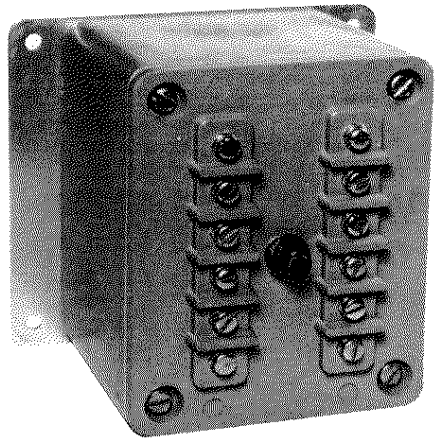
# CLASS 8501 TYPE SZF-1 FREQUENCY RELAY

## DESCRIPTION

The Class 8501 Type SZF-1 Frequency Relay is a solid state, frequency sensitive device. Components are mounted on printed circuit boards and enclosed in a molded housing. The relay is capable of detecting and annunciating (through an output contact operation) that the input frequency is above, below, or within selected bounds. An indicating light is used to denote the state of the output contact. A removable cover allows access to the programmable, 12 position, DIP switch to set the frequency set points and mode of operation.

The relay is a general purpose control device. However, it is specifically intended to be used as an acceleration, plugging, overspeed, or non-hoist relay on ac crane controllers where the relay detects the frequency of the rotor voltage of a wound rotor motor.



## PRECAUTIONS

The following list of recommended PRECAUTIONS must be studied and followed during installation, operation and servicing of the relay.

**DANGER**
**HAZARD OF ELECTRIC SHOCK OR BURN. TURN OFF POWER SUPPLYING THIS EQUIPMENT BEFORE WORKING ON IT.**

1. READ THIS SERVICE BULLETIN PRIOR TO INSTALLING OR OPERATING THE RELAY.
2. ONLY AUTHORIZED PERSONNEL SHOULD BE PERMITTED TO INSTALL OR SERVICE THE RELAY.
3. INSTALL TYPE NON 15 AMPERE OR EQUIVALENT FUSE IN CONTROL CIRCUIT FOR PROPER PROTECTION OF THE PRINTED CIRCUIT BOARD FOIL RUNS. **DO NOT USE TIME DELAY FUSES.**

## APPLICATION INFORMATION

**Frequency Sensor Input**

Terminal 1 - 6
Allowable input voltage range, 0-1250V AC
Allowable input frequency range, 0-200 Hz

Terminal 2 - 5
Allowable input voltage range, 0-625V AC
Allowable input frequency range, 0-200 Hz

Maximum continuous voltage rating is 600V AC.

Relay frequency detection circuit becomes inoperative if voltage is below value shown on Figure 1 for the proper input terminals.

**Power Supply Input**
Terminals 7 - 8
30V AC (-10%, +20%) @ 50-60 Hz, 5VA

**Normally closed contact output**
Terminals 11 - 12
1.5 amps continuous @ 120V AC or 250V DC
(390V Peak maximum)

A LED provides an external visual means of detecting relay status; the LED lights when output contacts are open.

Relay outputs are equipped with internal arc suppression circuitry. See Figure 2 for operation parameters.

**Operating Temperature** -20°C to 70°C

**Recommended Fuse Size**
The printed circuit board foil runs of the relay must be protected by installing maximum NON 15 ampere or equivalent fuses in the 30V AC, 5VA control power input (input terminals 7-8). The relay output contact (output terminals 11-12) should also be protected by maximum NON 15 ampere fuses in the output contact circuit. **Do not use time delay fuses.**

**CAUTION**
**FAILURE TO PROVIDE PROPER FUSE MAY ALLOW DAMAGE TO PRINTED CIRCUIT BOARD FOIL RUNS.**

**TABLE 1**
**MOTOR APPLICATION GUIDE**

| ROTOR FREQUENCY @STANDSTILL | MAXIMUM SETTING (FLS* or FHS*) | ALLOWABLE ROTOR VOLTAGE AT STANDSTILL | |
|---|---|---|---|
| | | LV INPUT (TERM. 2-5) | HV INPUT (TERM. 1-6) |
| 50 Hz | 125 Hz | 90-250V AC | 251-500V AC |
| 60 Hz | 150 Hz | 90-250V AC | 251-500V AC |

*$F_{LS}$ is low frequency setting *$F_{HS}$ is high frequency setting.

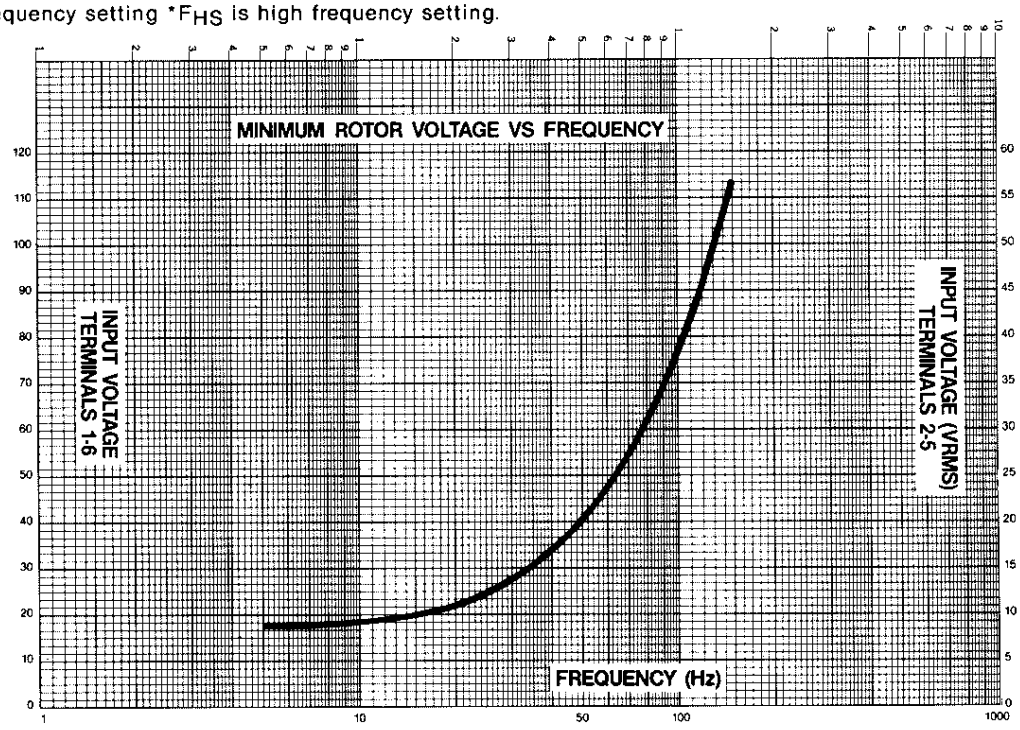
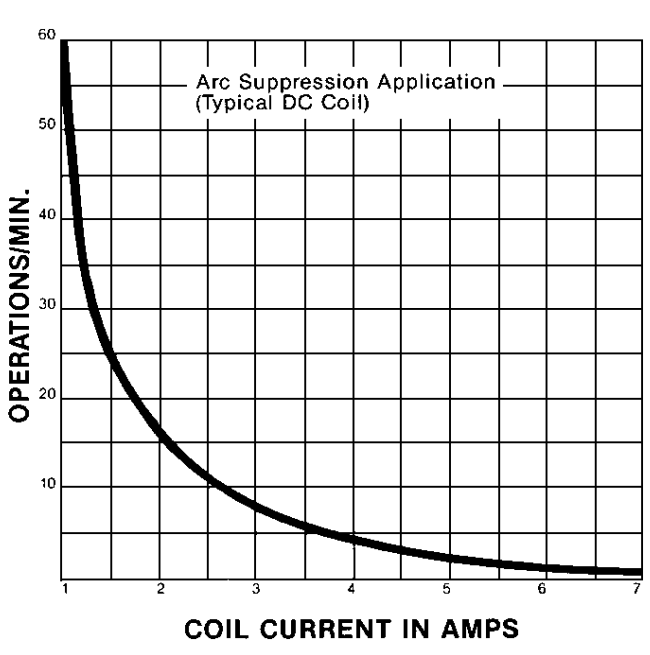



**FIGURE 1— MINIMUM DETECTION VOLTAGE**



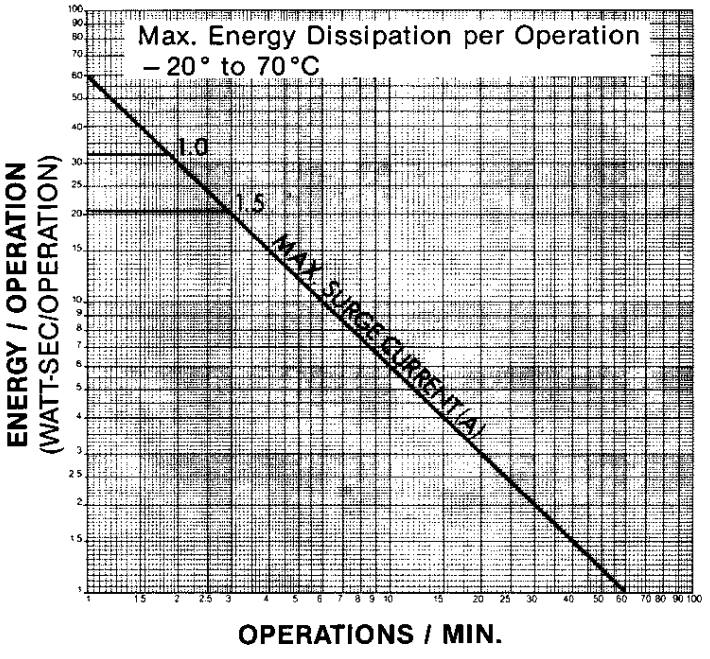




**FIGURE 2**

## ADJUSTMENT

The relay is adjustable (i.e. programmable) by use of a 12 position DIP switch located on a PC board inside the molded plastic housing (see Figure 3). Switches SW1 thru SW10 are used to program the user selected low frequency setting ($F_{LS}$) and high frequency setting ($F_{HS}$) as determined from the following equations:

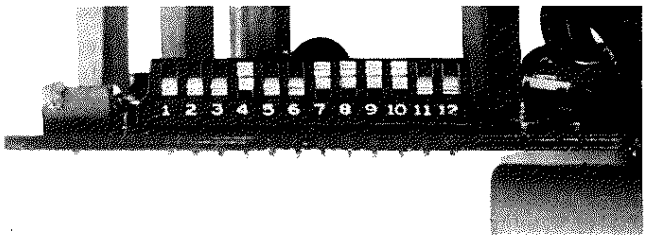



**FIGURE 3**
**12 POSITION DIP SWITCH SET AS PLUGGING RELAY (PR)**

$F_{LS}$ = 6 Hz + ___ + ___ + ___ + ___ + ___ + ___ + ___

1 Hz if SW1 closed (on)
0 Hz if SW1 open (off)

2 Hz if SW2 closed (on)
0 Hz if SW2 open (off)

4 Hz if SW3 closed (on)
0 Hz if SW3 open (off)

8 Hz if SW4 closed (on)
0 Hz if SW4 open (off)

16 Hz if SW5 closed (on)
0 Hz if SW5 open (off)

32 Hz if SW6 closed (on)
0 Hz if SW6 open (off)

64 Hz if SW7 closed (on)
0 Hz if SW7 open (off)

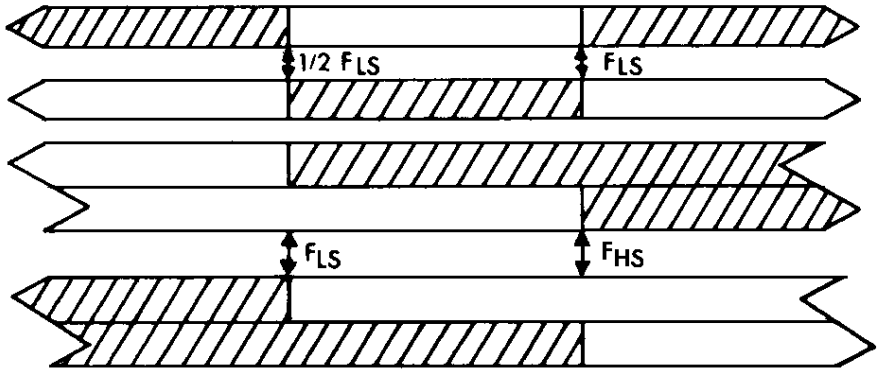
$F_{HS}$ = 2 Hz + $F_{LS}$ + ___ + ___ + ___

3 Hz if SW8 closed (on)
0 Hz if SW8 open (off)

18 Hz if SW9 closed (on)
0 Hz if SW9 open (off)

20 Hz if SW10 closed (on)
0 Hz if SW10 open (off)

Switches SW11 and SW12 are used to select one of the four possible modes of operation.

| MODE | RELAY OUTPUT CONTACT STATE ← DECREASING FREQUENCY INCREASING FREQUENCY → | SWITCHES SW11 | SWITCHES SW12 |
|---|---|---|---|
| 2 |  | O | X |
| 3 | | O | O |
| 4 | | X | O |
| 5 | | X | X |



□ denotes contacts (terminals 11-12) open
▨ denotes contacts (terminals 11-12) closed

X denotes switch in closed (on) position
O denotes switch in open (off) position

## OPERATION

The Class 8501 Type SZF-1 Frequency Relay can be installed in either a hoist or a travel drive controller as shown in Figure 4 or 5. Proper relay settings are obtained from Table 2.

For example, consider a plugging relay application for a 60 Hz motor. In this case we would need a frequency relay set for mode 5 with $F_{LS}$ = 61 Hz and $F_{HS}$ = 63 Hz. When the motor is plugged, the frequency will exceed 63 Hz and the contacts of the relay are open prohibiting further speed points in the reverse direction from being obtained. As the motor slows towards standstill, the rotor frequency approaches 60 Hz. At 61 Hz the relay contacts have closed allowing the motor to accelerate in the reverse direction.

In this example the switch settings are as follows:

| SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9 | SW10 | SW11 | SW12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| X | X | X | O | X | X | O | O | O | O | X | X |

$F_{LS} = 6+1+2+4+0+16+32+0 = 61$ Hz
$F_{HS} = 2+61+0+0+0 = 63$ Hz
Mode = 5

The actual switch setting for this relay is shown in Figure 3.

Table 2 lists the standard relays used on Square D Company ac crane control with the proper switch setting shown.

**TABLE 2**
STANDARD RELAY SETTINGS (For 60 Hz Applications)

| RELAY FUNCTION | RELAY DESIGNATIONS | | | | | SETTING Hz | | SWITCH POSITION | | | | | | | | | | | OPERATING MODE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CLASS 6420 | CLASS 6421 | CLASS 6422 | CLASS 6426 | CLASS 6435 | PICKUP | DROPOUT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| ACCELERATION RELAYS | 3AR | 2AR | 3AR | | | 44 | 42 | O | O | X | O | O | X | O | O | O | O | X | X | 5 |
| | | | | 1AR | | 41 | 39 | X | O | O | O | O | X | O | O | O | O | X | X | 5 |
| | 4AR | 3AR | 4AR | | | 25 | 23 | X | O | O | O | X | O | O | O | O | O | X | X | 5 |
| | | | | 2AR | 3AR | 22 | 20 | O | X | X | X | O | O | O | O | O | O | X | X | 5 |
| | 5AR | | | | | 12 | 10 | O | O | X | O | O | O | O | O | O | O | X | X | 5 |
| | | 4AR | 5AR | 3AR | | 11 | 9 | X | X | O | O | O | O | O | O | O | O | X | X | 5 |
| PLUGGING | | | | PR | PR | 63 | 61 | X | X | X | O | X | X | O | O | O | O | X | X | 5 |
| NON-HOIST | | | NH | | | 59 | | X | O | X | O | X | X | O | O | O | O | O | X | 2 |
| OVERSPEED | | | OS | | | 130 | 125 | X | X | X | O | X | X | X | X | O | O | X | O | 4 |

NOTE: O = open (off) X = closed (on)

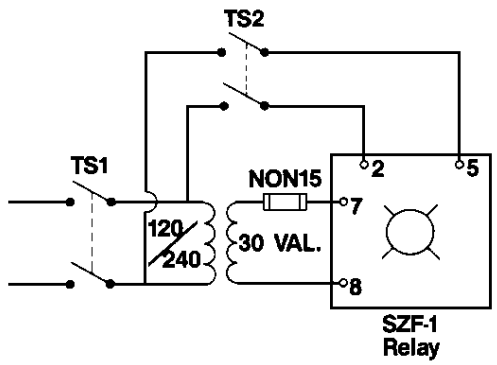
## TROUBLESHOOTING

**DANGER**
**HAZARD OF ELECTRIC SHOCK OR BURN. TURN OFF POWER SUPPLYING THIS EQUIPMENT BEFORE WORKING ON IT.**

The Class 8501 Type SZF Frequency Relay should not be tested in the control panel since motor rotation would be required to perform test. **Relay must be removed from controller to be tested.** Testing can be performed with the following equipment:

30V AC - 60 Hz - 5 VA control transformer
120V AC or 240Vac, 60 Hz power
Fuse: NON 15 Amp max.
2-15 amp 240V two pole ac knife switches

Test Preparations
1. Remove relay from controller
2. Connect relay per the following test circuit:




Test Procedure
1. Make a note of the present setting of the 12 position DIP switch since it will have to be reset when test is completed.
2. A continuity check of the output relay circuit (terminals 11 and 12) should be made as part of test procedure. When LED light is off, relay contact is closed. When LED is on, relay contact is open.
3. Switch settings inside the relay should be as follows:
   A.) Set relay for $F_{LS}$ = 59 Hz as shown in step 1 of Table 3.
      1. With switch TS1 closed and switch TS2 open, light should be off.
      2. Close switch TS2, light should be off.
   B.) Open switches TS1 and TS2 and change setting on switch SW12 as shown in step 2 of Table 3.
      1. With switch TS1 closed and switch TS2 open, light should be on.
      2. Close switch TS2, light should be on.
   C.) Open switches TS1 and TS2 and reset the relay at $F_{LS}$ = 57 Hz, $F_{HS}$ = 59 Hz as shown in step 3 of Table 3.
      1. With switch TS1 closed and switch TS2 open, light should be on.
      2. Close switch TS2, light should be off.
   D.) Open switches TS1 and TS2 and change setting of switch SW 12 as shown in step 4 of Table 3.
      1. With switch TS1 closed and switch TS2 open, light should be off.
      2. Close switch TS2, light should be on.

Note: For 50 HZ systems use table settings 1A, 2A, 3A and 4A. Input should be 120/240V AC - 50 Hz.

## TROUBLESHOOTING (cont'd.)

Test Procedure Setting

E.) The relay is inoperative if it does not pass the described test. Replace the relay.

F.) If the relay passes the test, reset relay switches to proper positions for desired relay application, and reinstall in panel.

G.) If problem still persists, check that the relay application is correct.

**TABLE 3**
TEST PROCEDURE SETTING

| STEP | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9 | SW10 | SW11 | SW12 | RELAY STATUS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | X | O | X | O | X | X | O | O | O | O | O | X | FLS = 59 Hz Operating Mode 2 |
| 2 | X | O | X | O | X | X | O | O | O | O | O | O | FLS = 59 Hz Operating Mode 3 |
| 3 | X | X | O | O | X | X | O | O | O | O | X | O | FLS = 57 Hz. FHS = 59 Hz, Operating Mode 4 |
| 4 | X | X | O | O | X | X | O | O | O | O | X | X | FLS = 57 Hz FHS = 59 Hz, Operating Mode 5 |
| 1A | X | X | O | X | O | X | O | O | O | O | O | X | FLS = 49 Hz Operating Mode 2 |
| 2A | X | X | O | X | O | X | O | O | O | O | O | O | FLS = 49 Hz Operating Mode 3 |
| 3A | X | O | O | X | O | X | O | O | O | O | X | O | FLS = 47 Hz, FHS = 49 Hz Operating Mode 4 |
| 4A | X | O | O | X | O | X | O | O | O | O | X | X | FLS = 47 Hz, FHS = 49 Hz Operating Mode 5 |

Note: O = open (off) X = closed (on)

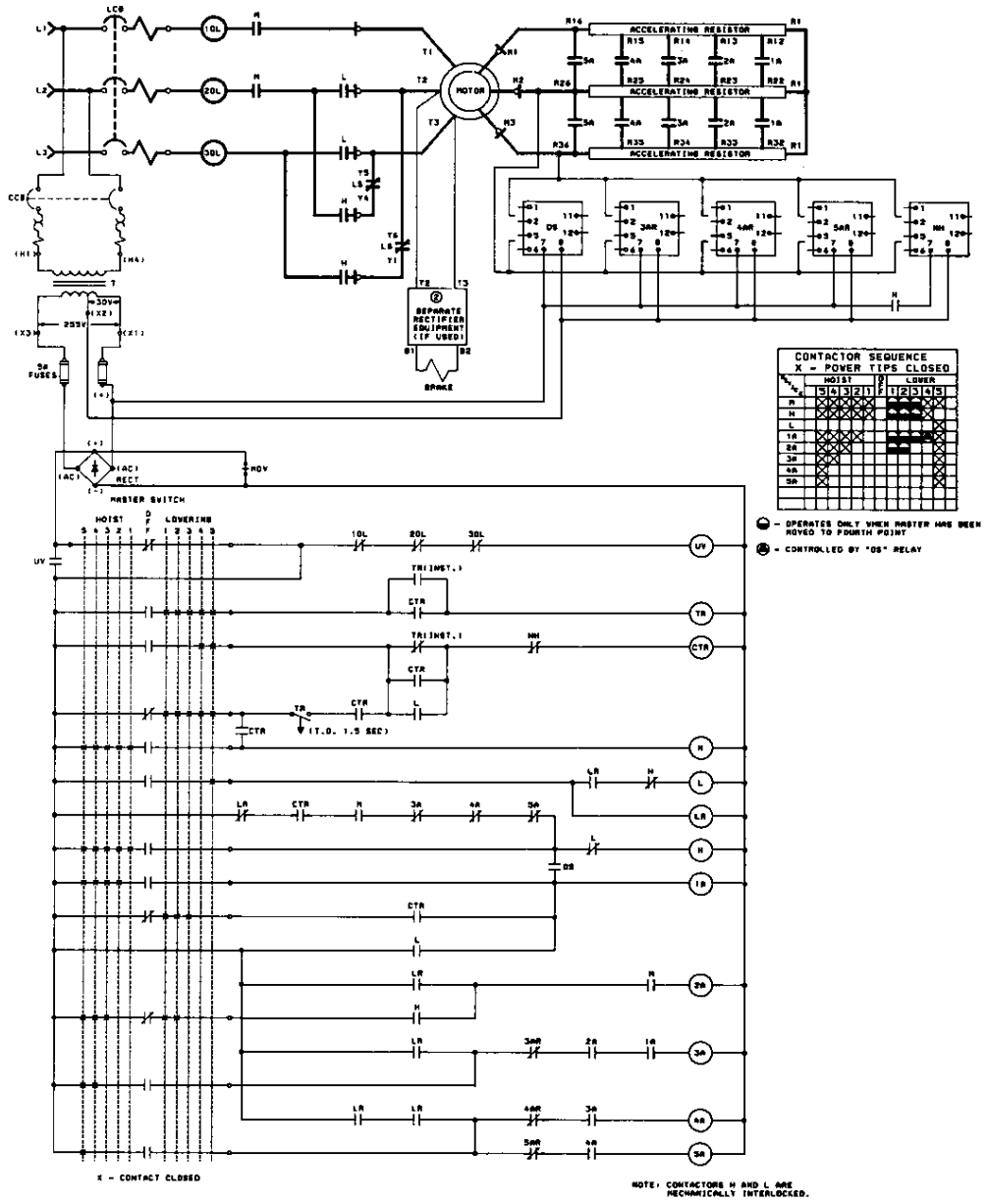
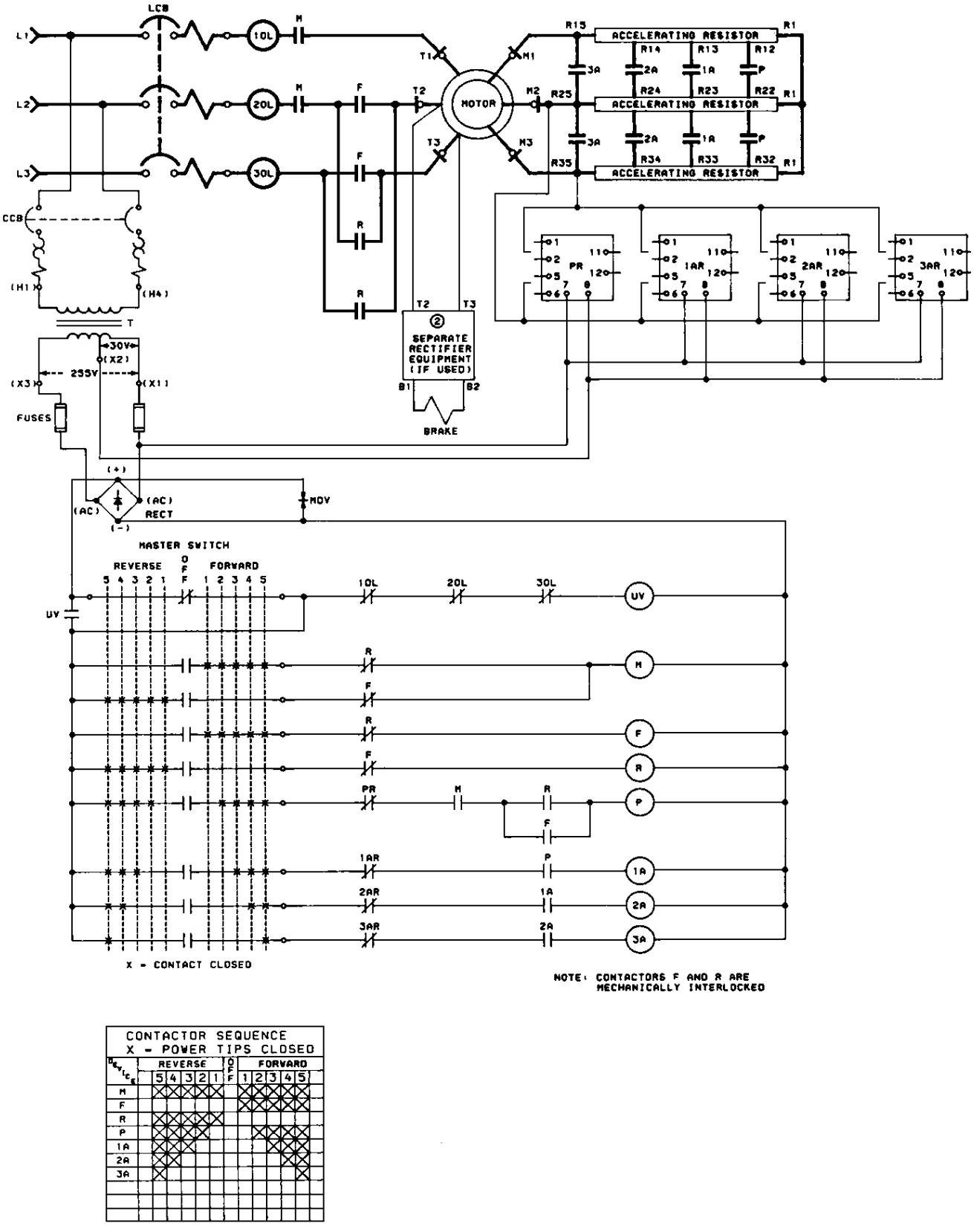


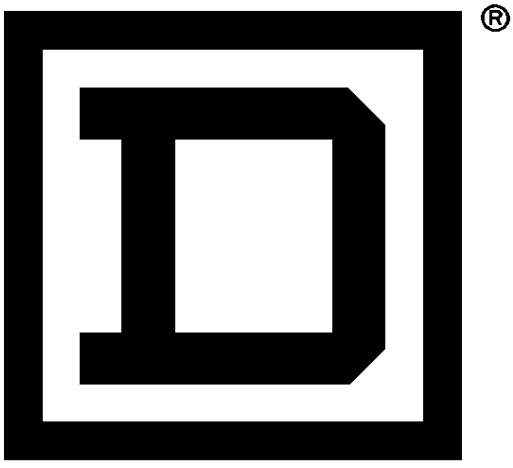

**FIGURE 4**
**CLASS 6422 CONTRA-TORQUE® CONTROLLER**




CONTACTOR SEQUENCE
X = POWER TIPS CLOSED

| DEVICE | REVERSE | | | | | OFF | FORWARD | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 | F | 1 | 2 | 3 | 4 | 5 |
| M | X | X | X | X | X | | X | X | X | X | X |
| F | | | | | | | X | X | X | X | X |
| R | X | X | X | X | X | | | | | | |
| P | X | X | X | X | | | | | X | X | X |
| 1A | X | X | X | | | | | | X | X | X |
| 2A | X | X | | | | | | | | X | X |
| 3A | X | | | | | | | | | | X |

**FIGURE 5**
**CLASS 6426 REVERSE PLUGGING CONTROLLER**



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