MEDIUM INTENSITY DUAL OBSTRUCTION LIGHTING SYSTEM

MODEL NO. - FLASHGUARD 3000

MANUAL UM3000G
I.D. No. 81E00100

HUGHEY & PHILLIPS, INC.
2162 UNION PLACE, SIMI VALLEY, CA 93065
P.O. BOX 2167, SIMI VALLEY, CA 93062
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INSTALLATION AND OPERATION GUIDE FOR

MEDIUM INTENSITY DUAL OBSTRUCTION LIGHTING SYSTEM

MODEL NO. - FLASHGUARD 3000

MANUAL UM3000G
I.D. No. 81E00100

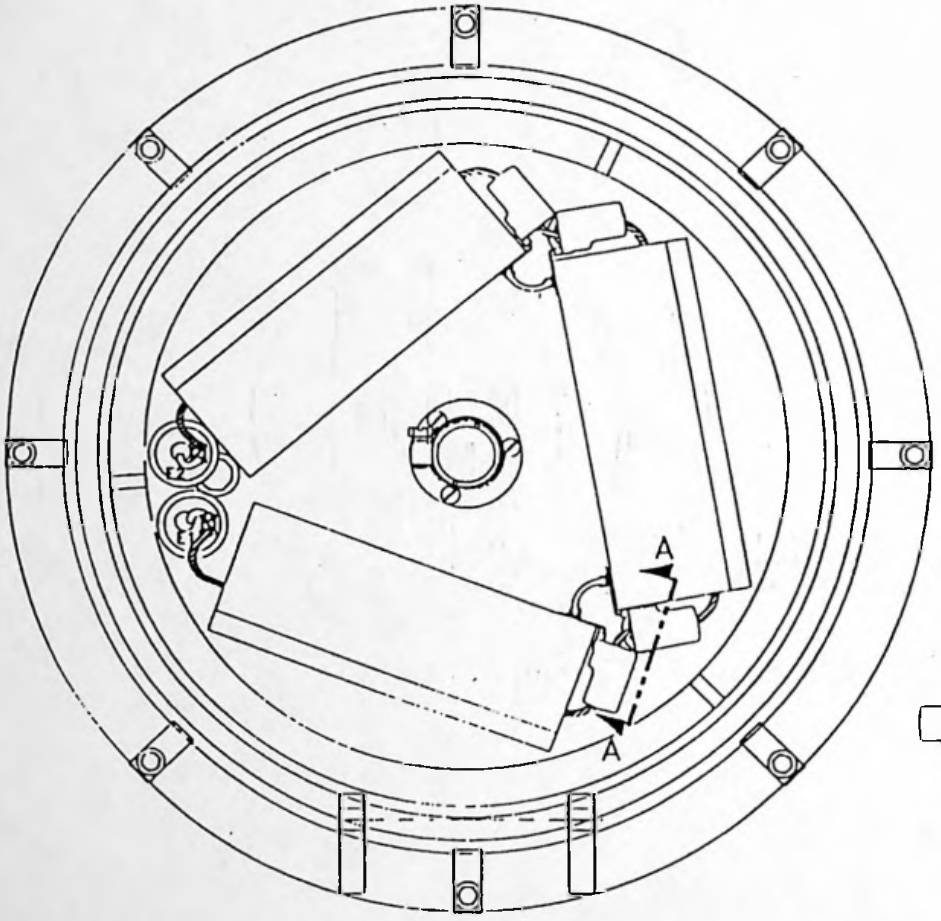
SERIAL NO.: _____

WORK ORDER NO.: _____

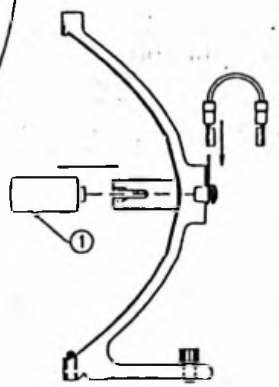
DATE of MFG.: _____

BY: *H.T.SMITH* *DATE:* 4 DEC 96
CHKD.: _____ *DATE:* _____
APPR.: _____ *DATE:* _____

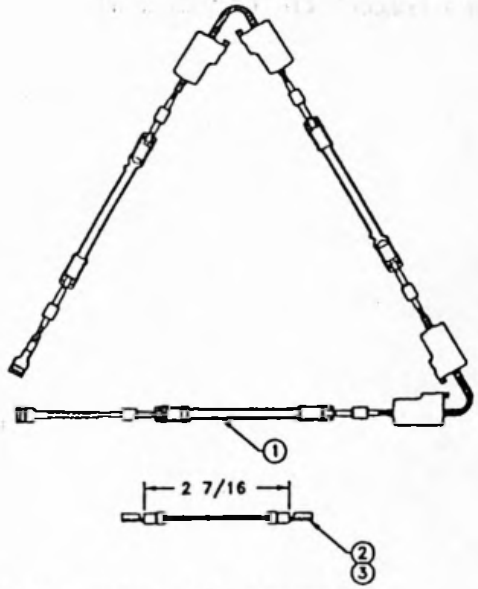
REV.: G DATE: 4 DEC 96



BASE DETAIL
FG2000 / FG3000



2 DETAIL A-A



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	12S00602	EMI SUPPRESSION KIT
2	A.R.	WR05X2002	WIRE #20 MIL16878/CU RED
3	4	WL093B250086	TERM. PUSH ON 16/14 .25 INS.SL
4	1	EMIFF150A-J	FERRITE TOROIDAL CORE (SHT2)

2 IN DETAIL A-A THE FLASH TUBE HAS BEEN OMITTED FOR CLARITY.

NOTES: UNLESS OTHERWISE SPECIFIED
1. ASSEMBLE EMI SUPPRESION KIT (ITEM 1) AS SHOWN IN BASE DETAIL.

REV	DESCRIPTION	DATE	APPV
A	RELEASE	18NOV94	AH

HUGHEY & PHILLIPS INC.
2162 UNION PL., SIMI VALLEY, CA. 93065

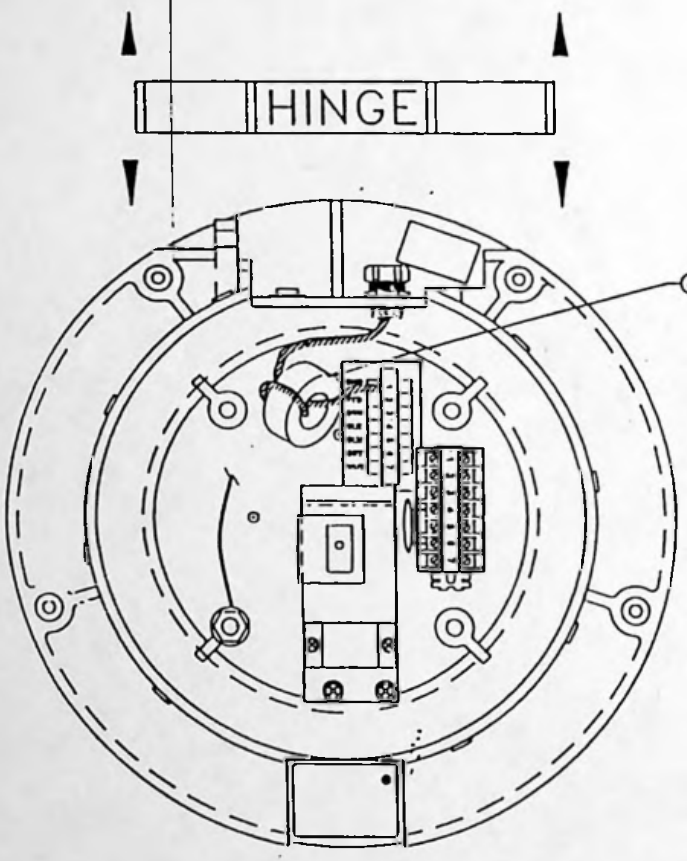
RVortlinez

ASSEMBLY, EMI SUPPRESSOR KIT

SCALE NONE

12S00601 A

(SHEET 1 OF 2)



④ WRAP RED WIRE TWO (2) TIMES THROUGH THE CENTER OF TOROID (ITEM 4).

CAUTION!
BE SURE TOROID DOES NOT INTERFERE WITH TRIGGER TRANSFORMER WHEN BASE IS CLOSED.

BASE ONLY, OTHER VIEWS REMOVED

HUGHEY & PHILLIPS INC.
8182 UNION PL., MIMI VALLEY, CA. 93065

DRWN RMartinez	(CONTINUED) ASSEMBLY, EMI TOROID
CHK'D 4/95	
APPROVED	
SCALE NTS	SIZE D DRAWING NUMBER 12500601
DO NOT SCALE PRINT	SHEET 2 OF 3

NOTICE

The integrity and reliability of H&P aviation obstruction lighting systems are dependent on the use of H&P parts and components. To ensure the optimum performance and reliability of your H&P system, it is strongly advised that only components and modules manufactured by H&P be used.

WARRANTY

H&P warrants the equipment described in this instruction manual and sold to the purchaser to be free from defects in material and workmanship at the time of shipment. H&P's liability under this warranty being limited to repairing or replacing, at H&P's option, items which are returned to it prepaid within eighteen (18) months from shipment to the original Purchaser and found, to H&P's satisfaction, to have been defective. In no event shall H&P be liable for consequential damages. NO PRODUCT IS WARRANTED AS BEING FIT FOR A PARTICULAR PURPOSE AND THERE IS NO WARRANTY OF MERCHANTABILITY. This warranty applies only if: (I) the items are used solely under the operating conditions and in the manner recommended in H&P's instruction manual, specifications, or other literature; (II) the items have not been misused or abused in any manner or repairs attempted thereon; (III) written notice of the failure within the warranty period is forwarded to H&P and the directions received for properly identifying items returned under warranty are followed; and (IV) such return notice authorizes H&P to examine and disassemble returned products to the extent H&P deems necessary to ascertain the cause of failure. The warranties stated herein are exclusive. THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, BEYOND THOSE SET FORTH HEREIN, and H&P does not assume, nor does H&P authorize anyone else to assume for it, any other obligation or liability in connection with the sale or use of said products. H&P's liability on any claim of any kind, including negligence, for loss or damages arising out of or connected with the manufacture, sale, delivery, repair or use of any equipment or services provided by H&P shall in no case exceed the price allocable to the item or service or part thereof which gives rise to the claim.

WARNING!

Modifications to the Power Supply are required for certain applications. Documentation to describe these changes may be found at the end of the manual.

TABLE OF CONTENTS

1.1 Scope

This manual provides information about the installation, operation, and maintenance of the FlashGuard 3000 Medium Intensity Dual Obstruction Lighting Systems manufactured by H&P, 2162 Union Place, Simi Valley, California 93065, tel. (805) 581-5591, FAX (805) 581-5032. The lighting systems described in this manual are FAA types L-864 and L-865, for use as medium intensity aviation obstruction warning systems.

1.2 General Description

The FG 3000 Lighting System is a capacitor discharge, xenon flash strobe light system manufactured to comply with Federal Aviation Administration Advisory Circular 150/5345-43. Each system consists of an omnidirectional flashhead, an associated power supply with integrated controls, an ambient light sensor (photocell), and an interconnecting cable (up to 1000 feet in length). System components are shown in Figures 1-1 and 1-2. Modifications may be made to suit different applications.

The flashhead consists of two acrylic lens assemblies (red and clear) attached to a hinged base. Included within the flashhead are the flashtube assemblies, an interlock switch, trigger transformer and the terminal block where the interconnecting cable terminates.

The power supply contains power control circuits (relays, fuses, switches) for both strobe and auxiliary side lights, a high-voltage circuit (power transformer, rectifiers, energy storage capacitors, discharge circuits), flash interval and timing circuits, dual monitor circuits, intensity selection controls, and a trigger generator. Also attached to (or remotely located from) the power supply is the ambient light sensor (photocell).

*Registered H&P Trademark

WARNING!

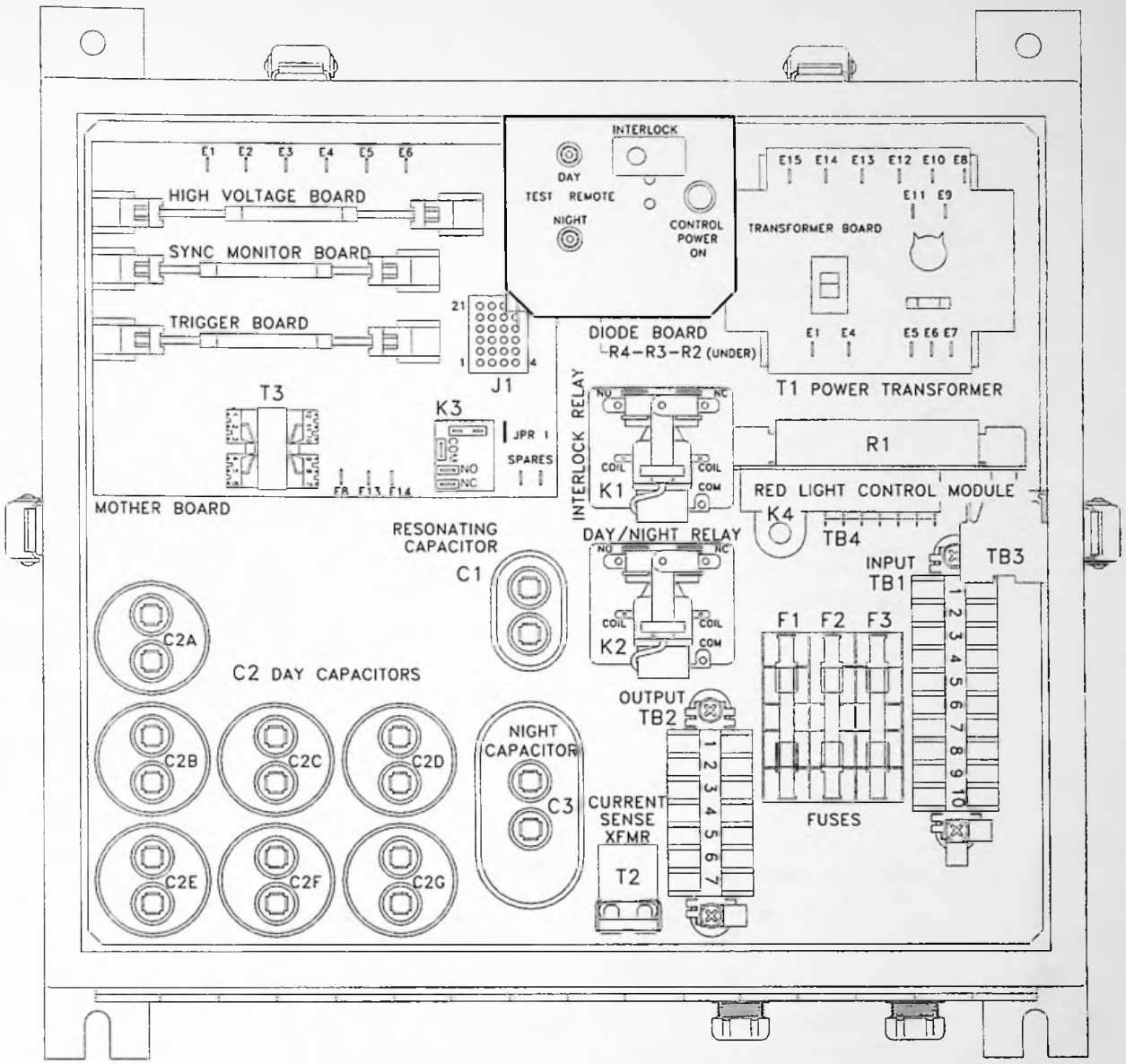
This system uses lethal voltages in both the power supply and the flashhead. Do not attempt to service or adjust the equipment with line power applied.

Interlock switches are provided in both the flashhead and power supply enclosures to interrupt main power to the power supply. These switches are activated when the power supply door or flashhead lens assembly is opened in a conventional manner. No interlock is provided when other means of access are used. Never tamper with (remove, short circuit) the interlocks in any way.

LINE VOLTAGE IS STILL PRESENT WHEN INTERLOCKS ARE ACTIVATED. DISCONNECT POWER BEFORE INSPECTING OR SERVICING.

WARNING!

Flashlamps in this lighting system produce brilliant flashes of light containing some ultraviolet radiation which can result in temporary or permanent eye damage. DO NOT LOOK DIRECTLY AT THE FLASHHEAD WHILE IT IS IN OPERATION.



DWG FILE 3000-1-1.DWG

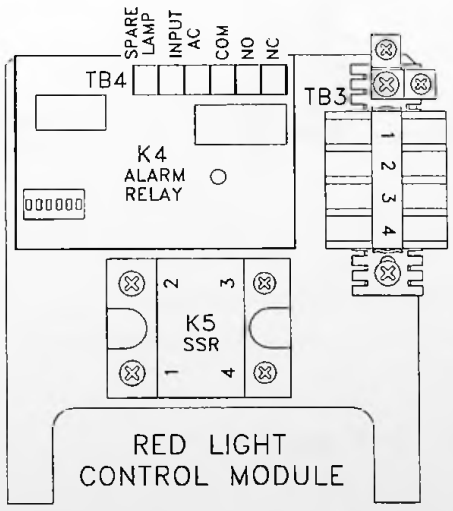


Figure 1-1. POWER SUPPLY COMPONENT LOCATIONS

FILE; 3000-1-1

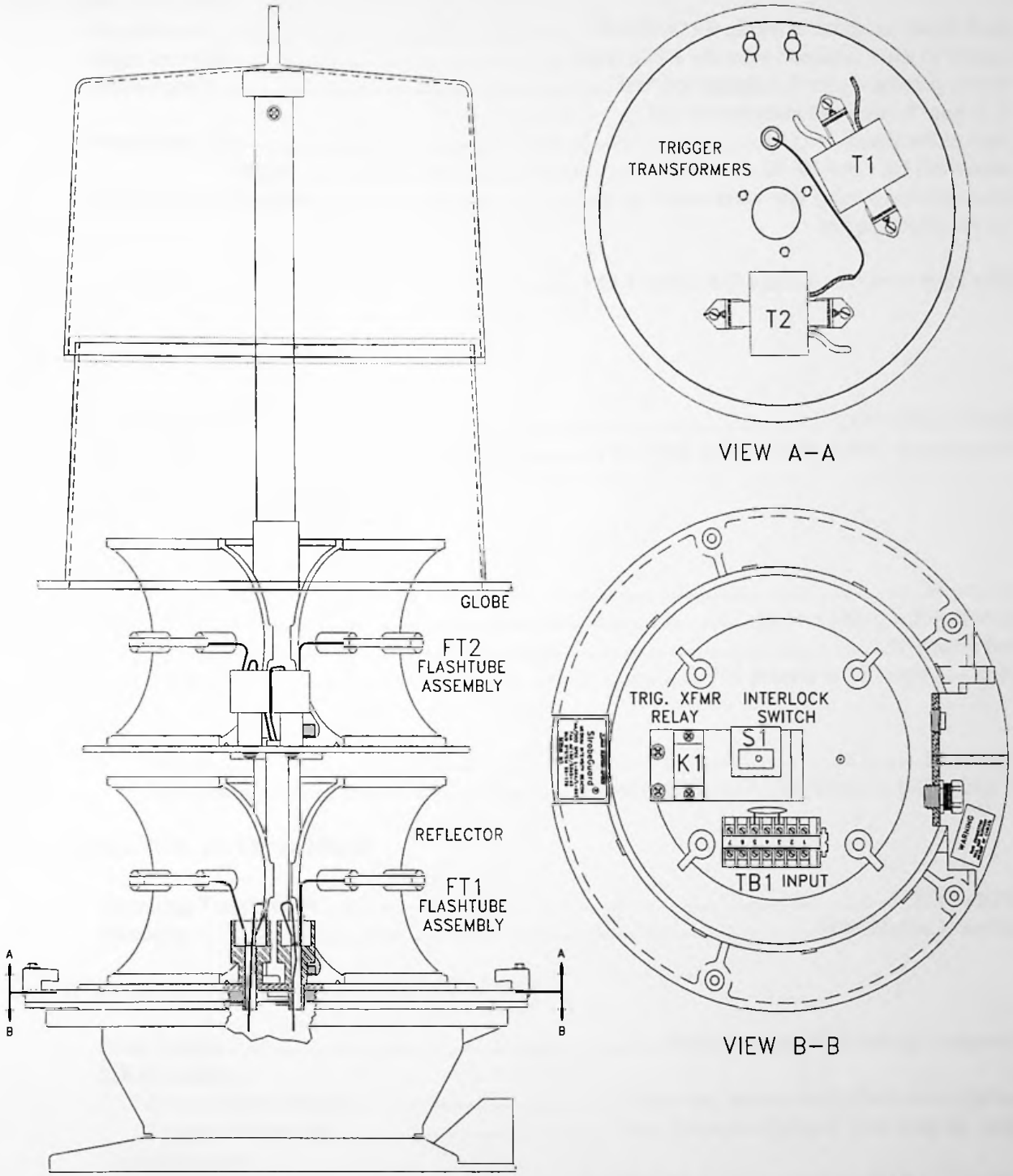


Figure 1–2. FLASHHEAD COMPONENT LOCATIONS

FILE; 30001-2

1.3 SPECIFICATIONS

1.3.1 LIGHT OUTPUT

Day Intensity ..... 20,000 ±25% effective candelas, single flash
Night Intensity ..... 2,000 ±25% effective candelas, burst of flashes
Beam Pattern ..... 360° horizontally; 3° min. vertically; lower half-power point between -.5° and -1.5°
Flash Rate: Day ..... 40 fpm - single white flash
Night ..... 20-40 fpm - red flash burst
Master/Slave Operation ..... up to 4 slave units may share a common sync and photocell circuit.

Side lights ..... 1 to 4 type L-810 lights steady burn night only

1.3.2 ELECTRICAL INPUT

Power Supply 120/240VAC 60HZ
Side Lights ..... 1 to 4 type L-810, 116w, 120V incandescent

1.3.3 MECHANICAL PROPERTIES

Flashhead
- Weight ..... 34 pounds
- Dimensions ..... 16.5w (419.1) x 23h (584.2)
- Surface Area ..... 1.98 square feet
- Wind Load ..... 105 pounds at 150 mph (240kph)

Power Supply
- Weight ..... 53 pounds
- Dimensions ..... 18.5w (469.9) x 17.25h (438.2) x 10.5d (266.7)

1.3.4 OPERATING ENVIRONMENT

Operating Temperature ..... -55°C to +55°C
Humidity ..... 95% relative humidity

1.3.5 SYSTEM OPERATING STATUS INDICATORS

Neon Lamps ..... Power line and high voltage indicators
L.E.D. Lamps:
- Sync/Monitor Board ..... Sync out, master (red); Fault relay (green)
- Trigger Control Bd ..... Sync line active (green); Red lamp on (red)

Fault Indication
- Strobe ..... Relay closure, contact ratings of 3A at 120VAC
- Incandesant ..... Relay closure, contact ratings of 3A at 120VAC

SECTION 2.0 - INSTALLATION

2.1 Unpacking

Carefully unpack each item and remove any internal packing material from the power supply and flashhead. Examine each item for obvious physical damage. Report any claims to the carrier immediately. Pertinent data such as installation drawings, schematics, interconnection drawings, and operation manuals are included in the power supply carton. The flashtube is packaged inside the flashhead.

2.2 Mounting and Preparation

Detailed drawings for mounting the flashhead and power supply are shown in Figures 2-1a and 2-1b (pages 10 & 11).

2.2.1 Flashhead SS178

Normally the flashhead is mounted at the uppermost point on the structure. It must be mounted level to assure proper light output.

2.2.2 Power Supply SS177

The power supply is connected to its flashhead via the cable provided by H&P. The length of this cable (up to 1000 feet) determines how far from the flashhead the power supply can be mounted.

The vent hole on the bottom surface of the power supply is covered with a solid plug prior to shipping. Optional screened plugs are furnished separately.

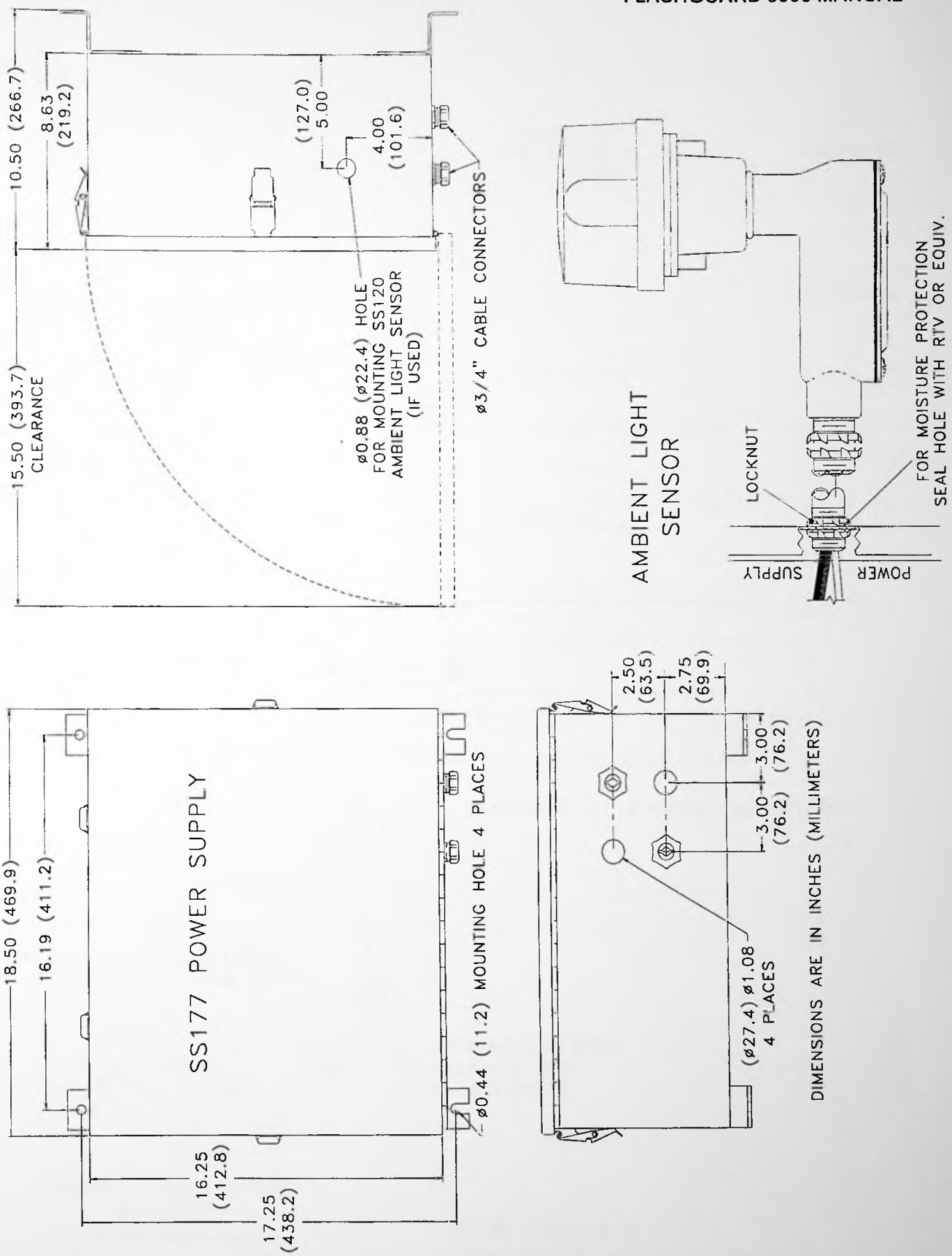
The user should determine that the power line voltage selector, located on the transformer board inside the power supply enclosure is set to the main voltage being used.

2.2.2.1 Side Light

One to four side lights (116W, 120V) may be connected to the side light module.

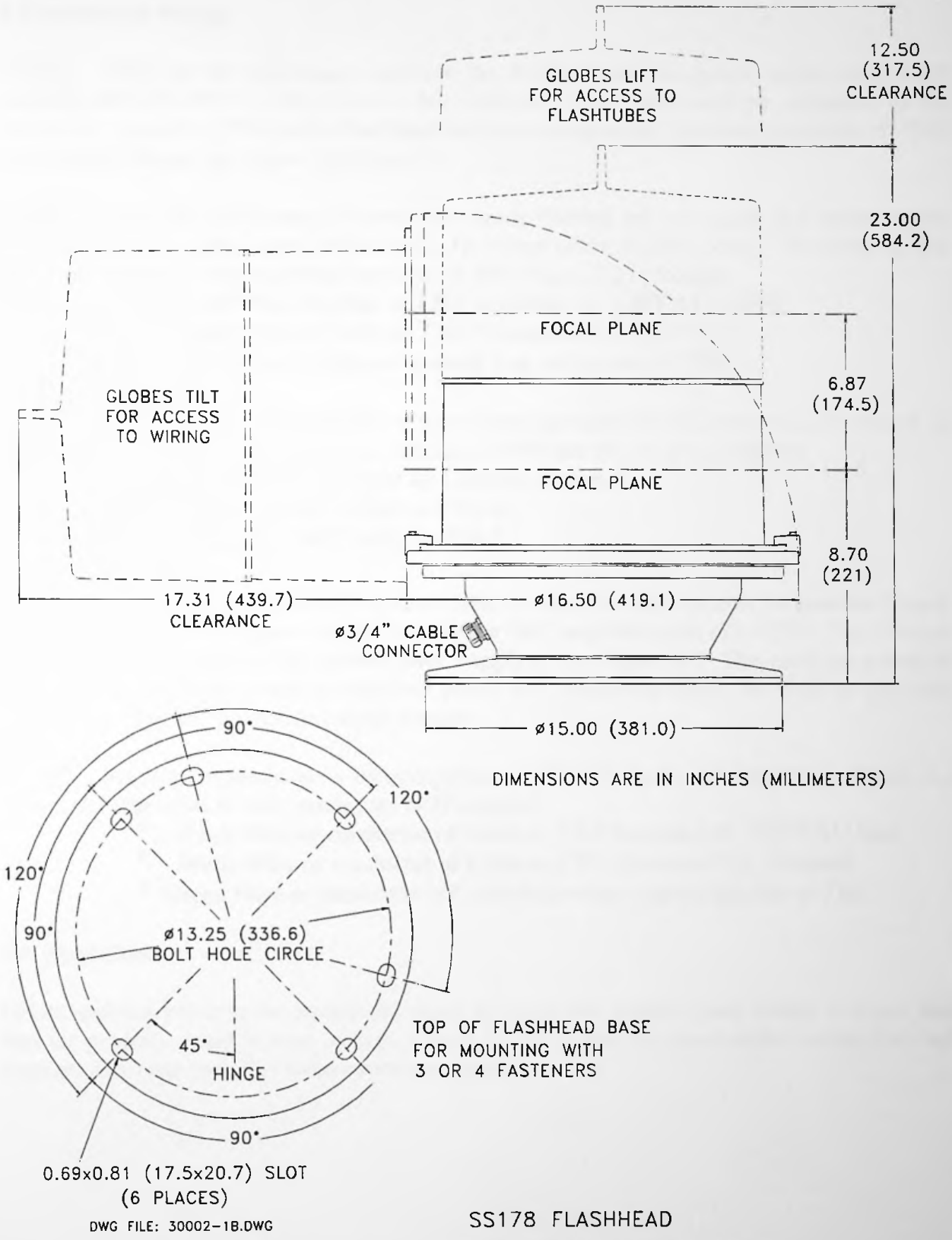
2.2.3 Ambient Light Sensor SS120

The ambient light sensor, when supplied with the system, should be mounted upright, away from artificial light (eg., floodlights), and in a location that will enable its sensor window to have an unobstructed view of the polar sky (eg., pointed north in the northern hemisphere).



FILE; 30002-1A

Figure 2–1a. OUTLINE AND MOUNTING DIMENSIONS



SS178 FLASHHEAD

Figure 2-1b. OUTLINE AND MOUNTING DIMENSIONS

FILE; 30002-1B

2.3 Installation Wiring

STEP1 - Make all the interconnects between the flashhead and the power supply using H&P supplied cable (77-4017). The wires in this cable are color coded and are connected to the numbered terminals of **TB1 in the flashhead** and the corresponding numbered terminals of **TB2 in the power supply** per *Figure 2-2(Page 13).*

STEP2 - Make the interconnects between the steady burning red side lights and power supply using the H&P supplied cable (WC01012CLOT or equivalent #12awg cord). The wires in this cable are connected to the numbered terminals of **TB3** *Figure 2-2* as follows:

* **Black Wire of Cable to *TB3* Terminal #1, 120VAC LINE**
* **White Wire of Cable to *TB3* Terminal #2, *NEUTRAL***
* **Green Wire of Cable to Ground Lug on the side of *TB3.***

STEP3 - Make the interconnects between the external photocell and the power supply using # 12 AWG wire. The wires in this cable are connected to **TB1 per** *Figure 2-2* as follows.

* **White Wire of Cable to *Chassis ground***
* **Red Wire of Cable to *TB1-1***
* **Black Wire of Cable to *TB-2***

STEP4 - For structures with two (2) or more systems make the interconnects between the Master power supply and Slave power supply (s) using the H&P supplied cable (77-4231). The wires in this cable are connected to) **TB1 in the Power Supply (s)** per *Figure 2-3.* This cable has a total of 10 conductors and can be used to distribute power and consolidate alarm functions to and from slave power supplies. For details *consult Factory.*

STEP5 - Make the connections for Incoming Power to **TB1 in the Power Supply** per *Figure 2-2* as follows. The wires or cable needed are NOT supplied.

* **Black Wire or conductor of Cable to *TB1* Terminal #9, 120VAC line**
* **White Wire or conductor of Cable to *TB1* Terminal #10, *Neutral***
* **Green Wire or conductor of Cable to Ground Lug on the side of *TB1.***

2.4 Final Check

Before applying power to the equipment, check all relays and printed circuit boards to ensure that they are properly seated in their sockets. Check to ensure that any user-installed wiring does not interfere with relay operation when covers are closed.

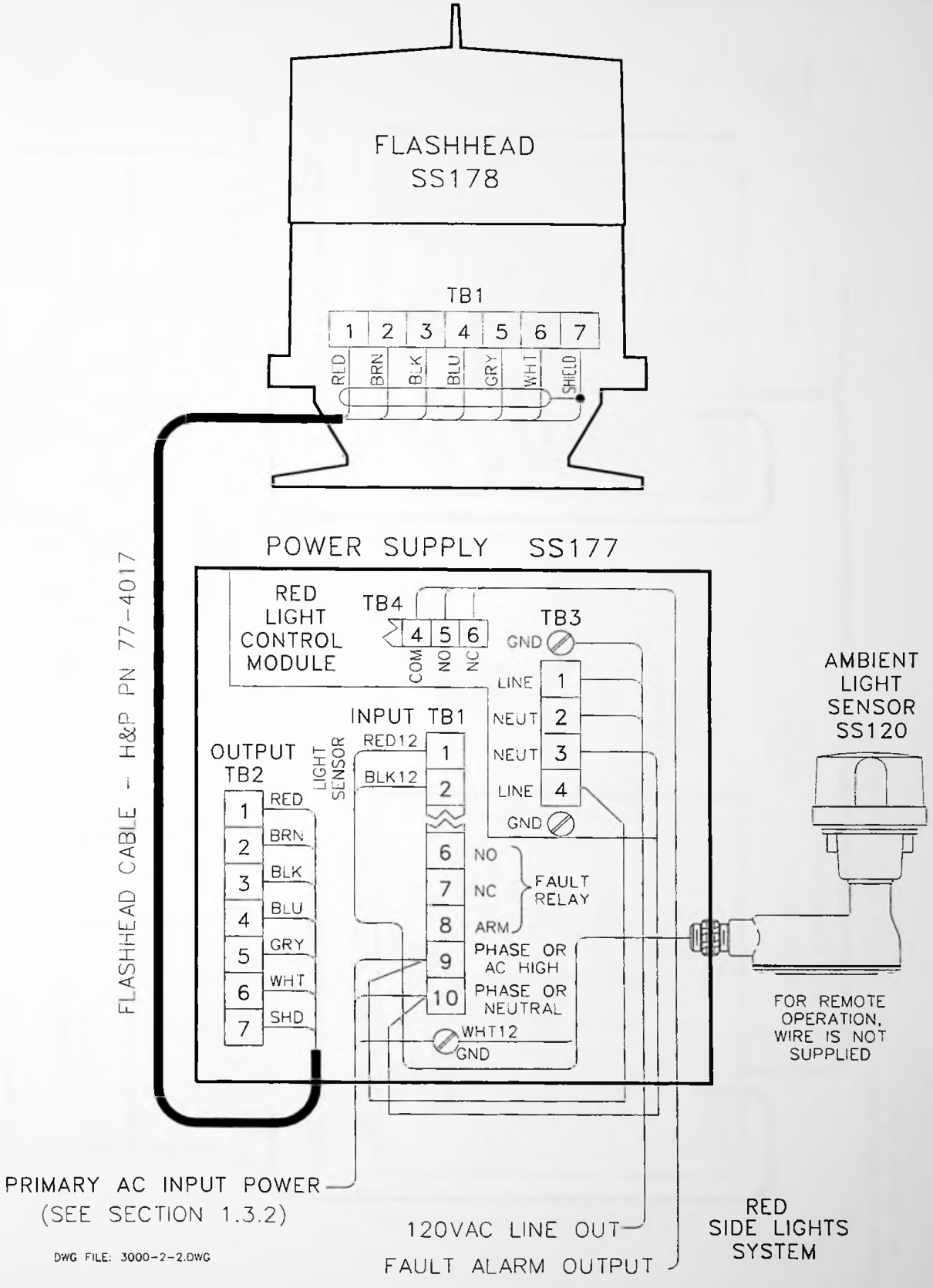


Figure 2-2. INSTALLATION WIRING FOR STAND-ALONE UNIT

FILE; 30002-2

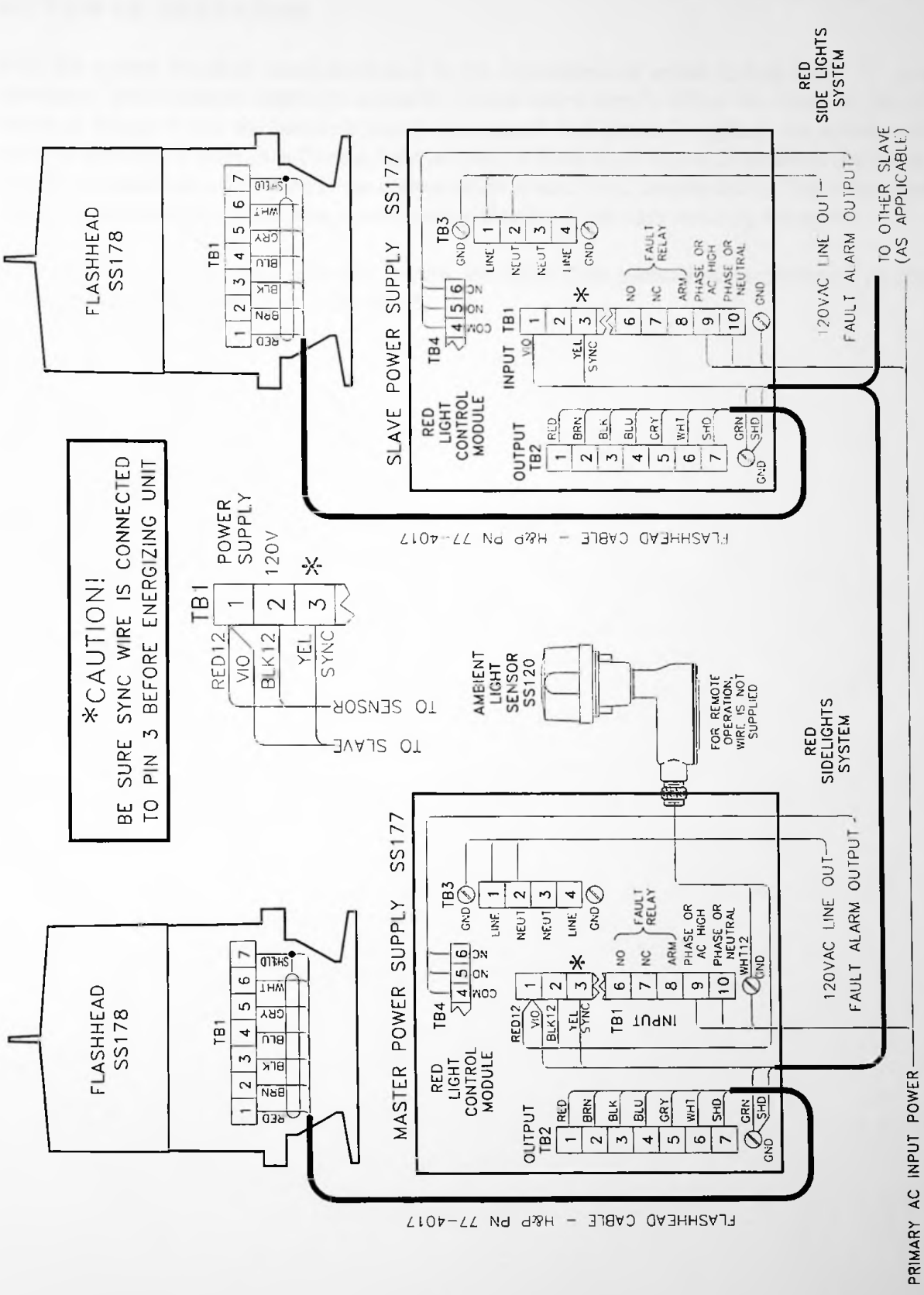


Figure 2-3. INSTALLATION WIRING FOR MASTER/SLAVE UNITS

FIGURE; 2-3
FILE;3000-2-3

SECTION 3.0 - OPERATION

After the system has been wired according to the instructions in setion 2, it is ready for normal operation. The flashhead assembly should be closed and secured. When the cover of the power supply is closed so that the interlock switch is engaged and power is applied, the system will be begin to operate. If there is sufficient light and the ambient light sensor is mounted correctly, the system will automatically switch to the correct mode after a 1 to 2 minute delay. The delay protects against unwarranted switching due to momentary changes in the light reaching the sensor.

If the system is not operating correctly, review the installation instructions in Section 2 or consult the troubleshooting information in Section 5.

SECTION 4.0 - PRINCIPLES OF OPERATION

4.1 Overall Description

The AC main power input to the power supply is converted to approximately 1000 VDC to bias the flashtubes in the flashhead and to charge the energy storage capacitors. The ambient light sensor sends correct control signals to the power supply to automatically change the intensity of the flashhead and control the red incandescent Side Lights.

The main power to the power supply is applied to the control and logic circuitry, thereby activating relays which determine the intensity of the flashhead. Logic circuits in the power supply generate a timing signal which controls the rate of flash.

Test switches located on the switch board allow the system to operate in either day or night mode. These switches should be left in the **remote** position for photocell operation as shown in figure 1-1, (page 6).

4.2 Functional Description of Subsystems

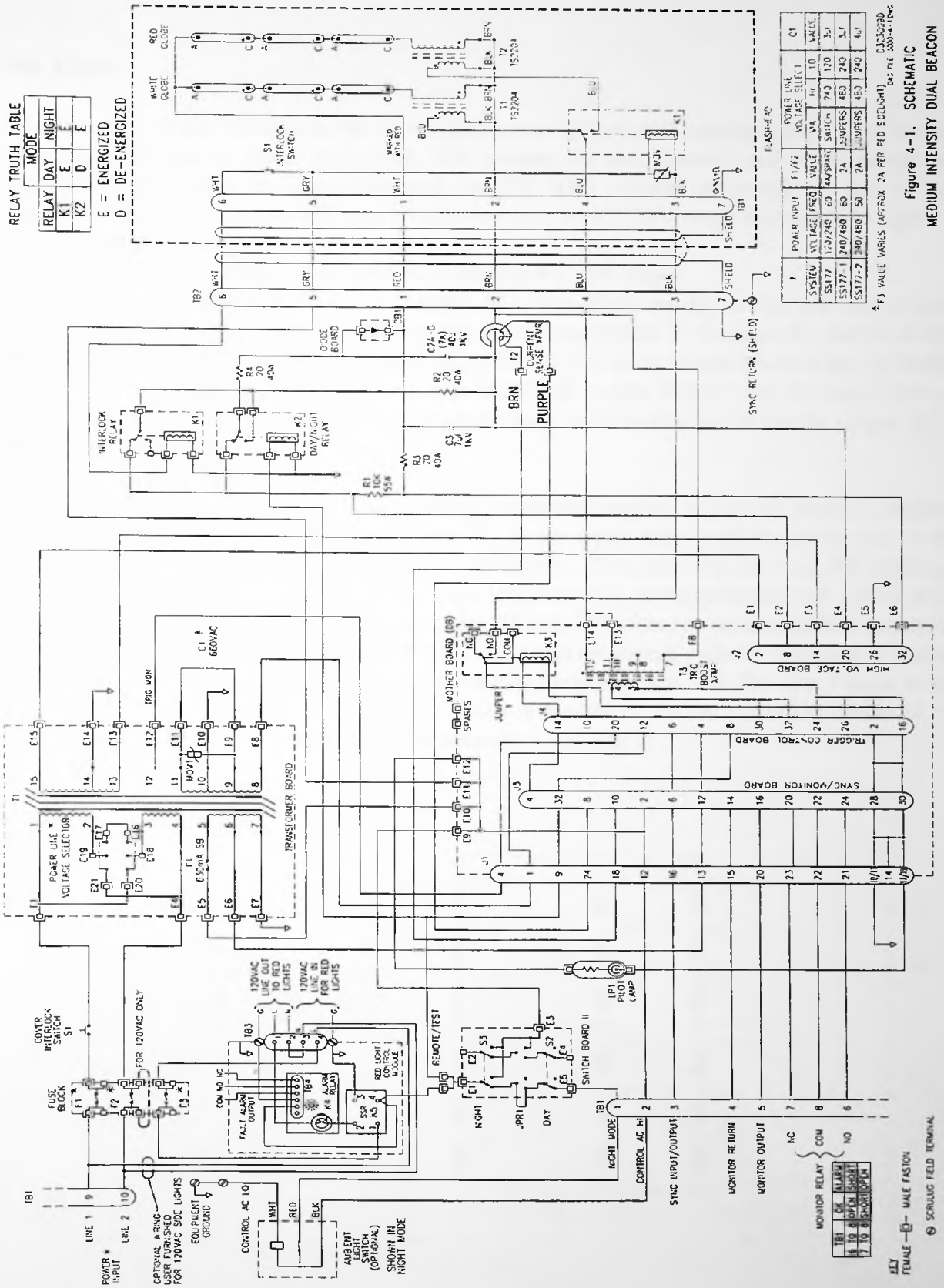
4.2.1 SS178 Flashhead and SS177 Power Supply (Figure 4-1, page 17)

The main AC input power is transformed to high voltage DC and stored in capacitors. The flashtube, in parallel with the capacitors, is fired by the trigger circuit. This discharges the capacitors, producing a flash of light. The intensity of the light is varied by changing the capacity for energy stored between flashes. The flashtube extinguishes when current from the capacitors is too low to support the arc. The power supply short circuit current is set below the minimum tube current to prevent continuous conduction. The capacitors then recharge for the next flash.

Input power is applied to the primary of the ferroresonant power transformer (T1) when the flashhead and cover interlocks are closed. The high voltage output of T1 is rectified and charges the energy storage capacitors.

In the day mode, normal operation has the interlock relay (K1) energized while the day/night relay (K2) is de-energized. Capacitors C2 and C3 in the high voltage circuit are kept charged. With this amount of capacitance in the circuit and DC voltage provided, sufficient energy is discharged through flashtube V1 to produce an effective intensity of 20,000 candelas (+/- 25%).

In the night mode (low intensity), 120VAC is supplied from the photocell and applied to the power supply (on TB1) and to the day/night relay (K2). When K2 is energized, its contacts will remove C2 from the high energy circuit and discharge it through R2 and R4. Now only C3, with R3 in series, is in the tube circuit. This provides the energy required to produce the effective intensity of approximately 2000 candelas. Concurrently, 120 VAC is applied to pin 8 of the trigger control printed circuit board, switching logic from single shot to burst mode. The AC voltage is also applied to pin 32 of the Sync/Monitor board, establishing the number of red flashes per minute (fpm).



SS178 Flashhead and SS177 Power Supply
Figure 4-1
FILE:D323009D

Side Lights

The AC night control voltage (at TB1-1) operates a red light control module consisting of a solid state relay (K5) and an alarm relay (K4). This module, in turn, controls and monitors any red obstruction lights used in conjunction with the FG 3000 system, indicating the loss of any incandesant bulb. The module will control up to four (4) 116W, 120V steady burning Side Lights.

4.2.1.1 High Voltage Printed Circuit Board (Figure 4-2, this page)

The high voltage printed circuit board consists of a three-diode-per-leg bridge and two 3-diode circuits. High voltage AC from the ferroresonant power transformer T1 feeds pin E1 and E3 to HV board connector pins 2 and 14. This high AC voltage is full wave bridge rectified by the bridge circuits legs CR1, CR2, CR3 and CR4. This in turn is fed to pins 8 (pos.) and 20 (neg.). Voltage divider circuit R1 through R5, with a series neon lamp, is connected to the bridge output. LP-1 lights whenever high voltage is present.

The bridge network is used for a day mode energy capacitor charging. When full charge is reached, the voltage is nominally 1 KV DC on C2 and C3. In the night mode burst operation, part of the bridge circuit CR1 and CR4, plus the two 3-diode circuits, CR5 and CR6, are used. All triggering occurs at zero crossing of the HV AC. The night capacitor (C3) recharge begins with current from the HV transformer tap (ground, pin 26) through CR6 and CR1, then, on the second half line cycle, from the full HV secondary, CR4 and CR5. This completes the charge cycle for one flash in a burst. In AC-powered systems, night flashing occurs at line frequency rate. The first few flashes in the burst establish the steady state operating conditions of the circuit for the remaining flashes of the burst. At the full charge, the voltage on C3 is normally 1 KV DC.

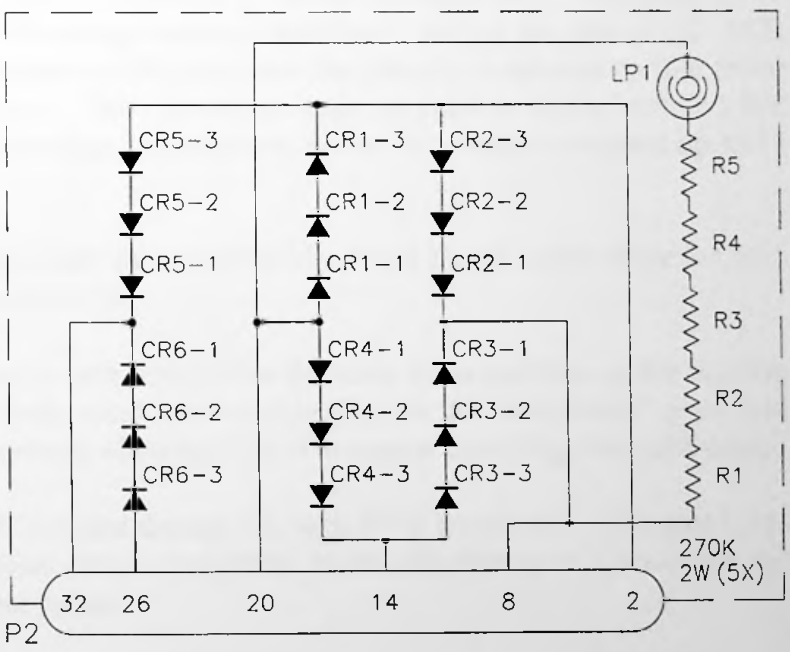


Figure 4-2.

SCHEMATIC -HIGH VOLTAGE BOARD

4.2.1.2 Trigger Control Printed Circuit Board (Figure 4-3, page 21)

The function of the Trigger Control PCB is to provide a synchronized trigger pulse to the primary of a trigger transformer located in the flashhead. A single pulse in the day mode, and a burst in the night mode, at a frequency of 20-40 fpm is required. Dip switches set the burst flashes individually for red and fault/white operation.

Twenty volts AC is supplied from a control winding on T1 to pin P4-A4 with respect to (P4-A2, A16). The 20 volts is half wave rectified and filtered by C1.Zeiner diodes CR1 and CR2 produce a regulated 7.5 and 15 volts for logic power and SCR (Q2) gate drive respectively.

For burst timing, AC from T1 is fed through P4-A12, R5, C3, and clamp diodes CR14 and CR15. The clamped wave form, at line frequency, is further shaped by inverter U1a, driving U2. U2 functions as a non-inverting buffer with output on pin 3. C6 and R8 differentiate the square wave, feeding U3A NAND gate pin 3 with a effective positive going high level lasting 750 µsec. The U2-3 square wave output is used to clock the other circuits.

A sync pulse of greater than 20 volts, with a duration of about 3 msec is applied from the sync/monitor board (or externally) to P4-A6. Resistors R21, R22 and R25 and diodes CR9 and CR10 clip and shape the waveform. The resulting output is shaped again by U1B (pin 3-4) buffer inverter, and is applied to Dual "D" flip-flop U5B, pin 11. The trailing edge (positive going) sets U5B-Q13 high, placing a high at U5A pin 5-"D". The next positive edge of the clock pulse sets U5A-Q1 high, enabling preset counter U6, as well as placing a high on U3A-4 NAND gate.

U3A-5 sinks low, since the clock and U5A-Q1 appear high at U3A pin 3 and 4. U3A-5 going low causes CR4 to conduct. This in turn forces the gate of Q1 below the anode of Q1 triggering Q1 - a "snap-action" unijunction switch. A fast rising current is developed, driving the gate of Q2. SCR Q2 then turns on, switching C10, charged to 450 volts, into the primary of the step-up line driver transformer, located on the mother board. This transformer steps the pulse to approximately 1 KV for transmission to the flashhead series trigger transformer, where the voltage is stepped up to 15 KV, flashing the flashtube.

C10 is resistor charged (R16) through a half wave rectifier circuit off T1. Rectifier diode is CR6. CR8 and R17 limit voltage reversals across Q2.

U6, a presettable down counter, registers each firing of the flashtube when enabled, on the negative clock transition. When the preset flash count reaches zero, U6 pin 14 "zero-detect" goes low, resetting U5, disabling U6 and consequently allowing U3A-5 to remain high (triggering inhibited).

The enable pulse from U5A-Q1 is AC coupled through C7, with R9 to ground to NAND gate U3A-4. Should the enable pulse fail to reset due to component failure, the voltage at U3A-4 will fall below gate threshold, inhibiting trigger pulses.

The number of flashes in a burst is factory set by adding binary counts on SW1 (night/red). For 45 flashes, SW1 positions 1, 3, 4 and 6 are switched on and positions 2 and 5 are switched off. SW2 sets the number of flashes in the night/white fault mode. Night operation is sensed at P4 -A8, receiving the DC coil voltage of K3 (mother board). The coil voltage is rectified by CR13, filtered by C12, placing a high level on U1D-9. A low appears at U8-15, enabling both tri-state buffers, U7 and U8, for night operation.

The tri-state buffers operate as switches, placing high levels on U6 preset inputs as required by the number of flashes in each burst.

For normal red light operation, SW1 and U7 are active, while U8 is high impedance. For this condition, P4 -A14 is low. The red LED lights indicating that the red flashlamp mother board relay is energized through the sync-monitor board (Q3). With P4 -A14 low, Q3 output is high. U8-12 is then low, U8-14 high.

For fault white light operation, SW2 and U8 are active, while U7 is high impedance. For this condition logic states on U8-12 and 14 reverse.

During the day mode, K3 voltage is zero, causing a high at U8-15, forcing a high impedance output state for U7 and U8. If SW2-5 switch is on (day enable), a high appears at U6-4 (J0), all others (J1-7) are low, pulled down by RN1. A single flash occurs in the day mode.

Loss of a sync pulse at P4-A6 will activate a timer circuit made up of timer U4, U3B, and U1E (inverter). U5B-Q13 normally goes high once every 1.5 seconds. With normal sync in, this holds the timer U4 trigger pin 2 below the threshold (through inverter U3B-9). Therefore the output of U4 stays high (pin 3) maintaining a low on U5B-8 (through inverter U1E-10).

Loss of sync causes U5B-Q13 to remain low for a time greater than the time constant of R19, R20 and C11. When the timer threshold is reached, the output goes low causing a high at the U5B "set" input (through U1E). U5E-Q13 then goes high, initiating a trigger sequence (high level at U5A-D5). While U5E-Q13 is high, inverter U3B output dumps C11 below threshold and in turn places a low on the "set" (U5B) input. After the flash sequence, U5 is reset, with pin 13 going low.

The cycle repeats until sync is restored. The mode of operation will produce a flash sequence once every 3 to 4 seconds, slower than the normal 1.5 sec. DS1, a green LED, at the top edge of the board will blink upon receiving a sync pulse.

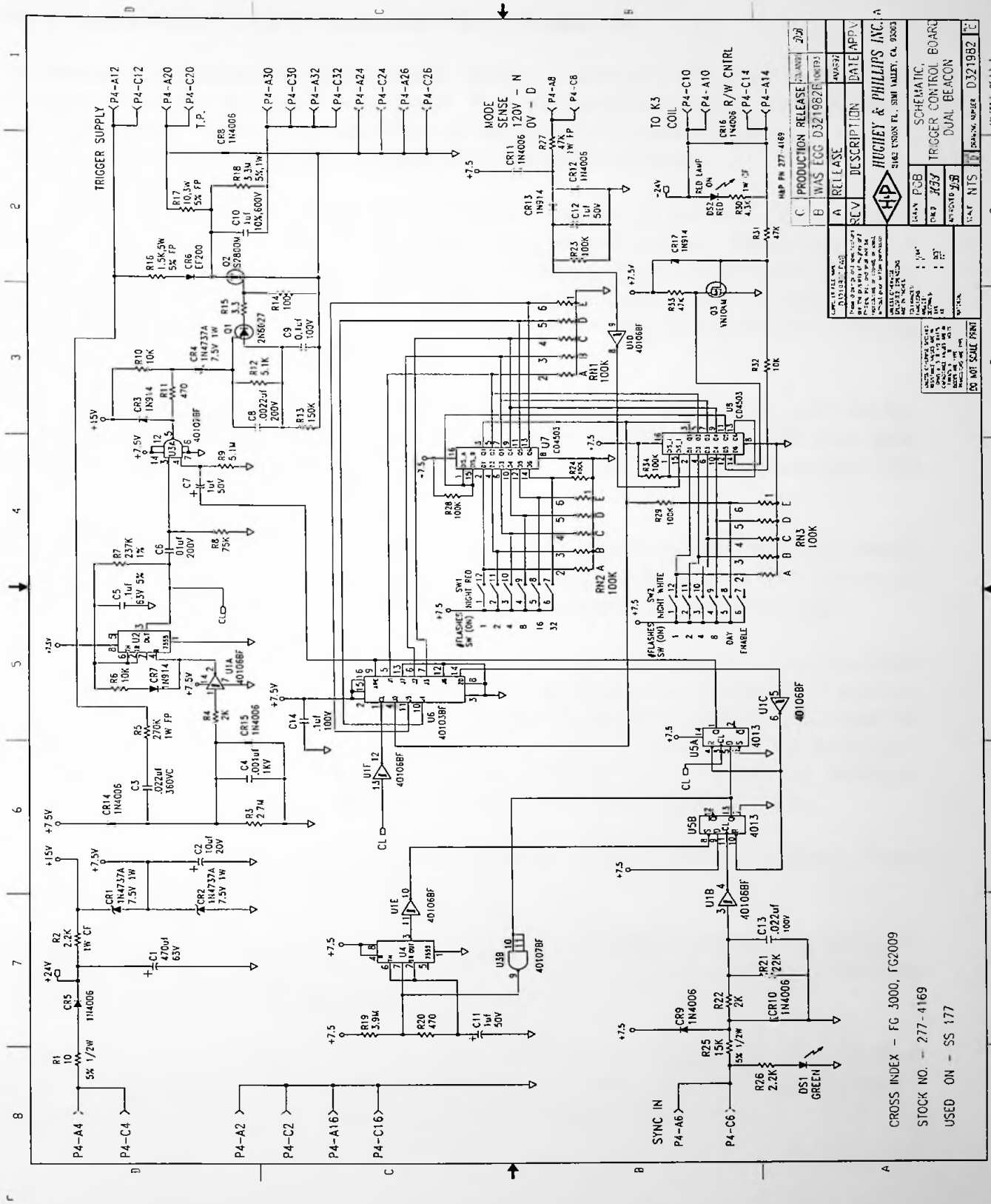


Figure 4-3
Trigger Control Printed Circuit Board
FILE; D321982C

4.2.1.3 Sync/Monitor Printed Circuit Board (Figure 4-4, page 24)

The function of the sync/monitor printed circuit board is to generate a sync pulse for the trigger control board; to select AC or DC input power, 50 or 60 Hz, master or slave operation; and to detect faulty operation of the FlashGuard 3000 such as missing or out of sync flashes.
This board is specifically designed for dual (red/night, white/day) flashheads.

For the FG 3000, S1C is on, selecting the red lamp for normal night operation. The number of red/night bursts per minute (or flashes per minute - fpm) must be selected. Normal operation is from 20 to 40 fpm. This is a factory-only adjustment. White/day, single flash operation, is preset at 40fpm. For 40fpm day operation, the down counter JAM inputs have been preset for division ratios of 75 for a 50 hz or DC line (S1B off), and 90 for a 60 hz line (S1B on). S1A should be set "off" for AC input power and "on" for DC input power.

20V AC (P3-A,C12) is rectified and filtered (CR7-C10) providing 25 VDC for the fault relay K1, sync pulse follower transistor Q2, and driver Q4. R13 drops the voltage to the 7.5V zener diode and filter C8. 7.5 volts is required for all logic and timer ICs. For DC sources (24 to 48V), CR7 conducts continuously.

120 VAC at 50 or 60 Hz (P3-A,C2) is current limited by R17, clipped by CR8, CR11, and buffered by Schmitt trigger/inverter U2-4. This pulse at line frequency is used to clock U1, a presettable down counter. For DC systems U5 operates as an astable oscillator to provide a clock signal.

The counter is decremented by one count on each positive transition of the clock. The zero detect output, U1-14, goes low when the counter reaches zero. This triggers one shot U4. U4-3 goes high for 3 msec. This pulse is inverted by U2-2. The resulting low on U1-9 presets the counter and the cycle repeats. A low on the gate of Q4 allows the voltage to rise at the gate of Q2 producing a positive pulse output at P3-A,C6. The pulse is 3 msec wide, 20 v peak, at 40 fpm day, 20-40 fpm night. If S1D is "on," the "slave" position, the gate of Q2 is grounded, inhibiting pulses.

The blinking "red" LED indicates that "master" sync pulses are being generated (S1D off). It will not blink when switched to "slave" (S1D on).

The fault monitor relay (K1) assures that the flash lamp is firing synchronously with the sync pulse. K1 remains energized as long as the flashtube fires in response to a sync pulse. A steady green LED (DS1) lights whenever K1 is energized, a "go" condition.

Flashtube current is sensed by a current transformer (T2) located in the ground side, or cathode return side of the capacitor bank. Whenever the flashlamp fires, a pulse current appears at P3-A,C10(+) and P3-A,C8(-) ground, which rapidly charges C11 to about 7.5 volts.

This C11 voltage will decay with a time constant of about 68msec. If the flashtube discharge current was initiated by a sync pulse, the switch transistor Q5 will be gated off for 120msec, allowing the C11 charge voltage to trip one-shot U3 (pin 4 section).

If flashtube current did not follow in response to a sync pulse, Q5 is on, shunting the C11 signal to ground.

Switch transistor Q5 is gated "off" for 120msec. The timing for this pulse comes from the second section of U3, a dual one-shot. The sync pulse appearing at P3-A,C6 or R19 is clipped by CR2, CR1. This sync pulse triggers the second section of U3, pin 12, delivering a 120msec gate pulse.

U3 (pin 4 section) is set to time out (pin 6, "Q", drops to zero) in 10 seconds. If the flashlamp is operating normally, the timer (U3) will be retriggered on each flash, establishing a fresh 10 second timeout. Pin 6 (Q) output therefore remains high, gating Q1 "on", holding K1 (fault relay) energized, a "go" condition.

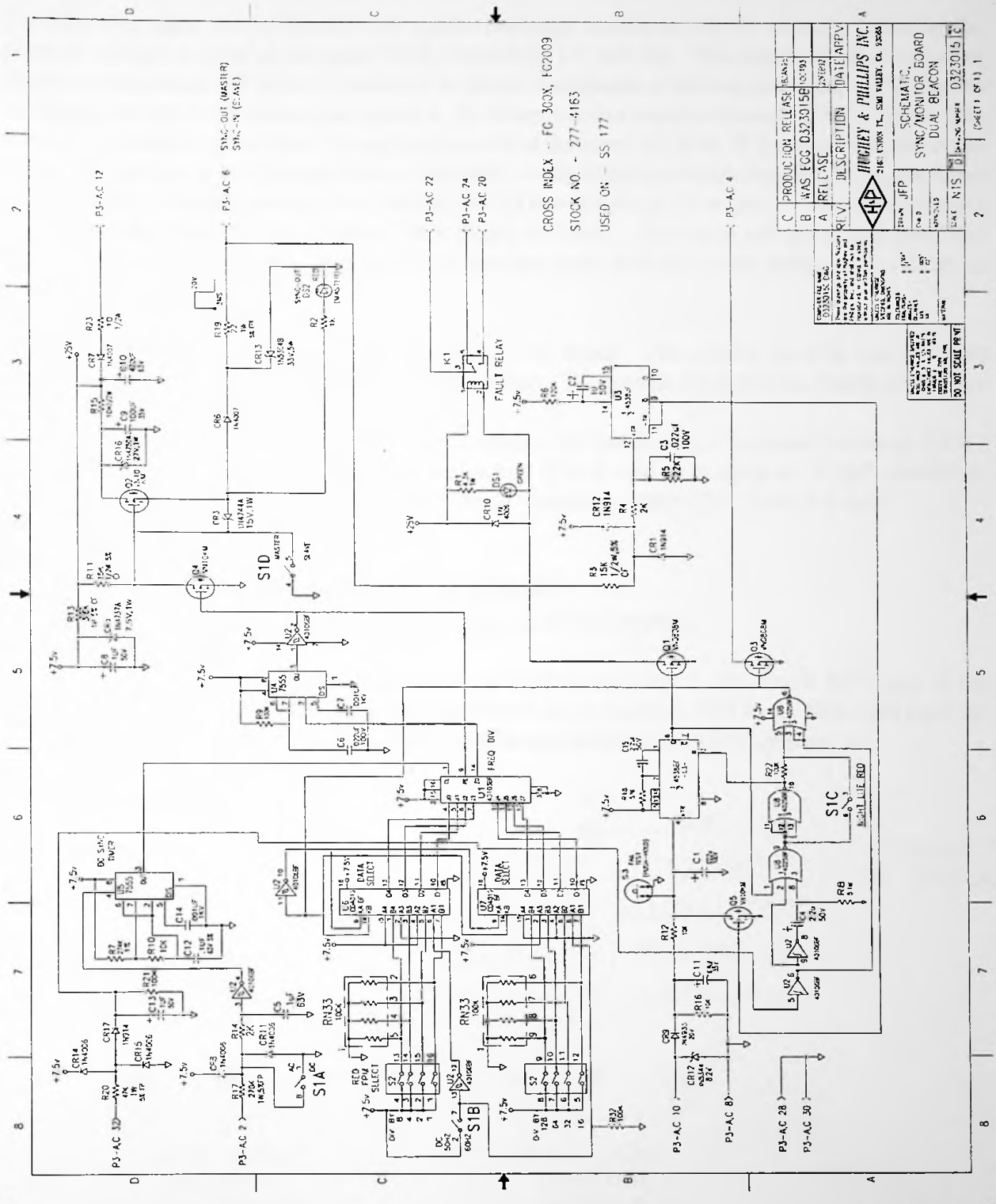
Day/night photocell operation of the beacon changes the HV trigger signal from the day (white) lamp to the night (red) lamp. K3 (mother board) completes the circuit (110VAC) to the trigger changeover relay located in the Dual Flashhead. This changeover relay simply transfers from one trigger transformer primary to the other. When K3 is open, the day lamp flashes, when closed, the changeover relay energizes, allowing the red lamp to flash. K3 is controlled by Q3 (sync/monitor board).

During night operation an AC signal appears at P3-A,C32, is clipped, rectified (CR17) and filtered (C13). The signal is inverted by one section of U2, driving "nor" gate output high (U8-6), gating Q3 on. Q3 on closes K3 (mother board). At the same time, the red FPM selector switches, S2, are enabled.

System failure: (Alarms)

Fail detection during the day operation causes the fault relay, K1, to open 10 seconds after the last normal flash. Occasional missed flashes will go undetected, however. The fault relay will close whenever normal operation is restored (a "go" condition).

Fail detection during night operation, in addition to opening the fault relay ("fail" condition), establishes operating conditions for white/night flashlamp operation. White/night operation only occurs whenever red operation fails, and begins 10 seconds after the last flash of the red lamp. The preset white/night flashing conditions are: 40fpm (with up to a 15 flash burst factory-selected on the trigger control board) giving an equivalent light output of 2,000 candellas. Operation in this mode continues until day mode is called for, or power is interrupted. When day operation is called for by the photocell, the fail detection system verifies proper day operation, closing the fail relay K1.



Sync/Monitor Printed Circuit Board
Figure 4-4
FILE; D323015.DWG

The following night, the fail circuit will enable red/night conditions for 10 seconds, timed by the decay of voltage at input to nor gate U8-8, formed by C4 and R8. The output of U8-10 enables (high) one-shot timer U3-3, for 10 seconds, to detect synchronized flashes, activating K1 if flashes are detected at Pin 4. If flashes are detected, the timer remains enabled through U3-Q6, U8-1, U8-10 to U3-3, overriding the initial 10 second time out at the input of U8-8. If flashing does not occur before the voltage at U8-8 drops below threshold, white/night operation begins. Nor gate U8-9 goes high (all U8 inputs are now low) forcing U8-10 low disabling U3 at pin 3. S1C is closed for a red light, completing the circuit from U8-9 (high) to U8-5. This turns off Q3 (U8-6 low) and presets a flash rate of 40 fpm. Since U3 one-shot has been disabled, white lamp firing voltage at U3-4 (+TR) is ignored.

A test button switch is located on the top edge of the board. This switch grounds out the flash signal when held closed, thus simulating flash failure. To operate, hold the test button closed for longer than 10 seconds.
Single-pole double-throw relay contacts are available for monitoring. Continuity between TB1-7 and 8 (NO and COM) is maintained closed while TB1-6 and 8 is open as a "go" condition. Continuity between TB1-6 and 8 represents a "fault" condition, while TB1-7 and 8 is open.

4.3 SIDE LIGHTS, INSTALLATION AND WIRING

The Side Light module is designed to operate from a 120VAC supply.

The Side Lights may be operated from the same input power line as the Strobe light only if the strobe light input is also 120VAC. Connect the Strobe input power at TB1 to the Side light input on TB3 as deplicted in Fig 4.5 This wiring has been factory installed for 120V systems only.

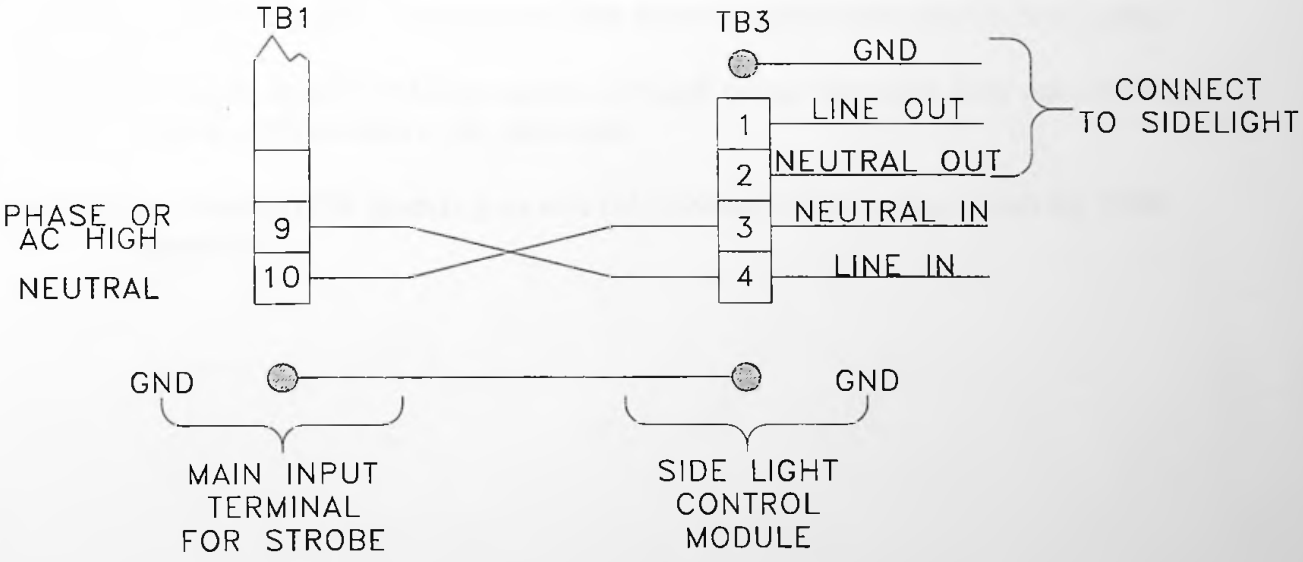
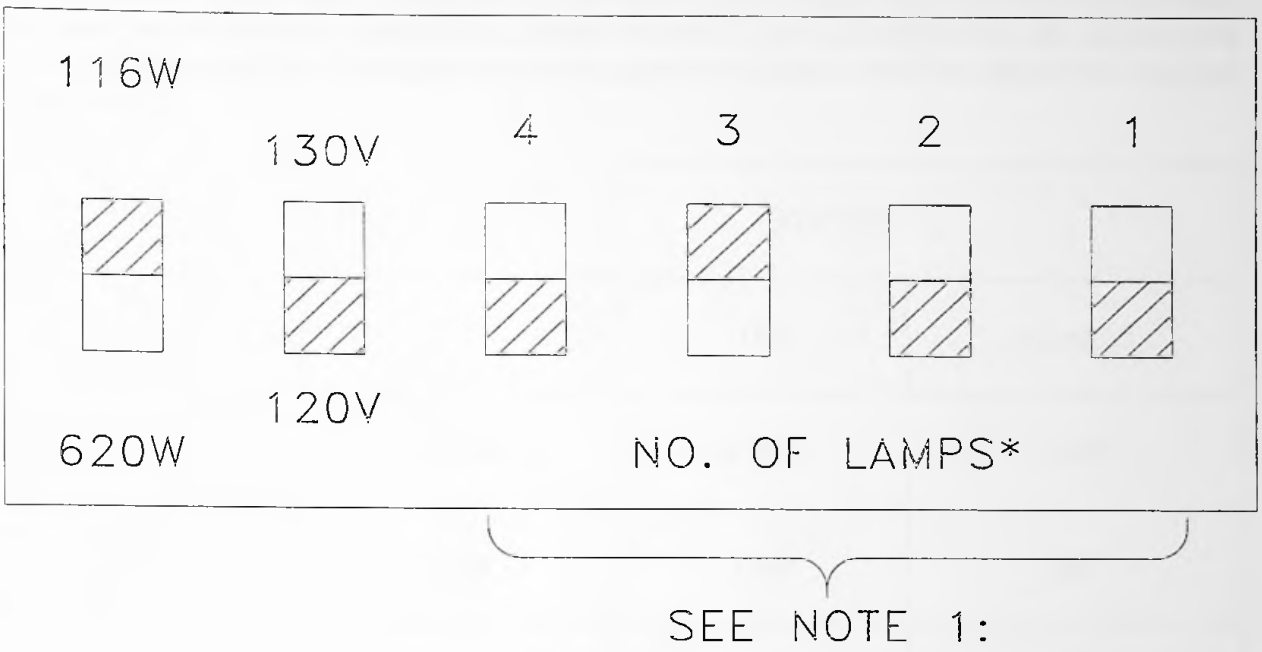


Fig 4.5

ALARM MODULE

The red light control system in the SS177 Power Supply is preset at the factory to operate with (3) 120V, 116W red lights. This is reflected in the following ways;

1. The selector switch on the K4 Alarm Relay is set in the following configuration :
   Shaded areas indicate switch positions:



2. A 6 Amp fuse is installed in the F3 position to protect the red light circuit.

Changes to the above figure will be required if the system supports more than (3) Side Lights.

*NOTE 1: Select the number of lamps that are on during normal operation. Only one switch may be in the **ON** position at any given time.

NOTE 2: For use with 60W lamp(s), pass wire twice through toroid and set switch for 116W operation.

ALARM MODULE

The Side Light alarm module provides fault indicators when one or more incandesant lamp(s) loads fail. When a lamp fails, a decrease in current is sensed and the module transfers to the alarm mode.This is reflected in two ways. The red LED lights and the relay transfers to provide an open circuit between the common (wiper) and the normally closed contacts and a closed circuit between the wiper and the normally open contact.. Replacement of a failed lamp(s) resets the alarm output and extinguishes the LED. During the day mode when the red lights are not on, the module does not report an alarm.

		STATUS	
MODE		OK	ALARM
DAY	RELAY	C-NC	C-NC
	LED	OFF	OFF
NIGHT	RELAY	C-NC	C-NO
	LED	OFF	ON

SECTION 5.0 - TROUBLESHOOTING (Figures 5-1a, b and c)

WARNING!

1. Always turn off power when changing any component or printed circuit board.

2. High voltage is present in both the power supply and the flashhead. Do not cheat the interlocks.

3. Do not put hands or tools in either the power supply or the flashhead until the neon lamp on the high voltage board is extinguished.

4. Do not look directly into the flashhead at close range when it is flashing.

5. Replace components in the order stated, keeping track of those replaced.

6. The procedures in Figure 5-1a, b and c presume that all fuses, interlocks, and controls are functioning properly.

7. The components and assemblies in this system were designed by H&P to handle the high voltages which are present. We do not recommend substituting components or assemblies which might be available through other vendors.

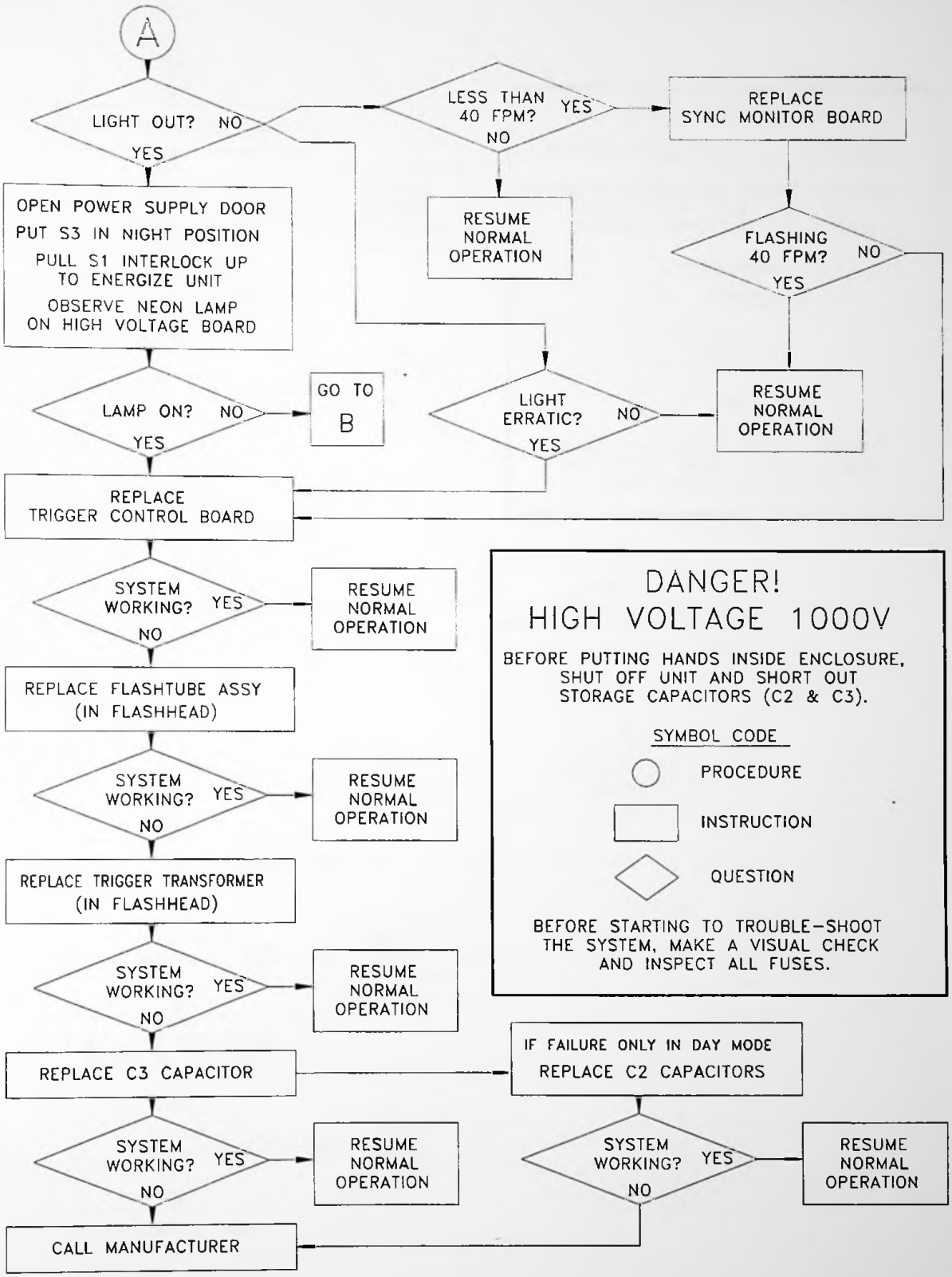


Figure 5-1a. TROUBLE-SHOOTING PROCEDURE

FILE; 30005-1A

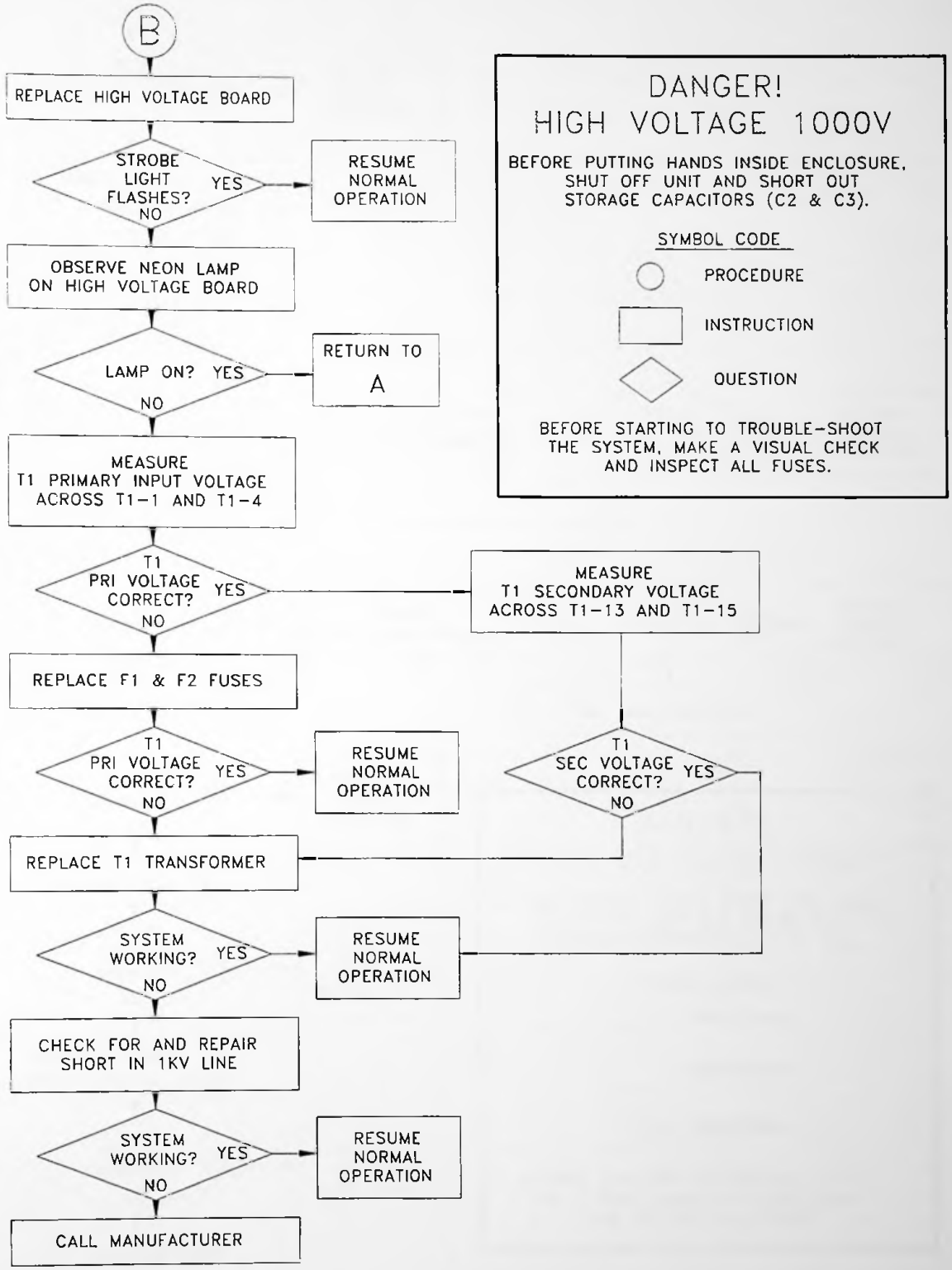


Figure 5-1b. TROUBLE-SHOOTING PROCEDURE
FILE; 30005-1B

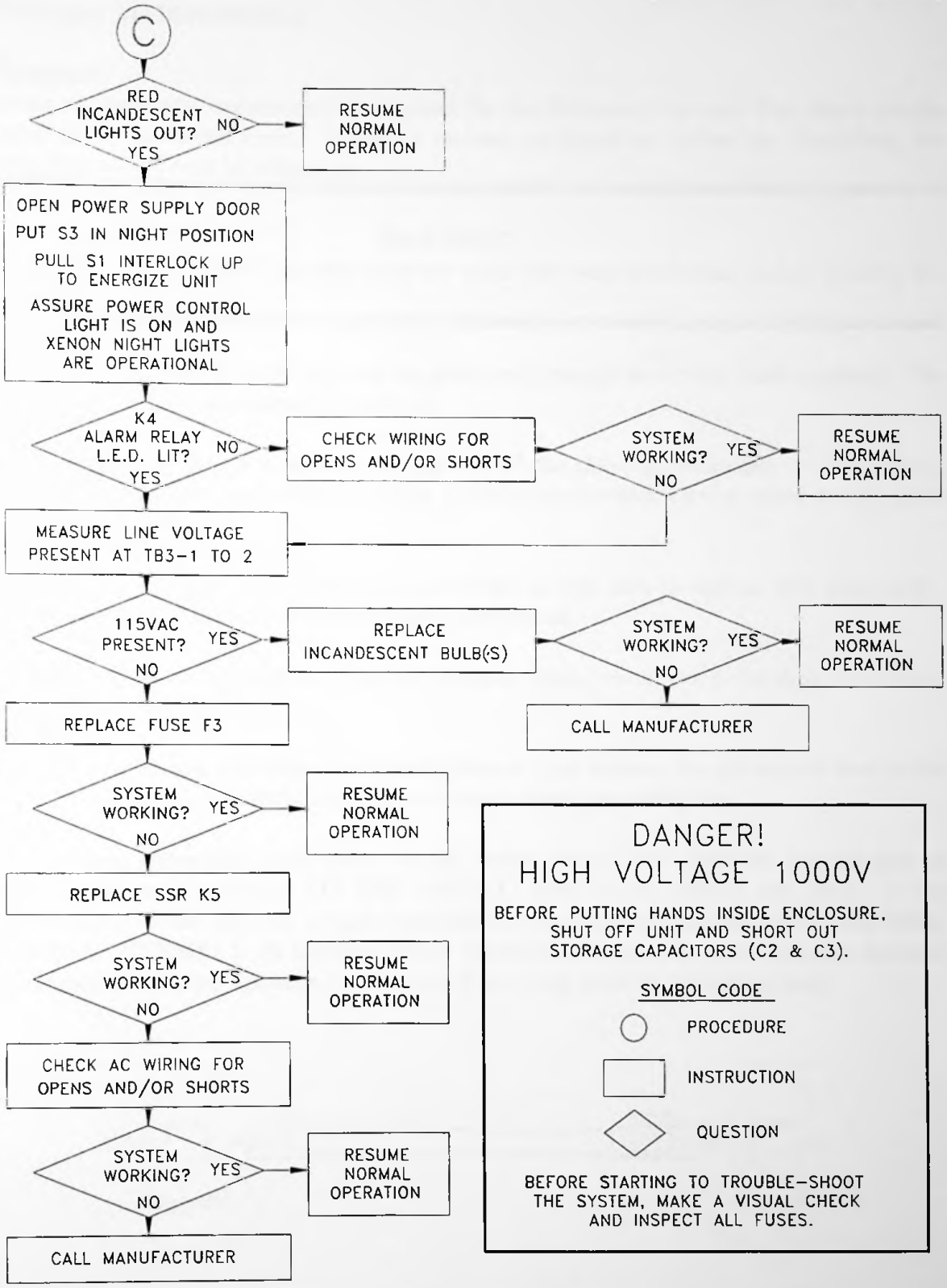


Figure 5-1c. TROUBLE-SHOOTING PROCEDURE

FILE; 30005-1C

SECTION 6.0 - MAINTENANCE

6.1 Flashhead

No special or preventive maintenance is required for the flashhead, but only that which can be performed on an as-needed basis. Should it become necessary to replace the flashtubes, the following instructions must be adhered to:

WARNING!

Ensure that the power is **OFF** and the capacitor bank has been discharged before opening the flashhead.

1. Loosen the eight (8) bolts securing the globe only enough to turn the black retainers. The bolts will fall out if they are loosened excessively.

2. After turning the black retainers 90 degrees, lift the globe approximately twelve inches. When the top extent is reached, rotate the globe slightly (counterclockwise) to move the lift guide into its support position.

3. The two strings of three flashtubes are attached at both ends to sockets with connectors. Disconnect both ends of the flashtube assembly to be replaced.

4. Gently remove each flashtube from its supports, being careful not to break it. Disconnect ferrite suppressors from fastons.

5. Remove the new flashtubes from their container and connect the red-marked lead to the red socket. Carefully connect ferrite suppressors to their faston grounding lugs.

6. Working counterclockwise from the red socket, insert each flashtube into its pair of supports. Apply equal pressure **TO THE METAL END CAPS ONLY** (as shown in the illustration below) so that the ends of each flashtube are simultaneously snapped into place. **THE FLASHTUBE ASSEMBLY IS EXTREMELY FRAGILE**, especially at the junction between glass and metal. Handle the flashtubes in a manner that avoids stressing this critical seal.

7. Connect the unmarked flashtube lead to the second socket.

8. Rotate the globe slightly (clockwise) to realign the lift guide in its vertical travel slot. Push down on the globe to re-seat it on the gasket.

9. Turn each black retainer back 90 degrees and tighten the bolts.

The Power Supply and Ambient Light Sensor require no special maintenance.

SECTION 7.0 - SPARE PARTS

FLASHHEAD	part no.
Flashtube Assembly FT1, FT2	12S00602
Holder, Flashtube	77-4026
Relay, Trig. Xfmr K1	77-4192
Switch, FH Interlock S1	77-2644
Terminal Block TB1	77-2556
Transformer, Trigger T1,WHITE	77-4040W
T2,RED	77-4040R

POWER SUPPLY	part no.
Capacitor, 40µf C2A-G	77-3949
Capacitor, 7µf C3	77-3982
Capacitor, 3µf C1	77-3311
Capacitor, 4µf C1 (50HZ ONLY)	77-3911
Fuse, 12A (24VDC) F1,F2	DP-4136
Fuse, 4A (120VAC) F1	DP-1020
Fuse, 2A (240/480VAC) F1,F2	DP-1021
Fuse, 630mA SB TB-F1	DP-1019
PC Board, Diode	277-3939
PC Board, High Voltage	277-3937
PC Board, Mother	277-4208
PC Board, Sync/Monitor	277-4163
PC Board, Trigger/Control	277-4169
Relay K1, K2	77-2013
Relay, Mother Board K3	77-4192
Relay, Alarm K4	77-4196
Relay, Solid State K5	77-4198
Resistor, 20Ω 40W R2,R3,R4	77-2759
Resistor, 10kΩ 55W R1	77-3959
Transformer, T1 (120/240V 60Hz)	77-3970
Transformer, T1 (240/480V 60Hz)	77-4137
Transformer, T1 (240/480V 50Hz)	77-4138
Transformer, Current Sense T2	277-3958
Interlock Switch Assembly	277-3990
Cable, Interconnection	77-4017
Cable Ties	77-4105
Bulb, Side Light	78-0181
Photocell	77-3259

SECTION 8.0 BOARD CONFIGURATION

8.1 CONFIGURATION OF REPLACEMENT PC BOARDS

This section contains information for configuring *replacement* printed circuit boards only. Under no circumstances should any control switch settings be modified on existing units in the field. Doing so may cause the system to fall out of compliance with FAA and other agency specifications.

H&P FlashGuard 2000 Beacons and FlashGuard 3000 Dual Beacons are controlled by circuitry on a series of printed circuit boards in the system power supply unit. The individual system's adaptation to input power variations and its mode of operation are determined by the settings of DIP switches on two of the PC boards, the Sync/Monitor Board and the Trigger Control Board.

> The switches and settings discussed here apply to the latest revisions of the Sync/Monitor and Trigger Control boards now in production. The configuration and design of earlier versions of these boards were different, but ALL NEW BOARDS ARE FULLY BACKWARD COMPATIBLE and will operate without problems in earlier systems if their switches are set appropriately.

These switches are set at the factory and under normal circumstances will be of no concern during installation, maintenance or operation of the beacon. However, replacement boards are manufactured and shipped in a standard, default state that will not be appropriate for all models. It is critical that the replacement boards be closely inspected and configured to insure that their settings match the installation.

WARNING:
INSTALLING CONTROL BOARDS THAT ARE INCORRECTLY CONFIGURED MAY CAUSE DAMAGE AND SYSTEM FAILURE.

The user manuals supplied with units shipped after June 1992 contain diagrams showing switch positions as shipped. In the absence of this information, the correct settings can be determined from the chart on the following page. The system in which the replacement board will be installed can be identified by its sub-systems, the Flashhead and the Power Supply. If the labels on the sub-systems are missing or damaged, the system can be identified by input power and flashhead lens color or configuration.

Example 1:

If the system is made up of an SS175-1 Power Supply and an SS-176 Flashhead, it is either a FG2002 or FG2004 (line 3 and line 5 of the chart, respectively), both of which share identical switch settings. Looking across the columns, it can be determined that the Sync/Monitor Board's S1-2 should be ON (all other S1 positions OFF), S2 is inactive; the Trigger Control Board's S1-1 & 4 should be ON (all other S1 positions OFF).

Example 2:

In the absence or illegibility of labels, the input power is known to be 24 volts DC and the flashhead is equipped with a red lens, the system is a FG2008 and the switches should be set according to the entries on line 9 of the chart.

8.2 SWITCH SETTINGS FOR CONTROL PC BOARDS

This chart contains information for configuring *replacement* printed circuit boards only. Under no circumstances should any control switch settings be modified on existing units in the field. Doing so may cause the system to fall out of compliance with FAA and other agency specifications.

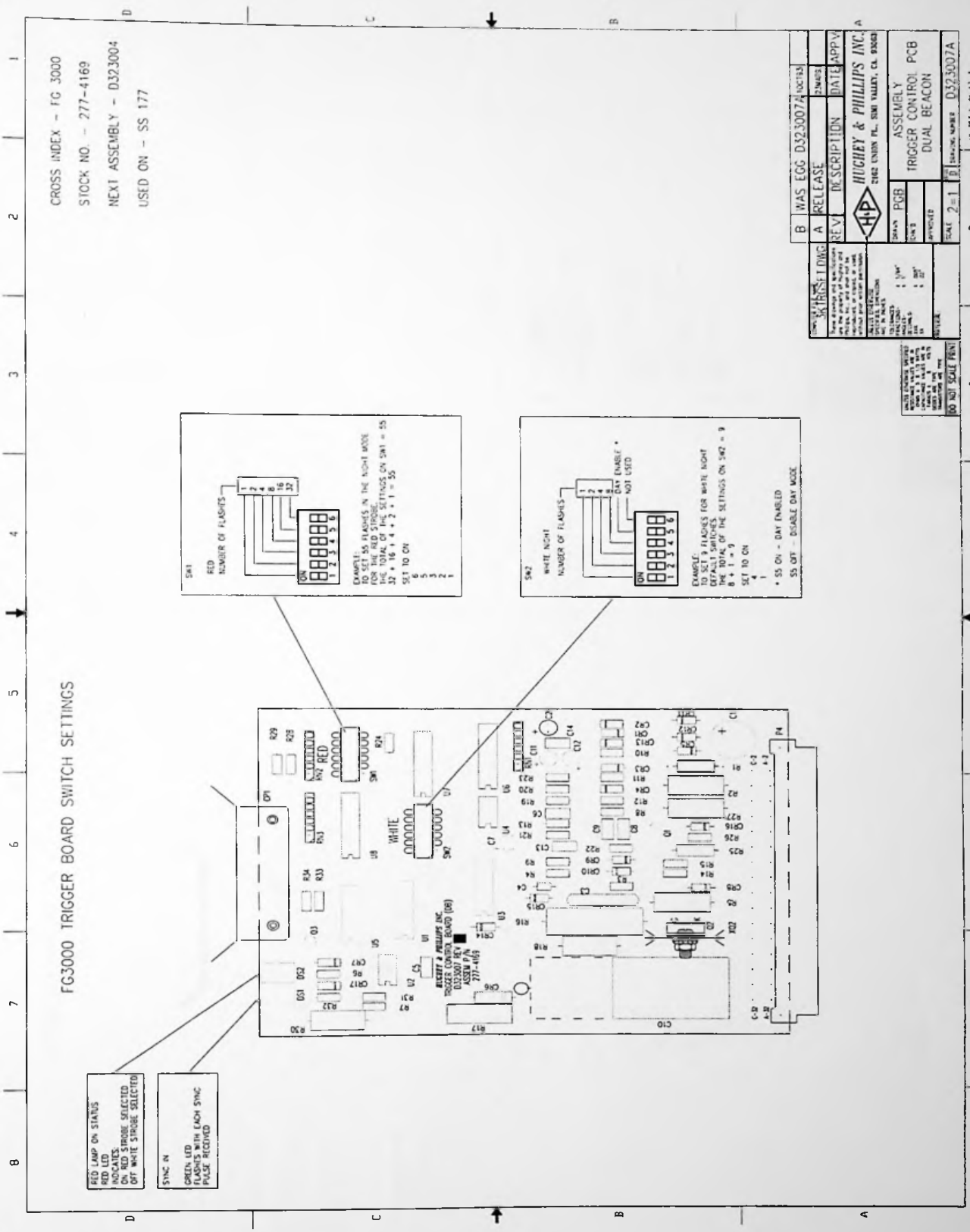
	SYSTEM IDENTIFICATION			SYNC/MONITOR PC BOARD ASSEMBLY		TRIGGER CONTROL PC BOARD ASSEMBLY	
SYSTEM	FLASH HEAD	POWER SUPPLY	INPUT VOLTAGE/FREQUENCY	S1-X ON ALL OTHERS OFF*	S2-X ON ALL OTHERS OFF	S1-X ON ALL OTHERS OFF	S2-X ON ALL OTHERS OFF
FG2000	SS176	SS175	120/240 60 HZ	2	NA	1,4	
FG2001	SS176	SS175-2	240/480 50HZ		NA	1,4	
FG2002	SS176	SS175-1	240/480 60HZ	2	NA	1,4	
FG2003	FG2003	SS175-3	24 DC	1	NA	1,4	
FG2004	SS176	SS175-1	240/480 60HZ	2	NA	1,4	
FG2005	SS176	SS175-2	240/480 50HZ		NA	1,4	
FG2006 (RED)	SS176-1	SS175-2	240/480 50HZ	3	1,2,4 & 7	1,3,4 & 6	1 & 4++
FG2007 (RED)	SS176-1	SS175-1	240/480 60HZ	2,3	2,4,5 & 7	1,3,4 & 6	
FG2008 (RED)	SS176-1	SS175-3	24 DC	1 & 3	3,6, & 7	1,3,4 & 6	1 & 4++
FG2009 (RED)	SS176-1	SS175	120/240 60HZ	2 & 3	2,4,5 & 7	1,3,4 & 6	1 & 4++
FG2010	277-4045-2	SS175	120/240 60HZ	2	NA	1 & 4	
DUAL (RED/WHITE) BEACONS							
FG3000	SS178	SS177	120/240 60HZ	2 & 3	2,4,5 & 7	1,3,4 & 6	1,2,3 & 5
FG3001	SS178	SS177-2	240/480 50HZ	3	1,2,4 & 5	1,3,4 & 6	1,2,3, & 5
FG3002	SS178	SS177-1	240/480 60HZ	2 & 3	1,2,4 & 5	1,3,4 & 6	1,2,3 & 5
FG3003	SS178	SS177	24 DC	1,3	3,6 & 7	2,3,4 & 5	1,2,3 & 5

*S1-4, Sync/Monitor Board, should be set according to the unit's application: ON = Slave; OFF = Master

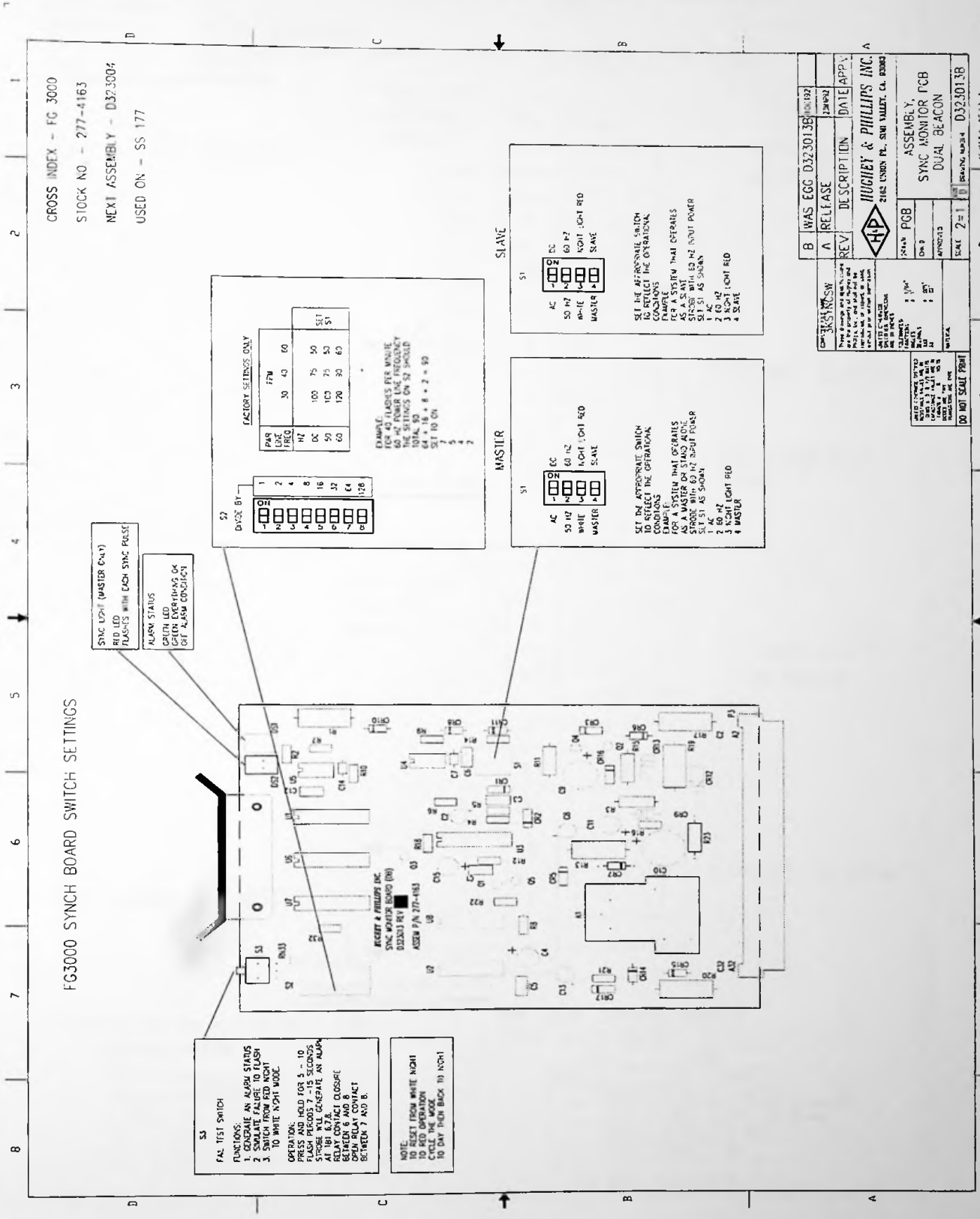
**S2, Sync/Monitor Board, is only active when S1-3 is on.

S2, trigger Control Board, appears only on the FG3000 series Trigger Control Board(277-4169). The FG2000 board (277-4123) does not have an S2.

++ FG2006, FG2008 and FG2009 use FG3000 BDS. Disable day operation, Night operation only,S2-5 is OFF.



FILE;3KTRGSET.DWG



FILE; 3KSYNCSW

FG 3000 ALARMS / OPTIONS

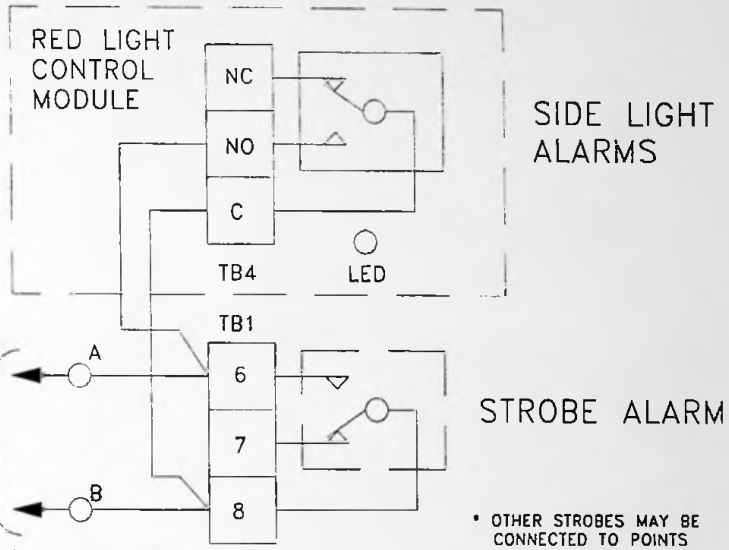
To combine Side Light alarm with Strobe alarm into a single alarm circuit wire as shown below.

NORMALLY OPEN ALARMS

For a normally open alarm system where any alarm will cause a closed circuit.

PARALLEL CIRCUIT

ANY ALARM CAUSES A CLOSURE



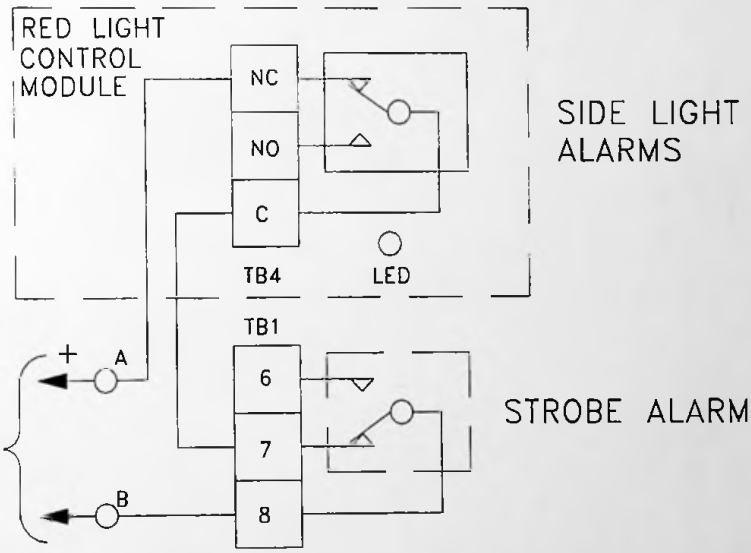
Normally Open = OK

NORMALLY CLOSED ALARM

For a normally closed alarm system where any alarm will cause an open circuit.

SERIES CIRCUIT

ANY ALARM CAUSES AN OPEN CIRCUIT



Normally Closed = OK

+ OTHER STROBES MAY BE CONNECTED IN SERIES

STROBE ALARM
TB1

	STATUS	
TB1	OK	ALARM
6 – 8	OPEN	SHORT
7 – 8	SHORT	OPEN

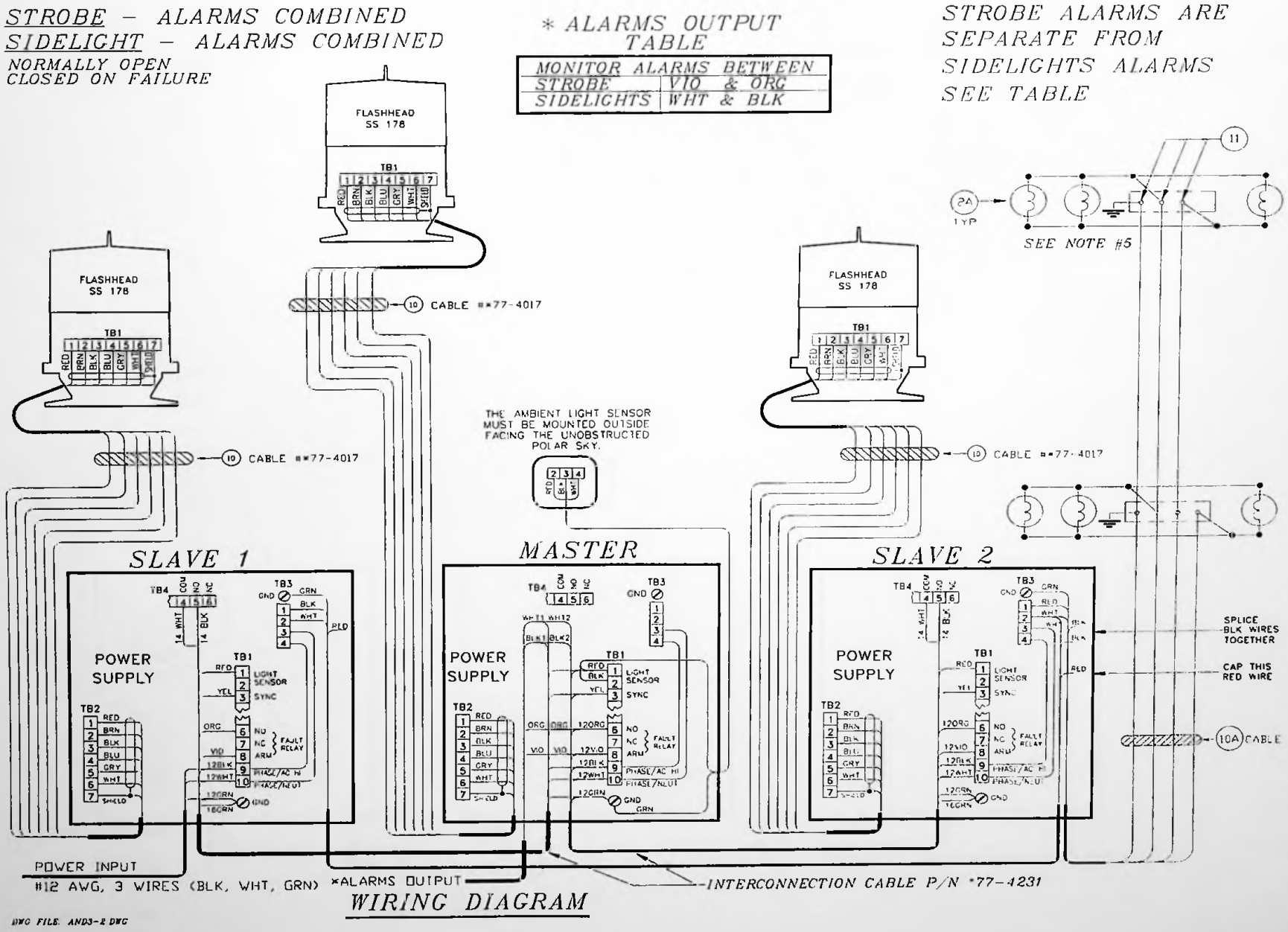
RED LIGHT CONTROL MODULE
FAULT ALARM OUTPUT STATUS
TB4

		STATUS	
MODE		OK	ALARM
DAY	RELAY	C–NC	C–NC
	LED	OFF	OFF
NIGHT	RELAY	C–NC	C–NO
	LED	OFF	ON

NO ALARM IN DAY

FILE NAME: FGALM01.DWG

FILE: FGALM01.DWG

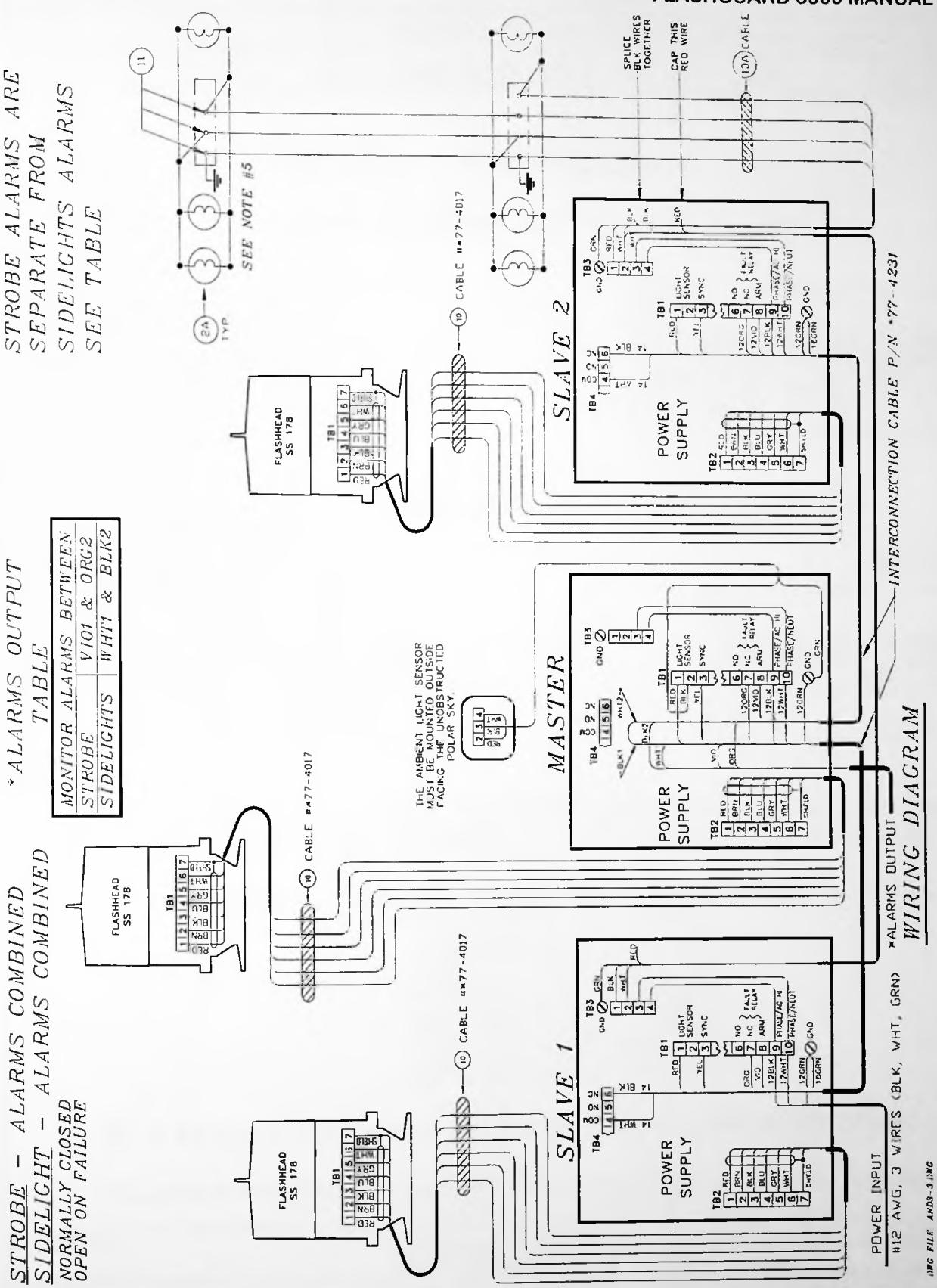


MEDIUM INTENSITY DUAL OBSTRUCTION LIGHTING SYSTEM

Company: Hughey & Phillips, Inc. **Effective Date: 12/4/96** **I.D No. : 81E00100**

File: G:\SHAREDMANUALS\UM3000G **Revision : G** **Page No. : 40**

FILE:AND3-2.DWG



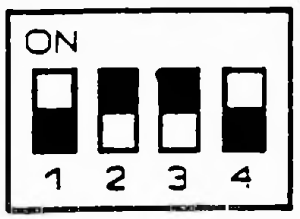
FILE: AND3-3.DWG

CROSS INDEX	NEXT ASSY	REVISIONS			
FG 3000	-	LTR	DESCRIPTION	DR	DATE	APPR
		A	RELEASED TO MANUFACTURING PER DCN 5388	DPS	21JUL92	DSY
		B	CORRECTED TITLE PER DCN C186.	DPS	22JUN93	JSH

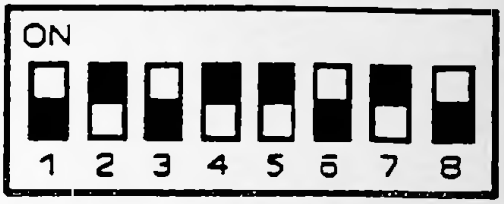
Unit Serial No. 981142 Voltage 120 VAC

Sync Monitor Board Serial No. 4-20-98 Rev. B

S1

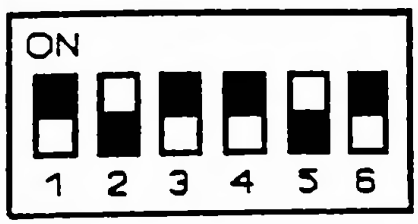


S2

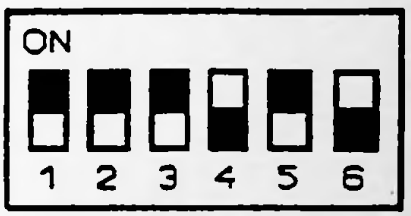


Trigger Control Board Serial No. 5-8-98 Rev. B

S1 (RED)

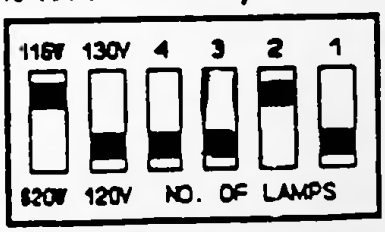


(WHITE) S2



The red light control system in the SS177 Power Supply is preset at the factory to operate with three 120V 116W red sidelights. This is reflected in the following ways:

1. The selector switch on the K4 Alarm Relay is set in the following configuration:



2. A 6A fuse is installed in the F3 position to protect the red light circuit.

Changes to the above are required if the system supports other than three side lights.

MATERIAL: -	INITIALS	DATE	HUGHEY & PHILLIPS, INC. P.O. BOX 2167, SIMI VALLEY, CA 93062			
FINISH: -	DR DPS	9JUL92	FG 3000 (L-864/865) CONTROL SWITCH SETTINGS			
	CHK					
UNLESS OTHERWISE SPECIFIED: REFER TO PROCESS STANDARDS 41001 AND 41002 DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± —— .XXX ± - ANGLES ± - .XX ± - DO NOT SCALE PRINT	DES		SIZE	CODE ID NO.	DWG NO.	REV.
	ENG DSY	21JUL92	A	25506	323085	B
	PROJ ENG		SCALE NTS		SHEET 1 OF 1	
	PROJ APPR.					