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# TSC 200 SWITCH PACK MANUAL

## I. GENERAL DESCRIPTION

The Traffic Sensor Corporation 200 Switch Pack was designed in accordance with the State of California publication, "Traffic Electrical Equipment Specifications (TEES)", March, 2009, the NEMA Standard, Publication No. TS1-1989 and FHWA Standards using the latest technologies available. FHWA publication #1P-78-16, "Type 170 Traffic Signal Controller Systems – Hardware Specifications", the State of New York publication "Safety with Traffic Technology Microcomputer Specifications", and the State of California publication "Traffic Electrical Equipment Specifications (TEES)" should be referred to for a detailed description of equipment. These models meet or exceed the referenced NEMA, Type 170 and 332L/334L equipment specifications.

This model features three independent switching circuits on a common printed circuit board. These circuits switch the a.c. line power to one or more incandescent lamps and/or to the primaries of neon transformers employed in pedestrian signals in response to the respective d.c. input signals. Each of the three switch pack circuits contains both d.c. input circuitry and a.c. output circuitry. Each of the three circuits contain 1) a zero-voltage switching optical coupler electrically isolating the d.c. input circuitry from the a.c. output circuitry, 2) a light emitting diode in the d.c. circuitry indicating the a.c. output circuit activated, and 3) a 25 ampere power triac. Every unit has been tested and is plug-in ready.

## II. GENERAL CHARACTERISTICS

### 1. Electrical

a. POWER INPUT – 90 to 135 volts, 57 to 63 hertz.

b. POWER OUTPUT – .03 – 25 Amps RMS at 25°C, 120 VAC per outlet at a min. power factor of 0.85. Max combined load on energized circuits is the equivalent of a 25 AMP tungsten-lamp load. Loads may be tungsten-lamp or neon gas tubing transformers of the type normally used in pedestrian signals. Above 25°C, derate .3A/°C.

c. LEAKAGE – Maximum load current from each de-energized output is less than 5 ma peak.

d. INPUT SIGNAL CURRENT – A maximum of 20 milliamperes is drawn by an operating circuit.

e. ZERO-VOLTAGE SWITCHING – Zero-Voltage Switching commences within 10 electrical degrees of the firs on-half cycle of line voltage during which the input signal is applied, and within 5 electrical degrees of the first zero-load current crossing after removal of the input signal.

### 2. Mechanical

a. SIZE – The nominal dimensions are 7.37 ± 0.1" long (from mating connector surface to front panel) by 4.17 ± 0.02" high by 1.74 ± 0.04" wide. The handle increases the length up to 8.62" ± 0.01".

b. CONNECTOR – The connector is a Beau P-5412-LAB or equal.

### 3. Environmental

AMBIENT TEMPERATURE – Minus 37° to plus 74° Centigrade.

HUMIDITY - From 5 to 95%, non-condensing.

## III. INSTALLATION

The TSC Model 200 Switch Pack intermates with the 332L output file. It is installed or removed using the attached specified handle. Interconnect is as shown on page 3.

| | | | |
|---|---|---|---|
| 10 | ac- | 9 \| | \| 10 |
| 11 | ac+ | | |
| 12 | None | 7 \| | \| 8 |

IV. Adjustments

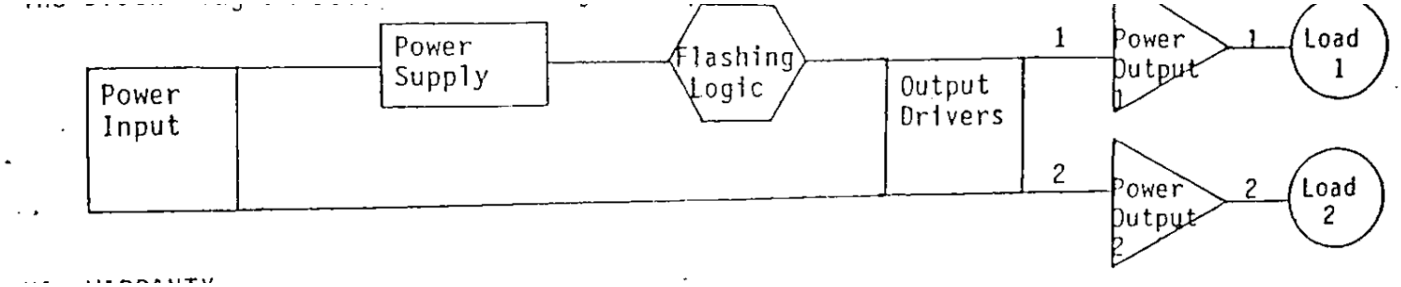
None are necessary.

V. THEORY OF OPERATION

Figure 1 is the Schematic and Logic Diagram for the Flasher Unit. When a.c. power is applied between pins #10 and #11, a d.c. voltage will develop across the electrolytic capacitor. This is the logic power supply for the flasher. The low-power driver triacs, T3 & T4, switch the Power Triacs, T1 & T2, ON and OFF at a rate of 56 ± 3 times per minute. Since the logic circuit operates from the a.c. line at a low voltage level, its output will switch within five degrees of the line voltage crossing. Output waveforms are sinusoidal with frequency and amplitude input. A capacitor, C2 or C3, in series with a resistor, R5 or R8, forms a snubber network which is connected across each power triac to assure triacs turn OFF with inductive loads.

L.E.D. indicators are connected directly across the output circuits to display whether the loads are ON or OFF.

The Block Diagram below describes System Operation.




VI. WARRANTY

TSC warrants that it will correct any defect in workmanship or material, by repair or replacement, F.O.B. Pomona, CA or at its option, issue credit at the original purchase price for any product manufactured by TSC for a period of TWO YEARS from the date of manufacture, unless a shorter warranty specifically applies, in which case the shorter warranty period shall apply. The alteration, misuse, repair or attempt to repair the product by anyone other than TSC shall void the warranty. All returns must have prior written authorization and are at buyer's risk and expense. All replacement parts warrantee for thirty days from date of delivery. In no event shall TSC be liable for incidental or consequential damages, whether buyer's claim is in contract negligence of otherwise.

VII. MAINTENANCE

The "PICTORIAL ASSEMBLY DIAGRAM & PARTS LIST" shows the component layout for this mode. Preventive maintenance consists of not overloading the unit or shorting loads to grounds. The following procedure to replace a Triac is provided for reference. If possible, it is suggested that a defective unit be returned to the factory for repair. The Flasher Triac Power Block, FTPB4204, consists of triacs T1 & T2 mounted on a 0.125 inch thick heat sinking plate and is available from TSC as a sub-assembly to facilitate maintenance. No alignment is necessary since the flasher unit is self-aligning.

1. Remove the #8-32 Nuts from the Case.

2. Remove the #6-32 screws from the Connector.
3. Pull the Case from the Cover Plate.
4. Remove the #8-32 Nuts, Lockwashers, and Spacers. Slide the ground wire off of the threaded stud.
5. Carefully remove solder from the Triac leads on the Printed Circuit Board using a soldering iron and 'Solder-Wick', etc. Remove the Flasher Circuit Board which holds the FTPB4204.
6. Coat the base of the new FTPB4204 with heat transfer compound (silicone thermal grease) and slip the assembly back onto the Cover Plate. Slip the Circuit Board onto the FTPB4204 already on the cover plate. Reinstall the spacers. Tighten these down by placing the #8-32 nuts and lockwashers on top and tightening.
7. Bend the Triac leads over the edge of the Printed Circuit Board. Solder the Triac leads. SLIDE GROUND WIRE OVER ONE OF TWO STUDS closest to connector. TIGHTEN WITH A #8-32 NUT.
8. Reinstall the Case and tighten the #8-32 nuts and lockwashers finger tight. The, tighten ½ turn more.
9. Reinstall the #6-32 screws into the connector.
10. Retest to ensure the fault was corrected.

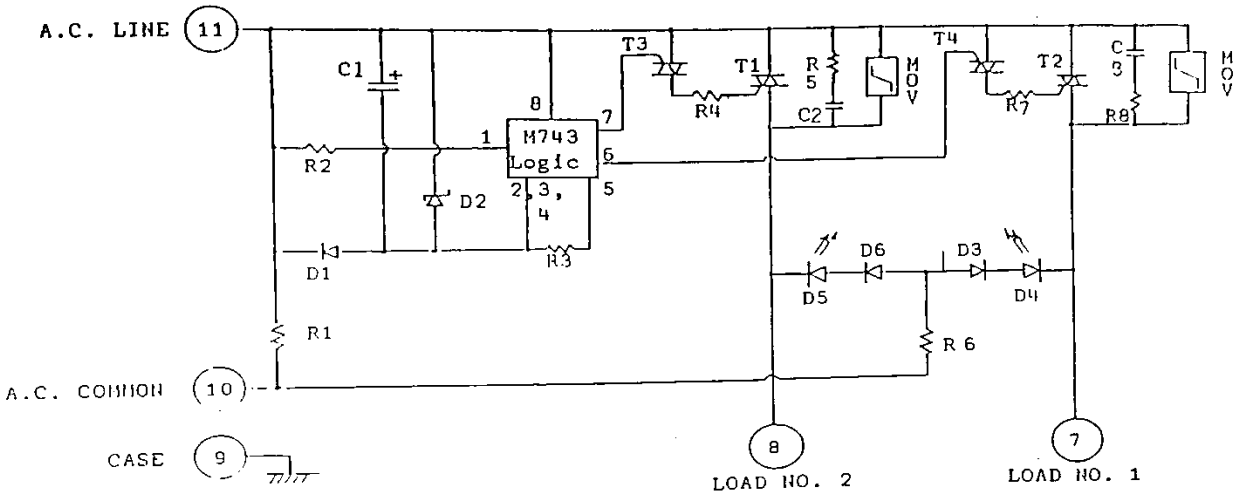
Sub-Assembly Procedure for T-3 replacement of a defective triac from the FTPB4204.

1. Drill out the pin holding the Triac to the FTPB4204.
2. With a hammer and cold chisel knock the bad triac off of the FTPB4204.
3. Scrap the area clean.
4. Replace the damaged triac with a new electrically ISOLATED CASE 25 ampere 500 volt Triac such as listed in the replacement parts list. Attachment of the new triac may be accomplished using an electrically non-conductive epoxy. Before epoxying, use a flux remover to clean the area to be epoxied and dry thoroughly. Use care in soldering not to overheat triacs. It is important that replacement of triacs on the FTPB4204 yield the same location as the original triac. Remove flux residues with a flux remover.

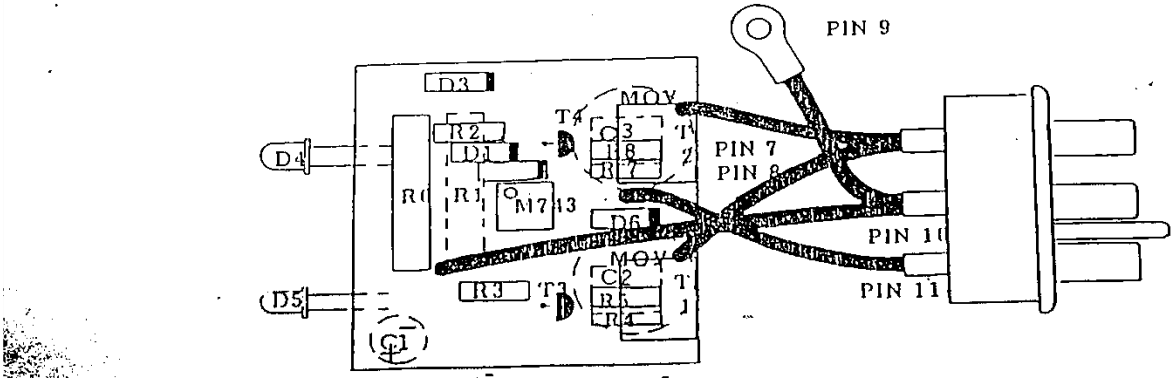
NOTE: Sub-Assembly Procedure T-3 need not be used if a new Flasher Triac Power Block is used for flasher repair.

Figure 1.

SCHEMATIC and LOGIC DIAGRAM




Pictorial Component Layout – View from Component Side
(Type 170 shown)




## Replacement Parts List

| Symbol | Qty. | Component | Description | Source | Part Number |
|---|---|---|---|---|---|
| C1 | 1 | Capacitor | .005 mfd 500-1kv | Any | N/A |
| C2 | 1 | Capacitor | 220 mfd 16v | Integra Electronics | NRSS221M16V6.3X11 |
| C3,4 | 2 | Capacitor | .047 mfd 400v | ITAL Electronics | DMPE473K2G-C |
| D1,3,6 | 3 | Diode | 1A 400V | Any | 1N4004, 1N4005 |
| D2 | 1 | Zener Diode | 4.3v 500mw | Any | 1N5229B, 1N5233B |
| D4,5 | 2 | LED | Indicator | LUMEX | SSL-LX5039IC |
| R1,6 | 2 | Resistor | 3k – 5k, 3w | Any | N/A |
| R2 | 1 | Resistor | 390k, 1/4w | Any | N/A |
| R3 | 1 | Resistor | 470, 1/4w | Any | N/A |
| R4,7 | 2 | Resistor | 30-100, 1/4w | Any | N/A |
| R5,8 | 2 | Resistor | 470, 1/4w | Any | N/A |
| M743 | 1 | IC | Flasher Logic | TSC/Distributor | M743 |

| | | | | | |
|---|---|---|---|---|---|
| MOV | 2 | MOV | .85w, 150v | Any | N/A |
| T1,2 | 2 | Triac | 500v, 25a | TECCOR | Q5025LX |
| T3,4 | 2 | Triac | 500v, Driver | TSC/Distributor | M37 |