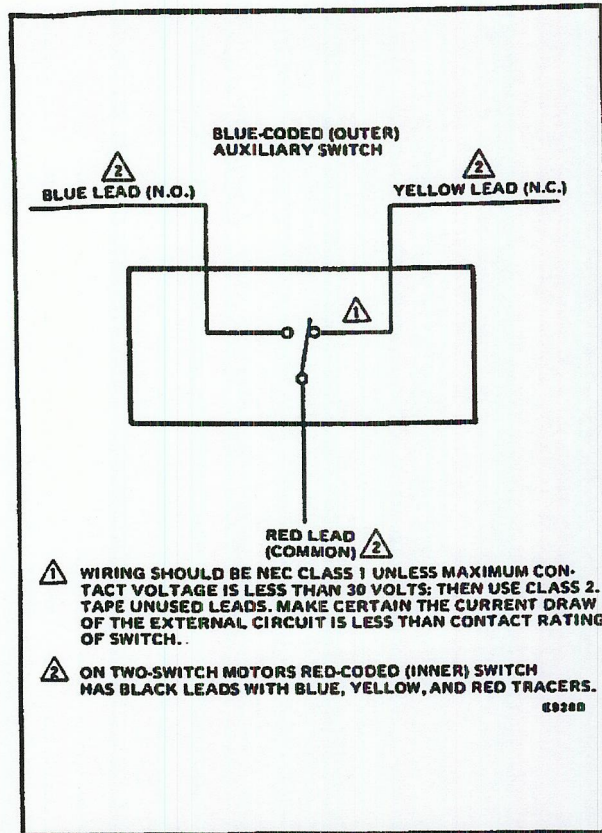


FIG. 5—AUXILIARY SWITCH CONNECTIONS.

## AUXILIARY SWITCH CONNECTIONS

### CAUTION

Disconnect all power supplies to de-energize the auxiliary switches before servicing.

#### M941C

The M941C has 1 internal auxiliary switch. The switch wires are color-coded as follows: solid yellow—normally closed (N.C.); solid red—common (COM.); solid blue—normally open (N.O.). Refer to Fig. 5.

#### SWITCH/CAM COLOR-CODING:

SWITCH LOCATION <sup>a</sup>	CAM ASSEMBLY LOCATION <sup>a</sup>	SWITCH/CAM COLOR CODE	SWITCH WIRES <sup>b</sup>	
			COLOR	DESIGNATION
Left	Outer	Blue Dot	Solid Yellow	Normally Closed (N.C.)
			Solid Red	Common (COM.)
			Solid Blue	Normally Open (N.O.)
Right	Inner	Red Dot	Yellow Tracer	Normally Closed (N.C.)
			Red Tracer	Common (COM.)
			Blue Tracer	Normally Open (N.O.)

<sup>a</sup>Viewed from auxiliary end of motor.

<sup>b</sup>See Fig. 5.

#### M941D

The M941D has 2 internal auxiliary switches which may be used to prove low fire and high fire positions (see Fig. 5).

1. To prove low fire use red (common) and yellow wires connected to outer switch. This switch makes red to yellow and breaks red to blue as motor closes.

2. Wires connected to the inner switch are black with colored tracers. To prove high fire, use red tracer (common) and blue tracer wires. The right switch makes red tracer to blue tracer and breaks red tracer to yellow tracer as motor opens.

Color coding and switching action are tabulated below to aid the installer.

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**SWITCHING ACTION:**

SWITCH LOCATION <sup>a</sup>	NORMAL FUNCTION	MAKES	BREAKS	CAM POSITION <sup>b</sup>	MOTOR POSITION
Left	Proves Low Fire Position	Red to Yellow	Red to Blue	Operational Cam Lobe not in Contact with Cam Roller	Closing
Right	Proves High Fire Position	Red Tracer to Blue Tracer	Red Tracer to Yellow Tracer	Operational Cam Lobe in Contact with Cam Roller	Opening

<sup>a</sup>Viewed from auxiliary end of motor.

<sup>b</sup>See Fig. 7.

# SETTINGS AND ADJUSTMENTS

## STROKE SETTING

On M941A,C,D motors, stroke is field selectable and can be set for 90° or 160° (as shipped). In order to set stroke, both mechanical and electrical adjustments are required. The mechanical adjustments (cams) establish the full open and full closed positions of the motor shaft. The electrical adjustment (trim pot) provides sufficient total stroke angle to ensure that cams will actuate both limit switches.

### STROKE SETTING PROCEDURE (Fig. 6)

CAUTION

Detach linkage from motor before adjusting stroke.

#### BEFORE SETTING STROKE:

1. Remove top cover from motor.
2. Disconnect controller from motor.
3. Connect R,B,W terminals on 135 ohm pot to matching terminals on motor.

#### SETTING 160° STROKE

1. Turn trim pot fully clockwise
2. Drive motor to mid-position, using 135 ohm pot.
3. Insert 1/8 in. screwdriver blade into slot on inner yellow cam and MOVE TOP OF SCREWDRIVER as far as possible counterclockwise . Repeat in successive cam slots until inner cam is against counterclockwise stop.

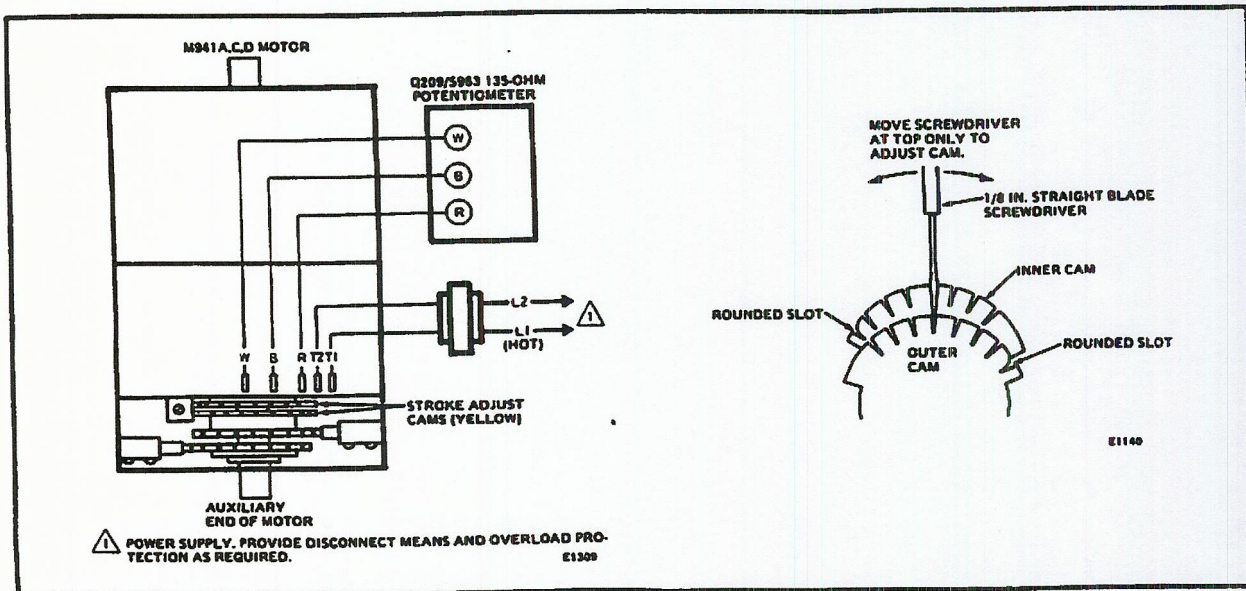
IMPORTANT

Set cams by moving top of screwdriver only. Pressing screwdriver against sides of cam slots could cause damage to motor end switches.

4. Insert 1/8 in. screwdriver blade into slot on outer yellow cam and MOVE TOP OF SCREWDRIVER as far as possible clockwise . Repeat in successive cam slots until outer cam is against clockwise stop.

NOTE: Excessive force will damage end switch.

5. Check motor stroke before connecting linkage.
6. Disconnect 135 ohm pot, reconnect controller, replace top cover and attach linkage to motor.



**FIG. 6—STROKE ADJUSTMENT SETUP.**

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### SETTING 90° STROKE

1. Turn trim pot fully counterclockwise .
2. Drive motor to mid-position, using 135 ohm pot.
3. Insert 1/8 in. screwdriver blade into slot on inner yellow cam and MOVE TOP OF SCREWDRIVER as far as possible clockwise. Repeat in successive cam slots until inner cam is against clockwise stop.

#### IMPORTANT

Set cams by moving top of screwdriver only. Pressing screwdriver against sides of cam slots could cause damage to motor end switches. Motor must be at mid-position.

4. Insert 1/8 in. screwdriver blade into slot on outer yellow cam and MOVE TOP OF SCREWDRIVER as far as possible counterclockwise . Repeat in successive cam slots until outer cam is against counterclockwise stop.

NOTE: Excessive force will damage end switch.





5. Check motor stroke before connecting linkage.
6. Disconnect 135 ohm pot, reconnect controller, replace motor top cover and attach linkage to motor.

### AUXILIARY SWITCHES

The auxiliary switches in M941C,D 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.

Motors are shipped in the closed position with auxiliary cams set to actuate switches 30° from the closed position, and to provide 1° differential. (Some cams set other positions.) With motor in closed position, auxiliary switch breaks R-B and makes R-W.

### AUXILIARY SWITCH SETTING PROCEDURE— (Fig. 7)

1. Remove top cover from motor to gain access to motor terminals and auxiliary cams.
2. Disconnect controller from motor and connect 135 ohm manual potentiometer with R,W,B terminals on pot connected to corresponding terminals on motor.
3. Drive the motor to the desired position where auxiliary equipment is to be switched by adjusting the 135 ohm pot.
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 counterclockwise  until R-B contacts close.
  - b. If contacts are closed, rotate cam clockwise  until R-B contacts open.
5. For switch differential of 10°, 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.
6. Check for proper differential and switching of auxiliary equipment by driving motor through full stroke (in both directions), using the 135 ohm pot. If necessary, repeat differential adjustments.
7. Disconnect 135 ohm pot, reconnect controller and replace top cover on motor.

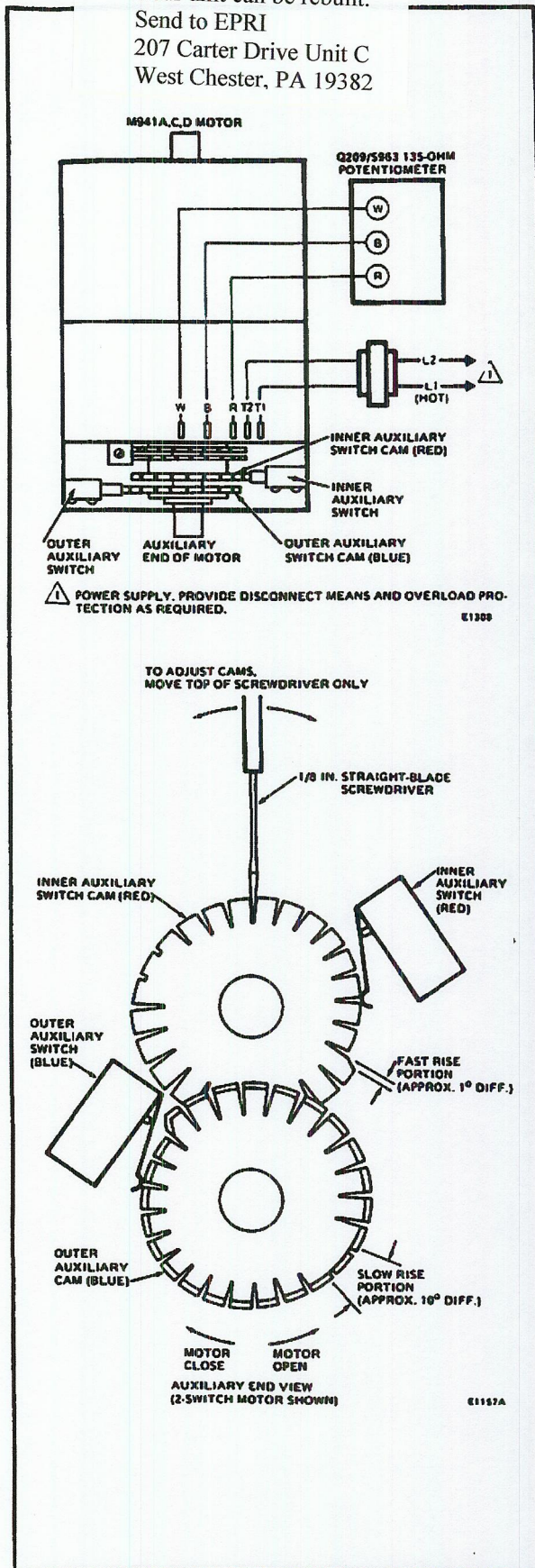


FIG. 7—AUXILIARY SWITCH ADJUSTMENT.



## OPERATION

### MODULATING SERIES 90 CIRCUIT

The 2 potentiometers, one in the controller and one in 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.

## CHECKOUT

After installation and linkage adjustment, check the entire motor and control hookup to prove 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.

M941 motors are shipped in the fully closed position (the limit of counterclockwise rotation as viewed from the power end of the motor).

To check operation of M941 motors, jumper R to W to close, or R to B to open the motor.

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