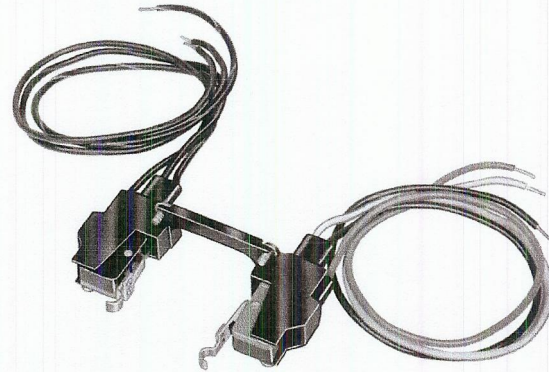


220736A,B Internal Auxiliary Switches

220736A,B Internal Auxiliary Switch kits can be installed in TRADELINE models of Modutrol IV Motors to control auxiliary equipment as a function of motor shaft position.



- The 220736A includes one Spdt Micro Switch V3 precision switch.
- The 220736B includes two Spdt Micro Switch V3 precision switches.
- Either kit can be installed in any Tradeline Modutrol IV Motor.
- Kits provide switch mounting bracket for easy installation internal to motor.
- The auxiliary switches are actuated by adjustable cams inside the motor. These cams can be set to

actuate the switches at any angle within the stroke of the motor. Only Modutrol IV TRADELINE models are equipped with the cam assemblies for actuating field-addable auxiliary switches. Switch adjustment procedures are the same as that for switches that come factory installed in Modutrol IV Motor models.

- Switch differentials of 1° or 10° can be selected.
- Leadwires color coded to ease correct wiring of auxiliary equipment.

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Specifications

MODELS: 220736A,B Internal Auxiliary Switches for TRADELINE Modutrol IV Motors. Switches are actuated by cams in the motor. The cams can be set to operate the switches at any point in the motor stroke.

220736A—Includes one Spdt Micro Switch V3 snap acting switch, mounted on left side and operated by outer cam.

220736B—Includes two Spdt Micro Switch V3 snap acting switches.

SWITCH DIFFERENTIAL (difference between switch make and break points): Approximately 1 or 10 degrees, determined by cam setting.

MOUNTING: Switches factory-installed on bracket designed for mounting inside motor.

WIRING: Color-coded, 15 in. [381 mm] leadwires.

ELECTRICAL RATINGS:

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.

Installation



CAUTION

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

NOTE: The wire colors of the 220736A,B auxiliary switches are different from those of factory installed auxiliary switches. See Tables 1-3 and Fig. 2.

1. When replacing a Modutrol motor determine origi-

nal motor model number and refer to Tables 1-3.

2. From the appropriate table, determine switch leadwire color coding and configuration (N.O. and N.C. contacts).

3. For wiring convenience, make note of the difference between the replaced motor and field addable switch color coding.

4. Disconnect and remove the motor to be replaced.

5. Remove the cover from the wiring box of the TRADELINE Modutrol IV motor.

6. Check motor for proper stroke setting. Adjust stroke as needed. Refer to motor specification sheet.

7. Position the switch assembly above the motor as shown in Fig. 1.

Ordering Information

When purchasing replacement and modernization products from your TRADELINE wholesaler or your distributor, refer to the TRADELINE catalog or price sheets for complete ordering number, or specify—

1. Order number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. EPRI Edgemont Precision Rebuilders, Inc., Controls Division Sales Office. (Check white pages of your phone directory.)
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207 Carter Drive

2. West Chester, PA 19382
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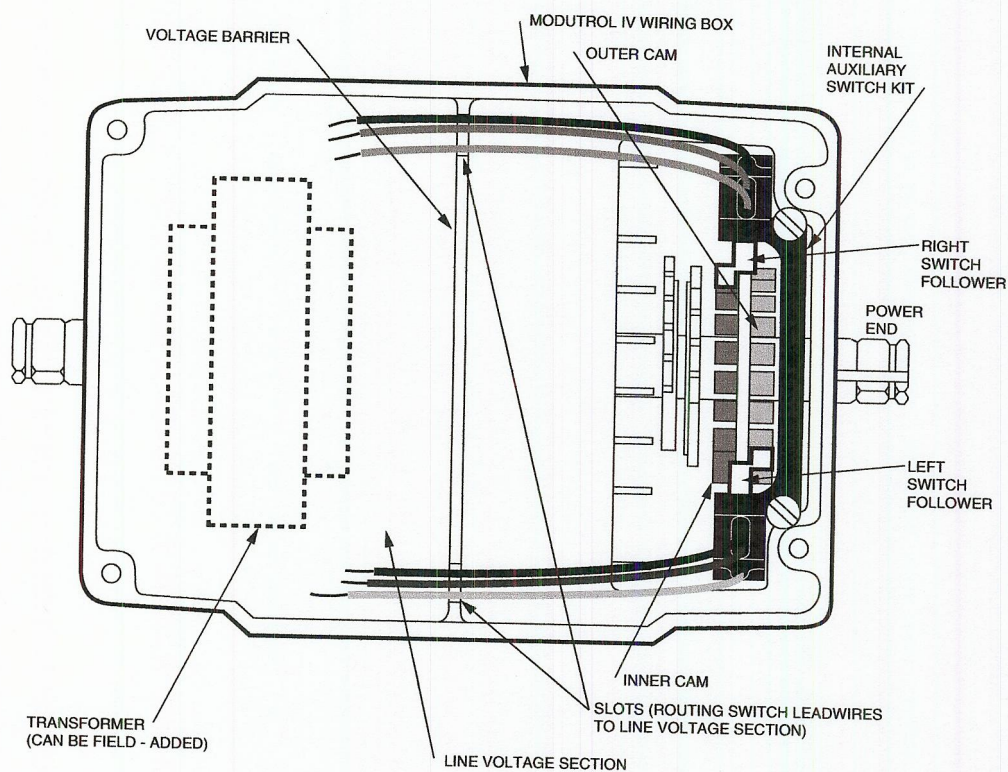
8. Lower the switch assembly into place and tighten the two mounting screws, making sure the switch followers are properly aligned with the inner and outer cams in the motor. The 220736A includes only the switch for the outer cam.

9. Run all switch leadwires through slots to line voltage section (at auxiliary end of motor), where connections to auxiliary equipment should be made with solderless connectors.

! CAUTION

The auxiliary switches in the Series 91 low and medium torque TRADELINE Modutrol IV Motors operate opposite to those in the Modutrol motors listed in Tables 1 and 2, page 4. When wiring the switches, connect the new switches to the controlled equipment as shown in the appropriate table.

Fig. 1—Position of auxiliary switch(es) in motor.



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TABLE 1—AUXILIARY SWITCH LEADWIRE COLORS FOR LOW AND MEDIUM TORQUE SERIES 91 MOTORS WITH ONE AUXILIARY SWITCH.

Left Auxiliary Switch	Factory-Installed Auxiliary Switch Leadwire Color ^{a,b}					Replace with 220736A,B Leadwire
	N.O.	Yellow	W/Yellow			
N.C.	Blue	W/Blue				Purple
Com.	Red	W/Red				Red
Right Auxiliary Switch						
N.O.			B/Yellow		B/Yellow	B/Orange
N.C.			B/Blue	B/Yellow		B/Purple
Com.			B/Red	B/Red	B/Red	B/Red
Motor	M9171B1012 M9171B1020 M9174B1019 M9174B1027 M9174B1035 M934D1026 M934D1059	M734D1053 M9164B M934A1565	M7161B M7164B M734J1072 M934A1433	M9171B1004 M9174B1001 M9174B1043 M934D1000	M9172W M9175W M975B1021 M975B1039	M9164D1009 M9174D1007 M9175D1014 Motors with 220736A,B Auxiliary Switch Kit

^a Wiring should be NEC Class 1 unless power supply meets Class 2 requirements. Tape unused leads. Make certain the current draw of the external circuit is less than contact rating of switch.

^b W/color= white wire with colored tracer.

B/color=black wire with colored tracer.

color = solid color wire.

TABLE 2—AUXILIARY SWITCH LEADWIRE COLORS FOR LOW AND MEDIUM TORQUE SERIES 91 MOTORS WITH TWO AUXILIARY SWITCHES.

Left Auxiliary Switch	Factory-Installed Auxiliary Switch Leadwire Color ^{a,b}				Replace with 220736A,B Leadwire
	N.O.	Yellow	W/Blue	W/Yellow	W/Yellow
N.C.	Blue		W/Blue		Purple
Com.	Red	W/Red	W/Red	W/Red	Red
Right Auxiliary Switch					
N.O.	B/Blue		B/Yellow	B/Yellow	B/Orange
N.C.	B/Yellow	B/Yellow	B/Blue		B/Purple
Com.	B/Red	B/Red	B/Red	B/Red	B/Red
Motor	M9171C M9174C1017 M9174C1025 M9174C1041 M934D1034 M934D1042	M9174C1009 M9174C1033 M934D1018	M9161C M9164C M9172C M934A1243 M934A1250 M934A1268 M934A1276 M934A1292 M934A1318 M965B1030	M9175Y M975B1047 M975B1062	M9164D1009 M9174D1007 M9175D1014 Motors with 220736A,B Auxiliary Switch Kit

^a Wiring should be NEC Class 1 unless power supply meets Class 2 requirements. Tape unused leads. Make certain the current draw of the external circuit is less than contact rating of switch.

^b W/color= white wire with colored tracer.

B/color=black wire with colored tracer.

color = solid color wire.

TABLE 3—AUXILIARY SWITCH LEADWIRE COLORS FOR ALL MOTOR SERIES EXCEPT LOW AND MEDIUM TORQUE SERIES 91 (See Tables 1 and 2).

Left Auxiliary Switch	N.O. N.C. Com.	Factory-Installed Auxiliary Switch Leadwire Color ^{a,b}					Replace with 220736A,B Leadwire	
		Blue	Blue		W/Yellow	Purple		
Right Auxiliary Switch	N.O.		B/Blue	B/Yellow			B/Purple	
	N.C.		B/Yellow				B/Orange	
	Com.		B/Red	B/Red			B/Red	
Motor		M445A	M4182B	M644D	M6181F	M9182W	M8175B M865B	M6184D1035
		M644E	M4185B	M744T	M6182F			M6194D1017
		M644L	M4185E	M744Y	M6184F			M6284D1000
		M845A	M4186H	M745T	M6194F			M6285A1005
		M845E	M4186L	M745Y	M6281F			M6285A1013
		M941C	M6161B	M941D	M6284C			M6294D1008
		M944B	M6184B	M944D	M6284F			M8185D1006
		M944C	M6191B	M944E	M6285C			M9184D1013
		M944G	M6194B	M944S	M7281C			M9184D1021
		M944H	M6194E	M945C	M7281Q			M9185D1004
		M954C	M6282B	M945D	M7284C			M9194D1003
		M955C	M6282E	M954B	M7284Q			Motors with 220736A,B Auxiliary Switch Kit
		M955E	M6284B	M954D	M7285C			
			M6285B	M955F	M7285Q			
			M6294B		M9181C			
			M8182B		M9182C			
			M8185B		M9184C			
			M9181B		M9184F			
			M9184B		M9185C			
			M9184E		M9481F			
			M9185B		M9484F			
			M9185E					
			M9194E					
			M9481E					
			M9484E					

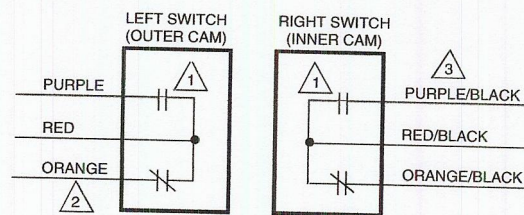
- ^a Wiring should be NEC Class 1 unless power supply meets Class 2 requirements. Tape unused leads. Make certain the current draw of the external circuit is less than contact rating of switch.
- ^b W/color = white wire with colored tracer.
B/color = black wire with colored tracer.
color = solid color wire.

WIRING

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

All wiring must comply with local codes and ordinances. Do not exceed switch ratings of auxiliary switches.

Fig. 2—Auxiliary Switch Wiring Diagram.



- ¹ Wiring should be NEC Class 1 unless power supply meets Class 2 requirements. Tape unused leads. Make certain the current draw of the external circuit is less than contact rating of switch.
- ² Switch leads on 220736A single-switch kit same as left switch above.
- ³ Colors are tracers on black background.

M418C

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Setting and Adjustments

AUXILIARY SWITCHES

The auxiliary switches are spdt switches that are actuated by adjustable cams. The cams are factory mounted on the motor shaft at the power end of the motor. The settings of the cams determine the point in motor shaft rotation at which the auxiliary equipment will be switched on or off. These cams can be set to actuate the switches at any angle within the stroke of the motor. All TRADELINE motors include auxiliary switch cams which permit installation of this auxiliary switch kit (220736A, 220736B).

NOTE: When the slow-rise portion of the cam is used, the switching differential is approximately 10° of rotation. When the fast-rise portion of the cam is used, the switch differential is approximately 1° of rotation. Do not use the fast rise portion of the cam if fast cycling of auxiliary equipment is undesirable.

AUXILIARY SWITCH ADJUSTMENT PROCEDURE



WARNING

**FIRE OR EXPLOSION HAZARD
 CAN CAUSE SEVERE INJURY OR DEATH**

When auxiliary switches control combustion equipment, incorrect wiring of the switches can allow the burner to come on at high fire. Check auxiliary switch wiring and cam adjustment before turning on the system. Watch the controlled equipment through one complete cycle. Shut the system down immediately if switches do not correctly sequence the equipment.



CAUTION

1. Live circuits are exposed during auxiliary switch adjustment procedure. Always turn off power before adjusting switch cams.
2. Do not turn motor shaft by hand or with wrench as damage to the motor can result.

NOTE: The following instructions are for normally closed motors (motor shaft rotates clockwise, as viewed from the power end of the motor, on an increase in signal).

Exact adjustment procedures vary for different TRADELINE motor models. Find your model on the following list. Then proceed to the correct section for that model.

Motor Model	Section
M8185	A
M9164, M9174, M9175	B
M9184, M9185, M9194	C
M6284, M6294	D
M6285	E
M6184, M6194	F

Additional instructions may also be found in the Auxiliary Switch Adjustment section in the specification sheet included with the Modutrol IV Motor.

Review Table 4 and Fig. 3 before adjusting cams. Table 4 applies to both the left and right switches.

TABLE 4—AUXILIARY SWITCH POSITION WITH MOTOR SHAFT ROTATED TO EITHER SIDE OF AUXILIARY SWITCH OPERATING POINT, AS VIEWED FROM POWER END.

Motor Type	Cam Arrangement	Switch Differential	Auxiliary Switch Contact Positions			
			N.O. Contact ^a (Red and Purple Leads)		N.C. Contact ^a (Red and Orange Leads)	
			Shaft Rotated ccw of Switch Operating Point	Shaft Rotated cw of Switch Operating Point	Shaft Rotated ccw of Switch Operating Point	Shaft Rotated cw of Switch Operating Point
TRADELINE, low and medium torque, series 91	Red inner cam, blue outer cam	1°	Closed	Open	Open	Closed
		10°	Open	Closed	Closed	Open
All other TRADELINE motors	Blue inner cam, red outer cam	1°	Open	Closed	Closed	Open
		10°	Closed	Open	Open	Closed

^a cw = clockwise
 ccw = counterclockwise

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To turn the cams, insert small screwdriver (1/8" or 3 mm blade) through wiring box into slot on cam and move the screwdriver at the top. Refer to Fig. 3. Each division on the cam represents 15° of motor rotation.

A) Two position motors (M8185):

1. Turn off power and remove cover of wiring box.
2. Determine amount of shaft rotation, in degrees, desired before switch is energized.
3. Note the position of the cam slots and, with screwdriver, rotate the cam to the desired position for switch

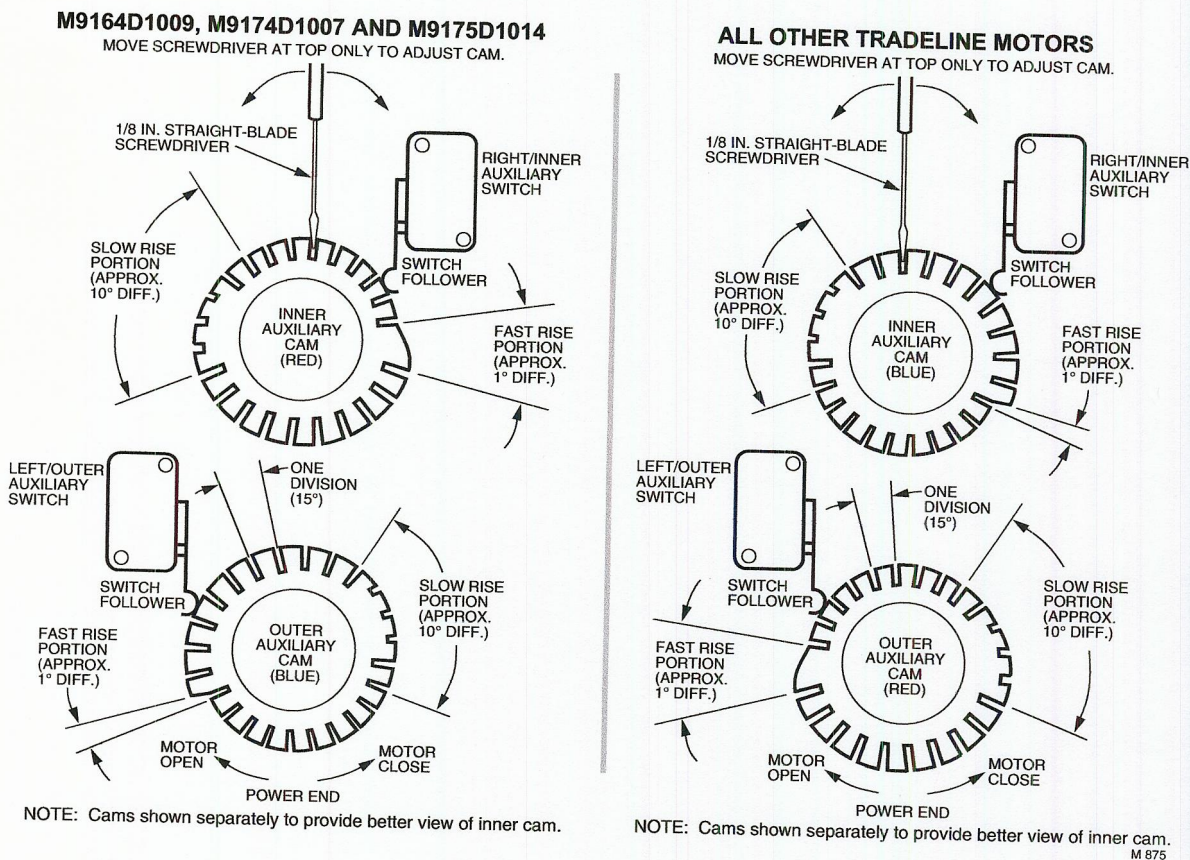
action. Each division on the cam represents 15° of motor rotation. Therefore, if 60° of motor rotation is desired before switch operates, rotate the cam 4 divisions from the reference point.

4. Connect auxiliary equipment to auxiliary switch leads. See Wiring section.

5. Turn on power and check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions). If necessary repeat steps 3 and 5 until correct switching action is obtained.

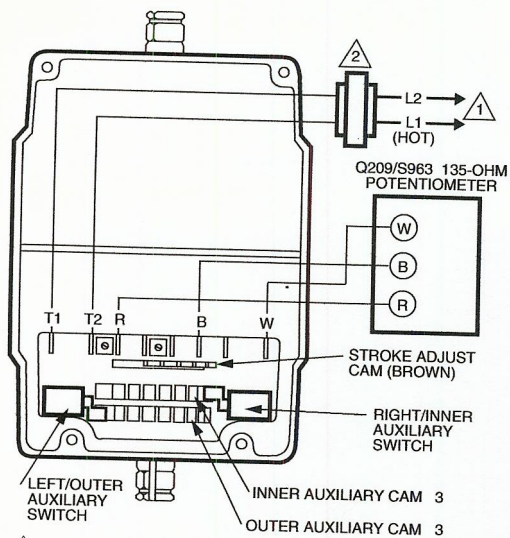
6. Replace cover of wiring box.

Fig. 3—Auxiliary switch adjustment.



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Fig. 4—Auxiliary switch adjustment for low and medium torque, Series 91 motors.



- 1 Power supply. Provide disconnect means and overload protection as required.
- 2 Transformer may be external or internal.
- 3 Cam arrangement varies as shown in table.

MOTOR MODEL	INNER CAM	OUTER CAM
M9164D1009, M9164D1007, M9175D1014	Red	Blue
ALL OTHER TRADELINE MOTORS	Blue	Red

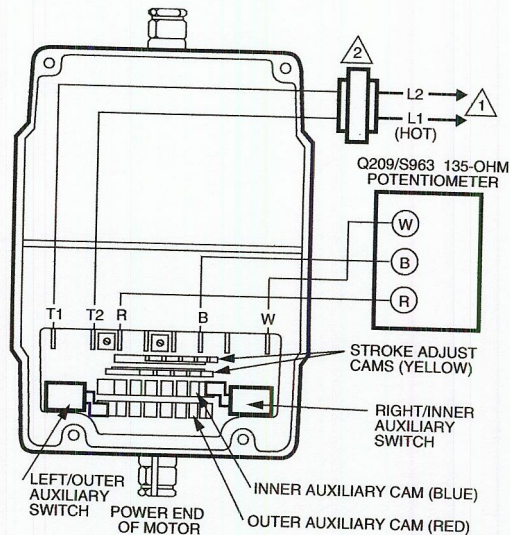
M 851

B) Low and Medium Torque, Series 91 Modulating (Proportional) Motors (M9164, M9174, M9175):

- Turn off power and remove cover of wiring box.
- Disconnect controller from motor.
- Connect 135 ohm potentiometer to terminals R, W, and B as shown in Fig. 4. Restore power.
- Adjust potentiometer to drive motor to the position where auxiliary equipment is to be switched.
- For switch differential of 1° , check continuity of auxiliary switch N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:
 - If contacts are open, rotate cam counterclockwise until N.O. (Red to Purple) contacts close.
 - If contacts are closed, rotate cam clockwise until N.O. (Red to Purple) contacts open.
- For switch differential of 10° , the cams must be rotated with screwdriver approximately 180° prior to setting switching action. Refer to Fig. 3. Check continuity of the N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:
 - If contacts are open, rotate cam clockwise until N.O. (Red to Purple) contacts close.
 - If contacts are closed, rotate cam counterclockwise until N.O. (Red to Purple) contacts open.

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Fig. 5—Auxiliary switch adjustment for high and extra high torque Series 91 motors.



- 1 Power supply. Provide disconnect means and overload protection as required.
- 2 Transformer may be external or internal.

M 852

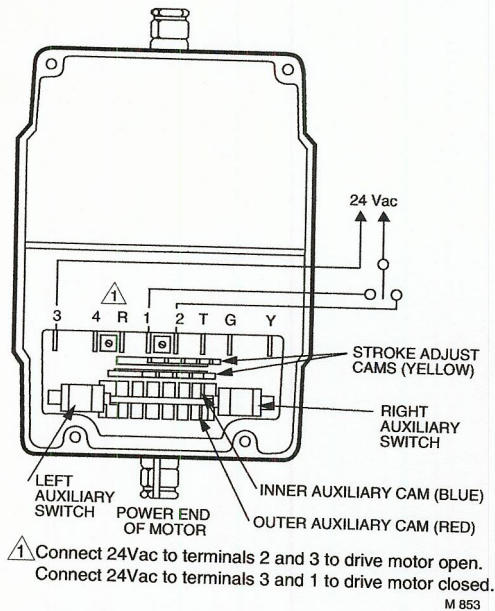
7. Check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions) using the potentiometer. If necessary repeat steps 5 and 7 for 1° differential, or 6 and 7 for 10° differential until correct switching action is obtained.

- Turn off power and disconnect potentiometer.
- Connect auxiliary equipment to auxiliary switch leads. See Wiring section.
- Reconnect controller and power supply to motor.
- Replace cover of wiring box. Turn on power.

C) High and Extra High Torque, Series 91 Modulating (Proportional) Motors (M9184, M9185, M9194):

- Turn off power and remove cover of wiring box.
- Disconnect controller from motor.
- Connect 135 ohm potentiometer to terminals R, W, and B as shown in Fig. 5. Restore power.
- Adjust potentiometer to drive motor to the position where auxiliary equipment is to be switched.
- For switch differential of 1° , check continuity of auxiliary switch N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:
 - If contacts are open, rotate cam clockwise until N.O. (Red to Purple) contacts close.
 - If contacts are closed, rotate cam counterclockwise until N.O. (Red to Purple) contacts open.
- For switch differential of 10° , the cams must be rotated with screwdriver approximately 180° prior to setting switching action. Refer to Fig. 3. Check continuity of the N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:

Fig. 6—Auxiliary switch adjustment for M6284, M6294 motors



- a. If contacts are open, rotate cam counterclockwise until N.O. (Red to Purple) contacts close.
- b. If contacts are closed, rotate cam clockwise until N.O. (Red to Purple) contacts open.
7. Check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions) using the potentiometer. If necessary repeat steps 5 and 7 for 1° differential, or 6 and 7 for 10° differential until correct switching action is obtained.
8. Turn off power and disconnect potentiometer.
9. Connect auxiliary equipment to auxiliary switch leads. See Wiring section.
10. Reconnect controller and power supply to motor.
11. Replace cover of wiring box. Turn on power.

D) Series 62 Floating Control with Feedback Non-Spring Return Motors (M6284, M6294):

1. Turn off power and remove cover of wiring box.
2. Disconnect controller from motor.
3. Connect 24 Vac power through switches or directly to quick-connect terminals to drive motor to position where auxiliary equipment is to be switched. Refer to Fig. 6. Turn on power. Connecting power to terminals 2 and 3 will drive motor in the open direction, connecting power to terminals 3 and 1 will drive the motor in the closed direction. To stop the motor at desired position, remove power from motor. Motor will remain at this position until power is restored.
4. For switch differential of 1°, check continuity of auxiliary switch N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:

- a. If contacts are open, rotate cam clockwise until N.O. (Red to Purple) contacts close.
- b. If contacts are closed, rotate cam counterclockwise until N.O. (Red to Purple) contacts open.

5. For switch differential of 10°, the cams must be rotated with screwdriver approximately 180° prior to setting the switching action. Refer to Fig. 3. Check continuity of the N.O. (Red to Purple) contacts and rotate cams as follows:

- a. If contacts are open, rotate cam counterclockwise until N.O. (Red to Purple) contacts close.
- b. If contacts are closed, rotate cam clockwise until N.O. (Red to Purple) contacts open.

6. Check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions). If necessary repeat steps 4 and 6 for 1° differential, or 5 and 6 for 10° differential until correct switching action is obtained.

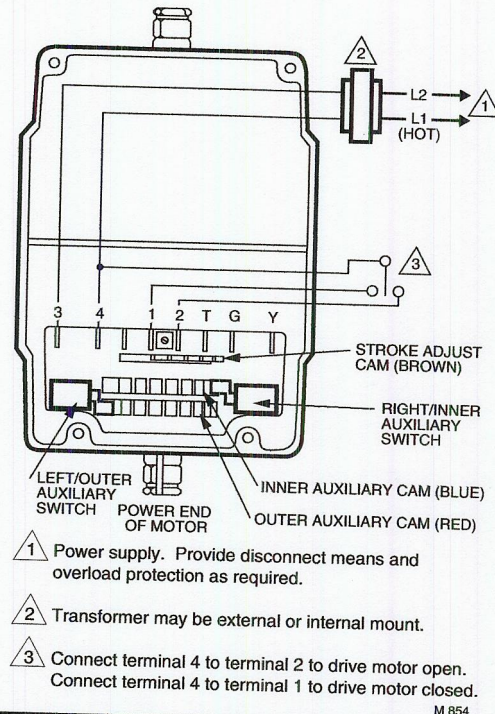
7. Disconnect power from switches or quick-connect terminals.

8. Connect auxiliary equipment to auxiliary switch leads. See Wiring section.

9. Reconnect controller and power supply to motor.

10. Replace cover of wiring box.

Fig. 7—Auxiliary switch adjustment for M6285 motors.



E) Series 62 Floating Control with Feedback Spring Return Motors (M6285):

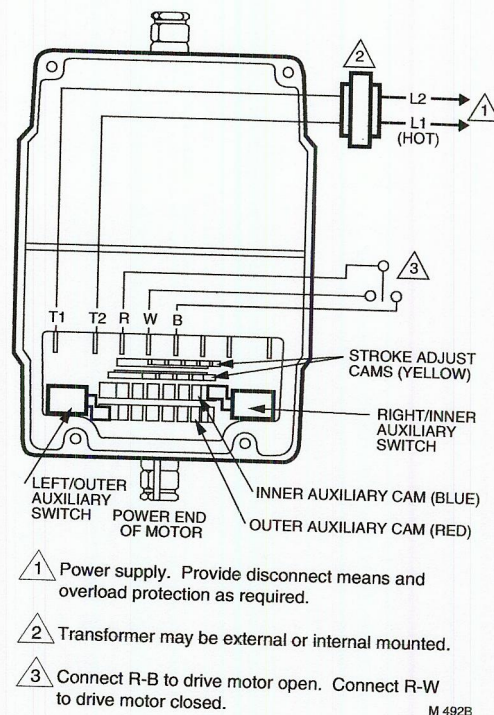
1. Turn off power and remove cover of wiring box.
2. Disconnect controller from motor.
3. Connect 24 Vac power and switches to drive motor to position where auxiliary equipment is to be switched. Refer to Fig. 7. Turn on power. Jumpering terminals 4 and 2 will drive motor in the open direction, jumpering terminals 4 and 1 will drive the motor in the closed direction. To stop the motor at desired position, disconnect jumpers. Motor will remain at this position until connection is restored. Removing power at this point will cause motor to spring return to closed position.

4. For switch differential of 1° , check continuity of auxiliary switch N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:
 - a. If contacts are open, rotate cam clockwise until N.O. (Red to Purple) contacts close.
 - b. If contacts are closed, rotate cam counterclockwise until N.O. (Red to Purple) contacts open.
5. For switch differential of 10° , the cams must be rotated with screwdriver approximately 180° prior to setting the switching action. Refer to Fig. 3. Check continuity of the N.O. (Red to Purple) contacts and, with screwdriver, rotate cam as follows:
 - a. If contacts are open, rotate cam counterclockwise until N.O. (Red to Purple) contacts close.
 - b. If contacts are closed, rotate cam clockwise until N.O. (Red to Purple) contacts open.
6. Check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions). If necessary, repeat steps 4 and 6 for 1° differential, or 5 and 6 for 10° differential until correct switching action is obtained.
7. Disconnect power from switches or quick-connect terminals.
8. Connect auxiliary equipment to auxiliary switch leads. See Wiring section.
9. Reconnect controller and power supply to motor.
10. Replace cover of wiring box.

F) Series 61 Floating Control Non-Spring Return Motors (M6184, M6194):

1. Turn off power and remove cover of wiring box.
2. Disconnect controller from motor.
3. Connect 24 Vac power and switches to drive motor to position where auxiliary equipment is to be switched. Refer to Fig. 8. Turn on power. Jumpering terminals R and B will drive motor in the open direction, jumpering terminals R and W will drive the motor in the closed direction. To stop the motor at desired position, disconnect jumpers. Motor will remain at this position until connection is restored.
4. For switch differential of 1° , check continuity of auxiliary switch N.O. (Red to Purple) contacts and rotate cams as follows:
 - a. If contacts are open, rotate cam clockwise until N.O. (Red to Purple) contacts close.
 - b. If contacts are closed, rotate cam counterclockwise until N.O. (Red to Purple) contacts open.

Fig. 8—Auxiliary switch adjustment for M6184, M6194 motors.



5. For switch differential of 10° , the cams must be rotated approximately 180° prior to setting the switching action. Refer to Fig. 3. Check continuity of the N.O. (Red to Purple) contacts and rotate cams as follows:
 - a. If contacts are open, rotate cam counterclockwise until N.O. (Red to Purple) contacts close.
 - b. If contacts are closed, rotate cam clockwise until N.O. (Red to Purple) contacts open.
6. Check for proper switch differential and switching of auxiliary equipment by driving the motor through full stroke (in both directions). If necessary repeat steps 4 and 6 for 1° differential, or 5 and 6 for 10° differential until correct switching action is obtained.
7. Disconnect 24 V power and switches.
8. Connect auxiliary equipment to auxiliary switch leads. See Wiring section.
9. Reconnect controller and power supply to motor.
10. Replace cover of wiring box.

Checkout



WARNING

**FIRE OR EXPLOSION HAZARD
CAN CAUSE SEVERE INJURY OR DEATH**

When auxiliary switches control combustion equipment, incorrect wiring of the switches can allow the burner to come on at high fire. Check auxiliary switch wiring and cam adjustment before turning on the system. Watch the controlled equipment through one complete cycle. Shut the system down immediately if switches do not correctly sequence the equipment.

Use the controller to run the motor fully open and then fully closed. Make sure that the auxiliary equipment starts and stops at the desired points in motor rotation. When checkout is complete, return the controller to the desired setting.

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