

# Operator's Manual

# ASCO® Series 386 Non-Automatic Transfer Switches E-design 260-400 A, G-design 1000-3000 A

## **⚠ DANGER**

DANGER is used in this manual to warn of a hazardous situation which, if not avoided, will result in death or serious injury.

## **⚠ WARNING**

WARNING is used in this manual to warn of a hazardous situation which, if not avoided, could result in death or serious injury.

## **⚠ CAUTION**

CAUTION is used in this manual to warn of a hazardous situation which, if not avoided, could result in minor or moderate injury.



G-design 1000-1200 A sizes

Refer to the outline and wiring drawings provided with the ASCO Series 386 N-ATS for all installation details.

### Rating Label

Each non-automatic transfer switch contains a rating label to define the loads and fault circuit withstand / closing ratings. Refer to the label on the transfer switch for specific values.

## **⚠ WARNING**

Do not exceed the values on the rating label. Exceeding the rating can cause personal injury or serious equipment damage.

### Identification Label

The identification label on the Transfer Switch includes data for each specific ASCO Series 386. Use the switch only within the limits shown on identification label.

An experienced licensed electrician must install the Non-Automatic Transfer Switch (N-ATS).

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## SECTION 1 INSTALLATION

ASCO 386 Non-Automatic Transfer Switches (N-ATSs) are factory wired and tested. Field installation simply requires mounting and connection of service cables, and auxiliary control circuits (if required).

### Remove the Shipping Skid (large N-ATSs)

For large N-ATSs, open the front door and remove the four lag screws (2 in front, 2 in rear) securing enclosure to the wood skid.

### Supporting Foundation

The supporting foundation for the enclosure must be level and straight. Refer to the applicable enclosure outline drawing included with the switch for all mounting details including door opening space.

If bottom cable entry is used, the foundation must be prepared so that the conduit stubs are located correctly. Refer to the enclosure outline drawing for specified area and location. Provide cable bending space and clearance to live metal parts. When a concrete floor is poured, use interlocking conduit spacer caps or a wood or metal template to maintain proper conduit alignment.

### Mounting

Refer to the *Outline and Mounting Diagram* provided with the N-ATS; it shows all mounting details and instructions.

#### NOTICE

Protect the non-automatic transfer switch from construction grit and metal chips to prevent malfunction or shortened life of the N-ATS.

Mount the ASCO 386 vertically to a rigid supporting structure. Level all mounting points by using flat washers behind the holes to avoid distortion of the switch.

### Auxiliary Cable Boxes for 1000 and 1200 A

For G-design 1000 and 1200 ampere sizes, auxiliary cable boxes are required for all (normal, emergency, & load) bottom or top entry. Be sure to install auxiliary cable boxes if both service and load cables are entering through the top or bottom of enclosure. Consult ASCO Power Technologies.

### Insulator Backing Piece for 260 and 400 A

E-design transfer switches rated 260 and 400 ampere are mounted on an insulator backing piece (installed behind the transfer switch). If the transfer switch is removed from the cabinet and then reinstalled, this insulator piece must be placed behind the transfer switch. See Figure 1-1.

#### WARNING

Be sure that the insulator piece is behind the 260 and 400 ampere transfer switches.

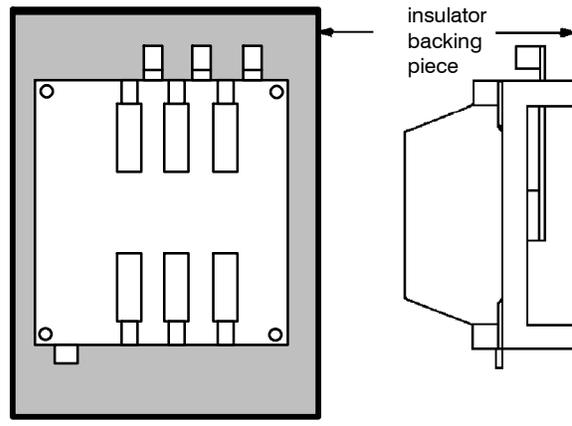


Figure 1-1. Insulator for E-design 260 and 400 ampere

### Controller Ground

The controller is mounted on the cabinet door. The transfer switch is connected to the left side of the controller by a plug-in harness (two plugs). An add-on DIN rail is provided for some optional accessories and is mounted below the controller on the door.

A grounding wire must be connected to the controller's lower left mounting stud. Because the controller is mounted on the enclosure door, a conductive strap must be used between the enclosure and the door. This connection provides proper grounding which does not rely upon the door hinges.

### Auxiliary Circuits

Connect auxiliary circuit wires to appropriate terminals on transfer switch terminal block TB as shown on the wiring diagram provided with this Non-Automatic Transfer Switch.

Read all instructions on the Wiring Diagram and labels affixed to the non-automatic transfer switch. Note the control features that are provided and review their operation before proceeding.

# INSTALLATION (continued)

## Line Connections

A *Wiring Diagram* is furnished with the ASCO 386 (separate from this manual). Refer to this drawing. All wiring must be made in accordance with the National Electrical Code and local codes.

### DANGER

De-energize the conductors before making any line or auxiliary circuitry connections. Be sure that Normal and Emergency line connections are in proper phase rotation. Place engine generator starting control in the OFF position. Make sure engine generator is not in operation.

## Testing Power Conductors

Do not connect the power conductors to the transfer switch until they are tested. Installing power cables in conduit, cable troughs and ceiling-suspended hangers often requires considerable force. The pulling of cables can damage insulation and stretch or break the conductor's strands. For this reason, after the cables are pulled into position, and before they are connected, they should be tested to verify that they are not defective or have been damaged during installation.

## Connecting Power Conductors

After the power cables have been tested, connect them to the appropriate terminal lugs on the transfer switch as shown on the wiring diagram provided with the switch. Make sure the lugs provided are suitable for use with the cables being installed. Standard terminal lugs are solderless screw type and will accept the wire sizes listed on the drawings provided with the switch. Be careful when stripping insulation from the cables; avoid nicking or ringing the conductor. Remove surface oxides from cables by cleaning with a wire brush. When aluminum cable is used, apply joint compound to conductors. Tighten cable lugs to the torque specified on rating label.

Do not run cables behind the switch. Cables can be bundled on the right side of the switch. Maintain proper electrical clearance between the live metal parts and grounded metal: 1/2 inch minimum for 260-400 amperes, 1 inch minimum over 400 amperes.

## Bus Connections

If bus connection is used, use SAE grade 5 hardware to connect bus to appropriate terminal plates on the transfer switch. Wipe off bus surfaces before they are joined. If bus is very dirty, gently clean surfaces with a non-flammable solvent. Avoid touching cleaned surfaces.

### CAUTION

Do not breathe cleaning solvent vapors.

Use SAE grade 5 hardware and tighten the bolted joints to the torque specified in Table A.

### NOTICE

The reliability of the connection depends on how clean and how tight the joint is.

Table A. Tightening torque values for bolted joints.

Bolt Diameter (Grade 5 hardware) in inches	Recommended Tightening Torque in foot pounds
5/16	12
3/8	20
1/2	50
5/8	95
3/4	155

Continue to **1 – Manual Operation Test** on next page.

# INSTALLATION (continued)

## Functional Test

The Functional Test consists of three checks: manual operation, voltage checks, and electrical operation.

### NOTICE

Do these checks in the order presented to avoid damaging the non-automatic transfer switch.

### 1 – Manual Operation Test

A detachable maintenance handle is provided on the transfer switch for maintenance purposes only. Manual operation of the switch should be checked before it is energized (operated electrically).

### WARNING

Do not manually operate the transfer switch until both power sources are disconnected: open both circuit breakers.

1. Select the appropriate switch amperage size / design and follow the directions for installing the handle:

*260 and 400 amp. E-design* See Figure 1-2.  
Insert the manual handle into the hole in the shaft, left side of the operator.

*1000 – 3000 ampere. G-design* See Figure 1-3.  
Install the hub onto the center operator shaft and insert the manual firmly into the hole in the side of the hub (spring fully compressed).

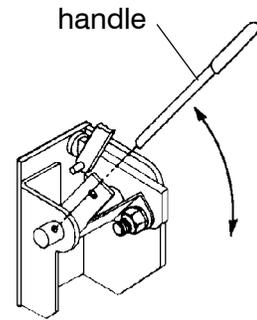


Figure 1-2. Maintenance handle for E-design 260 and 400 ampere

2. Move the handle as shown to manually operate the Transfer Switch. The switch should operate smoothly without binding. If it does not, check for shipping damage or construction debris.
3. Return the transfer switch to the *N* (normal) position. Remove manual operator handle (if detachable) and store it on the transfer switch in the place provided.

### NOTICE

Verify that the maintenance handle has been removed before proceeding!

Now continue to **2 – Voltage Checks** on next page.

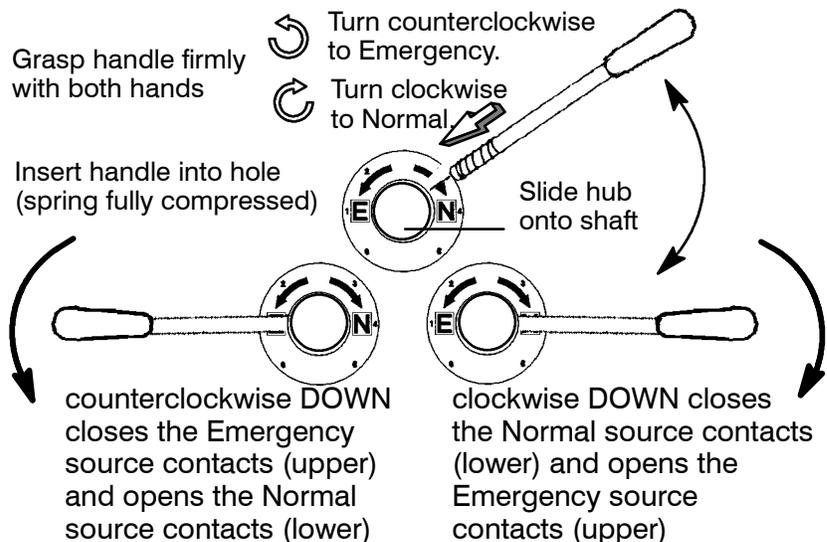
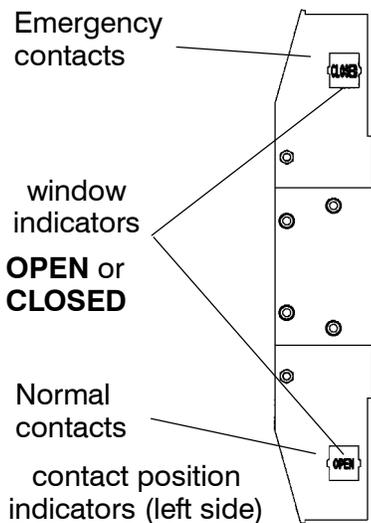


Figure 1-3. Maintenance handle on 1000 – 3000 ampere G design transfer switches.

## INSTALLATION (continued)

### Functional Test (continued)

#### 2 – Voltage Checks

First check nameplate on the transfer switch for rated voltage. It should be the same as the normal and emergency line voltages.

#### **⚠ DANGER**

Use extreme caution when using a meter to measure voltages in the following steps. Do not touch power terminals; shock, burns, or death could result !

1. Close the normal source circuit breaker. The *Load Connected To Normal* lamp should come on.
2. Use an accurate voltmeter to check phase to phase and phase to neutral voltages present at the Transfer Switch normal source terminals.
3. Close the emergency source circuit breaker. (Start the generator, if necessary.)
4. Use an accurate voltmeter to check phase to phase and phase to neutral voltages present at the Transfer Switch emergency source terminals.

If necessary, adjust the voltage regulator on the generator according to the manufacturer's recommendations. The ASCO 386 will respond only to the rated voltage specified on the Transfer Switch nameplate.

5. Check phase rotation; it must be the same as the normal source.
6. Shut down engine-driven generator, if applicable.
7. Close the cabinet door and tighten the screws.

#### 3 – Electrical Operation

This procedure will check the electrical operation of the Non-Automatic Transfer Switch. See Figure 1–4.

#### **⚠ WARNING**

Close the transfer switch enclosure door and tighten the screws before you test electrical operation.

#### **Transfer Test**

Both normal and emergency sources must be available and above 90% of nominal voltage specified on nameplate.

1. Turn the door-mounted **Transfer Control** switch clockwise to *Transfer To Emergency*.
2. The transfer switch will operate to the Emergency position. The *Load Connected To Emergency* light should come on and the *Load Connected To Normal* light should go off.
3. Turn the door-mounted **Transfer Control** switch counterclockwise to *Transfer To Normal*.
4. The transfer switch will operate back to the Normal position. The *Load Connected to Normal* light should come on and the *Load Connected To Emergency* light should go off.

This completes the Functional Test of the ASCO 386 non-automatic transfer switch.



Figure 1–4. Operating Controls.

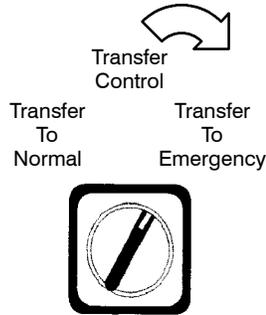
## SECTION 2

# SEQUENCE OF OPERATION

### Controller Code 1

Refer to **Section 5, Optional Accessories** for additional control functions.

Refer to **Wiring Diagram** furnished with the ASCO 386. Note Control Features furnished on this switch, and review operation.



### Transfer To Emergency

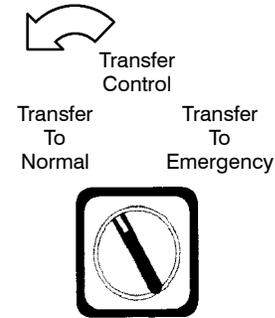
The sequence for load transfer to the emergency source begins when you turn the door-mounted **Transfer Control** switch clockwise to the *Transfer To Emergency* position.

When the **Transfer Control** switch is operated to *Transfer To Emergency*, the voltage and frequency sensor begins monitoring the emergency source. The sensor will accept the emergency source only when both voltage and frequency reach preset pickup points. If the emergency source is available immediately, the sensor may accept it as soon as the **Transfer Control** switch is operated.

When the emergency source is accepted by the sensor, relay ER picks up to transfer the load to the emergency source.

ER relay energizes, the TS coil is energized, the transfer switch operates, and all switch contacts (mains, controls, auxiliaries) reverse position. The transfer switch is now supplying the load from the emergency source.

The transfer switch will remain in the Emergency position until the **Transfer Control** switch is operated to the *Transfer To Normal* position.



### Retransfer to Normal

The sequence for load retransfer to the normal source begins when you turn the door-mounted **Transfer Control** switch counterclockwise to the *Transfer To Normal* position.

When the **Transfer Control** switch is operated to *Transfer To Normal*, the voltage sensor begins monitoring the normal source.

The SE relay energizes when the sensor accepts the normal source voltage.

SE relay energizes. The TS coil is energized, the transfer switch operates, and all switch contacts (mains, controls, auxiliaries) reverse position. The transfer switch is now supplying the load from the normal source again.

The SE relay de-energizes when the **Transfer Control** switch is released.

The transfer switch will remain in the Normal position until the **Transfer Control** switch is operated to the *Transfer To Emergency* position.

#### Note

Activation of standard control features shown in Section 5 will alter the sequence of operation and introduce additional time delays during transfer operations.

## SECTION 3

### TESTING & SERVICE

#### PREVENTIVE MAINTENANCE

Reasonable care in preventive maintenance will insure high reliability and long life for the switch. An annual preventive maintenance program is recommended.

ASCO Services, Inc. (ASI) is ASCO Power Technologies's national service organization. ASI can be contacted at 1-800-800-2726 for information on preventive maintenance agreements.

#### TESTING

Operate the switch at least once a month by following this four-step **Electrical Operation Test**.

##### Transfer Switch Test

- A. Turn the door-mounted **Transfer Control** switch clockwise to *Transfer to Emergency*.
- B. The transfer switch will operate to the Emergency position. The *Load Connected To Emergency* light should come on and the *Load Connected to Normal* light should go off.
- C. Turn the door-mounted **Transfer Control** switch counterclockwise to *Transfer to Normal*.
- D. The transfer switch will operate to the Normal position. The *Load Connected to Normal* light should come on and the *Load Connected to Emergency* light should go off.

#### Checklist for Yearly Inspection

##### **DANGER**

Hazardous voltage capable of causing shock, burns, or death is used in this switch. Deenergize both Normal & Emergency power sources before performing inspections!

- Clean the switch enclosure.** Brush and vacuum away any excessive dust accumulation. Remove any moisture with a clean cloth.
- Check the Switch Contacts.** Remove transfer switch barriers and check the condition of the contacts. Replace the contacts if they become pitted or worn excessively. Reinstall barriers carefully.
- Maintain transfer switch lubrication.** If switch is subjected to severe dust or abnormal operating conditions, renew factory lubrication on all movements and linkages. Relubricate solenoid operator if TS coil is replaced. For 260–400 A order **lubrication 625550–001** (Castrol *Endurex*® 4000 lubricant). For 1000–3000 A order **lubricant kit 75–100**.
- Check all cable connections and retighten them.

#### REPLACEMENT PARTS

Replacement parts are available in kit form. When ordering parts provide the Serial No., Bill of Material No. (BOM), and Catalog No. from the transfer switch nameplate. Contact your local ASCO Power Technologies sales office or ASI. In the United States call 1–800–800–ASCO (2726).

#### DISCONNECTING THE CONTROLLER

The harness disconnect plugs are furnished for repair purposes only and should not have to be unplugged. If the controller must be isolated, follow these steps:

##### Disconnecting the Plugs

1. Observe the position of the transfer switch.
  - a. If the transfer switch is in the *Normal* position, place standby engine starting control in the *off* position. Then open the emergency source circuit breaker.
  - b. If the transfer switch is in the *Emergency* position, open the normal source circuit breaker. Place the engine starting control in the *test* or *run* position.
2. Separate the quick disconnect plugs by squeezing the latches. Do not pull on the harness wires.

##### Reconnecting the Plugs

1. Observe the position of the transfer switch.
  - a. If the transfer switch is in the *Normal* position, be sure that the standby engine starting control is still in the *off* position. The emergency source circuit breaker still should be open.
  - b. If transfer switch is in the *Emergency* position, normal source circuit breaker still should be open.
2. The harness plugs and sockets are keyed. Carefully align the plugs with the sockets and press straight in until both latches click.
3. Restore the opposite source as follows:
  - a. If the transfer switch is in the *Normal* position, place the standby engine starting control in the *automatic* position. Then close the emergency source circuit breaker.
  - b. If the transfer switch is in the *Emergency* position, close the normal source circuit breaker.

# TESTING & SERVICE

(continued)

## MANUAL LOAD TRANSFER

This procedure will manually transfer the load if the Controller is disconnected.

### WARNING

Do not manually operate the transfer switch until both power sources are disconnected: open both circuit breakers.

1. Open normal and emergency source circuit breakers.
2. Use manual handle to manually operate transfer switch to the opposite source. Remove the handle. See **Section 1, Manual Operation**.
3. If the transfer switch is in the Emergency position manually start the engine generator and then close the emergency source circuit breaker.

## TROUBLE-SHOOTING

Note the Control Features that are activated or furnished on the switch and review their operation. Refer to **Section 5, Optional Features**.

### WARNING

Proceed with care! The ASCO 386 is energized.

Table 3-1. Trouble-Shooting Checks.

PROBLEM	CHECK IN NUMERICAL SEQUENCE	
	1 OPERATION	2 VOLTAGE
Transfer switch does not transfer the load to the emergency source.	Turn <i>Transfer Control</i> switch clockwise to <i>Transfer to Emergency</i> position.	Generator output circuit breaker must be closed. Voltmeter should read at least 90% of nominal phase to phase voltage between transfer switch terminals EA and EC (or EL1 and EL2 for 2 pole switches). * Generator frequency must be at least 57 Hz. * * These are factory settings.
Transfer switch does not transfer the load to the normal source.	Turn <i>Transfer Control</i> switch counterclockwise to <i>Transfer to Normal</i> position.	Voltmeter should read at least 90% of nominal phase to phase voltage between transfer switch terminals NB and NC, NC and NA, and NA and NB (or NL1 and NL2 for 2 pole switches).

## Trouble-Shooting Motor Load Transfer (Optional Feature 27) (refer to page 5-1)

### DANGER

Use extreme caution when using a meter to measure voltages in the following steps. Do not touch power terminals; shock, burns, or death could result !

1. Connect a voltmeter (set for twice system phase-to-phase voltage) between Transfer Switch terminals NA and EA.
2. Manually start generator. Voltmeter needle should sweep back and forth at a regular rate between 0 and about twice system voltage.
3. Turn the TRANSFER TO EMERGENCY control switch clockwise. The load should transfer to emergency source when meter needle is near 0 volts. If transfer does not occur, the Motor Load Transfer accessory is not operating.
4. Turn the TRANSFER TO NORMAL control switch counterclockwise. The load should retransfer back to the normal source when the needle is near 0 volts. If retransfer does not occur after the time delay, the Motor Load Transfer accessory is not operating.
5. Disconnect the voltmeter.

If the problem is isolated to circuits on the controller or the transfer switch, call your local ASCO Power Technologies sales office or ASI. In the United States, call 1-800-800-2726. Furnish the Serial No., Bill of Material (BOM) No., & Catalog No. from transfer switch nameplate.

## SECTION 4 ADJUSTMENTS

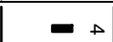
### Sensor Adjustments

Voltage and frequency sensor pickup and dropout points are factory set as specified on the Wiring Diagram. The frequency setting can be set for 50 or 60 Hz.. To change this setting, follow the procedure below. Use Table 4-1 for the setting and corresponding DIP switch actuator.

#### NOTICE

Do not change any other factory settings. Any change in these settings may affect the normal operation of the ASCO 386. This change could allow the load circuits to remain connected to a low voltage source.

Table 4-1. Frequency Settings. (■ Shaded DIP switch is standard factory setting).

DESCRIPTION	LABEL	FACTORY SETTING	ADJUSTMENT RANGE	S1 DIP SWITCH
Frequency	60 / 50 Hz	60 Hz	60 Hz	Actuator 4 off 
			50 Hz	Actuator 4 on 

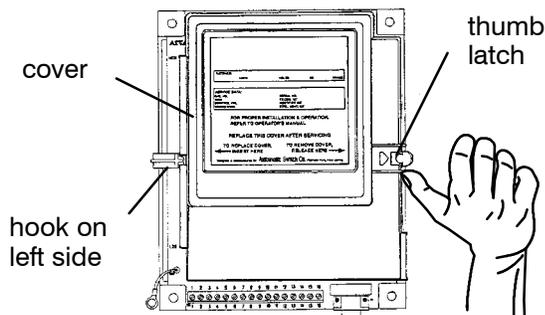


Figure 4-1. Controller cover latch.

### How to Change a Setting

#### NOTICE

Do not make any setting changes while the controller is energized.

1. Deenergize all power, then open the enclosure door.
2. Disconnect both harness plugs from controller by squeezing the latches. Do not pull on the wires.
3. Remove cover from the controller by releasing latch on right side with your thumb. See Figure 4-1.
4. Locate the appropriate adjustment DIP switch for the setting that you want to change. Refer to Table 4-1 above and Figure 4-2 and Figure 4-3.
5. Use a ball-point pen (or similar pointed tool) to slide the switch actuators left or right so they match the illustration next to the setting (left = off, right = on). Recheck the setting. See Figure 4-3.
6. Install the cover on the controller by hooking it on the left side and latching the right side.
7. Reconnect both harness plugs to the controller by aligning and pressing straight in until latches click.
8. Close the enclosure door, then restore both sources.

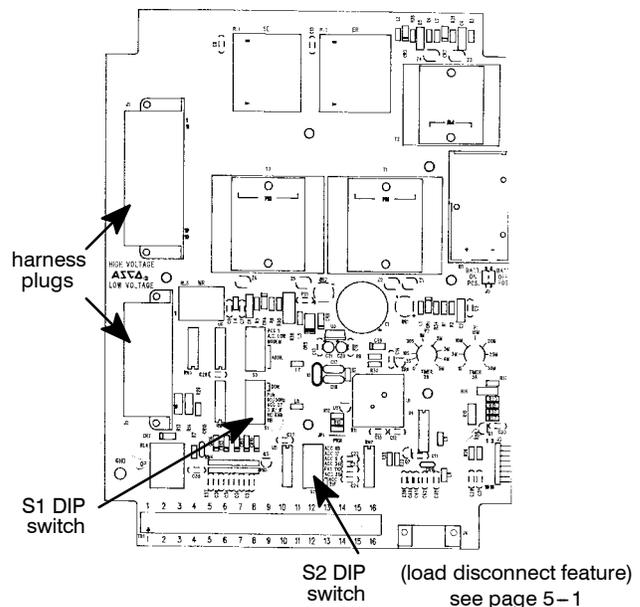


Figure 4-2. Location of DIP switch.

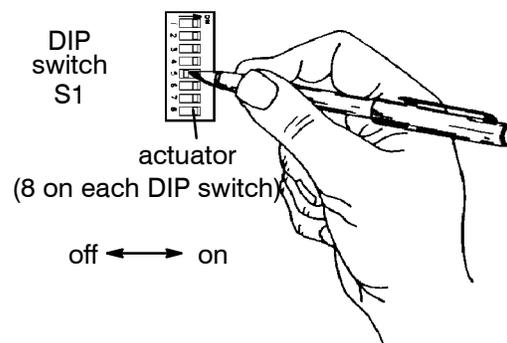


Figure 4-3. Setting DIP switch actuator.

## SECTION 5 OPTIONAL FEATURES

### MOTOR LOAD TRANSFER

Inphase monitoring logic controls transfer and retransfer of motor loads, so that inrush currents do not exceed normal starting currents. It avoids nuisance tripping of circuit breakers and mechanical damage to motor couplings.

The Motor Load Transfer feature is built into the controller. DIP switch S1 (actuator 5) activates this feature: right = ON, left = OFF.

FUNCTION	S1 DIP SWITCH	
enable	Actuator 5 on	
disable	Actuator 5 off	

Shaded DIP switches are standard factory settings.

#### Note

If the Motor Load Transfer feature is enabled, it will be activated following the Load Disconnect Feature Delay Before Transfer delay. Also, the transfer switch may not operate immediately after the transfer control switch is operated, even if both sources are available. This delay is intentional introduced if the two power sources are not inphase. Depending on the frequency difference, it may take a few seconds for the sources to reach synchronism.

### LOAD DISCONNECT FEATURE

Connect external circuits to the terminals indicated on the Wiring Diagram in the back of this manual.

The double throw (Form C) contact is rated for 28 VDC or 120 VAC (6 amps resistive). The contact operates prior to a selectable 0, 3, 10, or 20 second delay before transfer of the Non-Automatic Transfer Switch. The contact resets either immediately following transfer or after the same delay as set for pre-signal before transfer.

Time delay between the load disconnect control signal and initiation of transfer is set on the controller with DIP switch S2 (actuators 6, 7, 8) as shown below:

#### Delay Before Transfer

LD TDBT	S2 DIP SWITCH	
0 (disable)	Actuator 7 on Actuator 8 on	
3 seconds	Actuator 7 on Actuator 8 off	
10 seconds	Actuator 7 off Actuator 8 on	
20 seconds	Actuator 7 off Actuator 8 off	

Shaded DIP switches are standard factory settings.

#### Delay After Transfer\*

LD TDAT	S2 DIP SWITCH	
enable	Actuator 6 on	
disable	Actuator 6 off	

\*Enabling the Delay After Transfer will cause the control signal to reset after the same delay as set for the Delay Before Transfer.

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HELP

800-800-2726 (ASCO)

customer@asco.com

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