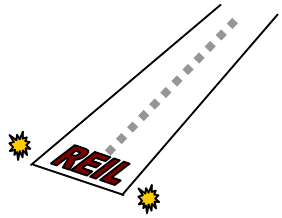
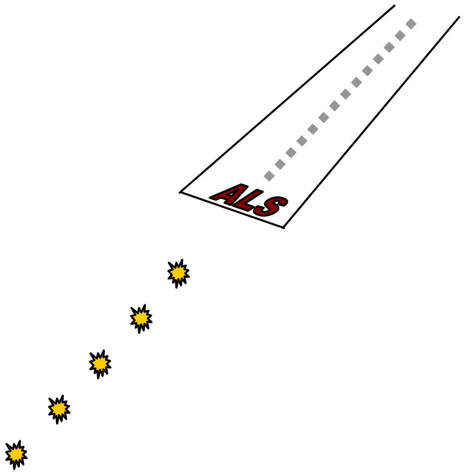
STROBE APPROACH LIGHTING TECHNOLOGY™





SALT™ Technology

UNI-DIRECTIONAL VOLTAGE-POWERED APPROACH LIGHTING SYSTEM

PSUV-101/102 USER'S MANUAL

STROBE APPROACH LIGHTING TECHNOLOGY
108 Fairgrounds Drive Manlius, NY 13104
603-598-4100

SCOPE

This manual contains Installation, Operation, and Maintenance information for Unidirectional Runway Approach Lights manufactured by Strobe Approach Lighting Technology™ (SAL Technology™), Manlius, NY, USA.

CARTON LABELING

Each carton contains one complete light consisting of a power supply and a flash head. The contents are identified by external labeling.
A REIL system typically consists of two cartons, one labeled Master and the other labeled Slave.
A system of sequential lights requires at least one carton for each light, and one of the cartons will be identified as Master. The remaining cartons containing Slave units are identified as Light #2, Light #3, and so on. The Master unit is considered to be Light #1.

Some systems may have accessory items that require separate packaging. Those packages are also appropriately identified.

In addition to a power supply and flash head, each carton contains two frangible fittings with short EMT couplings for power supply installation. An Owner's Manual is included in the carton containing the master unit.

UNPACKING

Inspect each shipping carton for external damage immediately upon receipt. There could be damage to the contents if the carton is damaged. Promptly file a claim with the freight carrier if you have received damaged equipment.

TOOLS RECOMMENDED

#2 Phillips screwdriver; 10-inch shank.
1/4-inch, flat blade screwdriver; 10-inch shank.
1/8-inch, flat blade screwdriver; short shank (for circuit board potentiometer adjustments).
Water pump pliers opening to 3-inches (for 2-inch EMT compression fittings).
Wire strippers.
Wire cutters (for small gage wire).
Volt-Ohm meter; 1000-volt range.

ABBREVIATIONS USED IN THIS MANUAL

PSUV → Power Supply Unidirectional Voltage (driven)
FHUD → Flash Head Uni-Directional
REIL → Runway End Identifier Lights
ALS → Approach Lighting System
SLC → Series Lighting Circuit
NPT → National Pipe Tapered (thread)
EMT → Electrical Metallic Tubing

DISCLAIMER

The information in this manual is believed to be accurate and up to date, however, Strobe Approach Lighting Technology™ assumes no liability for damages or injuries that may result from errors or omissions, or from the use of information presented herein. Strobe Approach Lighting reserves the right to modify this manual at its discretion without notification to any person or organization.

APPLICABLE SPECIFICATIONS

This equipment meets or exceeds the requirements in the FAA Advisory Circular, AC 150/5345-51, and is listed as FAA approved equipment in AC 150/5345-53, Addendum.

WARRANTY

Strobe Approach Lighting Technology warrants this equipment and all of its components when used under normal conditions. Failure of any component within one year from the date of shipment will be corrected by repair or replacement, FOB Manlius, NY 13104.

USE OF GENERIC PARTS

Using parts not manufactured or supplied by Strobe Approach Technology, or unauthorized modification of any part of this equipment, voids the warranty and could render the equipment noncompliant with applicable FAA specifications.

CONTACT INFORMATION

Strobe Approach Lighting Technology may be contacted by the following methods:
Tele: 603-598-4100
Fax: 603-598-4198
Email: sales@saltechnology.com

WARNING

Dangerous Voltages

This equipment generates voltages that are dangerous to personnel. Use appropriate caution while operating or servicing this equipment.

Capacitors can retain a substantial charge even after power has been removed. Allow at least one minute after turning off the power for the capacitors to be drained of charge–then check the safety lamps inside provided for this purpose.

Do Not Depend on Interlocks

Never depend on an interlock switch alone to render the equipment safe. Always look for the condition of the **High Voltage Indicating Lights** and check circuits with a voltmeter.

Do not disable the safety interlock switch.

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GENERAL DESCRIPTION

A flashing runway approach light from SAL Technology™ consists of a power supply and a flash head. The power supply (Figure 1a) may be either a master unit or a slave. The catalog designation for a Master Power Supply is PSUV-101. A Slave Power Supply is PSUV-102. The Flash Head (Figure 1b) in either case is FHUD-109. The flash head may be attached directly to a power supply enclosure (co-mounted) as in Figure 1c or installed separately and connected by up to 100 feet of suitable cable. This equipment is classified as a unidirectional discharge flasher (strobe) that operates from 120 or 240 V, 60 Hz (specify when ordering). It can also be provided to operate at 230 Volts, 50 Hz.

It is specifically designed and tested to meet the requirements for L-849V applications as defined by the FAA in "Specification for Discharge-Type Flashing Light Equipment", AC 150/5345-51.
L-849V is the designation applied by the FAA to voltage-driven Runway End Identification Lights (REIL). L-849V lights from SAL Technology are certified by third party testing under the FAA's Airport Lighting Equipment Certification Program (ALECP).

These lights also meet the photometric and functional requirements for discharge flashers in high or medium intensity precision Approach Lighting Systems (ALS).

Figure 1a
Power Supply, PSUV-101 or 102

Figure 1b
Flash Head, FHUD-109

Figure 1c, Co-Mounted Unit

ACCESS

The power supply cover is secured by quarter-turn latches with padlock provisions on the two front corners of the enclosure. A co-mounted unit also has two self-releasing latches across the hinge. The hinged cover when fully opened is supported by a lanyard.

The flash head does not have to be accessed for installation, even if it is mounted separately.
The front bezel can be removed to gain access to the flash lamp by loosening four captive screws.
A plate secured by two captive screws at the rear of the housing allows access to other internal flash head components. There is no interlock switch in an FHUD-109 flash head.

Always turn off and lock out the power supply when accessing the flash head.

EQUIPMENT SPECIFICATIONS

PHYSICAL: Dimensions are in inches (mm); Weight in lbs (kg).

PSUV-101, Master Power Supply, (Figure 1a).
Dimensions --8H x 16W x 14D (203 x 406 x 356)
Weight: --52(23.6)

PSUV-102, Slave Power Supply, (Figure 1a).
Dimensions --8H x 16W x 14D (203 x 406 x 356)
Weight: ---47(21.3)

FHUD-109, **Flash Head**, (Figure 1b).
Dimensions: --11.5H x 8.5W x7D (292 x 216 x 178)
Weight: --4.5 (2)

PSUV-101, Master Power Supply, (Co-mounted, Figure 1c).
Dimensions: --19.5H x 16W x 14D (495 x 406 x 356)
Weight: --56.5 (25.7)

PSUV-102, Slave Power Supply, (Co-mounted, Figure 1c).
Dimensions: --19.5H x 16W x 14D (495 x 406 x 356)
Weight: --51.5 (23.3)

OPERATIONAL:
Voltage (rms) ---120 or 240 Volts, 60 Hz
230 Volts, 50 Hz
Power: (Watts**) --**150 Ave, 290 Peak
Flashes Per Minute **--------------------------------------**120
Intensity: (Effective Candelas, total beam spread) High: 8000 to 22500
Med: 800 to 2250
Low: 160 to 450
Beam Spread: **---**30º Horizontal, 10º Vertical.

AVAILABLE OPTIONS: (Must be factory installed)

Remote Control by a Series Lighting Circuit
Flash Monitoring
Elapsed Time Meter

INSTALLATION

Installation consists of mounting the power supply onto previously prepared supports and making electrical connections. Some installation details could depend on site drawings and specifications originated by others. Basic requirements are given below.

If you are installing a system with sequentially flashing lights you should place each light in its assigned position. Light #1 is intended to be nearest to the runway threshold. Light #2 is intended to be next, and so on. A light that has not been placed in its intended position can be reprogrammed using the information in Figure 10.

MOUNTING THE POWER SUPPLY

The power supply requires two, 2-inch NPT base supports at ground level such as NPT flanges anchored in concrete at a spacing of 8.00 inches center to center, or a burial can cover with threaded entrance holes at the required spacing.

The power supply itself is provided with two attached, 2-inch, EMT compression fittings. Frangible fittings shipped with the equipment have male threads at one end and 2-inch EMT compression fittings at the other. Each one is furnished with a short (2-½ inch) length of EMT by which they may be coupled to the compression fittings on the bottom of the power supply enclosure.

The frangible fittings must first be screwed into the ground supports and securely tightened. The EMT couplings must be adjusted to extend out of the frangible fittings by 3/4 to 1-inch and the compression nuts securely tightened. Set the power supply down over the two EMT couplings and securely tighten the compression nuts.

A power supply with a co-mounted flash head meets the maximum height restriction set by the FAA when installed as described above and as shown in Figure 2. The 2-½ inch long EMT sections may be replaced by slightly longer sections if local conditions require raising the elevation of the light source by a few inches. This is not recommended for a substantial increase in light center elevation; mounting the flash head on a separate support while leaving the power supply close to the ground is recommended instead. This situation does not usually arise with REIL installations, but it is common with ALS installations.

Please note that separate flash head mounting in not intended as a field option. The method of flash head mounting should be specified when the equipment is ordered. Details pertaining to separate mounting are usually supplied by others.

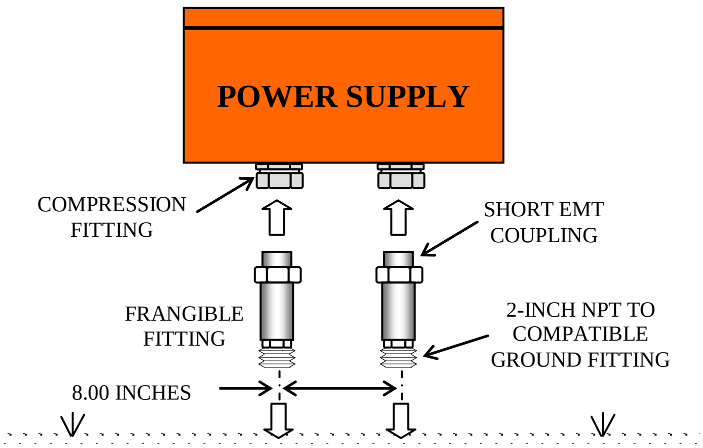


Figure 2, Typical Mounting Details

INSTALLATION (Cont.)

PRIMARY POWER HOOKUP FOR REILs:

Please refer Figure 19 on Page 27 to find the locations of TB1 and TB5 mentioned in the text that follows. Note that TB5 is found only in a master unit. A slave unit does not have a TB5 terminal block.

Power is brought into a REIL system through the master unit where it is connected to terminal TB5 as shown in Figure 3. Power distribution wiring for an ALS would be shown on a customized drawing prepared for each particular site, but in general, ALS units are connected just as described for REIL slave units. In either case, a neutral wire is required only for units powered by 120 volts. A neutral wire is not required for 240 volt units, but if 240 volt power is supplied in a 3-wire format, the neutral wire may be connected to position 2 on TB5. It is not necessary to carry the neutral wire to any of the 240 volt slave units.

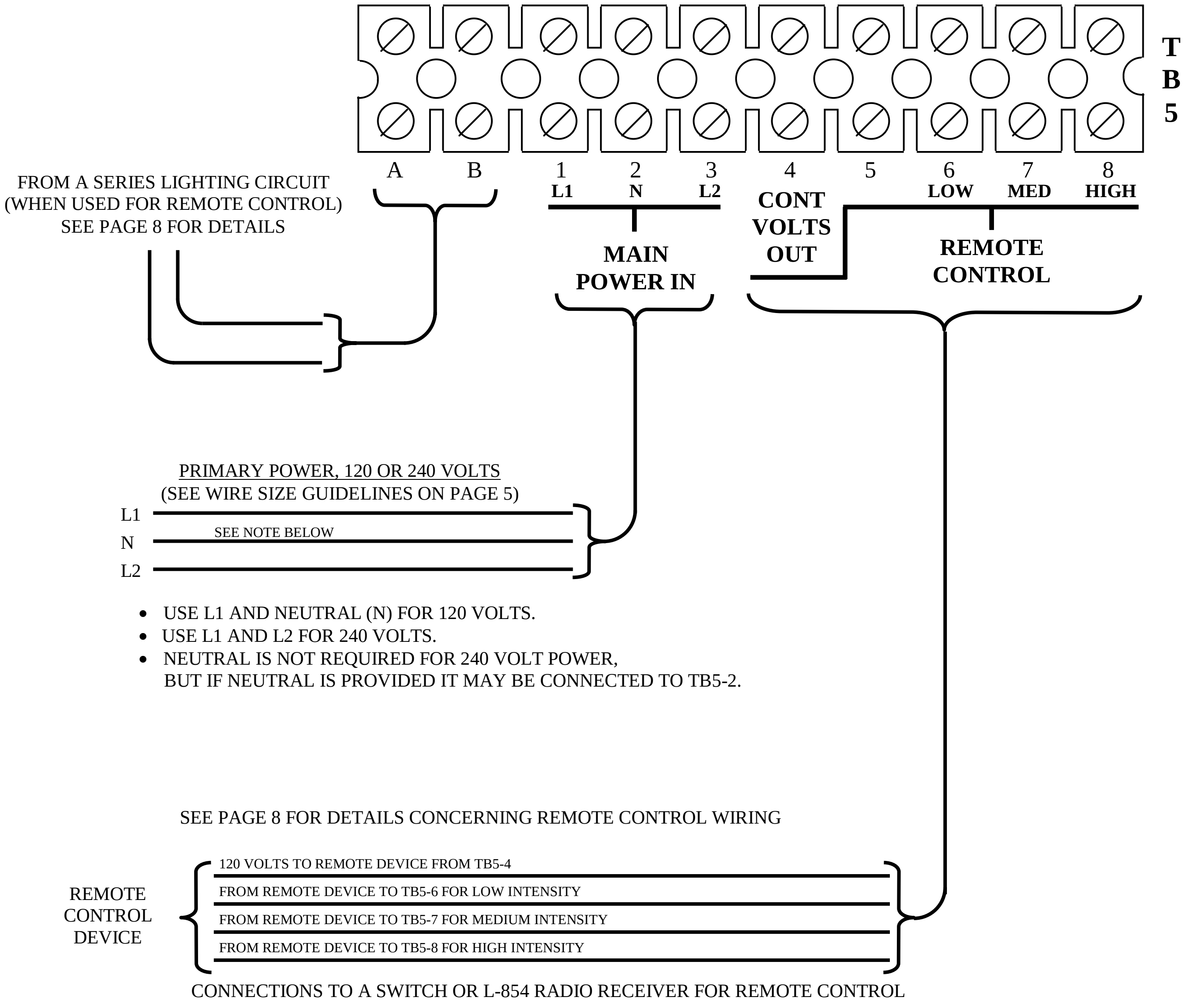


Figure 3
Installation Wiring Guidelines For a Master Unit

PRIMARY POWER HOOKUP FOR REILs (Cont.)

A slave unit does not have a TB5 terminal block, but all units, whether master or slave, have a TB1 terminal block. Primary power is distributed from TB1 in the master unit to TB1 in a slave. TB1 is labeled differently in a 240 volt unit than in a 120 volt unit as shown in Figure 4. The terminals labeled "To next unit" are used in a master unit, and the terminals labeled "From previous unit' are used in a slave. Additional slave units, as in an ALS, can be connected as shown in Figure 6.

Terminals 1 and 3 are used for 240 volts; Terminal 2 is unused.

Terminals 1 and 2 are used for 120 volts, and Terminal 3 is unused.

Units for 230 volts, 50 Hz, are wired as shown for 240 volts.

Units for 60 Hz are not interchangeable with units for 50 Hz.

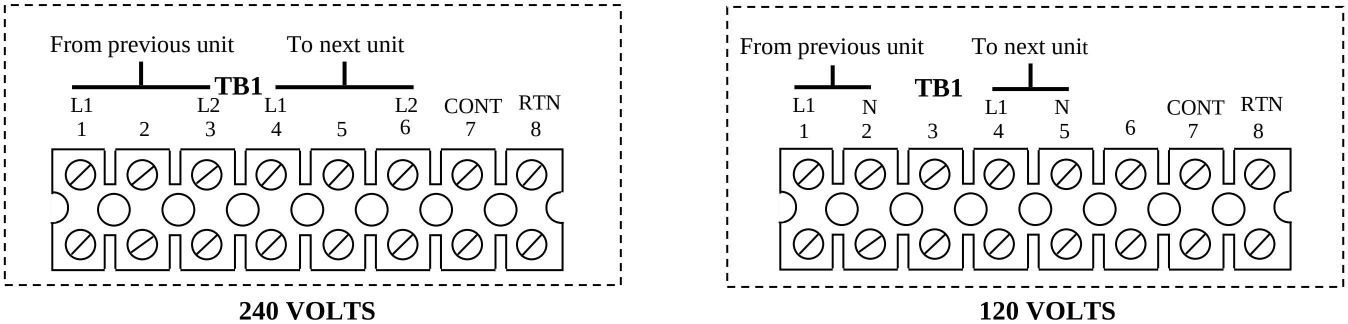


Figure 4
TB1 Labeling

Wire Size Guidelines For Primary Power:

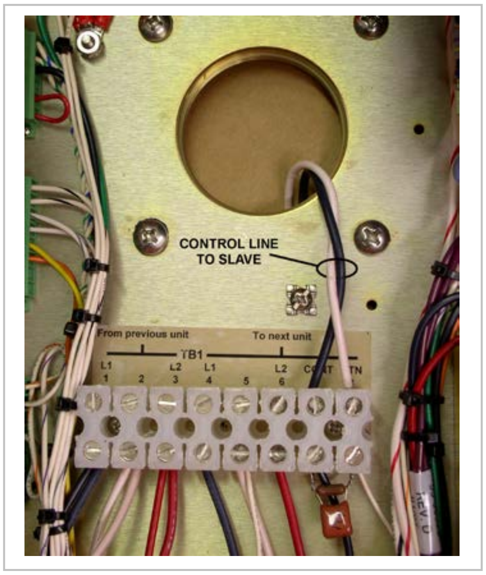
Wire size (gage) depends on the primary voltage, the length of the run, the total electrical load, and the permissible voltage drop due to resistive loss. To determine wire size for a REIL system (two lights) use a load of 300 watts (total for two lights) and a voltage drop due to wire loss of not more than 10%. For systems with sequential flashers use a load of 150 watts for each light. Routing system power through the master unit for a system containing more than 7 lights is not recommended. Consult the factory for power distribution details pertaining to large sequentially flashing systems. It is expected that NEC and local electrical codes will also apply at any installation.

CONTROL LINE HOOKUP (Figures 5 & 6)

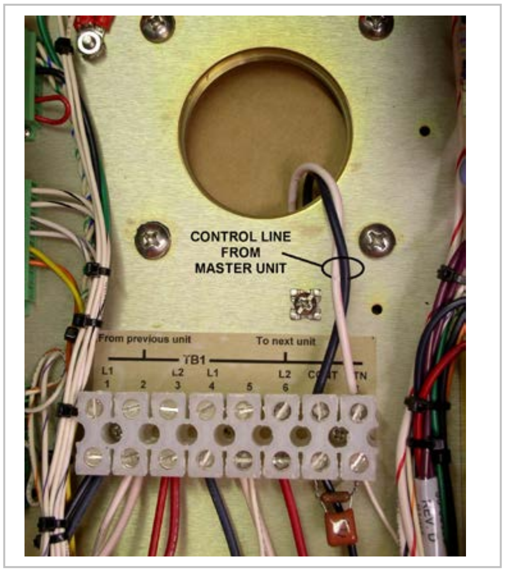
A two-conductor control line must be run between the power supplies. These conductors must be twisted together to minimize effects from electrical fields in close proximity, and especially from power conductors. The ideal control line consists of two stranded AWG 12 conductors twisted together with 3 to 4 twists per foot. A shielded cable is neither required nor recommended. AWG 12 wire is cited only for its mechanical strength property; it is not an electrical requirement because the control signal current is very low.

Control line connections are made at TB1, Terminals 7 & 8, in each power supply. Terminal 7 carries the driving signal, and Terminal 8 the return. Terminal 8 is also tied internally to the equipment chassis.

Be sure the wires are inserted into the terminal block cavities between the two clamping plates. The clamping screws must be firmly tightened to assure long-term reliability. Always tug on the wires to test them for secure holding after the terminal block screws have been tightened. This is especially important when more than one wire is inserted under a clamp.



Master Unit



Slave Unit

Figure 5
TB1 Control Line Connections

Figure 5 depicts typical control line connections in a REIL system (two lights). When there are multiple slave units (ALS, for example) the control line must be “daisy chained” from one slave unit to the next. Since the daisy chain connections are made at Terminals 7 and 8 there will be two conductors at those positions in all but the first unit (the master) and the last slave unit in the chain.

A complete wiring sketch for installation is shown in Figure 6.

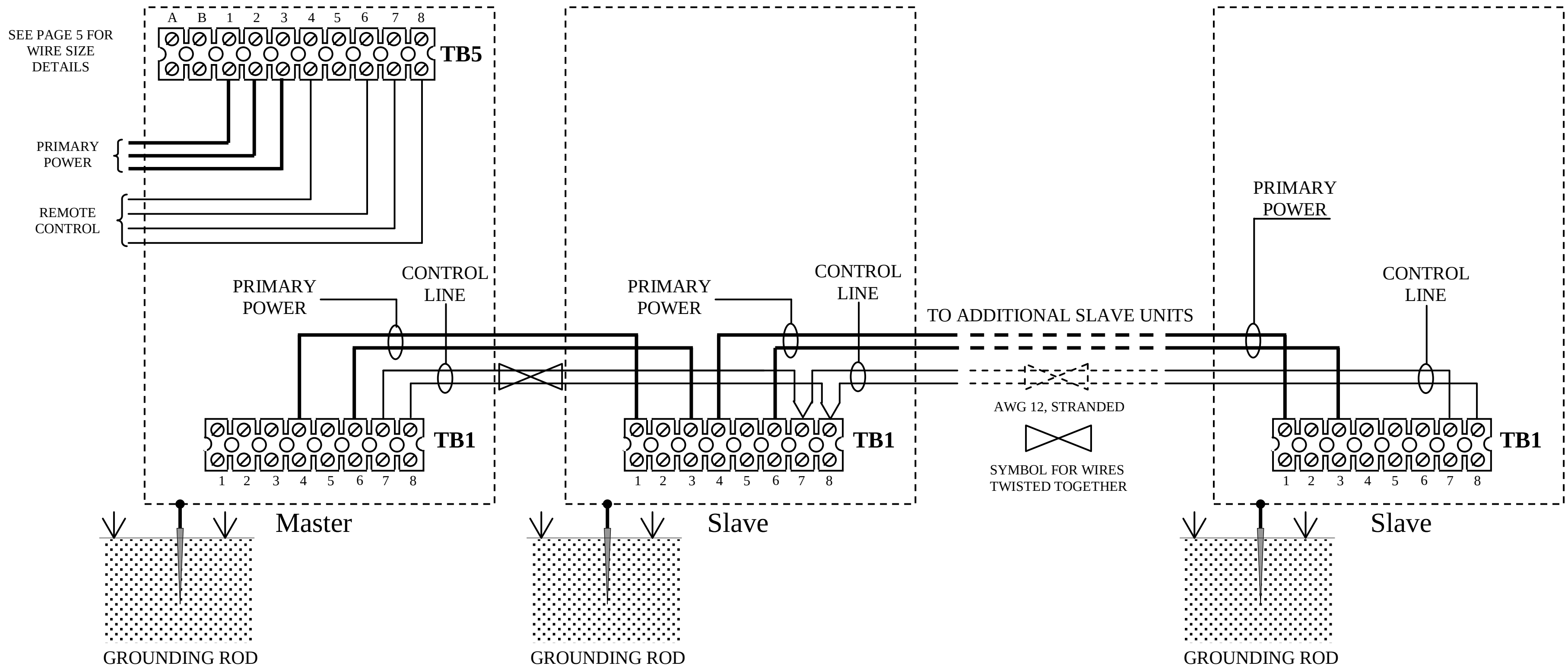


Figure 6
Basic System Interconnection Wiring

The control line conductors must be twisted together. Three or four twists per foot are recommended. Shielding is not necessary or recommended. AWG 12 is recommended for mechanical considerations only. It is not an electrical requirement.

Each power supply should be grounded <u>locally</u> for protection against lightning damage. An external grounding lug on the bottom of the power supply enclosure is provided for this purpose. <u>A grounding rod should be installed at each power supply for the best protection</u>.

GROUNDING THESE POWER SUPPLIES TO A COUNTERPOISE COULD <u>INCREASE</u> THE RISK OF DAMAGE DUE TO LIGHTNING

REMOTE CONTROL HOOKUP:

Connections to a remote switch or L-854 radio receiver are made at TB5 in the master unit as shown in Figures 3, 6, & 7. The control voltage is 120 volts ac. It is internally generated and not electrically referenced to primary power except in systems that utilize 120 Volts as primary power. The current is less than .03 amperes rms. Wire size can be based on mechanical considerations alone because the electrical load is so low.

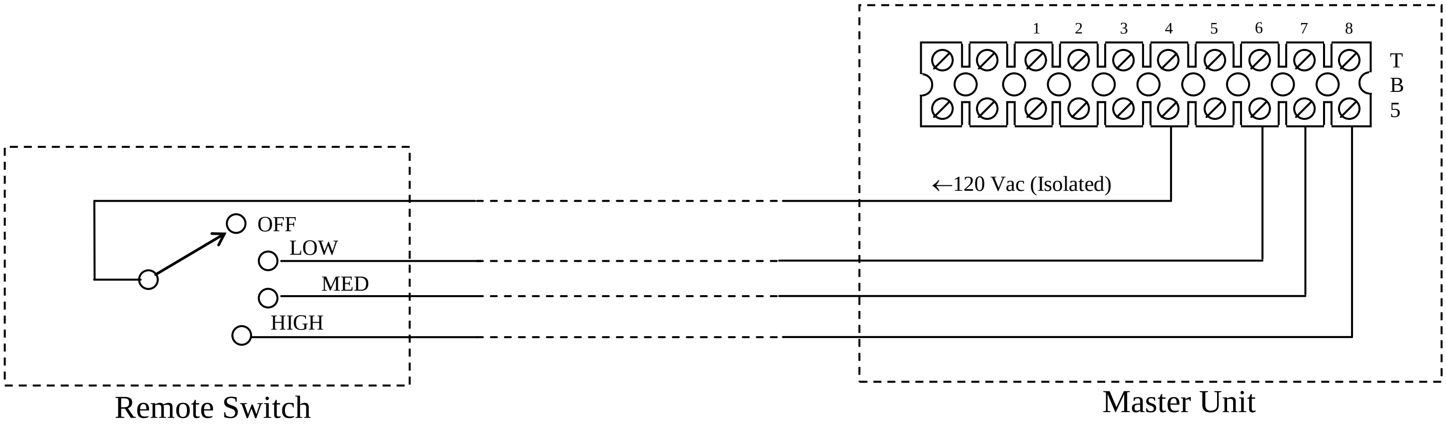


Figure 7, Remote Control Switch Circuit

A Series Lighting Circuit (SLC) can also be used for remote control. This requires an optional module in the master unit and should be specified when the equipment is ordered. The wiring connections are shown in Figure 8. The L-823 cord set shown from terminals A & B is part of the optional equipment, but the L-830-1 Isolation Transformer shown in Figure 8 is usually provided by others. This option may require initial setup adjustments in order to attain flash intensities at specific levels of SLC current. Refer to the setup procedures on Pages 12 through 15.

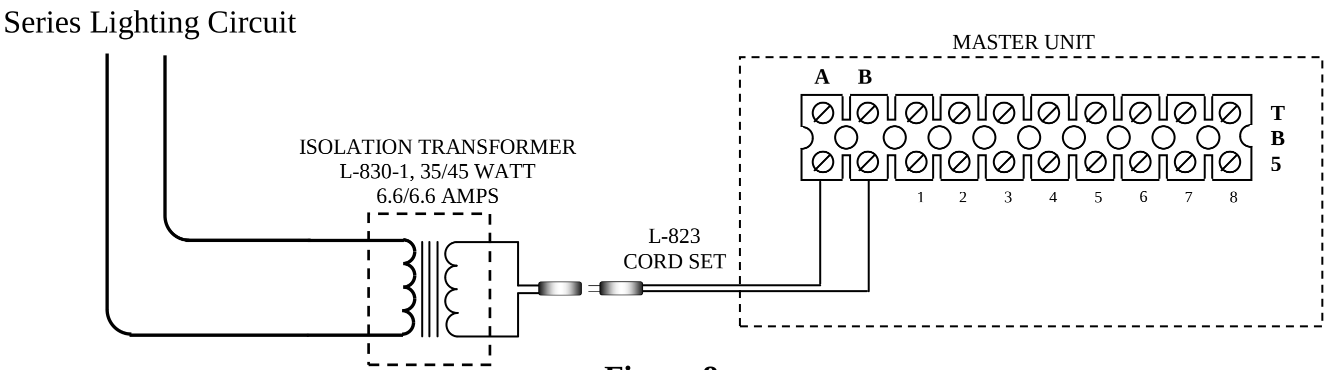


Figure 8
Remote Control By A Series Lighting Circuit

FUNCTIONAL DESCRIPTION

Each power supply, whether it is a master unit or a slave, has an identical PCB-1 circuit board for timing and control functions. These circuit boards communicate with one another over an interconnecting control line. System power for up to seven lights is typically controlled by a circuit breaker that is part of a control module located in the master unit. Larger systems may require an auxiliary power contactor. Flash intensity may be controlled at the master unit by a selector switch on the control module, or remotely by a selector switch or L-854 radio receiver. The control module is also available with an option that enables the system to be controlled by a Series Lighting Circuit.

APPLICATIONS

These lights may be used in both REIL and sequential ALS applications. The two lights in a REIL system must flash simultaneously, whereas ALS lights must flash sequentially. Switch SW1 on PCB-1 controls when the light will flash, i.e., simultaneously, or sequentially. SW2 controls the rate at which flashes repeat. See Figures 9a and 9b. The rate is generally 120 flashes per minute. These switches are initially set at the factory to comply with the application as ordered, although changes can easily be made in the field.

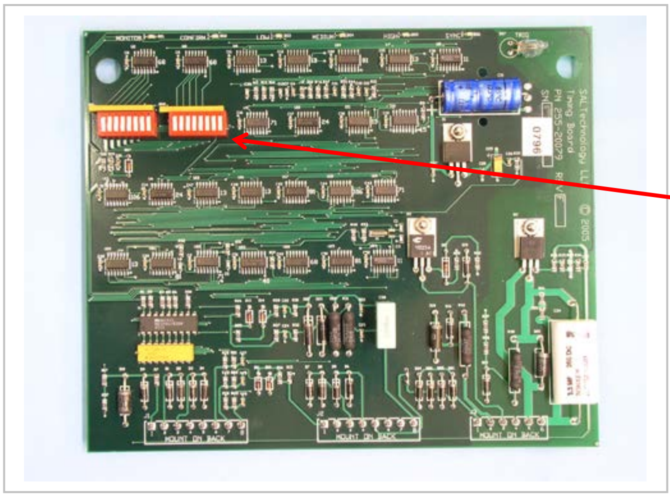


Figure 9a
PCB-1

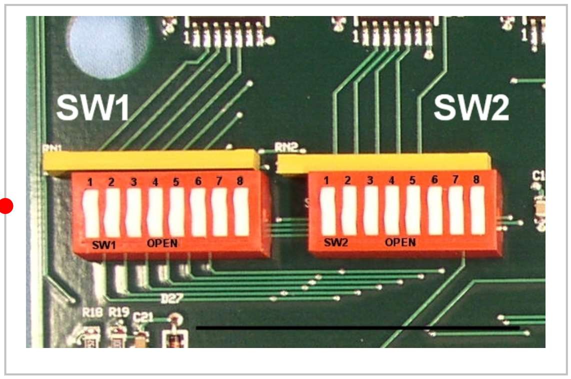


Figure 9b
Switch Detail

Since the lights in a REIL system must flash simultaneously SW1 in the Master unit and the Slave must be programmed identically, and of course the same applies to SW2 for flash rate, *with the exception of SW2-8*. SW2-8 must be in the OFF position in a Master unit, but it should in the ON position in a Slave unit.

SW1 in an ALS must be programmed differently in each light in order to achieve sequential flashing. SW2 must be programmed the same in each light with the exception of SW2-8, just as described above for REILs. Figure 10 shows SW1 and SW2 programming for REILs and for each light in an ALS. *Note particularly that SW2-8 is programmed differently in a master unit* *than it is in a slave.* Switch programming diagrams are also attached to the inside cover of every power supply.

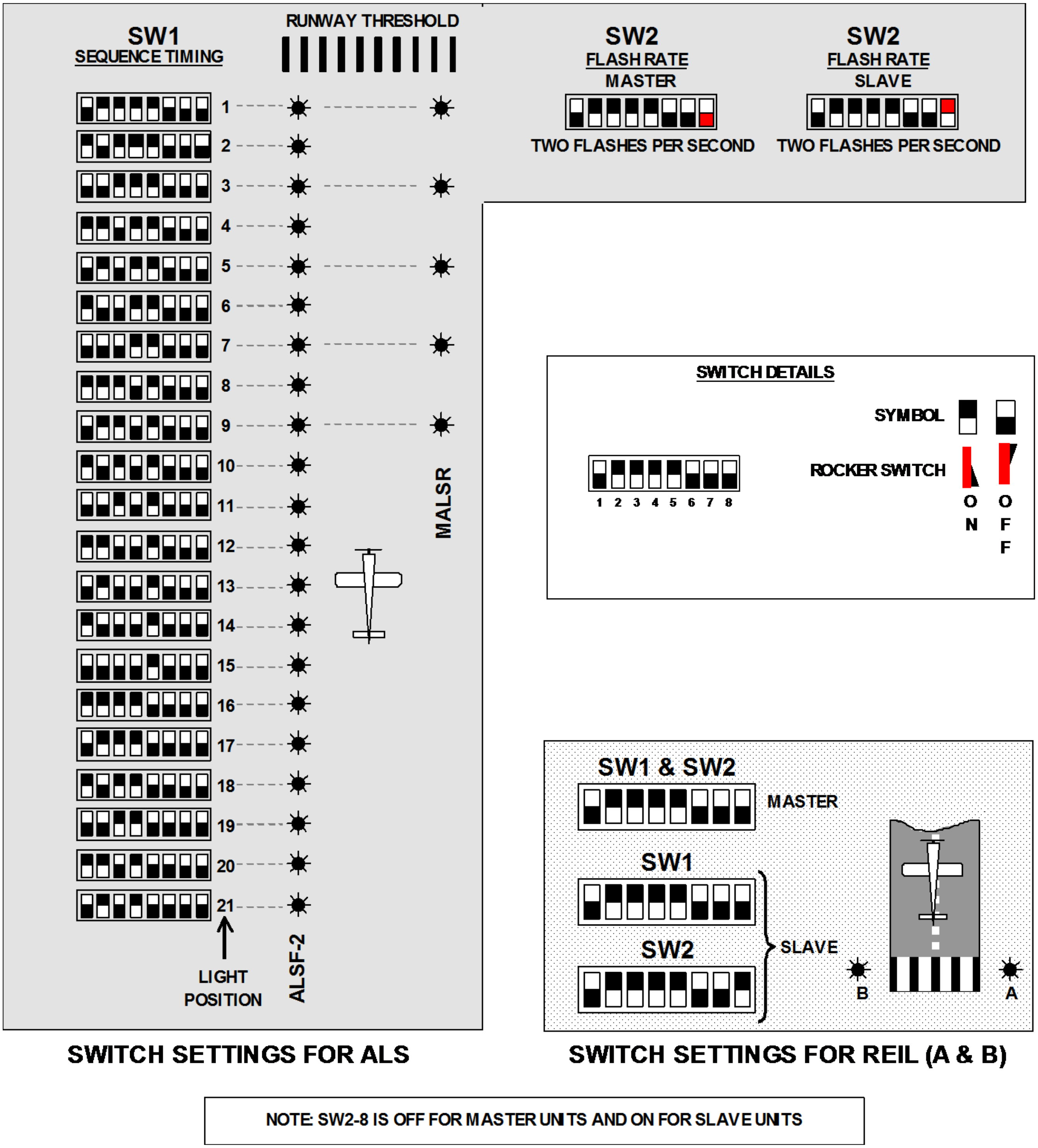


Figure 10
Circuit Board Programming

OPERATION

The Circuit Breaker (CB101) in the master unit must be closed in order to activate the system. When the circuit breaker is closed, the system can be controlled locally by means of SW101 on the CMV 111 Controller, or remotely when SW101 is in the REM (Remote) position. An auxiliary switch must be provided for remote operation. It typically would have four settings: Off, Low, Medium, & High, or it could be an L-854 radio receiver.

Figure 11a
CMV-111 Control Module

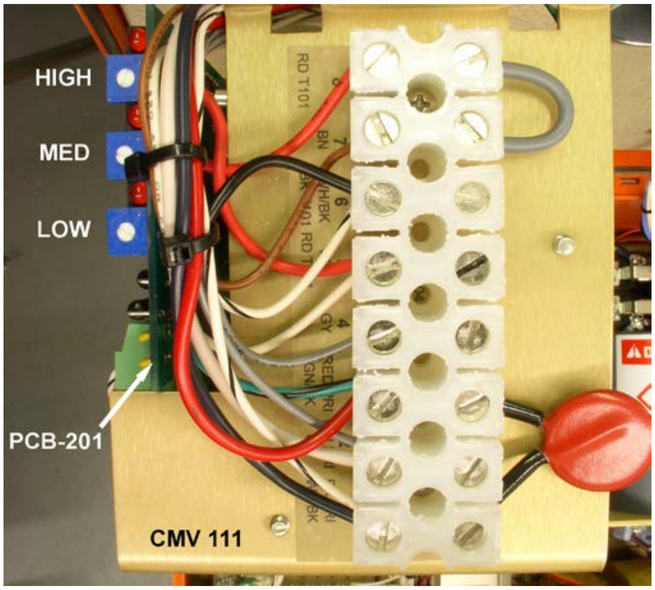


Figure 11b
Current Sensing Module

A Series Lighting Circuit (SLC) can also be used for remote control if that option has been elected at the time of purchase. A setup procedure is then required at installation. Pages 12 through 15 have instructions that cover most set up variations.The adjusting potentiometers (labeled HIGH, MED, and LOW) are on a circuit board (PCB-201) that is added to the CMV 111 Controller as a sub-assembly. The adjusting potentiometers are shown in Figure 11b.

SET UP PROCEDURES FOR REMOTE SLC FLASH CONTROL

The equipment is set up at the factory according to sales order instructions when the system is ordered with the option of intensity control from a Series Lighting Circuit. A five-step regulator is used at the factory for these initial adjustments, and the system is set up for three levels of intensity unless it has been ordered for a single intensity application. The tables below show the typical factory settings for three-step and five step CCRs. Bear in mind that the flash mode response does not necessarily have to be the same as those shown in the tables. You can customize the response at your site by making new adjustments. You can select any three CCR steps for three levels of intensity, but the current for a higher intensity must always be greater than the current for a lower intensity. For example, you cannot set Low intensity to occur at CCR Step 2 if Medium intensity has been set for CCR Step 1.

CCR STEP	CURRENT (AMPS)	FLASH MODE
3	6.6	HIGH
2	5.5	MED
1	4.8	LOW

Table 1
Three-Step CCR (STYLE 1)

CCR STEP	CURRENT (AMPS)	FLASH MODE
5	6.6	HIGH
4	5.2	MED
3	4.1	
2	3.4	LOW
1	2.8	

Table 2
Five-Step CCR (STYLE 2)

Although the switching levels are initially set up at the factory it is likely that they will have to be fine-tuned upon installation due to specific conditions at your site such as the type of CCR in use and other loads that may be driven by the same CCR. Adjustments are made at the current sensing module shown in Figure 11b. This module is part of the CMV-111 Controller when Series Circuit Control has been purchased as an option.

Set Up Procedure for Three Levels of Intensity With a **Three**-Step CCR (Style 1)

THE FOLLOWING INSTRUCTIONS REQUIRE SERVICING THE EQUIPMENT WHILE POWER IS APPLIED.
USE APPROPRIATE CAUTION WHILE ACCESSING INTERIOR COMPONENTS.

1. Open the cover of the master unit, and set the interlock switch to the 'service' position (pull up on the stem of the switch).
2. Flip the Circuit Breaker to the ON position (up). See Figure 7.
3. Turn the Control Switch to REMOTE.
4. At PCB-201, (See Figure 8) adjust all three potentiometers, LOW; MED; & HIGH, fully counter clockwise (CCW).
5. Set the CCR to Step 1 (4.8 amps).
   - Carefully adjust the LOW potentiometer CW until its adjacent LED comes on. Flashing will begin at Low intensity.
6. Set the CCR to Step 2 (5.5 amps).
   - Carefully adjust the MED potentiometer CW until its adjacent LED comes on. The unit will now flash at Medium intensity.
7. Set the CCR to Step 3 (6.6 amps).
   - Carefully adjust the HIGH potentiometer CW until its adjacent LED comes on. The unit will now flash at High intensity.
8. Set the CCR back to Step 2.
   - The HIGH LED should turn off. If it does not, adjust the HIGH potentiometer incrementally CCW until it does. The unit will then flash at Medium intensity.
9. Set the CCR to Step 1.
   - The MED LED should turn off. If it does not, adjust the MED potentiometer incrementally CCW until it does. The unit will then flash at Low intensity.
10. It is advisable to run through the CCR steps once more to verify that switching is correct. Make any necessary adjustments to the potentiometers to achieve correct switching by repeating the steps above.
11. Leave the Control Switch in the REMOTE position for continuous control by the CCR.
12. No adjustments are required at a slave unit.

Set Up Procedure for Three Levels of Intensity With a **Five**-Step CCR (Style 2)

THE FOLLOWING INSTRUCTIONS REQUIRE SERVICING THE EQUIPMENT WHILE POWER IS APPLIED.
USE APPROPRIATE CAUTION WHILE ACCESSING INTERIOR COMPONENTS.

1. Open the cover to the master unit, and set the interlock switch to the 'service' position (pull up on the stem of the switch).
2. Flip the Circuit Breaker to the ON position (up).
3. Turn the Control Switch to REMOTE.
4. At PCB-201, (See Figure 8) adjust all three potentiometers, LOW; MED; & HIGH, fully counter clockwise (CCW).
5. Set the CCR to Step 1 (2.8 amps).
   - Carefully adjust the LOW potentiometer CW until its adjacent LED comes on. Flashing will begin at Low intensity.
6. Set the CCR to Step 2 (3.4 amps).
   - The LOW LED should remain on and flash intensity should be unaffected.
7. Set the CCR to Step 3 (4.1 amps).
   - Carefully adjust the MED potentiometer CW until its adjacent LED comes on. The unit will switch to Medium intensity flashes.
8. Set the CCR to Step 4 (5.2 amps).
   - The MED LED should remain on and flash intensity should be unaffected.
9. Set the CCR to Step 5 (6.6 amps).
   - Carefully adjust the HIGH potentiometer CW until its adjacent LED comes on. The unit will switch to High intensity flashes.
10. Set the CCR back to Step 4.
    - The HIGH LED should turn off. If it does not, adjust the HIGH potentiometer incrementally CCW until the LED turns off. MED & LOW LEDs should remain on.
11. Set the CCR to Step 3.
    - There should be no change from the conditions in Step 10.
12. Set the CCR to Step 2.
    - The MED LED should turn off. If it does not, adjust the MED potentiometer incrementally CCW until the MED LED turns off. The LOW LED should remain on and the unit should be flashing at Low intensity.
13. Set the CCR to Step 1.
    - There should be no change from the conditions in Step 12.
14. It is advisable to run through the CCR steps once more to verify that switching is correct. Make any necessary adjustments to the potentiometers to achieve correct switching by repeating the steps above.
15. Leave the Control Switch in the REMOTE position for continuous control by the CCR.
16. No adjustments are required at a slave unit.

Set Up Procedure for **Single** Intensity Operation

THE FOLLOWING INSTRUCTIONS REQUIRE SERVICING THE EQUIPMENT WHILE POWER IS APPLIED.
USE APPROPRIATE CAUTION WHILE ACCESSING INTERIOR COMPONENTS.

The procedure for single intensity operation is essentially the same for all CCRs whether they are three or five-step regulators (Style 1 or Style 2).
Most single intensity runway approach strobes operate at High intensity, although the system could also be set up for a single intensity of Medium or Low.

For single **High** intensity operation:

1. Open the cover to the master unit, and set the Interlock Switch to the ‘service’ position (pull up on the stem of the switch).
2. Flip the Circuit Breaker to the ON position (up)
3. Turn the Control Switch to REMOTE.
4. At PCB 201 (See Figure 11b), adjust all three potentiometers, LOW; MED; & HIGH, fully counter clockwise (CCW).
5. Set the CCR to the current level at which you want the light to start flashing (must be at least 5.2 amperes).
6. Adjust the HIGH potentiometer CW until the adjacent LED comes on. The strobe will begin flashing at High intensity.
7. Do not adjust the MED or LOW potentiometers. They must remain fully CCW.
8. Set the CCR (whether 3-step or 5-step) to the next lower step. The HIGH LED should extinguish, and the strobe should stop flashing. If it does not, adjust the HIGH potentiometer incrementally CCW until it does.
9. Test the adjustments by observing the results as the CCR is switched from one step to another.
10. Leave the Control Switch in the REMOTE position for continuous control by the CCR.
11. No adjustments are required at a slave unit.

Contact the factory for other custom flash control conditions.

THEORY OF OPERATION

A xenon capacitive discharge light is often referred to as a “strobe”. A flash is produced when sufficient electrical energy is abruptly ‘dumped’ into a lamp filled with xenon gas. The gas, which is normally nonconductive, must be brought to a conductive state for a flash to occur. This requires applying a pulse of high amplitude (a triggering pulse) to the lamp. The energy producing the flash is stored in a bank of capacitors connected to the lamp electrodes. The capacitors, charged to a relatively high potential, discharge through the lamp when the internal gas becomes conductive.

SAL Technology™ strobes consist of two major subassemblies called power supplies and flash heads. A power supply converts external ac primary power to dc (direct current) that is fed to a bank of energy storage capacitors bringing them to a charge potential of about 1000 Volts dc (±500 Volts).

Most runway approach strobes must be capable of 3 levels of flash intensity–High, Medium, and Low. Flash intensity levels are changed by switching the lamp to different values of bank capacitance.

Flash head components consist of a sealed-beam xenon lamp, a triggering transformer, and additional minor circuitry. The flash head is connected to the power supply by a short harness if it is co-mounted or by a cable when it is installed remotely. The harness/cable connects the bank of capacitors in the power supply to the anode and cathode flash lamp electrodes. The maximum voltage on the anode conductor is +500 Volts dc. The maximum voltage on the cathode conductor is –500 Volts dc. The total lamp voltage at discharge is therefore 1000 volts. The harness/cable also carries a low level triggering pulse that is applied to a small transformer in the flash head where it is boosted to a voltage level high enough to trigger the flash lamp into its conductive state. A coupling transformer located in the power supply provides an intermediate signal boost that improves triggering when a very long flash head cable is used.

A REIL system has two lights that flash simultaneously. Some approach lighting systems have as many as 21 lights that flash sequentially. The practical limit for SAL Technology™ sequential flashers is even higher. The point is that these lights must always operate as an integrated system. This requires a form of communication between the lights. The method used in SAL Technology systems is an encoded signal that is distributed by an interconnecting control line. The encoded signal carries timing and flash intensity information that originates at a master unit. The only difference between a master unit and a slave unit is an internal control module residing in the master unit. The control module monitors the current in a Series Lighting Circuit and provides adjustments for setting intensity switching thresholds at specific levels of SLC current.

MAINTENANCE

SAL Technology™ approach lights require minimal maintenance.

Every 6 months

- Make sure that the cover latches are secured and holding the cover tightly closed.
- Check the venting plug on the bottom of the power supply, and clear the breathing holes if they have become clogged.
- Check co-mounted flash head sealing. There should be a continuous bead of sealing compound between the housing hub and the EMT compression nut as shown is Figure 12a. Sealing compound must also be packed all around the harness sleeve as shown in Figure 12b. Only the back view is shown, but it should also be packed around the harness in front. Use Gardner-Bender DS 110, or similar, Duct Seal when repairing or replacing.
- Check screw tightness on TB1 and TB3 (8-position terminal blocks; (See Figure 13 for locations). Check every position that has a wire connection whether to external wiring or to internal circuits. You should also check TB5 in master units.

Figure12a

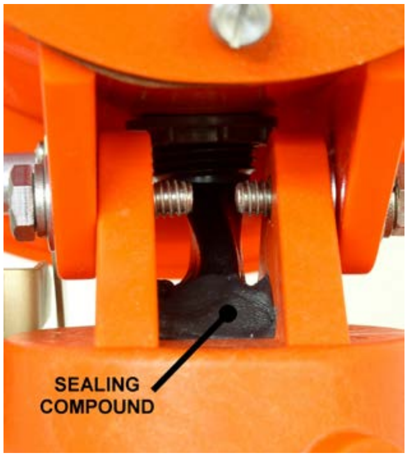


Figure 12b

Annually:

- Check the neoprene cover gasket on the power supply enclosure for nicks or tears. If repair is needed use a neoprene compatible adhesive. RTV may not adhere well to the neoprene gasket.
- Perform a mode switching response check. Verify the lights respond correctly to all commands from the SW101 Control Switch in the master unit.
- Verify that the flash rate is 120 flashes per minute.
- Verify that the threshold lights flash simultaneously, and that sequenced lights flash in the correct order.

TROUBLESHOOTING

Some problems affect only one light while other problems may affect part or all of an entire system. Most problems occur at initial turn on. This is primarily because the control line is the only untested part of a newly installed system. Control line problems usually affect not just one light, but all of the lights in a system. It is, however, possible for only one light to be affected if a programming switch was bumped while working in a power supply during electrical hookup causing it to become unintentionally reprogrammed.

Faults that may arise after a system has been working properly are usually due to rather predictable causes brought on by component aging, deferred maintenance, or perhaps some type of damage. These problems usually affect only one light, although there can be exceptions.

It is important to know where the major components are located, especially when attempting to follow troubleshooting procedures. Use Figures 13 and 14 for this purpose. A slave power supply does not have a CMV-111 Control Module; it is otherwise identical to a master unit shown in Figure 13.

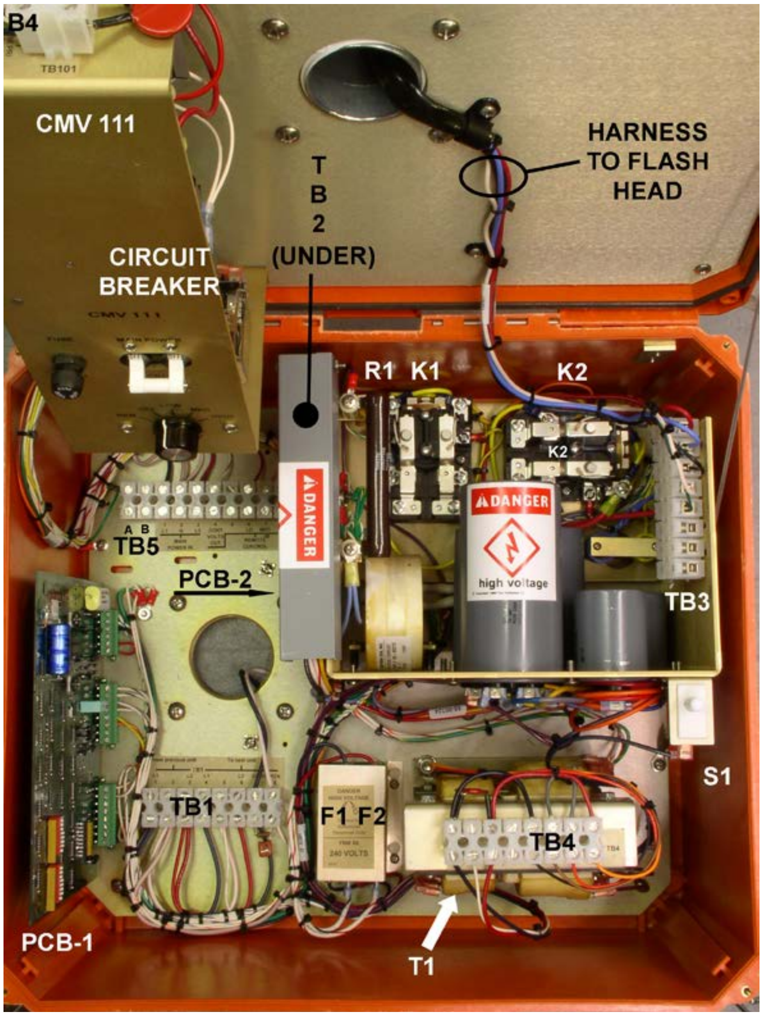


Figure 13
Master Power Supply Component Identification

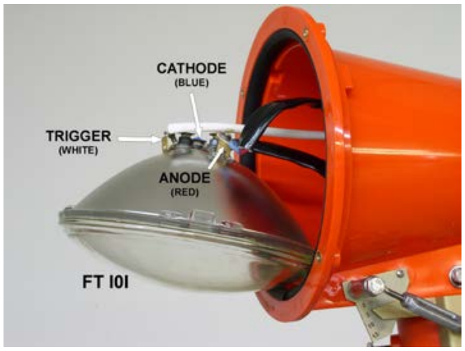


Figure 14a
FHUD-109-Front

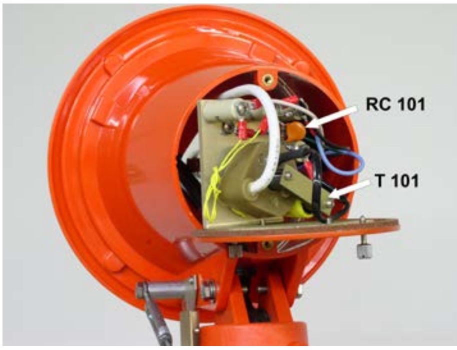


Figure 14b
FHUD-109-Back

TROUBLESHOOTING-STATUS LIGHTS

Each power supply has two circuit boards with indicator lights that can be used to interpret operating conditions. PCB-1 (Figure 15) is the timing and control circuit board. Its location is shown in Figure 13. It has six red LEDs, but only four of these apply to standard functions. DS1 and DS2, labeled Monitor and Confirm, are used only when the Monitoring option has been elected at the time of purchase. DS7 is a neon glow lamp. SW1 and SW2 are programming switches.

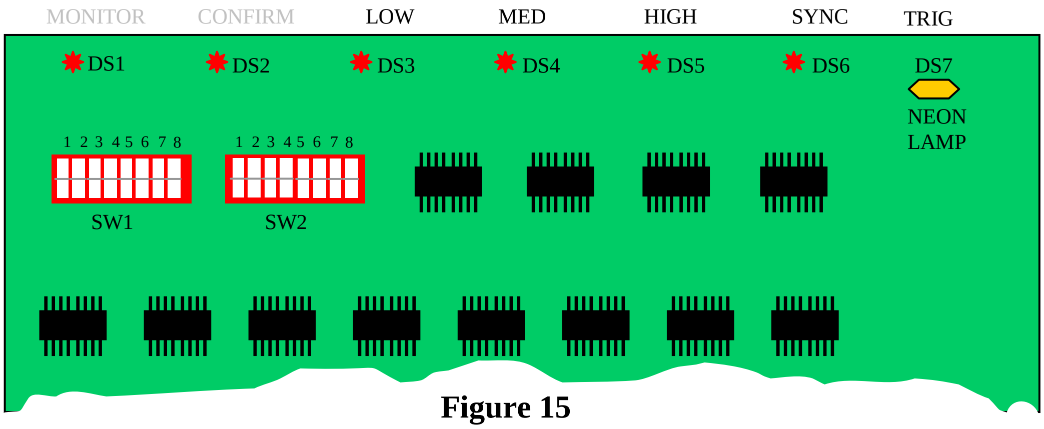


Figure 15
PCB-1 Status Lights

PCB-2 does not show in Figure 13, but its location beneath the High Voltage Guard is noted. The neon lamps on PCB-2 (Figure 16) are in prominent view for safety and troubleshooting. DS3 is a <u>safety</u> lamp. It is lit whenever the dc bank voltage exceeds about 80 volts.

Do not touch any circuit component within the power supply or flash head when DS3 is lit.

DS1 and DS2 on PCB-2 are provided for troubleshooting. They are lit whenever the <u>total</u> bank voltage exceeds about 800 volts dc (± 400). The bank voltage consists of a negative component and a positive component–each reaching about 500 volts dc at full charge. Both lights must be lit for flashing to occur.

The full bank voltage is 1000 volts dc. This is a dangerous potential–Use appropriate caution!

<u>NOTE</u>:
There is no interlock switch in an FHUD-109 flash head.

Always turn off the power supply when accessing the flash head.

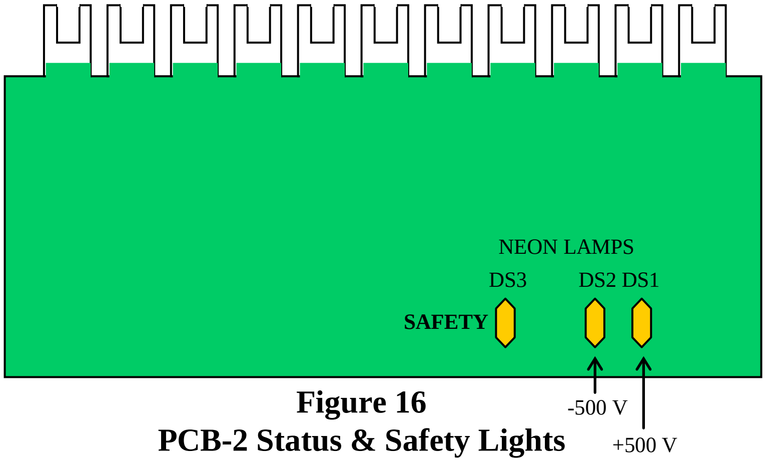


Figure 16
PCB-2 Status & Safety Lights

TROUBLESHOOTING–NORMAL INDICATIONS

Effective troubleshooting does not necessarily require measuring instruments. Most problems can be identified by audio and visual techniques, but first one must know what to look and listen for as the equipment operates. When a light is working properly there will be characteristic sounds and circuit board status light conditions. Recognizing the absence of any typical indication is the first step in tracking down the cause of a malfunction. To use sight and sound diagnostically you should know what to look and listen for in normal operation.

With power applied, the interlock switch set to the service position (plunger pulled upwards), a unit that works correctly will flash steadily at a rate of 120 FPM. The flash intensity will depend on the control switch setting in the master unit, or at a remote switch when in remote control.

Diagnostics By Sight and Sound

When a light is operating correctly:

- There will be an audible "buzz" from the T1 power transformer.
- There will be an audible "thump" accompanying each High intensity flash as the capacitors discharge through the lamp. This discharge thump may not noticeable for Medium or Low intensity flashes.
- There will be a sharp, audible snap coinciding with each Medium and Low intensity flash if the flash head is co-mounted. The snap is from the triggering circuit in the flash head. At High intensity the snap is likely to be completely masked by the louder discharge thump. The snap may not be noticeable if the flash head is remotely mounted from the power supply.

At PCB-1:

- DS7 will 'wink' out with each flash.
- DS6 will blink at the same rate as flashing, but does not quite coincide with the flashes.
- In High mode, DS3, DS4, & DS5 will be on steady.
- In Medium mode, DS5 will be off while DS 3 & DS4 will be on steady.
- In Low mode DS4 & DS5 will be off while DS3 will be on steady.

An exception to any of the above conditions is the first troubleshooting clue. Procedures for identifying the cause of a problem are broken down into categories in order to speed up troubleshooting. The broadest category is whether the problem is occurring at initial turn-on of the system or after the system has previously worked correctly. The next category is whether the problem affects one light only or appears to be a system problem affecting all or most of the lights. Possible causes are generally listed according to estimated probability.

I. PROBLEMS OCCURRING AT INSTALLATION

The most common problems when a system is first turned on are:

1. Flashing at the Wrong Intensity or Erratic Flashing.
2. No Flash at all.

Erratic Flashing is the term used when a light skips flashes or toggles from one intensity to another as it flashes. Erratic flashing that affects an entire system could be caused by sporadic intensity changes that could appear as missed flashes when viewed from a distance.
These problems would typically affect all of the lights the same way, but there can be exceptions.

A. When all of the lights are affected

1. Flashing at the Wrong Intensity or Erratic Flashing
   Probable cause–Electrical interference on the control line.
   Disconnect the control line at TB1, Terminal 7 in the master unit. If the master unit then works properly reconnect the control line, and remove the control line from TB1, Terminal 7 in the slave unit. If the slave unit then works properly, the problem is being caused by interfering signals on the control line. See control line comments below.

2. No flash at all
   Probable cause–**Severe** interference on the control line could prevent flashing altogether.

   Control line comments:
   The control line wires must be twisted together. Shielding is not necessary or recommended. Shielding is not a substitute for twisting. If the control line consists of two wires twisted together inside of a surrounding shield, it might help to disconnect the shield at both ends. A control line problem can usually be further verified by temporarily laying a substitute line (twisted) on the surface between the master and slave units.

B. When only one light is affected:
   No flash or flashing at the wrong time:

   - This is an unusual condition at initial turn on. If it does happen it is most likely because a programming switch on PCB-1 was unintentionally bumped while working inside the power supply during installation causing a programming error. Correct programming information can be found in Figure 10 and also on the inside of the power supply cover of the unit affected.
   - It is also possible that the equipment was somehow damaged after leaving the factory.
   - If the flash head is located remotely from the power supply, the cable could be incorrectly hooked up.

II. EVOLVING PROBLEMS (When a Light Stops Working Correctly)

Most problems that develop after a system has been working correctly affect only one light. These typically fall into one of the following categories:

A. No Flash
B. Wrong Intensity
C. Skipping Flashes

The method of fault isolation prescribed below consists mainly of following the tips leading to a specific component, and verification by temporarily exchanging that component with one known to be working correctly.

A. No Flash

1. Blown fuse in the power supply?
2. No High Voltage, evidenced by DS1, DS2, & DS3 on PCB-2 not being lit:
   a) PCB-2 defective.
   b) T1 Power Transformer defective.
   c) Bank capacitor shorted. Call 1-603-598-4100 for assistance.
3. No Trigger, evidenced by no audible ‘snap’:
   a) Change PCB-1 if DS7 is lit steady.
   b) Change PCB-2 if DS7 on PCB-1 is not lit–then change PCB-1 if DS7 remains unlit.
   c) Change T101 (trigger transformer in flash head) if the problem is yet unresolved.
4. Defective flash Lamp:
   Change out the flash lamp.
5. SW2-8 on PCB-1 incorrectly set:
   Be sure this switch is in the off position.

EVOLVING PROBLEMS, Cont.

B. Wrong Intensity

1. DS5, DS4, or DS3 do not agree with the mode indications at the CMV-111:
   a) Change out PCB-1.
   b) Change out PCB-101.
2. DS5, DS4, & DS3 agree with the CSM-111, yet the flash intensity is wrong:
   a) Check K1 & K2 for correct switching responses as shown in Table 3 below.

Table 3, Mode Relay Conditions

RELAY	IN*	OUT	INTENSITY
K1		√	LOW
K2		√	
K1		√	MED
K2	√		
K1	√		HIGH
K2	√		

* IN means the relay is 'pulled in', that is, energized.

C. Skipping Flashes

When a flash lamp skips flashes it is probable that either the flash lamp or the trigger transformer is approaching failure. To pin down which one:

a. Turn off the power. Power is automatically turned off when the power supply cover is opened. Do not pull up the stem of the interlock switch to the service position.
b. Disconnect the RED wire from TB3 in the power supply (be sure DS3 on PCB-2 is not lit).
c. Apply power (pull up on the interlock switch plunger).
d. Listen for trigger snaps as mentioned earlier.
e. Change out the T101 trigger transformer if trigger skipping is detected.
f. Change out the flash lamp if the trigger does not skip.
g. Replace the RED wire to TB3 and tighten the terminal block screw firmly.

REPLACING FLASH HEAD COMPONENTS

The following instructions apply to replacing major flash head components.

CAUTION

Be sure that the power supply connected to this flash head has been turned off and the safety lamp (DS3) on PCB-2 is not lit (see Figure 16). The interlock switch in the power supply removes power when the cover is open; however, removing primary power by disconnecting it at its source to the system is recommended for safety.

1. FLASH LAMP:

a) Removal:

- Referring to Figure 17a, disengage four captive screws from the housing but do not remove them from the bezel. Set the bezel aside.
- Remove the lamp from the housing. You might have to use the tip of a flat-blade screwdriver, or similar tool, to free the lamp from the sponge gasket.
- Loosen, but go not remove three Phillips head screws securing electrical wires at the back of the lamp (shown in Figure 17b).
- Remove the wires from the flash lamp terminal posts.

Figure 17a
Front View

Figure 17b
Flash Lamp Terminals

See the next page for replacement instructions.

FLASH LAMP (Cont.)

b) Replacement:

Replacement is the reverse of removal, but with attention to wire routing and flash lamp orientation. **Be sure that the wires approach the lamp terminals exactly as shown in Figure 17b!**

- Attach the blue wire to the blue flash lamp terminal.
- Attach the red wire to the red flash lamp terminal.
- Attach the white wire to the white flash lamp terminal.
- Center the lamp against the foam rubber gasket.
- **Make sure that the arrow identified in Figure 17a is in the 12-o'clock position!**
- Replace the bezel and tighten the four screws.

2. TRIGGER TRANSFORMER:

It will be necessary to access the flash lamp and remove the rear access plate in order to replace the trigger transformer.
The trigger transformer is an open frame assembly consisting of a primary coil, a potted high voltage (HV) secondary coil, a ferrite core, and assembly hardware. The entire assembly is held to the flash tube bracket by two 4-40 Phillips head screws. It is generally unnecessary to replace the entire transformer assembly if a problem develops. A replacement kit (255-20027) consists of a potted secondary HV coil and two ferrite C-cores.

a) Removal:

At the front of the housing:

- Remove the bezel holding the flash lamp, and tip the flash lamp out far enough to access the electrode screws on the back of the lamp.
- Note the manner in which the white wire approaches the electrode terminal post on the lamp, then loosen, but do not remove, the screw holding the wire. See Figure 17b.
- Do not loosen the screws holding the blue wire or the red wire.
- Disconnect the white wire from the lamp.

At the back of the housing:

- Disengage the two captive screws from the main body of the housing, allowing rear plate to be opened as shown in Figure 18.
- Identify the black wire from the potted HV coil, and detach it at its ceramic post connection.
- Remove the two 4-40 Phillips-head screws (identified in Figure 18a). These screws hold the trigger transformer to the bracket.
- Try to avoid disturbing the position of the loosened parts after the screws have been removed.
- Remove the small flat plate lying across the top of the ferrite core.
- Carefully remove the top half of the ferrite core. The bottom half can be left undisturbed.
- Lift the HV secondary coil away from the bottom half of the ferrite core (Figure 18b).
- Examine the top half and bottom half of the ferrite core for chipping or fracture, and replace either one if necessary.

<u>TRIGGER TRANSFORMER</u> (Cont.):

b) Replacement:

- Install the replacement HV coil over the bottom half of the ferrite core with the white HV lead positioned in the same manner as the original.
- Insert the upper half of the ferrite core down through the center of the HV coil and the spool that holds the primary coil.
- Re-install the small flat plate and the long 4-40 screws.
- Tighten the screws symmetrically–alternating from one to the other until the two screws begin to tighten.

Be very careful when-tightening these screws. Over-tightening can fracture the ferrite core.

- Re-attach the black wire from the HV coil to the ceramic insulating post.
- Set the bracket back into the housing with the component shelf towards the bottom.
- Secure the rear plate with the two captive screws.
- At the front of the housing, attach the white wire to the proper lamp terminal taking care to bring the wire to the lamp terminal as shown in Figure 17b.
- Follow the instructions on Page 25 for re-installing the flash lamp.

Figure 18a
Flash Head Bracket

Figure 18b
Trigger Transformer Replacement

Table 4, Replaceable Parts

REF	DESCRIPTION	PN
A-100	Flash Head Bracket Ass'y (See Figure 18a)	255-20140
C1	Bank Capacitor, 70 µf	55-00105
C2	Bank Capacitor, 30 µf	55-00257
C3	Bank Capacitor, 8 µf	55-00109
C4, C5	Bank Capacitor, 5 µf	55-00110
C6	Tuning Capacitor, 3 µf	55-00259
CB 101	Circuit Breaker, 20 Amp, (For CMV-111.1 & 111.2)	55-00406
CB 101	Circuit Breaker, 20 Amp (For CMV-111.3))	55-00483
FT 101	Flash Lamp (See Figure 15a)	55-00145
F 101	Fuse, 1.5 Amps, Master unit only, (Remote Control)	55-00267
F1, F2	8 Amps, (F1 only for 120 volts, or 230 Volts, 50 Hz)	55-00186
K1, K2	Relay, Mode Switching	55-00193
PCB-1	Printed Circuit Board, Timing & Control	255-20079
PCB-2	Printed Circuit Board, High Voltage Rectifier	255-20081
PCB-201	Printed Circuit Board, Current Sensing Option (See Figure11b)	255-20086
P1, P2	Ceramic Standoff, 1 inch, (for R1, See Figure 19)	55-00200
R1	Capacitor Bleed Resistor, 75 KΩ, 50 W	55-00228
S1	Interlock Switch	55-00201
T1	Power Transformer, High Voltage: 60 Hz; Specify 120 or 240 V.	55-00224
T1	Power Transformer, High Voltage: 230 Volts, 50 Hz	55-00386
T 101	Trigger Transformer Kit	255-20027
TB1, TB3	Terminal Block, 8 Position	55-00146
TB2	Terminal Block, 11 Position (for PCB-2)	55-00273
TB5	Terminal Block, 10 Position (Master unit only)	55-00147

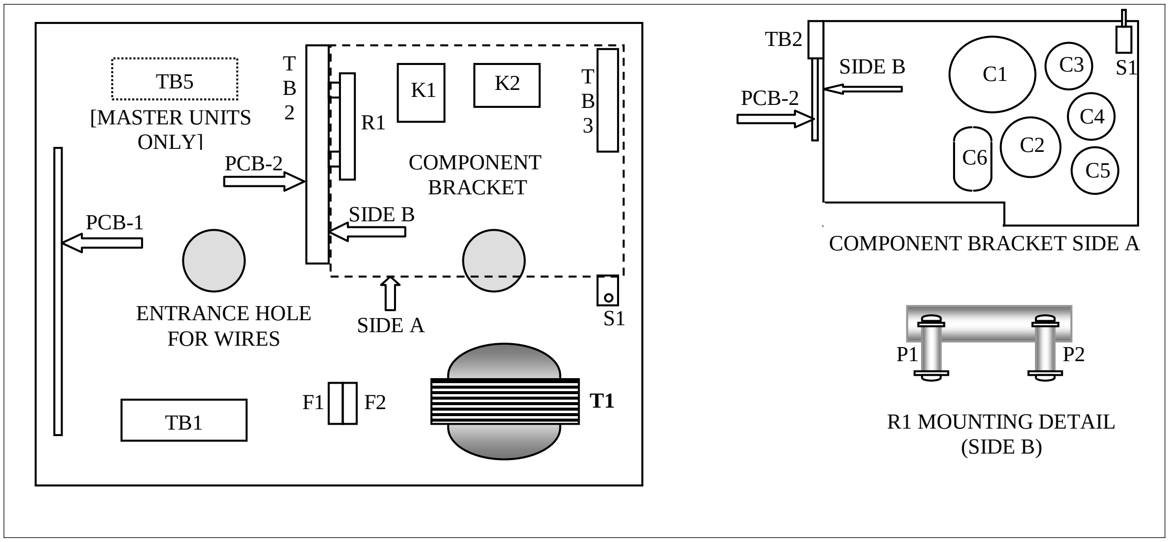


Figure 19
Component Location Diagrams