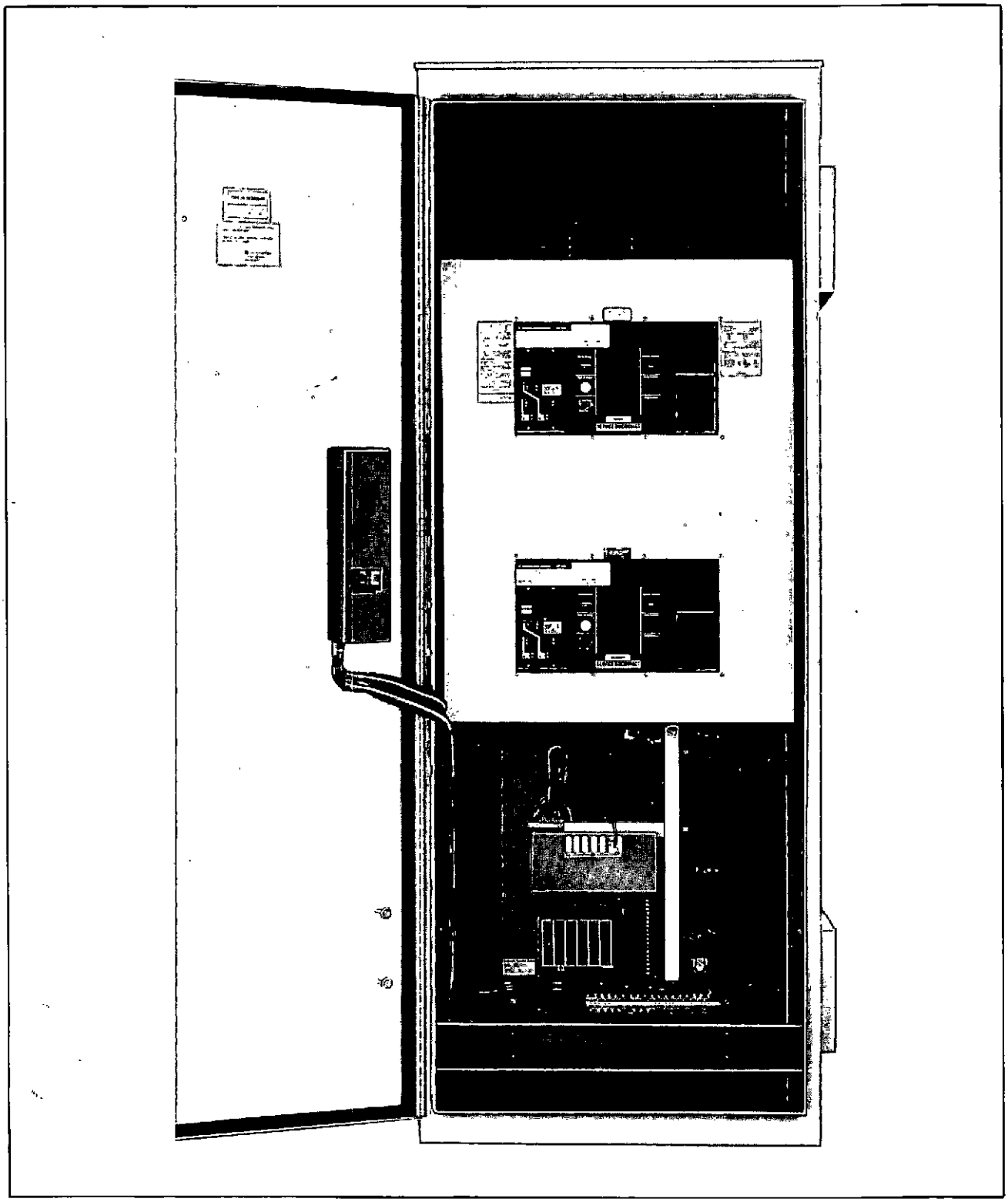
# Instructions for 1000-4000 Amp Solid-State Logic SPB Transfer Switch

I.L. 15482-A
File 29-900



Effective July, 1990 Supersedes I.L. 15482 dated September, 1983

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FOR MORE INFORMATION

CALL

1-800-354-2070 Outside KY
(606) 878-6100 In KY

## GENERAL INFORMATION

### WARRANTY

**Westinghouse warrants that the product sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Westinghouse shall, upon prompt written notice from the purchaser, correct such non-conformity, by repair or replacement F.O.B. factory, of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Westinghouse with respect to the quality of the products.**

**Westinghouse is not responsible for damage to the product which results from improper installation, operation, or maintenance.**

**Westinghouse assumes no responsibility for personal injury or property damage which results while the product is in the possession of the buyer.**

**THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE).**

**The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Westinghouse to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).**

### SAFETY PRECAUTIONS

**WARNING: HAZARDOUS VOLTAGES ARE PRESENT INSIDE TRANSFER SWITCH ENCLOSURES THAT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY.**

**FOLLOW PROPER INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS TO AVOID THESE HAZARDOUS VOLTAGES.**

1. **The transfer switch should be accessible to authorized personnel only.**
2. **The power source should be disconnected before attempting service to the switch.**
3. **Remove any metallic jewelry that could contact any hazardous voltage before performing any service to the transfer switch.**
4. **Avoid wearing damp clothing or wet shoes when working on any electrical apparatus.**
5. **Service personnel should use rubber mats where required to avoid accidental grounding of hazardous voltages.**
6. **If any repairs are necessary they should be made by a qualified electrician.**

## INTRODUCTION

This instruction manual provides installation, testing, and subsequent operation of Westinghouse split panel SPB transfer switches.

Operators should be familiar with this manual before attempting to install or operate the transfer switch.

## TRANSFER SWITCH DESCRIPTION

Westinghouse transfer switches are reliable, safe, rugged, versatile, and compact assemblies for use in electrical distribution systems.

The intelligence/supervisory circuits on Westinghouse transfer switches constantly monitor the condition of both the normal and the emergency power sources. These circuits automatically initiate an immediate transfer of power from the normal source to the emergency source, when power fails or voltage levels drop below a preset value. Transfer back to the normal source is automatic upon return of the normal power source.

Monitoring of the power source is always performed on the line side of the power source to which the switch is connected, and power to drive each breaker's motor mechanism is taken from the side to which the load is being transferred. The normal power source is the preferred source and the switch will always seek this source when it is available.

The SPB automatic transfer switch has the following features as standard:

- Plug-in solid state cards are provided for voltage sensing, frequency sensing and time delay functions. Each card has adjustment knobs which can be screwdriver or finger adjusted. Captive screw locks positively lock the adjustment settings with a uniform force that does not alter the setting when it is tightened. All sensing cards are interchangeable. However, a timing card cannot be used in a voltage/frequency slot, or vice versa, since the cards are keyed to prevent improper insertion. Each card is held in place by two screws. Empty card slots are covered by blank covers. All cards have conformal coating for environmental protection.
- Adjustable voltage sensing protection on all phases of the normal power source.
- Automatic transfer operation.
- Wiring gutter space to meet code requirements.
- Safe manual operation under load.
- Test selector switch (TSS) – test, auto.
- Solid neutral bar assembly.
- Engine Start Contact provided on a red colored terminal block (51 and 52). This contact closes upon a loss of normal power, thus initiating an engine start.
- Rear terminal connections suitable for top or bottom cable or busway entrance.
- Wiring leads are clearly identified with hot ink stamped numbers.
- Common load bus conveniently located behind the power switching panel.
- Two interlocked, high withstand SPB devices.
- High speed, stored-energy, switching mechanisms for fast transfer operation – less than five cycles.
- Mechanical interlocks prevent paralleling both power sources.
- Ventilated NEMA 1 enclosure with keylock handle.
- Split panel construction for ease of equipment maintenance.
- Transfer mechanism is powered from the source to which the load is being transferred.
- Transfer switches are 100 per cent equipment rated in either open or enclosed mounting arrangements.
- Continuous rating for all classes of loads.
- Auxiliary contacts – three normally open (NO) and three normally closed (NC) for both normal and emergency switch positions.
- Integral multi-voltage transformer taps to satisfy any required application voltage. Selector plug provides quick-change capability to desired voltage rating.
- Intelligence panel disconnect between the power switching panel and the intelligence panel.
- UL listed or component recognized accessories are available for field installation.

5. Make necessary connections of options using wiring diagrams supplied with the unit.

6. Connect engine start wires to the red terminal blocks marked 51 and 52.

## TESTING

### Functional Checkout Procedure

At installation or during planned power outages.

**NOTE: If Option 4 (Time Delay Engine Cool-off) is furnished, an engine start signal will be present for a period of time equal to the timer setting when the switch is first energized. To avoid starting the engine during this time, turn the generator controls to the "OFF" position.**

Energize the transfer switch using the following steps:

**WARNING**

**HAZARDOUS VOLTAGES MAY BE PRESENT THAT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY.**

**AVOID CONTACT WITH ANY VOLTAGE SOURCE WHILE ENERGIZING THE TRANSFER SWITCH.**

### A. With No Voltage Available on Either Power Source and Breakers Charged

1. Both the Normal (NB) and Emergency (EB) power switching devices should be in the "OPEN" and "CHARGED" position. (If breakers do not read "CHARGED", they can be manually charged. See Manual Charging of SPB Breaker and Fig. 4.)

2. The Test Selector Switch (TSS) should be in the "AUTO" position.

3. When used, the Four Position Selector Switch (FPSS) should be in the "OFF" position.

4. If the Four Position Selector Switch (FPSS) is not used as in A3 above, the generator engine start controls should be in the "OFF" position to prevent an undesired start.

5. Preset all timing circuits to meet job specifications.

6. Precheck all transfer switch loads to insure that they are ready to be energized.

### B. Connect Power Sources

1. Close the normal source upstream protective device.

a) If the Four Position Selector Switch (FPSS) is not used as in A.4. above, the normal power switching device (NB) should charge and then automatically close.

b) If the Four Position Selector Switch (FPSS) is used as in A.4. and in the "OFF" position, the normal power switching device will not automatically close. Place switch (FPSS) in "AUTO" position.

2. With the emergency generator in the "OFF" position, where used, close the emergency source upstream protective device.

**NOTE: Prior to making any attempt to energize the transfer switch, the engine-driven generator should be operated. If necessary, the voltage regulator on the generator should be adjusted according to the manufacturer's recommendations. The Automatic Transfer Switch will respond only to rated voltage and frequency indicated on the switch rating nameplate.**

4. Reclose any generator engine-start controls opened as a result of step A.4. above.

5. Where required, use an accurate voltmeter to check phase-to-phase and phase-to-neutral voltages present at the transfer switch normal, emergency and/or load terminals.

### C. Operational Checks – Without Four Position Selector Switch (FPSS)

1. The normal switching device (NB) should be in the "CLOSED" position as a result of step B1a above.

2. Initiate an automatic transfer operation from the normal to emergency power source by moving the Test Selector Switch (TSS) from the "AUTO" to the "TEST" position.

a) The engine should start and run – building up to normal voltage and frequency – within a few seconds, depending upon the machine characteristics. If a Time Delay on Engine Starting (TDES) option is provided, it must time out before the engine will start.

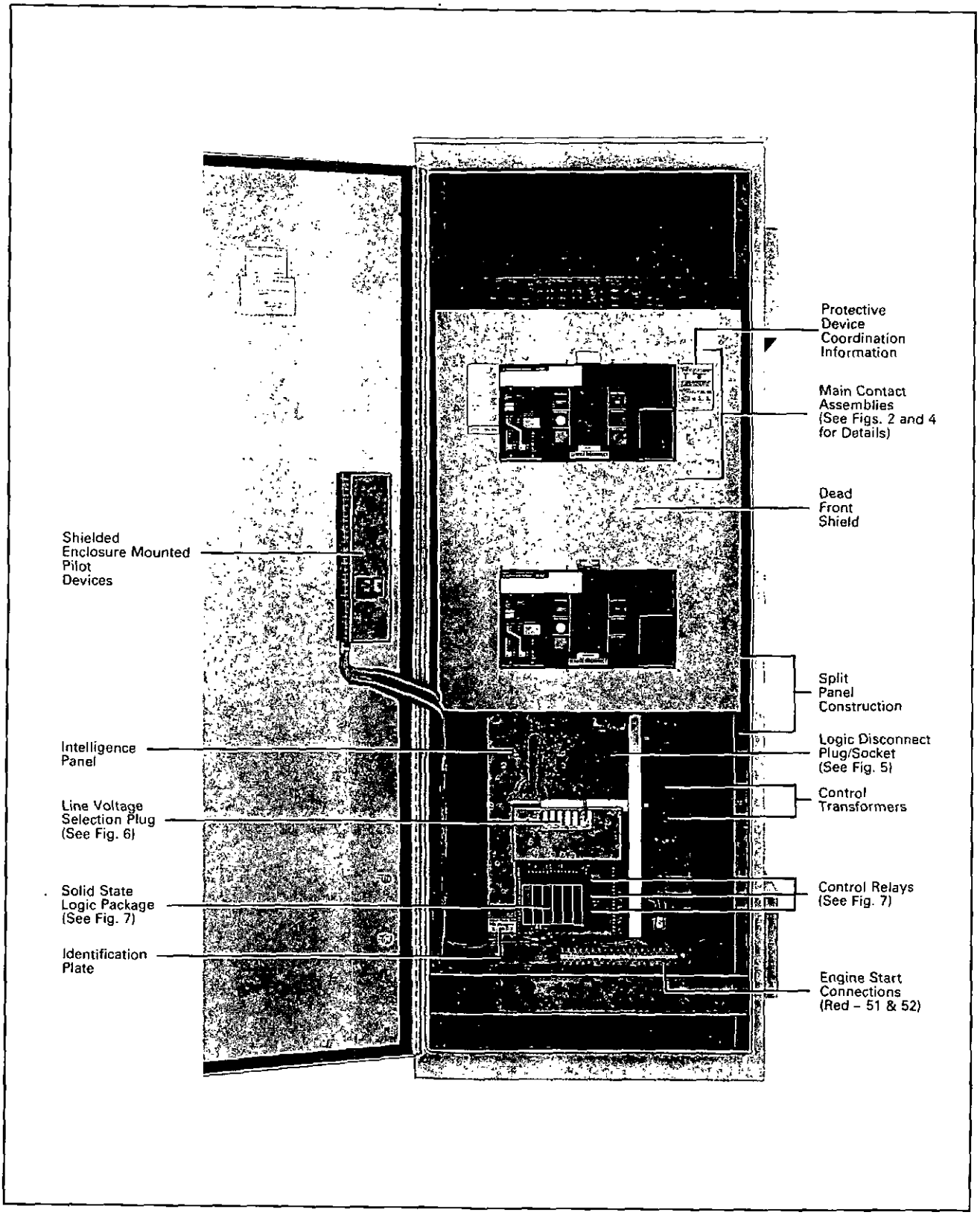
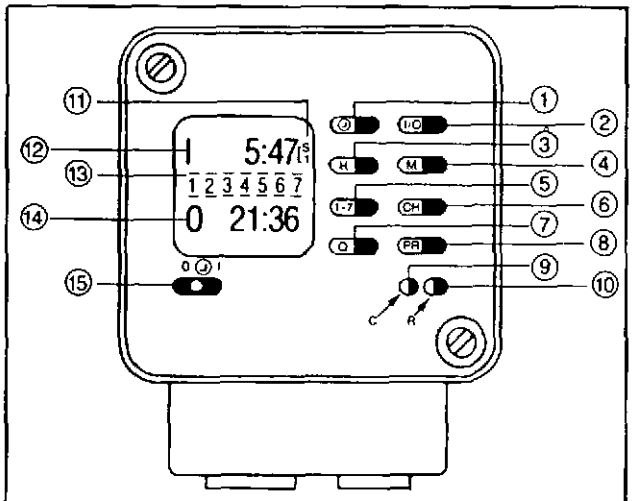



**Fig. 1** *SPB Automatic Transfer Switch*

## ACCESSORY ADJUSTMENTS

### Plant Exercisor Time Clock

This is a seven (7) day timer switch used to exercise the engine-driven generator (Option 23).




(1) Clock Mode — For setting time and day of week

(2) I/O — For programming "ON" and "OFF" cycles
- I — Programs "ON" time
- O — Programs "OFF" time

(3) Hours Setting

(4) Minutes Setting

(5) Day of Week Setting

(6) Checks programs successively which have been entered into the time switch

(7) "Q" Button — Enters days of the week to be programmed

(8) Program Button

(9) Clears selected programs, during or after program is entered

(10) Reset — Resets everything in memory, including time of day and all programs

(11) Output Energized Indicator

(12) Displays "On" Time

(13) Day Indicator

(14) Displays "Off" Time

(15) Output Switch — Program mode and output override
- (J) : In Program Mode
- I : Output Energized
- 0 : Output De-energized

**Fig. 8** *P.E. Timer*

### Setting Time of Day:

1. Push Reset Button [R] to clear all memory.
2. Press the Clock Button (J) The display should read 0:00.
3. Press the [H] button to set the hour of day.

   **NOTE:** Time is set in 24 hr. (military) time.
4. Press the [M] button to set the minutes of the hour.
5. Press the [1-7] button to select the day of week. Either Sunday or Monday can be designated as Day 1.
6. Press the Program Button [PR] to enter the time. The points between the hours and minutes will begin to flash.

### Programming:

#### A. How to Set the Turn ON Time

1. Slide the Output Selector Switch to the clock or program mode.
2. Press [I/O] Button. (This button programs the ON and OFF times.) A logic symbol "I" will appear in the top display window. "I" is the symbol for "ON".
3. Press the [H] Button to set the hour of the day the program will start or "Turn ON".
4. Press the [M] Button to set the minute of the hour the program will start.
5. Pressing the [1-7] Button advances the day marker from 1-7 and back to 1. For each and every day to be selected, press the [Q] Button when the marker is over the desired day.

#### B. How to Set the Turn OFF Time

1. Press the [I/O] Button. A logic symbol "O" will appear in the bottom display window. "O" is the symbol for "OFF".
2. Press the [H] Button to set the hour and the [M] Button to set the minute, the program will end or "Turn OFF".
3. Press the [1-7] Button. For each and every day to be selected, press the [Q] Button when the marker is over the desired day.

### Solid-State Card Adjustments

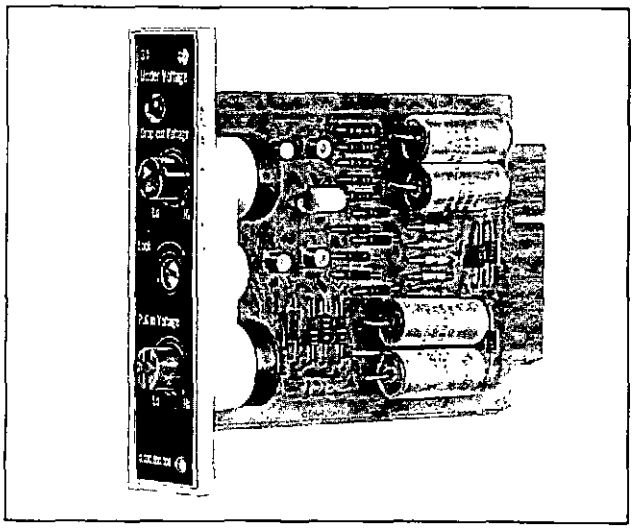
All SPB Transfer Switches are furnished with an adjustable line voltage plug and receptacles. To change line voltage, remove the covers and insert the plug in the desired receptacle (see Fig. 6). Replace the covers.

**CAUTION**

**Be sure the plug is inserted in the receptacle corresponding to the system voltage. Improper connection can cause damage.**

Devices such as voltage sensing relays, timers, etc. furnished with transfer switches will be similar to one of the following types of devices and adjustments should be made as shown for that type of device.

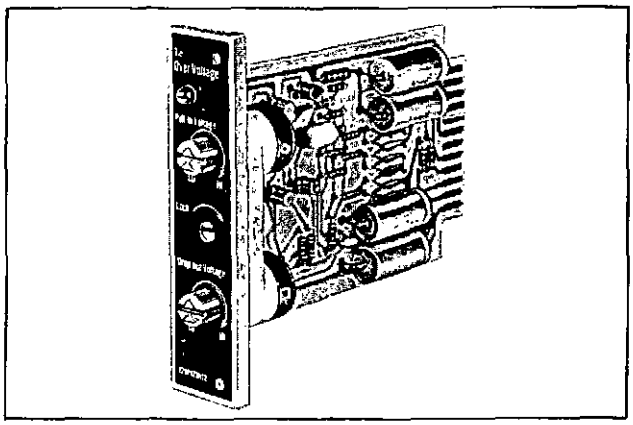
### Solid-State Logic Cards



*Undervoltage Card*

**NOTE: Voltage and frequency cards are pre-calibrated at the factory. Further adjustments are not typically required and should not be attempted unless a variable supply of voltage and frequency control power is available.**

| Step | Description |
|---|---|
| 1 | Set Drop-out knob maximum Counterclockwise |
| 2 | Set Pick-up knob maximum Counterclockwise |
| 3 | Increase line volts to desired Drop-out value (normally 70%) LED should be "ON" |
| 4 | Rotate Drop-out Clockwise until LED goes "OFF" |
| 5 | Rotate Pick-up to maximum Clockwise LED is "OFF" |
| 6 | Increase line volts to desired Pick-up value (normally 90%) LED is "OFF" |
| 7 | Rotate Pick-up knob Counterclockwise until LED comes "ON" |
| 8 | Recheck Pick-up and Drop-out by running voltage up and down check by LED indication |



*Overvoltage Card – Used on Options 5E, 26C*

| Step | Description |
|---|---|
| 1 | Set Drop-out to maximum Counterclockwise |
| 2 | Set Pick-up to maximum Counterclockwise |
| 3 | Set line voltage to pull in value desired (normally 105%) LED is "OFF" |
| 4 | Rotate Pick-up Clockwise until LED comes "ON" |
| 5 | Rotate Drop-out maximum Clockwise |
| 6 | Set line voltage to Drop-out value desired (normally 115%) |
| 7 | Rotate Drop-out Counterclockwise until LED is "OFF" |
| 8 | Drop line voltage to pull-in desired value. LED should come "ON" |
| 9 | Increase line voltage to desired Drop-out value. LED should go "OFF" |

4. Check signal circuit with TSS in "AUTO" position. Disconnect and tape start signal wires. Connect ohmmeter between terminals 51 and 52. Reading should indicate an open circuit. Operate test switch. After Time Delay on Engine Starting (TDES) times out, ohmmeter should indicate a closed circuit.

**B. With Generator Set Running, Transfer Switch Does Not Transfer the Load to Emergency**

1. Check operation. Allow sufficient time for Time Delay Normal to Emergency (TDNE) to time out.

2. Check engine controls. Check generator output frequency and voltage. Output should, typically, be at least 85% of nominal voltage and 95% of nominal frequency, unless frequency and voltage sensing function options which provide stricter tolerances for emergency source are ordered. Make sure generator upstream protective device is closed.

3. Check wiring. With a voltmeter, read phase-to-phase voltage between transfer switch terminals E1 and E2.

**C. Transfer Switch Does Not Retransfer the Load After Normal Source is Returned or After Test Switch (TSS) is Released**

1. Check operation. Make sure that sufficient time has passed to allow Time Delay Emergency to Normal (TDEN) to operate.

2. Check normal source voltage levels. With a voltmeter, read phase-to-phase voltage between transfer switch terminals N1 and N2.

3. Check signal circuit. Confirm that the Test Switch (TSS) has reclosed by measuring 0 volts between terminals 60 and 61.

**D. Transfer Switch Retransfers the Load, but Generator Set Continues to Run**

1. Check operation. Make sure that sufficient time has passed to allow Time Delay Engine Cool-off (TDEC) to operate.

2. Check engine controls. Make sure engine starting control circuit is in the "AUTO" position.

3. Check signal circuit. Disconnect and tape wires to terminals 51 and 52. Connect ohmmeter between these terminals; reading should indicate an open circuit.

If above problem(s) continue or other problems exist, contact your local Westinghouse sales representative, or call the factory at 800-354-2070.

## OPERATION

### Operation Sequence

**NOTE: Only standard options are included in this operation sequence. Follow each step below while reviewing the schematic diagram provided with the transfer switch.**

### Normal Source Failure

Standard normal source failure is defined as "a reduction or loss of voltage". The sequence is as follows:

1. A voltage reduction in any phase of a three phase unit (or a phase-to-phase reduction on a single phase unit) is monitored by Undervoltage Sensing Relay (UV).

2. With a voltage reduction, the UV relay de-energizes at a preset voltage dropout point.

3. With the UV contact open, the Normal Relay (NR) drops out, opening some contacts while closing others. One contact starts the engine-driven generator.

4. When the emergency source voltage reaches operational rating, an Emergency Relay (ER) closes, starting the transfer operation. This operation opens the Normal Breaker (NB) and closes the Emergency Breaker (EB).

5. The transfer switch then supplies the load with emergency power until the normal source is restored.

### Normal Source Restoration

1. The return to the normal power source begins when the voltage in all phases of a three phase sensing unit, (or phase-to-phase in a single phase sensing unit) is restored to a preset value.

2. At the preset pickup voltage, the UV operates causing the Normal Relay (NR) to pickup.

3. This NR closes several contacts while opening others, thus starting the return to normal transfer switch operation.

4. This operation opens the Emergency Source Breaker (EB) and closes the Normal Source Breaker (NB).

## OPTIONS

An extensive list of options are available for the transfer switch as indicated below. Many of these options can be field mounted to the transfer switch to allow modification to the switch as the customer's needs develop and change. For this reason, the electrical diagrams sent with the transfer switch should be retained for future reference.

### 1. Time Delay Normal to Emergency (TDNE)

Delays the transfer from normal source to override momentary power outages or fluctuations. Timing begins when emergency source voltage appears. Does not affect initiation of engine start circuit.

A. Adjustable 1 to 60 seconds.
B. Adjustable .1 to 10 minutes.
C. Adjustable .2 to 30 minutes.

### 2. Time Delay on Engine Starting (TDES)

This option is for use only where the emergency source is an engine generator. It delays initiation of the engine start circuit in order to override momentary normal power outages or fluctuations.

B. Adjustable .5 to 15 seconds.
C. Adjustable 4 to 120 seconds.

### 3. Time Delay Emergency to Normal (TDEN)

Delays return from emergency source to permit stabilization of the normal power source before re-transfer is made. Timing begins when the normal source voltage appears. If the emergency source fails during timing, transfer to normal source is immediate, overriding the time delay.

**CAUTION**

**Where large motor loads are involved, a delayed return to normal is desired to avoid synchronizing problems. See Option 32.**

A. Adjustable 1 to 60 seconds.
B. Adjustable .1 to 10 minutes.
C. Adjustable .2 to 30 minutes.

### 4. Time Delay for Engine Cool-Off (TDEC)

Permits the generator to run under a no-load condition after transfer to normal has been made. Timing begins when transfer is made.

A. Adjustable 1 to 60 seconds.
B. Adjustable .1 to 10 minutes.
C. Adjustable .2 to 30 minutes.
D. Fixed five (5) minutes.

### 5. Frequency/Voltage Sensing Function for Emergency Source

Solid state card constantly monitors the emergency source. This function prevents transfer from normal to emergency, until the engine generator has reached its operating frequency and/or voltage.

A. Underfrequency: adjustable 45-60 Hz (drops out two Hz lower than setting. Single phase protection.

B. Undervoltage/frequency: voltage is fixed at 90% pick-up, 70% drop-out; frequency is adjustable 45-60 Hz (drops out two Hz lower than setting). Single phase protection.

C. Overfrequency: adjustable 50-65 Hz (drops out two Hz above setting). Single phase protection.

D. Undervoltage: adjustable 70%-100% (nominally set at 90% pick-up, 70% drop-out). Single phase protection.

E. Overvoltage: adjustable 100%-115% (nominally set at 115% drop-out, pick-up below 105%). Single phase protection.

F. Undervoltage: adjustable 70%-100% (nominally set at 90% pick-up, 70% drop-out). Three phase protection.

G. Overvoltage: adjustable 100%-115% (nominally set at 115% drop-out, pick-up below 105%). Three phase protection.

### 6. Alternate Test Operators

Provides test operation of the transfer switch by simulating a loss of normal power. Engine starting will be initiated and transfer to the emergency source will occur.

If this option is supplied, the standard test selector switch is omitted.

A. Momentary Contact (Pushbutton) (TPB)

H. Four Position Selector Switch (FPSS)

Permits four modes of switch operation: "TEST", "AUTO", "OFF", and "ENGINE START". The "OFF" position de-energizes the control relays, and opens the

K. Same as Option 16J, except trip supplied on emergency breaker only.

L. Same as Option 16J, except trip supplied on normal breaker only.

M. Digitrip RMS trip device with adjustable ampere, adjustable long time delay, and adjustable short time delay. The ampere and long time delay trip settings are the same as Option 16J. The short time delay pick-up is adjustable at 2, 4, 6, and 8X (times) the plug's rating with selectable short time bands of 6, 12, or 18 cycles.

N. Same as Option 16M, except trip device supplied on emergency breaker only.

O. Same as Option 16M, except trip device supplied on normal breaker only.

Switch ratings and rating plug amperes available.

| Switch Rating (Amps) | Rating Plug (Amps) |
|---|---|
| 1200 | 600, 700, 800, 1000, 1200 |
| 1600 | 800, 1000, 1200, 1600 |
| 2000 | 1000, 1200, 1600, 2000 |
| 2500 | 1600, 2000, 2500 |
| 3000 | 1600, 2000, 2500, 3000 |
| 4000 | 2000, 2500, 3000, 4000 |

**NOTE: When this option is supplied a trip lock-out circuit is employed to prevent subsequent transfer operations until the reason for trip has been investigated and resolved. Depression of an enclosure mounted trip reset pushbutton will reset the tripped breaker.**

**18. Instrumentation**

E. Voltmeter mounted in cover (includes selector switch).

F. Ammeter mounted in cover (includes current transformers and selector switch). ①

G. Frequency Meter

H. Running Time Meter

**20. Non-Standard Connections**

Rear connected solderless lugs are furnished as standard on all switches.

C. Rear bus connections on line and load.

**21. Non-Standard Terminals (Refer to the Factory)**

**23. Plant Exerciser (PE)**

Digital Time Clock provides for automatic test operation of the plant for pre-selected intervals (adj. 0-168 hours in multiples of 15 minutes) at least once a week, mounted on intelligence circuit. Refer to instructions on setting timer.

C. Without interrupting normal supply.

D. By simulation of power failure.

G. Plant exerciser with selector switch for choosing 23C, 23D, or for bypassing exerciser. Refer to Westinghouse for 14 day timer.

I. Similar to Option 23D except with fail safe feature. This feature provides an immediate transfer to the normal source if emergency source fails during exercising period.

J. Similar to Option 23G except with fail safe feature during simulation of power failure.

**24. Battery Charger (BC)**

The trickle charge Dc output is 12 or 24 volts. Units are supplied in separate wall mounted enclosure. Automatic high-low charge rate with 2 amp high rate maximum.

C. 12 volt①

D. 24 volt①

**26. Type of Protection (Normal Source)**

Provided as standard is a solid state undervoltage sensing card which monitors each phase of the normal power supply. Card is adjustable 70%-100% (nominally set at 70% drop-out and 90% pick-up).

① Refer to field connection or mounting instructions for these options.