TECHNICAL MANUAL

OPERATOR'S, AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR STROBEX BLADE TRACKER (MODEL 135M-9) NSN 4920-00-156-9946

HEADQUARTERS, DEPARTMENT OF THE ARMY

29 DECEMBER 1980

FIRST AID DATA

For artificial respiration and other first aid data, refer to FM 21-11.

WEAR EYE PROTECTION

The flash tubes contain gas under high pressure and are subject to breakage. The flash tube produces harmful ultra-violet radiation. Avoid looking directly at the source when flashing. Wear protective glasses whenever handling or working with the flash tubes.

HIGH VOLTAGE

High voltages are present in the Strobex. They may be dangerous to life and destructive to the instrument. Use care to avoid personnel contact and avoid shorting circuit board parts. Discharge the discharge capacitors (Test point A to ground), whenever probing in instrument without power applied.

TECHNICAL MANUAL

No. 55-4920-390-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *29 December 1980*

OPERATOR'S, AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST STROBEX BLADE TRACKER MODEL 135M-9 NSN 4920-00-156-9946

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support & Aviation Materiel Readiness Command, ATTN: DRSTS-MTT, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished directly to you.

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GENERAL INFORMATION

MAINTENANCE FORMS, RECORDS, AND REPORTS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, the Army Maintenance Management System.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. Procedures for destroying Army materiel to prevent enemy use are listed in TM 750-244-4.

EQUIPMENT INPROVEMENT RECOMMENDATIONS (EIR). EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to do a procedure; just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Mail directly to Commander, US Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MPM, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished to you.

COMPONENT DESIGNATION NUMBERS. The circuit diagram, figure 9-5 provides component designation numbers. Some designation numbers are listed in Section IX, Parts List. These same designation numbers are referenced through out the manual where the items are discussed; for example: fuse holders. (F101 and F 102).

SECTION/PARAGRAPH REFERENCE. Instructions make reference to various sections and paragraphs within the manual. For example, Section 5-2 refers to paragraph 2 of section 5.

SECTION I
INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION. This handbook contains operating and service instructions and appropriate parts lists and illustrations for the Strobex Blade Tracker, Model 135M-9.

1-2. PURPOSE AND USE. The Strobex Blade Tracker, Model 135M-9 (Figure 1-1), is a bright, collimated, stroboscopic light source whose flash rate is controlled by an internal oscillator locked to a one-per-rev rotor signal. It is used for observing the "track" and "lead-lag" of helicopter blades both during ground run-up and in flight. "Track" refers to the relative path (vertical) of the helicopter blade tips as they pass any given point in azimuth, and "Lead-lag" refers to errors in uniform azimuth relations of the blades. Faulty track or lead-lag induces low frequency vibrations in the air frame of the helicopter which adversely affect service and life and constitute a hazard and inconvenience to crew and passengers.

1-3. DISPLAY OBSERVED. When directed so as to illuminate the rotating blade tips, the properly synchronized Strobex displays the previously attached, retro-reflective tip targets so as to present a grouped display of all targets in the sky. This "stopped" display enables the operator to observe the relative positions of the targets (blades) and thus determine track and lead-lag.

1-4. DESCRIPTION OF EQUIPMENT. (See Figure 1-1) The M-9 Strobex consists of a hinged, sealable case with an electronics compartment, the hand-held lamp on a flexible 9' cable, with its pistol grip handle and oscillator controls, and two 40' cables one for each 28 VDC and signal input. All cables are secured to the instrument (without connectors) so they cannot be inadvertently lost, and provision is made within the case for storage. When the case is closed (as in Figure 1-1 a), the unit is sealed and entirely self-contained.

TABLE 1-1. EQUIPMENT SUPPLIED

Quantity	Item Description	C-H Part No.	NAT. Stock No.
10 sets	Tip Target Numbers (1 thru 6)	B2764-16	
1 each	Spare Flash Tube	35 S	6240-019-5835
2 each	Spare fuses	5 amp 32V slo blo	
1 each	Rubber Hand Roller	A 2787	

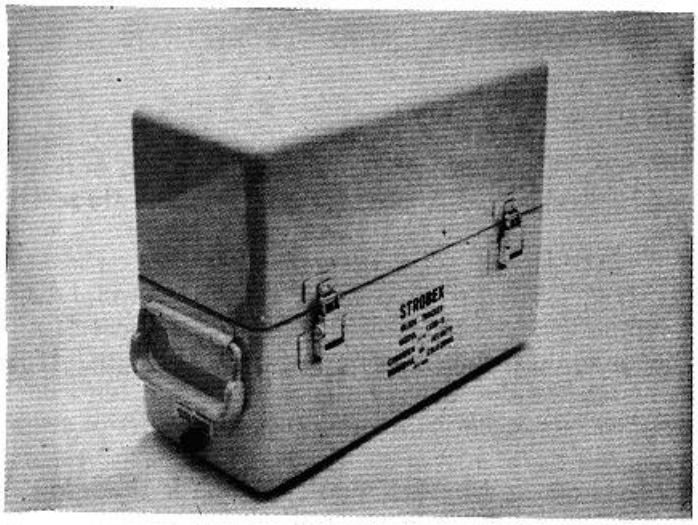


Fig. 1-1.,a.

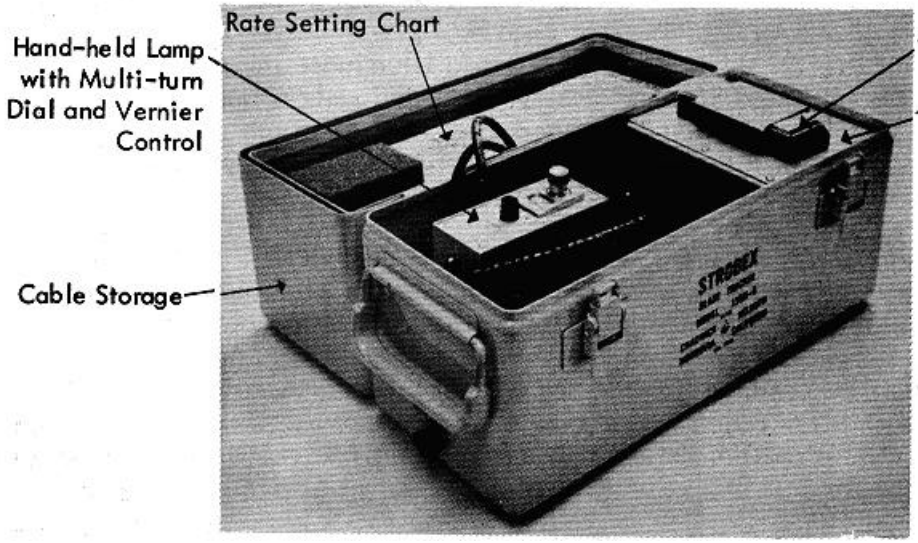


Fig. 1-1., b.

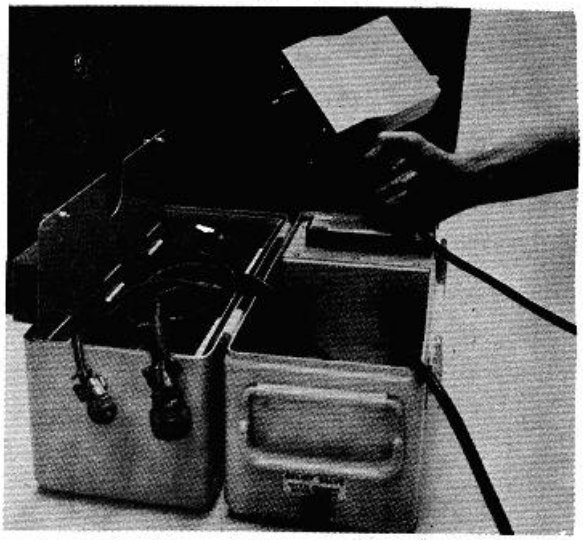


Fig. 1-1., c.

Figure 1-1. The Strobex Blade Tracker, Model 135M-9.

TABLE 1-2. LEADING PARTICULARS

Item	Characteristic	
Input power required	25 to 34 volts DC (from aircraft)	
Power consumption	150 watts maximum at 28 VDC (prox. 5 amps max.)	
Lamp output	Prox. 2000 beam candle-sec/flash at 15 feet and 40 flashes per second.	
Lamp flash rate	40 flashes per second ("counts down" if commanded in excess of 50 to 70 pulses per second.	
Internal locking oscillator	Locks to 1 per rev signal from magnetic pickup at rotor head.	
Weight	24 pounds.	
Overall dimensions	Closed	Open
Height	12 inches	6 inches
Width	6-1/2 inches	13 inches
Length	15-1/2 inches	15-1/2 inches

1-5. ELECTRONIC ASSEMBLY. The electronic assembly is housed within a closed compartment in the case. In it are found a circuit board with conventional electronic components, a toroidal power transformer, a filter capacitor (for power supply), three each 10/u discharge capacitors, and a choke (inductor) in the charging path. A bulkhead, secured to the inside of the bottom of the case serves, with a removable cover, to form the separate electronics compartment. On this bulkhead are found the following - (See Figure 1-2)

a) 40' DC Power Cable, secured to bulkhead, with appropriate connector on free end. (P 101)
b) 40' Signal Cable, secured to bulkhead, with appropriate connector on free end. (P 102)
c) 9' Lamp Cable, secured to bulkhead, with hand-held lamp assembly on free end.
d) Two each 5 amp (32 volt) fuses in fuse holders. (F 101 and F 102)
e) Pilot lamp (lighted whenever 28 VDC is applied to instrument, whether or not trigger on pistol grip handle is depressed). (I 101)
f) "Position" control (a locking pot) (R 101) Function described in 1-14.
g) "Gain" control, to reduce input sensitivity and reject "noise" on input signal.

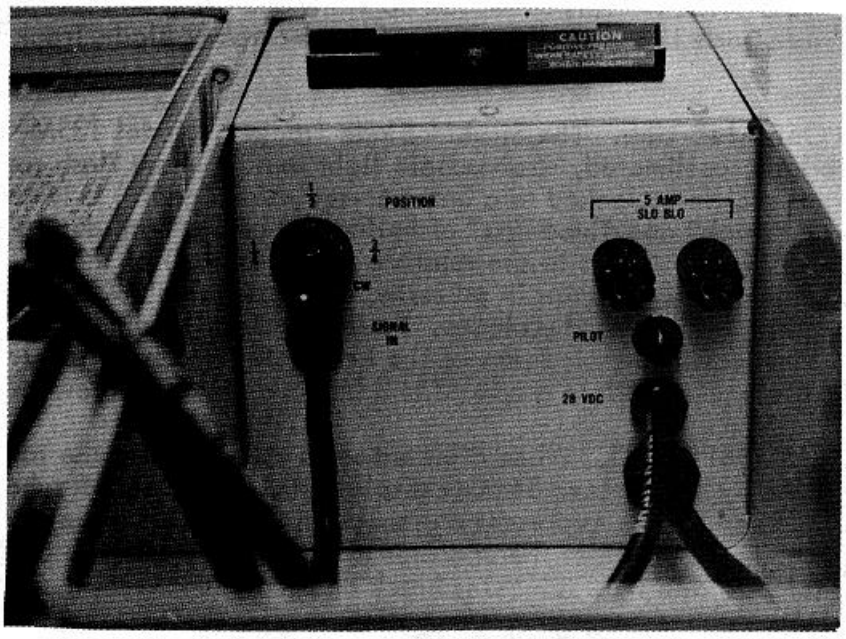


Figure 1-2. Bulkhead.

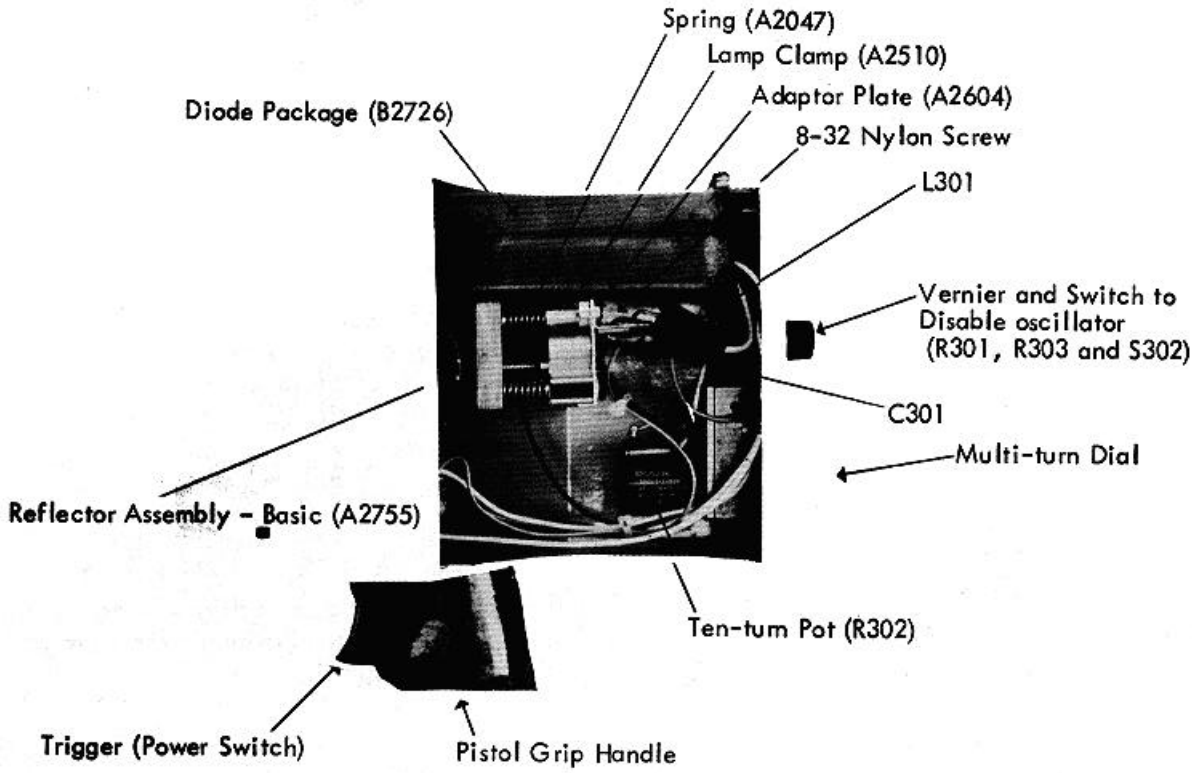


Figure 1-3. Lamp Assembly - Cutaway View.

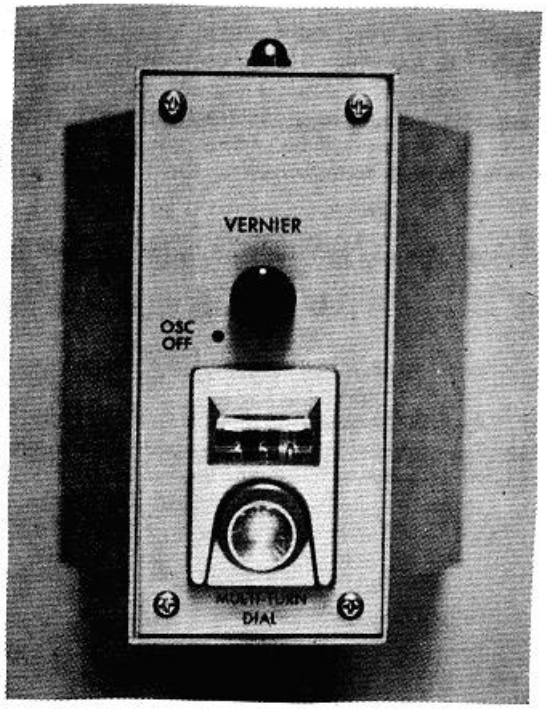


Figure 1-4. Rear of Hand-held Lamp.

1-6. LAMP ASSEMBLY. The hand-held lamp assembly is at the free end of its 9' cable. It consists of a housing on a pistol grip handle with trigger switch (S 301) for the DC power to the electronics section. Storage is provided in the bottom of the case. In the housing are the following -

a) The source lamp appropriately mounted in its reflector. (V 301)
b) The "Diode Package" (Part #B2726).
c) Multi-turn Dial" for setting of locked oscillator flash rate. (R 302)
d) Single turn pot/switch assembly and knob for vernier adjustment of oscillator rate to achieve optimum pattern of blade tip targets. (R 301, S 302) Activation of switch (knob full CCVW disables oscillator so that lamp flashes once per external command, causing unit to operate like previous Strobex Blade Tracker.

1-7. CABLE STORAGE. The top half of the case is provided with a hinged inner lid (See Fig. 1-1, b and c) which, when closed, forms a compartment for storage of two each 40' cables (one for DC power and one for signal).

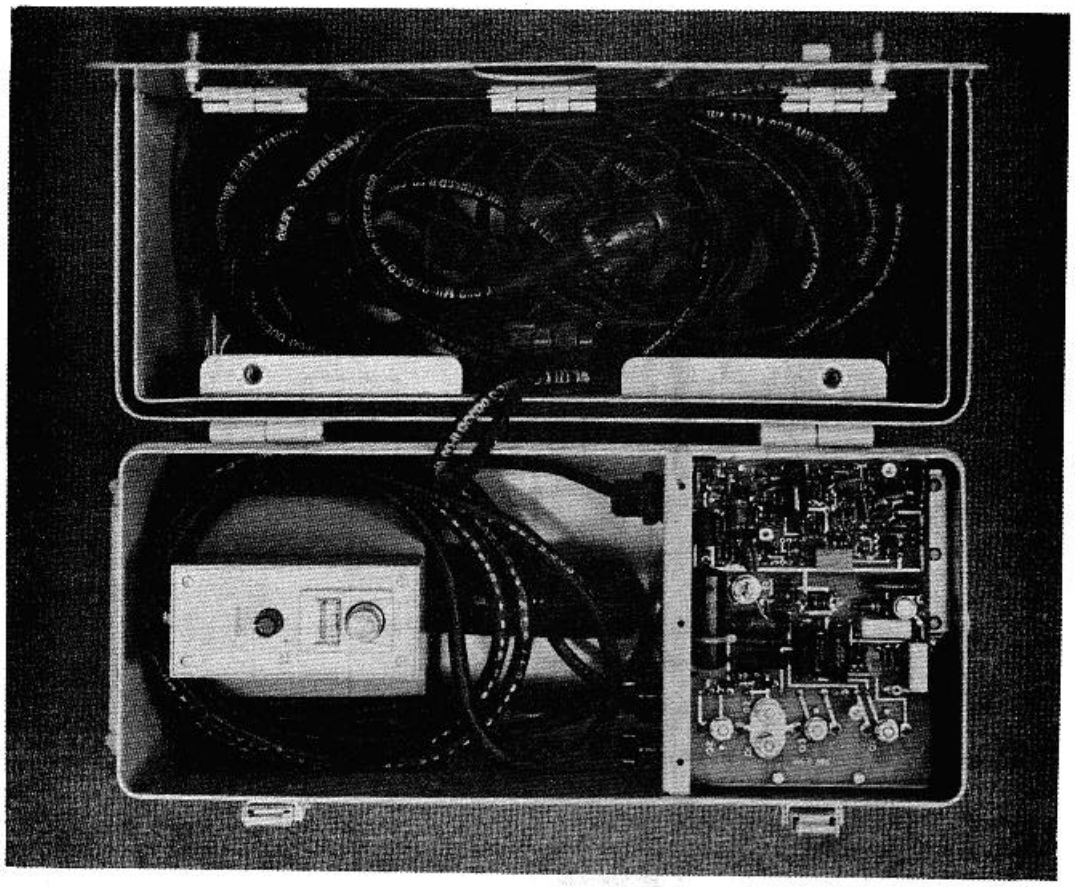


Figure 1-5. Cable and Lamp Storage And Circuit Compartment.

1-8. RATE SETTING CHART. (See Fig. 1-6.) On the hinged inner lid appears a graph such that the 6perator, knowing helicopter main rotor RPM and number of blades, can set the "Multi-turn Dial" on the back of the hand-held lamp and the "Position" control on the bulkhead. A chart in the corner of this graph is treated so that the operator may write the helicopter types with which he is working and the appropriate values for "Multi-turn Dial" and "Position". Thus, he is not forced to refer to the graph after the first use. This information can be erased and re-written at will, using pencil or ball point pen.

1-9. SPARE LAMP STORAGE. (See Fig. 1-1, b). A handy clip is provided on the cover of the electronics compartment which will carry a spare flash tube in its plastic box. Instructions for replacement of flash tube age provided in the plastic box and in Section 5-2 of this handbook.

NOTE

Always replace spare flash tube whenever previous spare has been used. This will avoid annoying down time.

WARNING

The flash tubes contain gas under high pressure and are subject to breakage. This constitutes an eye hazard so WEAR PROTECTIVE GLASSES whenever handling flash tubes.

1-10. SIZE. Size closed is 6-1/2" x 15-1/2" high; open for use is 13" x 15-1/2" x 6" high. Weight complete is 24 pounds.

1-11. THEORY OF OPERATION. Figure 1-7 is a simplified block diagram showing the relationship of the major Strobex circuits. The schematic circuit diagram is shown in Figure 1-8. The following paragraphs, keyed to Figures 1-7 and 1-8 constitute a functional description of the Strobex Model 135M-9 circuits.

1-12. POWER SUPPLY. The Power Supply derives its energy from the aircraft's 28 VDC supply via the 40' power cable fixed to the case. This is regulated to about 25 volts DC and then converted, in the transistorized inverter section, to high frequency (prox. 2.5 KC) AC which is applied to the toroidal power transformer (T201) where the various required voltages are generated, such as -

420 V, for charging discharge capacitors C 101, C 102 and C 103, Test Point A.
420 V, for SCR, Test Point 2.
13 V, for Amplifier and trigger circuits, Test Point D.

The above voltages are suitably rectified and filtered for their respective purposes.

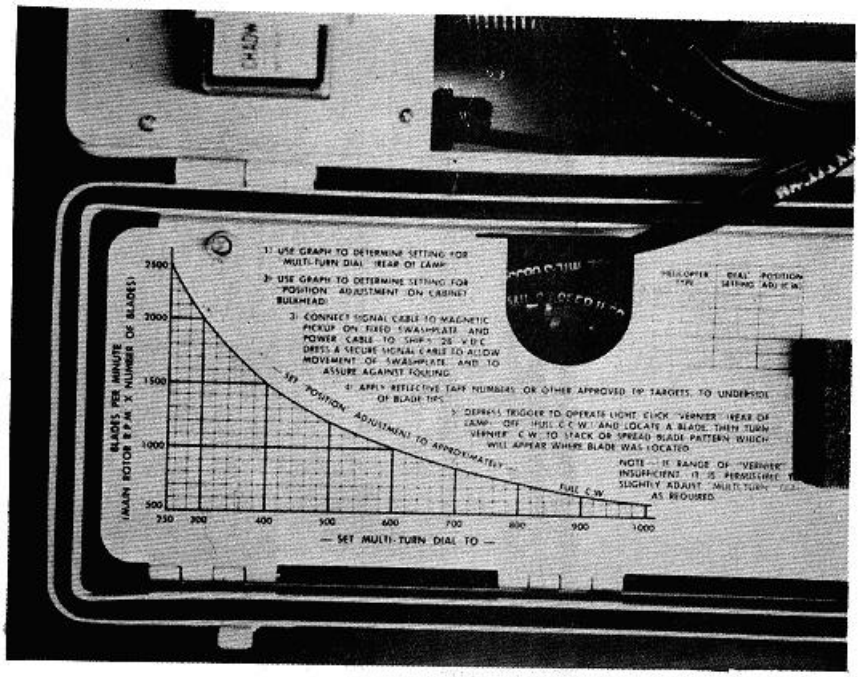


Figure 1-6. Rate Setting Chart.

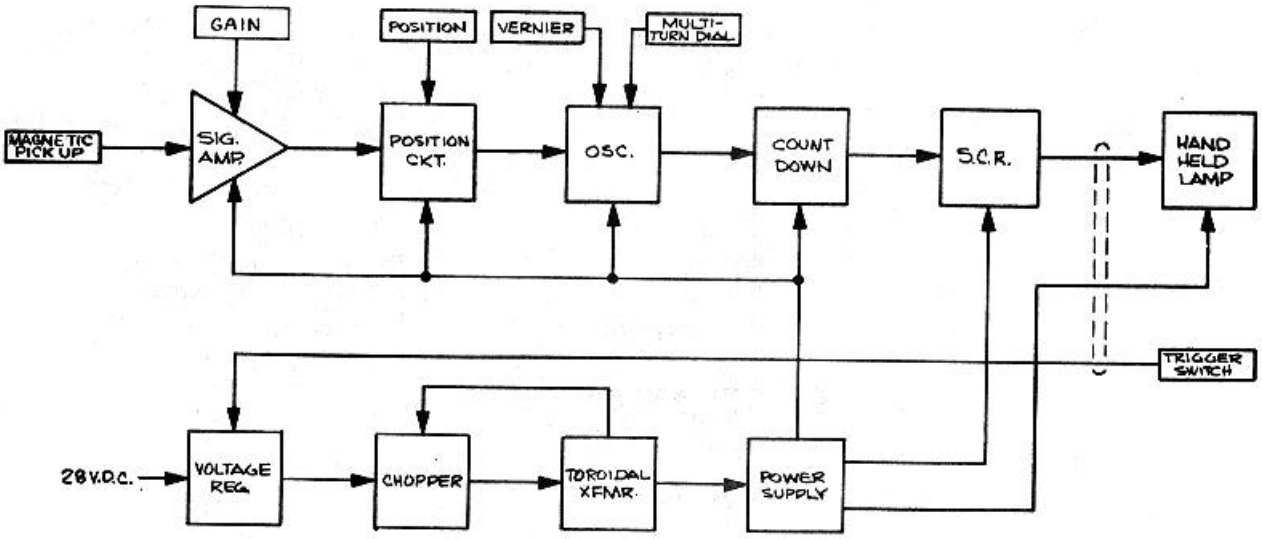


Figure 1-7. Simplified Block Diagram.

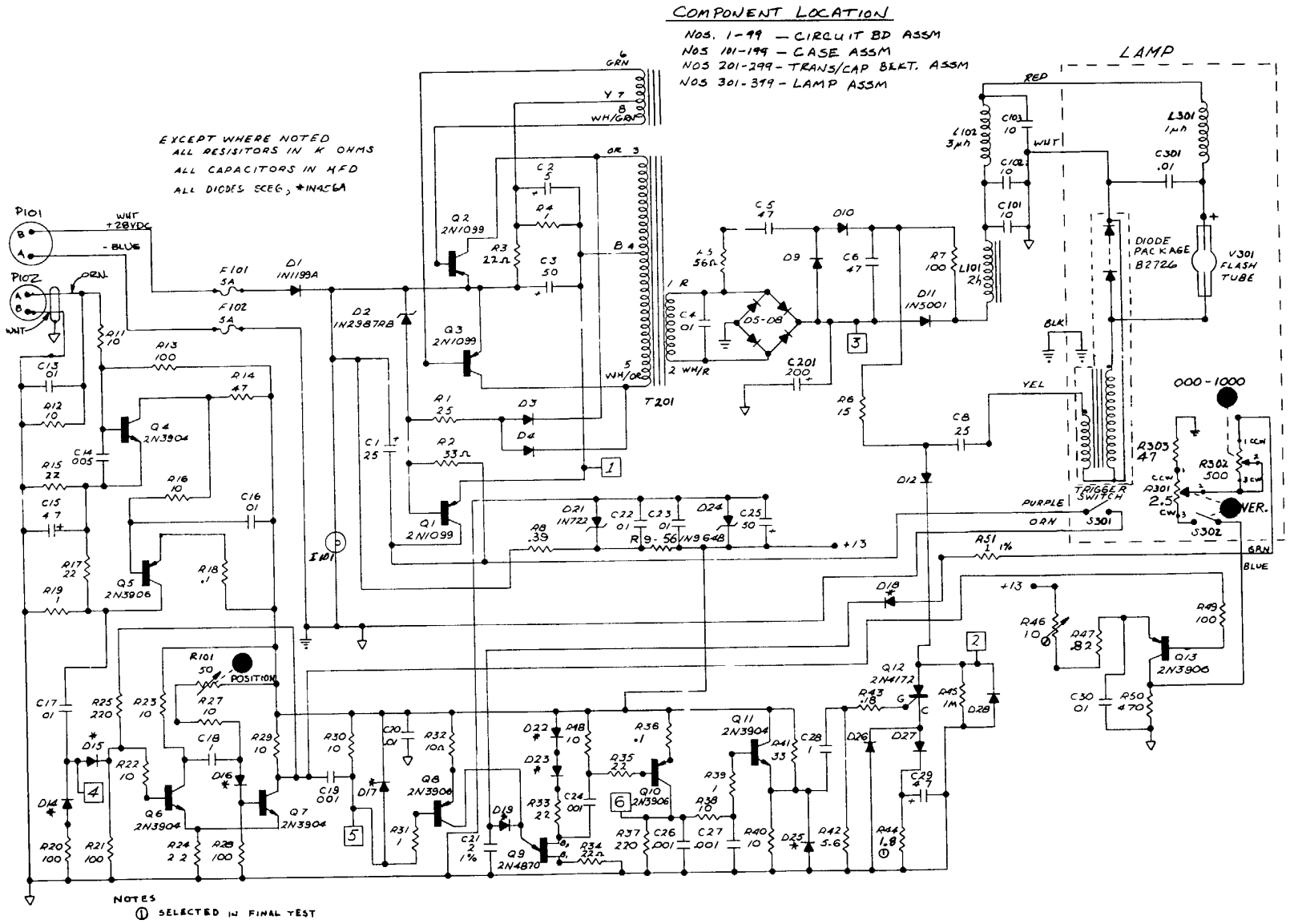


Figure 1-8. Circuit Diagram.

1-13. OSCILLATOR SECTION. A locking oscillator is on the circuit board in the electronics section. Its rate is controlled by the controls located on the rear of the hand-held lamp (See Fig. 1-4). The control setting is determined by use of the chart on the inner lid (Fig. 1-6). It is locked to a one-per-rev signal from the magnetic pickup previously fixed to the rotor head. This locking signal is delivered via the 40' cable (P 102) provided for the purpose.

1-14. POSITION CIRCUIT. Means are provided to introduce a time delay in the locking signal from the magnetic pickup (one-per-rev signal). This delay is controlled by R 101 found on the bulkhead (Fig. 1-2) and is set as indicated on graph on inner lid (Fig. 1-6). It serves two purposes -

a) It is a means of positioning the tip target display to a convenient viewing point in azimuth.

b) It introduces a delay which makes possible the operation of an "inhibit" circuit, avoiding the appearance of a blade out of position. The logic is as follows.

The internal oscillator rate is set near blade rate by setting the "Multi-turn Dial" by means of the chart on the inner lid (See 4-7, b and c). The oscillator rate is then "fine-tuned" by means of the vernier control on the rear of the hand-held lamp. If the flash rate is precisely the same as blade rate the tip targets will be "stacked" (See 4-7, i). Assuming blade rotation right to left, the targets will be spread to the left if the oscillator is adjusted slightly slower than blade rate, and to the right if faster.

If the oscillator is set at a rate slower than blade rate, there is no problem because the last pulse (fourth on a four blade helicopter) would occur after the sync pulse from the magnetic pickup.

Therefore, the sync pulse causes the first flash and starts the oscillator over again and the fourth pulse never appears and a proper display is presented.

However, if oscillator rate is set faster than blade rate, the fourth pulse appears causing a flash and immediately thereafter the sync pulse appears before the capacitors have recharged and the light will not flash. This causes a visual horizontal displacement of one blade because the flash should have occurred at the sync pulse.

This leads to the main reason for the "Position" control, for if we insert a time delay such that the flashes occur roughly midway between blades (relative to the position of the sync pulse), the sync pulse will appear before the fourth oscillator pulse, but the light will not flash because of the delay. The delay allows operation of an "inhibit" circuit which prevents the fourth oscillator pulse from causing a flash, and after the appropriate delay, allows the sync pulse to cause a flash.

This puts that blade back where it belongs and allows use of the oscillator at a rate either slower or faster (or the same) than blade rate.

c) Setting the "Position" knob full CCW results in almost no time delay; the lamp flashes, essentially, in coincidence with the input command. (This position is used for balancing in conjunction with the Chadwick-Helmuth 170 series Balancers.)

1-15. COUNTDOWN CIRCUIT. In the event of a noisy signal, or one at a higher rate than the flash rate capability of the Strobex, the countdown circuit automatically limits the flash rate to a rate acceptable to the instrument. It effectively rejects commands in excess of the permissible rate. The countdown occurs between 50 and 70 flashes per second. This is an effective self-[protective device built into the Strobex Blade Tracker.

1-16. SCR CIRCUIT. During operation, SCR, Q12, conducts only after the turn-on signal from Q 11 is applied to the SCR gate. When a signal is applied to the gate of the SCR, C 8 discharges through the primary of pulse transformer T 301 A very high voltage is then generated across the secondary of T 301 and at the trigger input to lamp V 301.

1-17. LAMP CIRCUIT. When the high voltage pulse from T 301 (approximately 10 kv) triggers the lamp, the xenon gas in the lamp ionizes and becomes conductive. Capacitors C 101, C 102 and C 103 then discharge through V 301 creating the light flash. When the voltage across V 301 falls close to zero, the gas in the lam-p de-ionizes (non-conductive) and the discharge capacitors recharge. After C 8 recharges, the SCR (Q12) switches off and C8 recharges. This completes a single light flash cycle. The flashes continue as long as the input pulses from the pickup and/or oscillator keep triggering the SCR (Q12).

1-18. GAIN CIRCUIT. The Gain Circuit is a pot which attenuates in input signal. Its purpose is to allow the rejection of unwanted inputs from Noise or magnetic objects on the rotating swash plate. (These unwanted pulses must be smaller in amplitude than the desired pulse.)

SECTION II
SPECIAL SERVICE TOOLS

SPECIAL SERVICE TOOLS REQUIRED. No special service tools are required for operation or maintenance of the Strobex, Model 135M-9.

SECTION III
PREPARATION FOR USE, STORAGE OR SHIPMENT

3-1. PREPARATION FOR USE. The Strobex Blade Tracker, Model 135M-9, is built in a sealable case with no penetrations (See Fig. 1-1) and storage is provided for all cables, hand-held lamp and any ancillary equipment required. When configured as in Fig. 1-1, a, the unit is completely assembled and ready for use.

3-2. INSPECTION. Perform a complete visual inspection of the Strobex as follows:

a) Unlatch the two fasteners and open case as in Fig. 1-1, b.

b) Lift out lamp assembly and verify that it is free from damage.

c) Check exterior of electronics section to verify that there are no loose controls, fittings, cables, etc.

3-3. TEST. To verify that the Strobex is in an operational condition, plug 40' Power Cable into suitable 28 VDC supply. Pilot light on bulkhead will be lighted. Activate oscillator by turning vernier knob (on rear of hand-held lamp) CW. Depress trigger in pistol grip handle on lamp unit. The lamp will flash at rate set on "Multi-turn Dial".

NOTE

1) **It is not necessary that the Signal Cable be connected to anything for the above test. Unit will operate from its internal oscillator.**

2) **The pilot light being lighted only indicates the 28 VDC into which unit is plugged is "hot". NO POWER is applied to the circuitry until the trigger in the pistol grip handle is depressed. It is the power switch.**

See Section IV for operating instructions, and Section VII for adjustment procedures.

3-4. PREPARATION FOR STORAGE OR CARRYING. Prepare the Strobex for storage or carrying as follows:

a) Unplug two each 40' cables from 28 VDC power and signal respectively, and coil them in cover of case. It is easiest to coil (or zig-zag) the Power and Signal Cables in cover together. This makes them easier to remove. Close inner lid (See Fig. 1-5 and 1-1, b and c).

b) Replace hand-held lamp in case nesting it in foam pad as provided. Coil its cable loosely around back of lamp. (See Fig. 1-5).

c) Close and latch case. (See Fig. 1-1, a). Strobex is now sealed and ready for storage, or carrying by its convenient handle.

d) For prolonged storage it is recommended that dessicant packages be dropped in the case.

3-5. PREPARATION FOR SHIPMENT. Prepare the Strobex for shipment as follows -

a) Secure unit as in 3-6 above.

b) Place unit in cardboard carton with AT LEAST 2" clearance on each side (4" larger in each dimension).

c) Cushion all sides and top and bottom with suitable material such as rubberized hair, plastic foam, plastic foam chips, etc.

NOTE

The unit can be shipped configured as in Fig. 1-1, a, but for added protection and to save exterior of case from abuse, it is recommended that it be prepared as in 3-5, c.

d) Preservation, packaging, packing, and marking requirements for reshipment of the Strobex must be in accordance with figure 3-1.

CONTINUATION SHEET (TSARCOM Reg 746-1 (J))	REF NO OF DOCUMENT BEING CONTINUED	PAGE	OF
	TM 55-4920-390-13 & P		

NAME OF OFFEROR OR CONTRACTOR

SECTION G - PRESERVATION/PACKAGING/PACKING

PREPARATION FOR DELIVERY *(OVERHAUL)*

All specifications and standards applicable to the requirements herein shall be the issue in effect on date of invitations for bids

NOMENCLATURE	STOCK NUMBER
	4920-00-156-9946
Strobex Blade Tracker	PART NUMBER 135M-9

NET WEIGHT	SHIPPING DIMENSIONS	GROSS WEIGHT	CUBIC FEET
24 Lbs.	16" x 10.5" x 19.5"	26 Lbs.	1.9

1. PRESERVATION AND PACKAGING ☐ LEVEL A ☐ LEVEL B

☒ PACKAGING SHALL BE IN ACCORDANCE WITH SPECIFICATION MIL-P-116 THE FOLLOWING DETAILED REQUIREMENTS SHALL APPLY

UNIT PKG QTY	METHOD	PRESERVATIVE	WRAP	DUNNAGE	CONTAINER
1	III	NONE	NONE	PP-C-1752	PP-B-636 Weather Resistant

☐ a. ITEMS SHALL BE PRESERVED AND PACKAGED IN ACCORDANCE WITH MIL-STD-1188

☐ b OTHER

2. PACKING ☐ LEVEL A ☒ LEVEL B

☒ a. ITEMS, PRESERVED AND PACKAGED AS ABOVE SHALL BE PACKED IN SNUG-FITTING FIBERBOARD CONTAINERS CONFORMING TO WEATHER-RESISTANT CLASS OF PPP-B-636

☐ b ITEMS, PRESERVED AND PACKAGED AS ABOVE, SHALL BE PACKED IN SNUG-FITTING CONTAINERS CONFORMING TO PPP-B-601, STYLE I, OVERSEAS TYPE

☐ c ITEMS, PRESERVED AND PACKAGED AS ABOVE, SHALL BE PACKED IN ACCORDANCE WITH MIL-STD-1188

☐ d NO PACKING REQUIRED (THE UNIT CONTAINER IS THE SHIPPING CONTAINER)

☐ e OTHER

3. MARKING

☒ a MARKING OF SHIPMENTS
THE CONTRACTOR SHALL MARK ALL SHIPMENTS UNDER THIS CONTRACT IN ACCORDANCE WITH THE EDITION OF MIL-STD-129, "MARKING FOR SHIPMENT AND STORAGE," IN EFFECT AS OF THE DATE OF THE SOLICITATION

☐ b MARKING SHALL CONFORM TO REQUIREMENTS OF MIL-STD-1188

☒ c MATERIEL CONDITION MARKING SHALL BE APPLIED IN ACCORDANCE WITH MIL-STD-129 A MATERIEL CONDITION TAG OF THE APPLICABLE TYPE WILL BE SECURELY ATTACHED DIRECTLY TO ALL UNINSTALLED OR STORED AERONAUTICAL OR AIR DELIVERY ITEMS WHEN SUCH ITEMS ARE PLACED OR STORED IN CARTONS, PACKAGES, CRATES OR METAL *SHIPPING CONTAINERS*, A DUPLICATE MATERIEL CONDITION TAG OR LABEL WILL BE SECURELY ATTACHED TO THE EXTERIOR OF THE PACKAGE OR CONTAINER IN SUCH A MANNER THAT WILL AFFORD MAXIMUM PROTECTION FROM HANDLING AND WEATHER TAGS WILL BE COMPLETED EITHER BY TYPEWRITTEN OR PRINTED BLACK LEAD PENCIL ENTRIES ITEMS OF A COMMON OR NONTECHNICAL NATURE (*i e , common hardware, bulk materials, etc.*) THE SERVICEABILITY OF WHICH IS OBVIOUS, AND THE IDENTITY AND INSPECTION REQUIREMENTS ADEQUATELY INDICATED BY COMMERCIAL TAGS, LABELS OR MARKINGS, MAY BE RECEIVED, STORED, ISSUED OR SHIPPED WITHOUT MATERIEL CONDITION TAGS

☐ d EXTERIOR SHIPPING CONTAINERS OF SIMS (*Selected Item Management System*) MATERIEL SHALL BE MARKED WITH SIM PROJECT CODE DISC LABELS IN ACCORDANCE WITH MIL-STD-129 THE CONTRACTING OFFICER WILL PROVIDE SIM PROJECT CODE LABELS ON REQUEST THEY ARE AVAILABLE IN TWO SIZES, 3 X 3 AND 9 X 9 SPECIFY ON YOUR ORDER THE SIZE AND QUANTITY REQUIRED

APPROVED BY	ORGANIZATION	DATE
Nathan Silverman Packaging Specialist	DRSTS-SDP	28 Jan 80

Figure 3-1. Preservation, Packaging, and Marking Requirements.

SECTION IV
OPERATION INSTRUCTIONS

4-1. GENERAL. This section contains:

a) Required "equipping" of the helicopter.
b) Operation and use of the Strobex 135M-9.
c) Aids in interpretation of results.

4-2. EQUIPPING THE HELICOPTER.

4-3. DC POWER. Means must be provided (a suitable connector) to furnish 28 VDC from the aircraft's supply. 28 VDC is universally available, and suitable connectors generally exist. The Strobex has a 40', 2 conductor power cable with an MS-3106-E16-11P connector (P 101) on the free end. The helicopter should have a suitable mating connector or an adaptor can be devised for whatever connector exists in the helicopter. Refer to circuit diagram (Fig. 1-8) for polarity.

4-4. SIGNAL FROM ROTOR HEAD. The helicopter rotor head must be fitted to deliver a one-per-rev pulse as follows -

a) The rotating swash plate must be fitted with a soft iron (magnetic material, but not a magnet) wiper which will pass close by a magnetic pickup secured to the fixed swash plate. (4-4, b).

b) A suitable magnetic pickup (Electro Products 3030AN or equal) must be secured to the fixed swash plate so that the wiper (4-4, a) will pass in close proximity to it once per rev, thus generating one electrical pulse per rev. The gap should be adjusted to about .020" to .040". This is approximately equal to the thickness of a matchbook cover.

WARNING

The aforementioned parts are in a very sensitive area of the helicopter mechanism and they must be absolutely secured so they cannot loosen and interfere with the "machinery".

NOTE [1]

Many helicopter types are equipped to receive the wiper and pickup as above, and many others can be so equipped quickly and easily. In many cases the airframe manufacturers have suitable bracketry already designed and may be in a position to help.

NOTE 2

Several helicopter types are equipped by the manufacturer with "n" wipers (one for each blade), thus producing one pulse per blade. Thus equipped, the helicopter can use the previous Strobex Trackers, 135M, 135M-2, 135M-5, 135M-7.

The 135M-9 can be used with this set-up also if the locked oscillator is de-activated by turning the vernier control on the rear of the hand-held lamp full CCW (See Fig. 1-4). (The other models, however, cannot be used with a one-per-rev pulse.)

4-5. RETRO-REFLECTIVE TIP TARGETS. The helicopter must be fitted with retro-reflective tip reflectors, one on each blade tip as follows-

a) The flat numbers provided (Part No. B2764) are secured to the underside of the blade tip by means of their adhesive backing. These numbers are especially made so that their retro-reflective properties are effective when viewed at unusually "flat" or oblique angles and are shaped to be very long in relation to their width so that, when viewed at the flat angle from within the helicopter, the numbers will appear bright and foreshortened to normal proportions. (The effect is similar to the reflective paint sign in the school crosswalk on the pavement.) These numbers are to be applied in the following manner -

1) Determine a suitable location on the bottom of the blade tip. It must be a fairly flat area, back from the leading edge to avoid excessive wind erosion. It should be near a screw or a rivet line or a seam so that uniform location can be determined on each blade.

2) Clean the selected area with a non-oily solvent to remove dirt, oil and moisture.

3) Remove backing from adhesive coating on selected retro-reflective number (label).

4) Apply number to cleaned area of the blade with its top inboard (toward rotor head).

5) Roll number down flat, with rubber roller provided, with special attention to the edges.

6) Apply proper number to each blade in succession, as above.

NOTE [1]

Blades are generally identified by number and/or color. It avoids confusion to apply numbers in accordance with number convention where possible.

NOTE[2]

Avoid touching adhesive backing on numbers, for oily fingerprints spoil adhesion.

NOTE [3]

Low temperature adversely affects adhesion. The lowest temperature for application of the numbers is 40 °to 50° F.

b) As an alternate to 4-5, a, a bracket must be secured to each blade tip. These brackets shall extend vertically downward from the underside of the blade about 1", and shall be aligned tangent to the tip path. To the inside face of these brackets shall be secured the retro-reflective tip targets. (It is best to fix the targets to the brackets before the brackets are secured to the blade tips.) The targets may be any one of several forms such as:

1) Numbers (1 " high) one for each blade. See Figs. 4-4 & 4-5
2) Colors, a different one for each blade. Color blindness of the operator can be a problem, and poor uniformity of reflection from the different colors is another.
3) Shapes, a different one for each blade, such as

In each case, the material must be retro-reflective.

NOTE

With this method, each aircraft will require a different bracket to accommodate available screw hole patterns, etc.

4-6. HEUCOPTER TO REMAIN EQUIPPED. It is recommended that the helicopter be left equipped, as in 4-3 thru 4-5, at all times. This keeps tracking time to bare minutes. (The decision to keep tip tabs (4-5, b) on the aircraft during service must be the choice of the using agency.)

TABLE 4-1. OPERATING CONTROLS AND INDICATORS

Index No.	Control or Indicator	Function	(See Fig. 1-2, Location 1-4 and 1-6.)
1.	Pilot Indicator Light	Illuminates when 28 VDC is applied to unit.(However, no power is applied to electronics section until trigger is depressed.	On Bulkhead
2.	Position control	Positions pattern in azimuth, and enables "inhibit" circuit to operate and maintain display of all targets. (See 1-14)	On Bulkhead
3.	Pistol grip trigger switch	Constitutes power switch and applies 28 VDC to electronics. Activates unit.	On hand-held lamp.
4.	Multi-turn Dial	Adjusts frequency of locked oscillator	On rear of hand- held lamp.
5.	Vernier	Fine tunes oscillator and when turned full CCW disables oscillator.	On rear of hand- held lamp .
6.	Dial Setting Chart	Used to determine setting for Multi-turn dial and position control.	On inner lid.

4-7. PROCEDURE FOR TRACKING. With the helicopter equipped as in 4-3 thru 4-5, proceed as folllows to accomplish a "track".

a) Open case and remove hand-held lamp as in Fig. 1-1, c.

b) Calculate "blades-per-minute" for the particular helicopter being tracked by multiplying known main rotor RPM by number of blades.

c) Use graph (Index #6, Table 4-1, Figure 4-1) to determine setting of Multi-turn Dial and Position control. Set dial and control.

EXAMPLE

The main rotor RPM of the CH 53 helicopter is 185 RPM and it has six blades. Thus 6 x 185 = 1110.

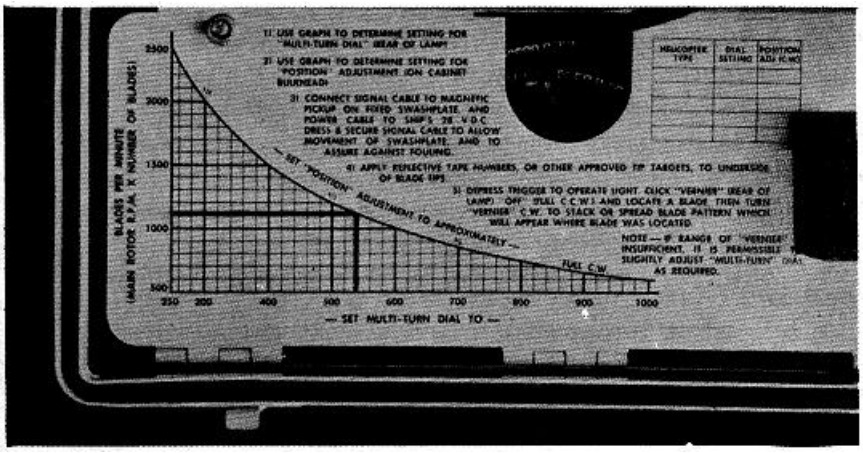


Figure 4-1. Rate Setting Chart.
(See Index #6, Table 4-1 .)

From the graph we see that the "Multi-turn Dial" should be set to about 540 and the "Position" control to about 1/2 CW.

NOTE

The blank chart in the top right comer of the chart (Fig. 4-1) is provided so the operator can write in the numbers for various helicopter types he might be using. The information can be erased and re-written. Use pencil or ball point pen.

NOTE

We assume tracking at 100% RPM which is generally the case. However, tracking can be accomplished at any other RPM. For example if a ship is so rough that 80% RPM is all that is safe for a first ground run-up one simply uses 80% of 185 RPM = 148, and proceeds as in C.

d Deploy the 40' Power and Signal Cables and plug the DC power cable into its receptacle (4-3), and signal directly into the magnetic pickup (4-4, b), or receptacle provided for the purpose.

WARNING

When the Signal Cable is plugged into the magnetic pickup, it passes in the area of vital moving parts and IT MUST BE SECURED so as to guarantee that it cannot foul the mechanism. It should be secured with tie-wraps or equal, and must have sufficient slack to permit full articulation and motion of the swash plate.

e) Turn up the helicopter. As soon as the 28 VDC receptacle, into which the Strobex has been plugged is hot, the Strobex "Pilot" light will light. Operation of the Strobex and its oscillator can now be verified by depressing the pistol grip trigger (the vernier must be turned at least part way CW). The light should flash at a constant rate as determined by setting of Multiturn Dial.

As soon as the rotor is turning, the adequacy of the locking pulse from the magnetic pickup can be verified. Turn vernier control full CCW, thus disabling the oscillator, depress the trigger, and the light should flash once per rev (very slowly). (If not, turn Gain Pot full CCW. Then advance knob CW until steady flashing results. Advance knob only 10-20° farther to assure "solid" input while not introducing "noise" and extraneous signals. If flash is still not proper, check the gap between pickup and wiper (ten to twenty thousandths), continuity of wiring, etc.)

f) With operation of the light thus verified, direct the hand-held light from within the helicopter toward the blade tip path. With the vernier control full CCW (oscillator disabled) depress the trigger to cause the light to flash once-per-rev. Sweep the light slowly in azimuth until a retro-reflective tip target is seen. Now turn the vernier control CW. This activates the oscillator and the flashing rate of the light will increase to "n" times the one-per-rev rate (assuming "n" blades). Adjust the vernier control (thus oscillator rate) so that all targets are superimposed or "stacked". Now the vernier can be adjusted slightly to spread the pattern left or right to suit the preference of the operator.

g) With the targets thus displayed, the operator may make judgments of track and lead-lag. A typical display might be as in Fig. 4-2.

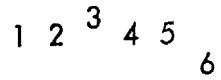


Figure 4-2. Typical Blade Pattern.

Assuming the numbers are about an inch high, this would indicate blade 3 to be about 1/2" high and 6 about an inch low. It also indicates that lead-lag is OK.

h) A similar pattern can be seen at "n" equally spaced points in azimuth around the "disc" described by the blade tips (assuming "n" blades). Keep in mind that the display will appear with the numbers in a different sequence when viewed at a different point in azimuth, such as -

i) Further, depending on the "sense" of the "error" (or spread of the numbers) introduced by means of the vernier, the numbers may be reversed, as

j) Precise adjustment of the vernier to achieve exact synchronization will "stack" the numbers as

k) Any of these situations are useable and acceptable, and the choice of the optimum display should be left to the individual observer. The best display may change from one situation to another.

NOTE

It is best to "stay loose" when holding and aiming the light. Generally, the light should be held at arm's length, with arm slightly bent. Keep both eyes open and watch the blade tip path while slowly sweeping light beam in azimuth and vertically until reflection is caught. Don't tense up, don't squint an eye, don't "aim" the light, don't brace against the airframe. Especially, in flight, the blades swing up and down due to gusting and maneuvering. It is easy to pick up the targets quickly, and keep them in sight, if you STAY LOOSE!

4-8. CORRECTIVE ACTION. With the track thus determined, corrective action follows. This typically involves shutting down the helicopter and adjusting the appropriate pitch links the right number of "clicks" in the right direction. For example, Blade 3, up (or CW) 2 "clicks", and 6 goes down (CCW) 4 "clicks".

NOTE

The number of "clicks" to correct a 1" error will be different depending on whether the 1" is observed on the ground or in flight. The required ratios are quickly learned for each helicopter type and in the different conditions of service.

4-9. CONFIRM TRACK. The Strobex Tracker is so quick and simple to use, it is quick and advisable to check the result and confirm proper track.

4-10. LEAD-LAG ACTION. If lead-lag errors are observed, the dampers are suspect. Adjustment or replacement may be indicated. Other parts may be at fault, however, and the decision must be left to qualified personnel.

NOTE

It is often helpful to perform certain maneuvers while looking for lead-lag. A climbing left turn may expose a problem that otherwise would go undetected. This is a suggestion only and the appropriate maneuver will depend on helicopter type and circumstances. The choice must be left to qualified personnel.

4-11. USE WITH OSCILLATOR DE-ACTIVATED. When the Strobex Blade Tracker, Model 135M-9 is used on helicopters previously equipped to use the earlier models M, M-2 or M-5, the vernier on the back of the hand-held lamp (Fig. 1-4) must be turned full CCW to de-activate the oscillator. The light will then be caused to flash once per blade ("n" per rev) by the "n" wipers fixed to the rotating swash plate.

Operation then is exactly like the older models. The pattern is determined by the placement of strikers and cannot be spread or stacked at will as in 4-7, but the Position can still be adjusted by the "Position" control knob on the bulkhead.

NOTE

The useful characteristic of the material from which the retro-reflective targets is made is its ability to reflect light back to its source regardless of the incidence of the light. Thus the operator must hold the lamp (source) directly in front of his face and only he, or to a lesser extent one or two others (if they are close enough), will see the targets. DO NOT EXPECT A GROUP TO BE ABLE TO SEE THE TARGETS simultaneously, for all but one or two near the source will be too far "off axis" to see the reflection.

4-12. CARRYING THE STROBEX WHILE IN SERVICE. It is often necessary or convenient to move the Strobex around the cabin of the helicopter while observing track. One may want to look at the "other" rotor on a double rotor ship or look at the rotor at a different point in azimuth from a different window. The Strobex can easily be carried, with lamp and cables deployed simply by grasping lid and case near the bulkhead, as in Fig. 4-3.

4-13. SECURING TRACKER. After the tracking operation, secure the tracker for storage in accordance with 3-4.

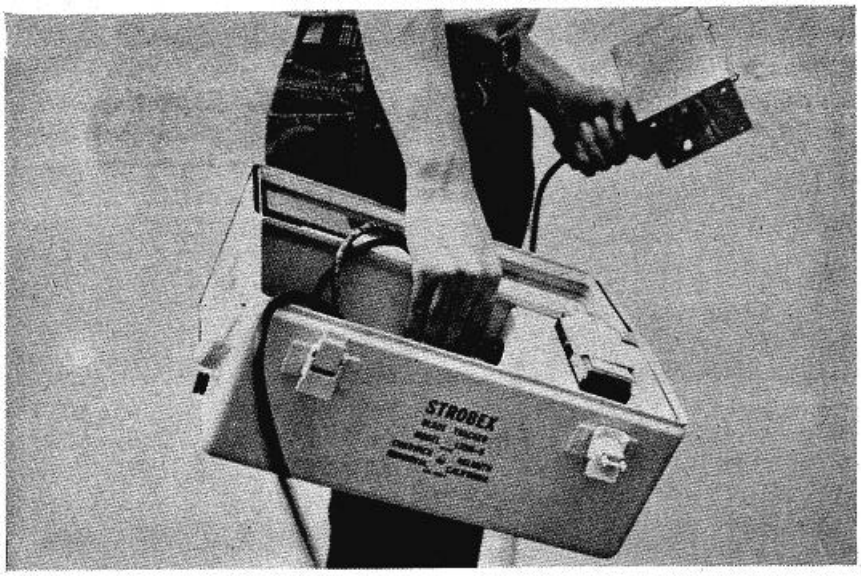


Figure 4-3. Carrying the Strobex while in Service.

SECTION V

PERIODIC INSPECTION, MAINTENANCE AND LUBRICATION

5-1. PERIODIC INSPECTION.

a) Periodically inspect for loose connectors, cable clamps, strain relief bushings, etc.
b) Inspect for loose screws, knobs and other mechanical parts.
c) Inspect for damaged or cut cables.
d) Repair or replace above as required.

5-2. FLASH TUBE. The flash tube in the hand-held lamp is the only item requiring periodic replacement. Abusive handling may result in breakage, obviously requiring replacement. Termination of useful life generally results from darkening of the inside of the flash tube due to evaporation of the electrodes. Expected life is several years, but if light level falls to an unacceptably low level and it is attributed to the darkening of the tube, it should be replaced. -If replacement is required for any reason, proceed as follows (See Fig. 1-3).

WARNING

The flash tube is filled to a high pressure with xenon gas and is subject to explosion. The flash tube produces harmful ultra-violet radiation. Avoid looking directly at the source when flashing and WEAR PROTECTIVE GLASSES whenever working with the flash tube.

Avoid finger prints on reflector and flash tube glass.

Do not disconnect any wiring.

a) Remove the hand-held lamp from the case.
b) Remove the four acorn nuts from the plastic cover over the flash tube. Remove the plastic cover. DO NOT REMOVE THE NUTS HOLDING THE REFLECTOR.
c) Remove the four screws from the rear of the lamp. Remove the rear cover, and let it, and the controls mounted to it, hang from the wires connected to it. DO NOT DISCONNECT ANY WIRING!

WARNING
WEAR EYE PROTECTION

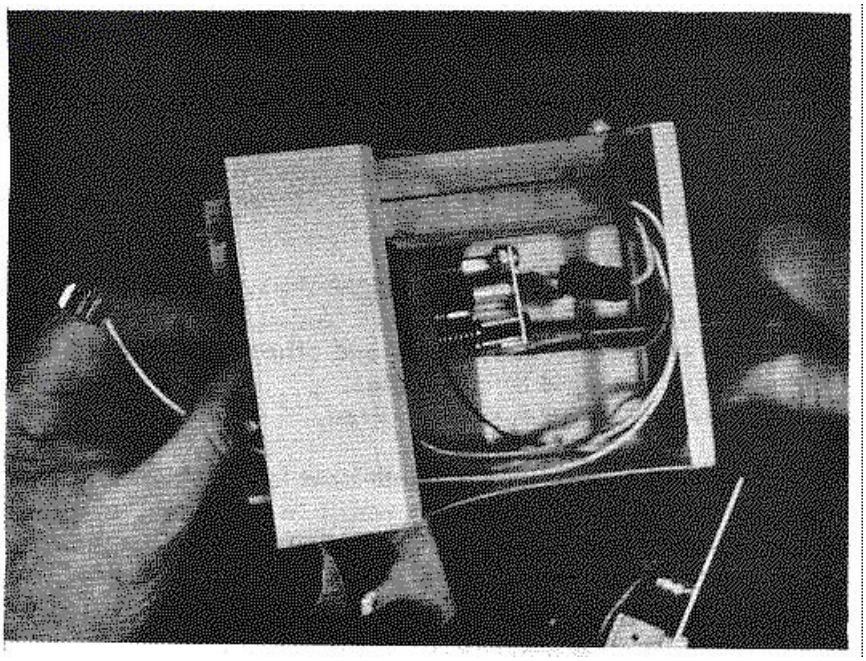


Figure 5-1. Removing Flash Tube.

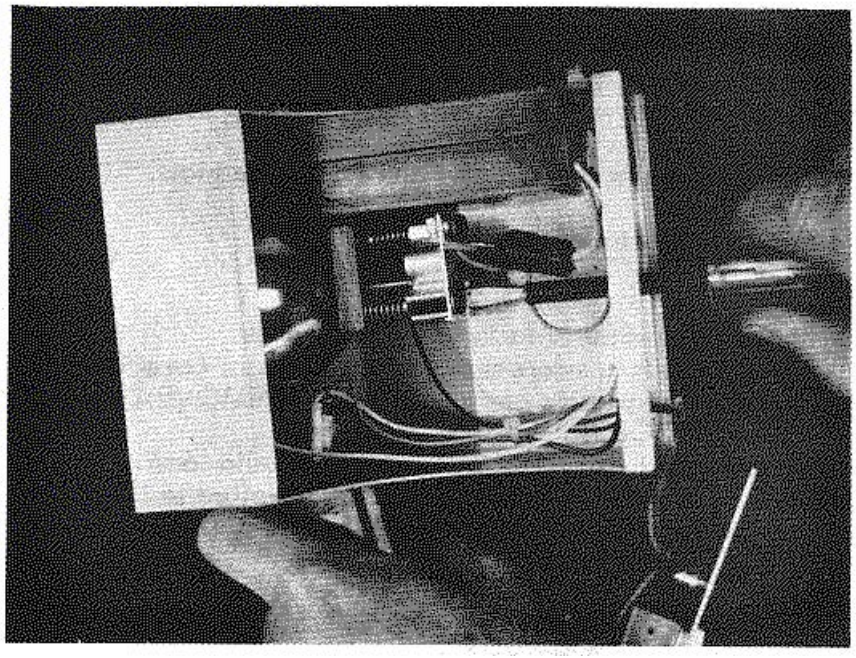


Figure 5-2. Focusing Flash Tube.

d) Carefully remove terminal clip from "outboard" end of flash tube. Leave clip secured to its wire.

e) Insert thick-bladed screwdriver into slot of tube clamp and pry open only enough to withdraw the flash tube out the front end. Avoid opening so far that the clamp is "sprung", for it will not grip the new tube securely. (See Fig. 5-1.)

f) Carefully re-apply clip to front terminal of flash tube.

g) Insert the new flash tube so its base is flush with the rear of clamp. Avoid pinching fine trigger wire in clamp.

NOTE

If clamp is inadvertently pried open so far it no longer grips the Flash Tube, the clamp can be squeezed together to restore grip.

h) Plug the Strobex into a suitable 28 VDC source.

i) Operate the unit by setting "Multi-turn Dial" to about 400, vernier control somewhat CW, and depress trigger.

NOTE

High voltages are present in the lamp unit. Use an insulated screwdriver (tape the shank) and use care to avoid shorting lamp to case.

i) Using insulated screwdriver (see note) thru rear of lamp, focus lamp by adjusting the three nylon screws holding the clamp. This allows motion of the light source both radially and in-and-out. Direct the light on a wall 10 to 30 feet distant and adjust for tightest spot possible. (1 to 2 feet in diameter, depending on distance.) (See Fig. 5-2.)

k) Replace plastic front and rear cover. This completes replacement.

5-3. CLEANING REFLECTOR. Whenever the reflector appears dirty or dingy, remove the plastic cover as in 5-2, b, and clean the reflector using a clean cloth, cleaning tissue or similar. Water or solvent may be used, but avoid anything that will leave an oily film. Such cleaning should be done whenever the flash tube is replaced.

5-4. FOCUSING LAMP. Periodically check focus of lamp, and when required, re-focus as in 5-2.

5-5. Lubrication is not required.

NOTE

A spare flash tube Nat. Stock No. 6240-019-5835, is kept in a plastic box secured by a clip on the cover of the electronic section. ALWAYS replace the spare immediately after it is used. Otherwise, the next user who needs a spare will be disappointed and this provision will have lost its value.

5-6. REPLACEMENT OF PARTS. If it should be determined, from tests in Section VI, that replacement of circuit board, discharge capacitors, diode package, or reflector is required, proceed as follows -

5-7. REPLACEMENT OF CIRCUIT BOARD.

a) Open case as in Fig. 1-1, b.

b) Remove five screws securing electronic compartment cover. Remove cover. (See Fig. 1-5).

c) Remove two screws holding circuit board at heat-sink end, and nut and threaded bushing from other end. (DO NOT REMOVE threaded bushing secured to "center" of board near heat sink end.)

d) Circuit board can now be removed. "Rotate" on service loop of cables so that board is upside down over storage area of case. (See Fig. 5-3).

e) Unsolder the 20 wires from circuit board. (Mark wires as they are disconnected to facilitate replacement.)

f) Install new circuit board.

g) Check operation of instrument per Section 6.

h) Re-paint disturbed solder joints with anti-fungus varnish as required.

i) Replace circuit board, reversing operations 5-7 a thru e.

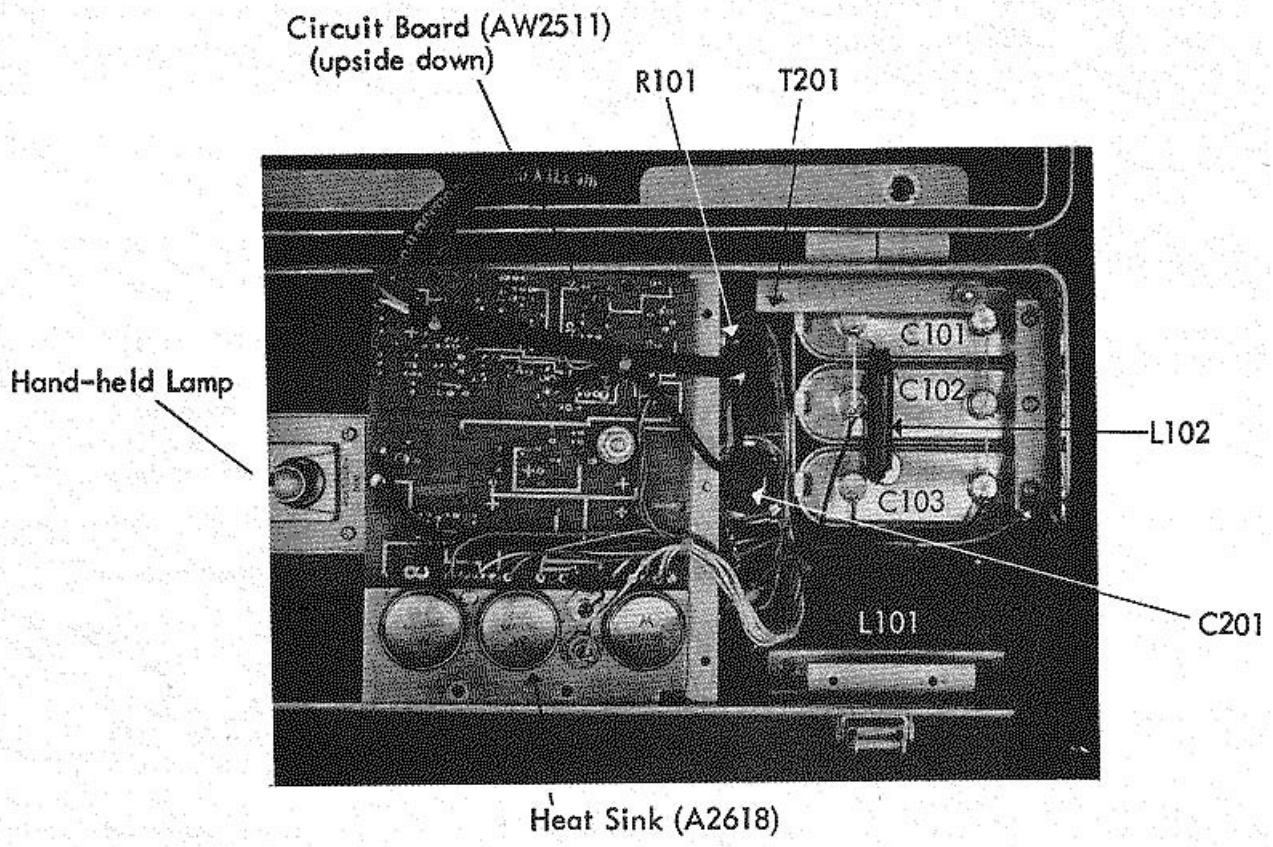


Figure 5-3. Circuit Compartment with Circuit Board Removed.

5-8. REPLACEMENT OF DISCHARGE CAPACITORS. If it is determined that one or all of the discharge capacitors, Part C101, C102 or C103 require replacement, proceed as follows -

NOTE

Physical size and shape of the capacitors is important since off-size parts will not fit. Avoid substitutes.

a) Mechanically loosen circuit board as in 5-7 a thru d. DO NOT REMOVE ANY WIRING.

b) The discharge capacitors can now be seen and visually inspected and electrically checked. (Look for oil leaks in capacitors.)

c) Loosen "Position" pot (R101) and "Gain" pot (R102) and withdraw from their holes. (It shouldn't be necessary to unsolder them.) Remove Heyco strain relief bushing from Signal wire.

d) Remove three screws holding capacitor clip from near open end of case. Remove clip.

e) Remove one screw from other capacitor clip. This screw is "buried" deep between toroidal transformer (T201) and electrolytic can filter capacitor (C201). Remove "ground" wire from electrolytic can only. Leave soldered to fuse holder. Leave the five wires soldered to this "buss". Withdraw the plate carrying T201 and C201 and the two pots.

f) Unwire capacitors as required tagging wires to facilitate replacement.

g) Remove and replace capacitors as required.

h) Restore, reversing preceeding procedures.

5-9. REPLACEMENT OF REFLECTOR. If the reflector (Part #B2755) will not take a polish and is damaged or dull, replace it as follows.

a) Open hand-held lamp and remove flash tube as in 5-2 a thru e. WEAR PROTECTIVE GLASSES.

b) Unsolder tube clip (which clips on "free" end of flash tube) from wire penetrating side of reflector. (This joint uses high temperature solder.)

c) Remove the three nylon screws from lamp clamp at rear of reflector. This will result in a basketfull of loose parts -- save them.

d) Remove the four nuts securing the front of the reflector (open end).

e) Remove reflector.

f) Replace reflector, reversing procedure above.

g) Re-focus lamp as in 5-2, i and Fig. 5-2.

5-10. REPLACEMENT OF DIODE PACKAGE. (See Fig. 1-3). To replace the "Diode Package", Part #B2726, proceed as follows -

a) Open hand-held lamp and remove reflector as in 5-9, a thru e.

b) Unsolder wires from "terminal strip" on diode package. Mark wires to facilitate replacement.

c) Loosen acorn nut at small end of housing (nearest terminal strip end of diode package), but do not remove it.

d) Remove the other acorn nut and screw. Do not unwire solder lug.

e) Remove old diode package.

f) Replace diode package by sliding it under screw head which is hanging loose from its acorn nut. (5-10, c).

g) Replace other screw and acorn nut, making sure solder lug with its two wires is secured under screw head and that lockwasher is under acorn nut on outside of housing.

h) Tighten acorn nuts, rewire, replace reflector and restore.

SECTION VI

TROUBLESHOOTING

6-1. GENERAL. This section contains instructions and procedures for troubleshooting the Strobex Blade Tracker, Model 135M-9. Refer to Circuit Diagram (Fig. 1-8), Block Diagram (Fig. 1-7), and Circuit Board Layout showing parts placement (Fig. 8-1), during troubleshooting.

6-2. TROUBLESHOOTING CHECK CHART. The trouble analysis check chart, Table 6-1, is a chart which includes the most common faults that may be encountered with probable causes and suggested action required for correction.

NOTE

Failure of the Strobex to operate can usually be traced to simple causes. Always check fuses, pilot lights, connector continuity, and be sure the DC to which the Strobex is connected is, indeed, "hot". Perform all tests systematically.

WARNING

1) High voltages are present.

2) Flash tube is subject to explosion - wear protective glasses.

3) The flashing light emits dangerous ultra violet light. DO NOT look directly at source when operating.

TABLE 6-1. TROUBLESHOOTING CHECK CHART

Item	Trouble	Probable Cause	Corrective Action
1.	Broken Flash Tube. Note - Air leak in a flash tube from a small break causes a weak, violet flash.	Abusive handling.	Replace with spare as in 5-2.
2.	Light output gradually falls below useful level.	a) Flash Tube used beyond its useful life as evidenced by darkened bulbous center.	Replace with spare as in 5-2.
		b) Flash Tube not focused.	Check for crisp spot of light on wall 10 to 30' distant. Focus as in 5-2, a thru c, and 5-2, h thru k, if focusing is indicated.
		c) Dull (dirty) reflector.	Remove plastic cover from front of hand-held lamp as in 5-2, b. Clean reflector with soft dry cloth or tissue. It is permissible to use a non-oily solvent, or water, as required. Check focus and re-focus as in (b) above if required. If necessary, replace as in 5-9.
3.	Light fails to flash.	a) No DC power.	Check that DC source is "hot", check fuses, connector, cables, etc. Remember trigger on pistol grip must be depressed.
		b) No signal.	"Vernier" control on back of hand-held lamp (Fig. 1-4) must be turned CW to activate oscillator.

Table 6-1. Troubleshooting Check Chart, continued.

Item	Trouble	Probable Cause	Corrective Action
4.	Failure of oscillator to lock. No one-per-rev flash with "vernier" CCW.	Lack of locking signal.	Turn Gain pot CW. Check that gap between magnetic pickup and wiper is approximately .020" to .040" (thickness of match-book cover). Make certain pickup is good. Check conn connector and cable. Remember rotor head must be turning to generate signal.

6-3. TEST PROCEDURES. To test the Strobex, proceed as follows -

Test equipment required:

a) Voltohmmeter (multimeter) Simpson 260 or equal.

b) Signal generator (sine wave or pulse).

c) DC power source - 28 VDC at 5 amps.

d) Oscilloscope - Tektronix 503 or equal.

NOTE

Great care has been taken to make all test points available WITHOUT REMOVING CIRCUIT BOARD. Remove circuit compartment cover by removing the five screws holding it and sliding it out. DO NOT LOOSEN or REMOVE CIRCUIT BOARD, and DO NOT UNWIRE ANYTHING unless fault is located by the following tests. ONLY THEN remove (loosen) circuit board (as in 5-7, a thru d) and repair or replace parts as required.

NOTE

Test points 1 thru 6 appear as numbers on circuit board and on Circuit Diagram (Fig. 1-8) and Circuit Board Assembly Drawing (Fig. 9-4). Test points A, B, C and D show on Circuit Diagram (Fig. 1-8) and Circuit Board Assembly Drawing (Fig. 9-4), but do not appear-on circuit board.

6-4. RESISTANCE CHECKS. Before applying 28 VDC power to Strobex, perform the resistance checks as shown in Table 6-2. Use voltohmmeter. DO NOT apply 28 VDC power to Strobex.

TABLE 6-2. RESISTANCE CHECK CHART

From (+ Meter Leads)	To (-)	Resistance Readings
Test Point 3	Ground	1 MEGOHM
Test Point A (Discharge capacitors C101, 102 & 103)	Ground	1.1 MEGOHM
Test Point 1 (Emitter of Q1)	Ground	200 OHMS
Test Point 2 (Anode of SCR)	Ground	1 MEGOHM
Collector of Q1 (center stud) (ground when mounted in case.)	Heat Sink	200 OHMS

WARNING

High voltages are present in the Strobex. They may be dangerous to life, and destructive to the instrument. Use care to avoid personal contact and avoid shorting circuit board parts. Discharge the discharge capacitors (Test point A-to ground), whenever probing in instrument without power applied.

The flash tube is pressurized and subject to explosion, and when operating it emits harmful ultra-violet radiation. ALWAYS wear protective glasses when working with it and avoid looking directly at source while it is flashing.

6-5. FUNCTIONAL TESTS. If resistance Checks are OK, proceed as follows. Refer to Voltage Check Chart, Table 6-3, as required.

a) Plug Strobex into 28 VDC source. Observe polarity. Pilot light will not light if polarity is reversed.
b) If light does not light, check fuses and pilot light bulb, cables, connector,etc.
c) Set "Vernier" on rear of hand-held lamp full CCW (internal oscillator off). Depress trigger in pistol grip handle and listen for a 3 KHz. hum (singing). Check that current drawn by the Strobex (with no pulsing) is between .3 and .6 amps. A greater current drain indicates a faulty power supply section.

NOTE

If 28 VDC source does not include an ammeter, use the ammeter section of the voltohmmeter in series with 28 VDC line to make above current measurements.

NOTE

If 3 KHz tone is heard and current drain is OK, proceed to Step f.

NOTE

Test Point 1 should read about 27 VDC when trigger is not depressed, and about .2 VDC when pulled.

d) Apply 28 VDC and try again. If hum is still absent, remove power, and "lift" one end of each of the four diodes, D5, D6, D7 and D8. Check the diodes for forward and reverse resistance.

e) While diodes are disconnected as in d, pull trigger. Three KHz. Should be heard and current should be .3 to .6 amps. Restore diodes, replacing as required.

This should check out the power supply section.
Proceed to Step f.

f) Connect 28 VDC supply and apply a 1 volt RMS (2.8 V peak to peak) sine wave at 20 Hz. to the signal input cable ("+" to pin A and "-" or ground to pin B). Turn "Vernier" on rear of hand-held lamp full CCW to turn internal "oscillator" off. Turn "Gain" full CW, depress trigger on hand-held lamp. Lamp should flash at 20 flashes per second.

g) If lamp does not flash, remove power and check signal cable and its connector for continuity from Pin A in connector to Test Point C on circuit board and Pin B in connector to Test Point B on circuit board. Perform visual inspection for obvious faults on the circuit board.

CAUTION

Dangerous voltages are present. Discharge the discharge capacitors (Test Point A to ground) whenever working on the Strobex without power.

h) Re-apply 28 VDC and pull trigger. If light still fails to operate, remove external oscillator signal and go thru voltage checks in Table 6-3.

NOTE

Apply 28 VDC power, but NO signal to unit for these checks. Turn "Vernier" control on rear of hand-held lamp full CCW to turn "oscillator off".

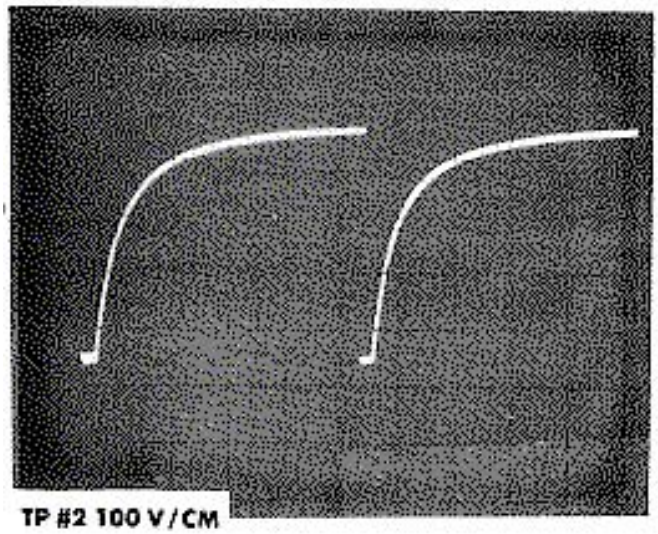
TABLE 6-3. VOLTAGE CHECK CHART

From + Meter Leads	To -	Voltage (±10%)
Test Point 3	Ground	+ 230 VDC
Test Point 2	Ground	+ 420 VDC
Discharge capacitors (Test Point A)	Ground	+ 420 VDC
Collector of Q 1 (D) Ground (Test Point D)	+ 13 VDC	

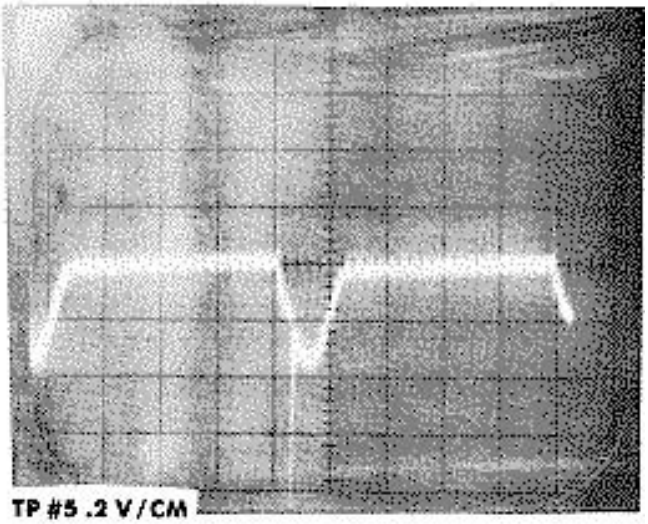
NOTE

These voltages are approximate and intended as guides for trouble shooting only.

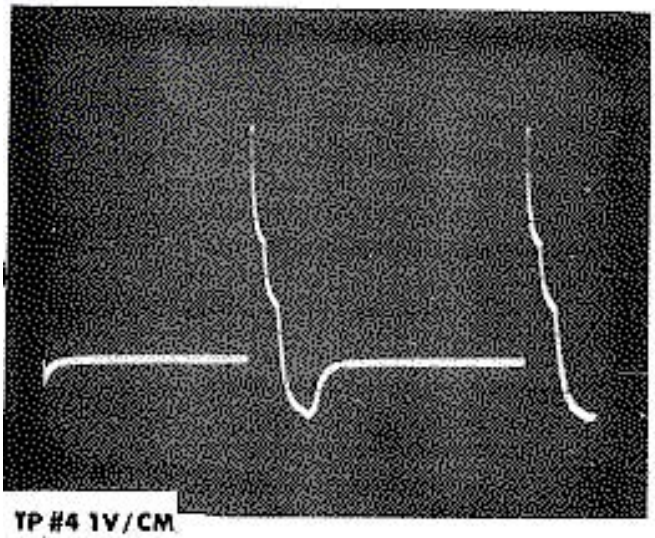
i) To check internal oscillator, remove external oscillator signal, apply 28 VDC power, set "Vernier" on rear of hand-held lamp to mid-range (oscillator on), set "Multi-turn Dial" to 350, and depress trigger. Light should flash at about 30 flashes per second.



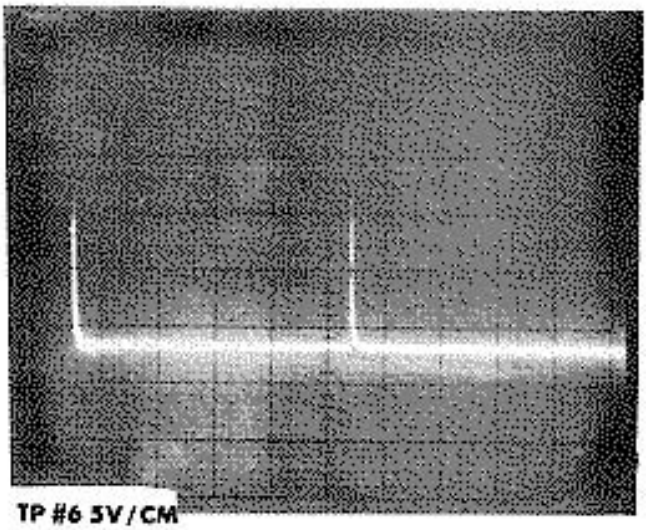
TP #2 100 V/CM



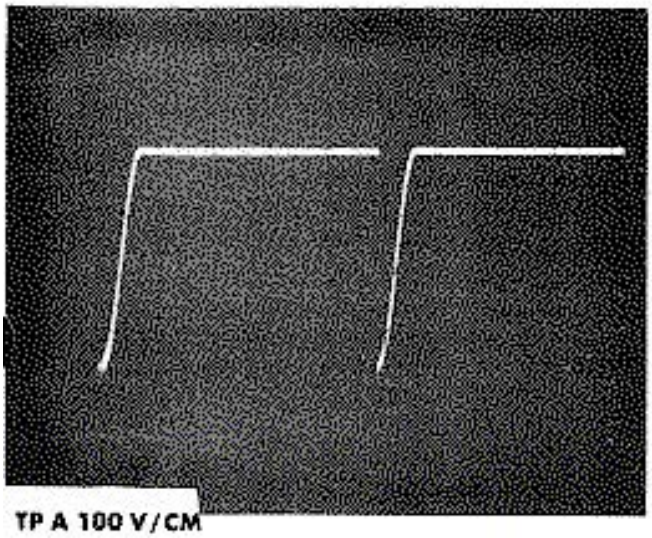
TP #5 .2 V/CM



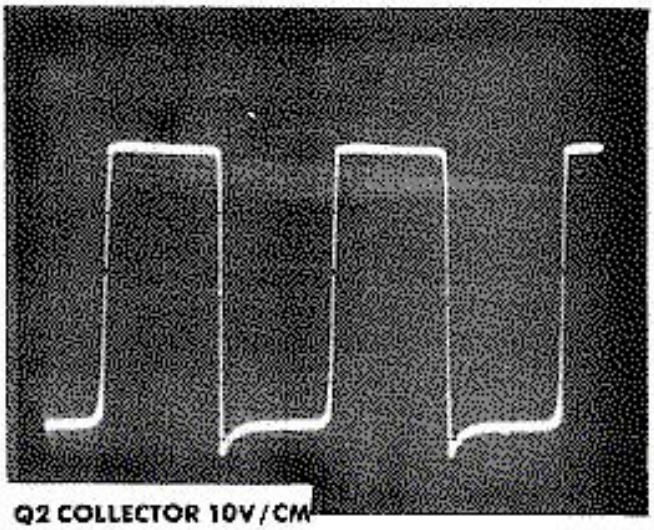
TP #4 1V/CM



TP #6 5V/CM



TP A 100 V/CM



Q2 COLLECTOR 10V/CM

Table 6-4. Waveform Chart.

i) If no, check waveforms as follows, using oscilloscope and referring to Table 6-4, Waveform Chart. At Test Point 2, if waveform is abnormal, check trigger circuits Q9 thru Q13.

k) Check operation of Strobex from external signal as follows. Turn “Vernier" on rear of hand-held lamp full CCW (oscillator off), apply +1 volt RMS sine wave at 20 Hz. to the signal input cable ("+" to pin A and "-" to B), depress trigger.

l) Observe waveformat Test Point 4 and compare with Table 6-4, Test Point 4. If it appears faulty, check signal amplifier section, Q4 thru Q7. Repair as required.

TABLE 6-4. WAVEFORM CHART

These waveforms are to be expected under the following conditions:

a) 28 VDC applied to Strobex.

b) "Vernier" on rear of hand-held lamp to off.

c) "Multi-turn Dial" on rear of hand-held lamp set to 350.

d) Trigger on hand-held lamp pulled.

e) 1 VRMS 20 Hz. sine wave in.

SECTION VII

ADJUSTMENT

7-1. GENERAL. This section provides procedures for the Strobex Blade Tracker, Model 135M-9.

7-2 ADJUSTMENT

7-3 ADJUSTMENT OF LAMP To adjust the hand-held lamp proceed as follows-

WARNING

a) High voltages are present. Use insulated screwdriver (tape shank) and avoid shorting lamp clamp to housing.

b) The flash tube is pressurized and presents serious eye hazard. WEAR PROTECTIVE GLASSES.

c) The flash tube emits harmful ultra-violet radiation. AVOID LOOKING DIRECTLY AT SOURCE.

Refer to 5-2, a thru c and 5-2, h thru k, if focusing is required.

7-4. ADJUSTMENT OF OSCILLATOR Adjustment of the internal (locking) oscillator is accomplished as follows-

NOTE
A frequency counter is required, Hewlett-Packard 5211B or equal.

a) Set "Vernier" on back of hand-held lamp to mid-range.

b) Set "Multi-turn Dial" on back of hand-held lamp to 350.

c) Connect counter to anode of SCR (Q12) (Test Point 2).

d) Apply 28 VDC to power cord and depress trigger on pistol grip handle of hand-held lamp, e) Reading should be 1/350 X 10-4 or 28.6 Hz. or 1/dial reading X 10-4 +100/o.

f) If adjustment is required, it is accomplished by means of the small pot (R 46) located on circuit board near SCR.

g) Check at other settings to check tracking with vernier centered, using the following table.

TABLE 7-1. OSCILLATOR ADJUSTMENT.

Dial Settings	Counter ±10%
200	50 Hz.
250	40 Hz.
350	28.5 Hz.
400	25 Hz.
500	20 Hz.
600	16.7 Hz.
800	12.5 Hz.
1000	10 Hz.

SECTION VIII

INTRODUCTION TO PARTS LISTS AND ILLUSTRATIONS

8-1. GENERAL. The parts lists and illustrations in Section IX are intended to enable the user to procure the parts necessary to accomplish repairs to the Strobex Blade Tracker Model 135M-9, manufactured by the Chadwick-Helmuth Company, Monrovia, California.

8-2. SYSTEM.

a) Those garden variety" parts which should be universally available are listed by Chadwick-Helmuth part number, and a complete generic description, which should allow procurement from a variety of sources. In these cases, electrical equivalents are generally available from a number of manufacturers. This is true of resistors, capacitors, diodes, transistors, etc. However, especially in the case of diodes and transistors, it is important that care be taken to assure that the replacement part is a true electrical equivalent.

b) Unique parts made by or for Chadwick-Helmuth Co. especially for the Strobex Model 135M-9, are listed by Chadwick-Helmuth part numbers and a description which is, however, inadequate to reproduce the parts. Such parts must be procured from the Chadwick-Helmuth Co., except in the few cases where a National Stock Number is shown, and the part would be available from the Chadwick-Helmuth Co. or from a military depot where that part is stocked.

c) Ordinary screw, nuts, washers, etc., and a number of brackets, etc., which are either very common, or unlikely to require replacement, are not listed. A written description or sketch will enable the Chadwick-Helmuth Co. to supply such parts as required.

d) A recommended spare parts list is shown in Section IX. This consists of parts most likely to fail and/or most likely to be difficult to procure from limited sources, or sources that do not stock sophisticated parts.

e) The part number code is as shown in Table 8-1.

TABLE 8-1. PART NUMBER CODE SYSTEM

Parts Numbered	Are located
0-100	On circuit board
101-200	In circuit compartment
201-300	On bracket securing discharge capacitors (C101, C102, and C103)
301-400	In hand-held lamp housing

SECTION IX

PARTS LIST

Item	Qty	Part No. (on circuit diagram)	C-H Part No.	Description
1.	1		C2654	Circuit Board Assembly (Fig. 9-1). Note: Dwg. includes complete parts list.
2.	1	L101		Choke, .2 henry
3.	1	L102	A2670-2	Choke, 3u henry
4.	3	C101		Capacitor, 10 ,u @ 600V* C102 Sangamo 702012-3001. C103
5.	2	F101		Fuseholders, Littelfuse
		F102		342014 or equal.
6.	2			Fuses, 5 amp, 32 V slo blo Buss MDL5 or equal.
7.	1	1 101		Pilot light holder, Dialco 101-5030-9-R-301 or equal.
8.	1	1 101		Pilot light bulb, GE 327 or equal.
9.	1	R 101		50K pot, Centralab NCP 232-503U or equal.
10.	1	P 101		Power Plug, MS3106E16-11P
11.	1	P 102		Signal Plug, MS3106E10OSL-4S(C)
12.	1	C 201		Capacitor, 200/u @ 250V Electrolytic ca , Sprague TVL 1547 or equal.
13.	1	T 201		Power Transformer (Toroid)
14.	1	V 301	35 S	Flash Tube (NSN 6240-019-5835)

***Substitute not likely to fit.**

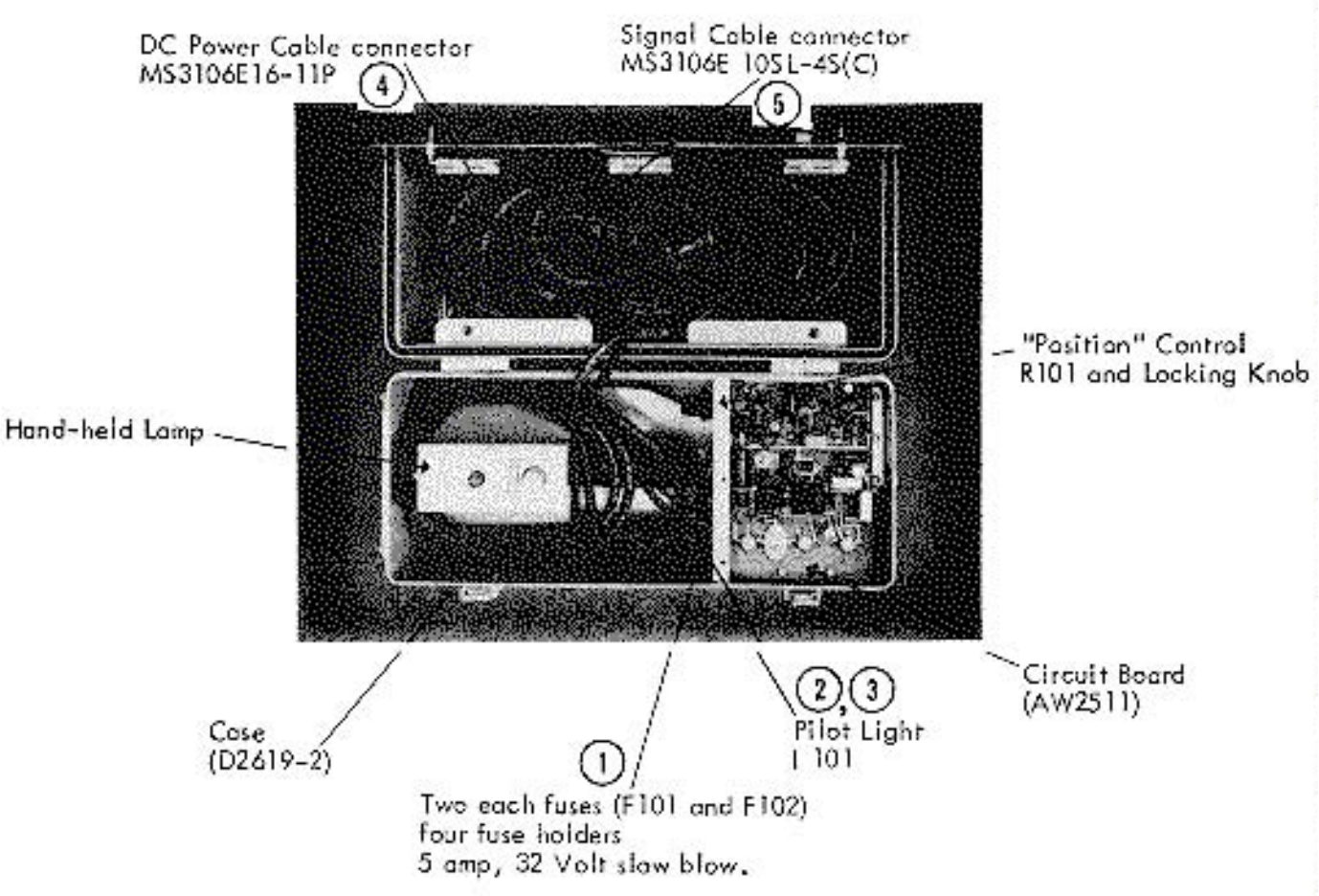


Figure 9-1. Cable and Lamp Storage and Circuit Compartment

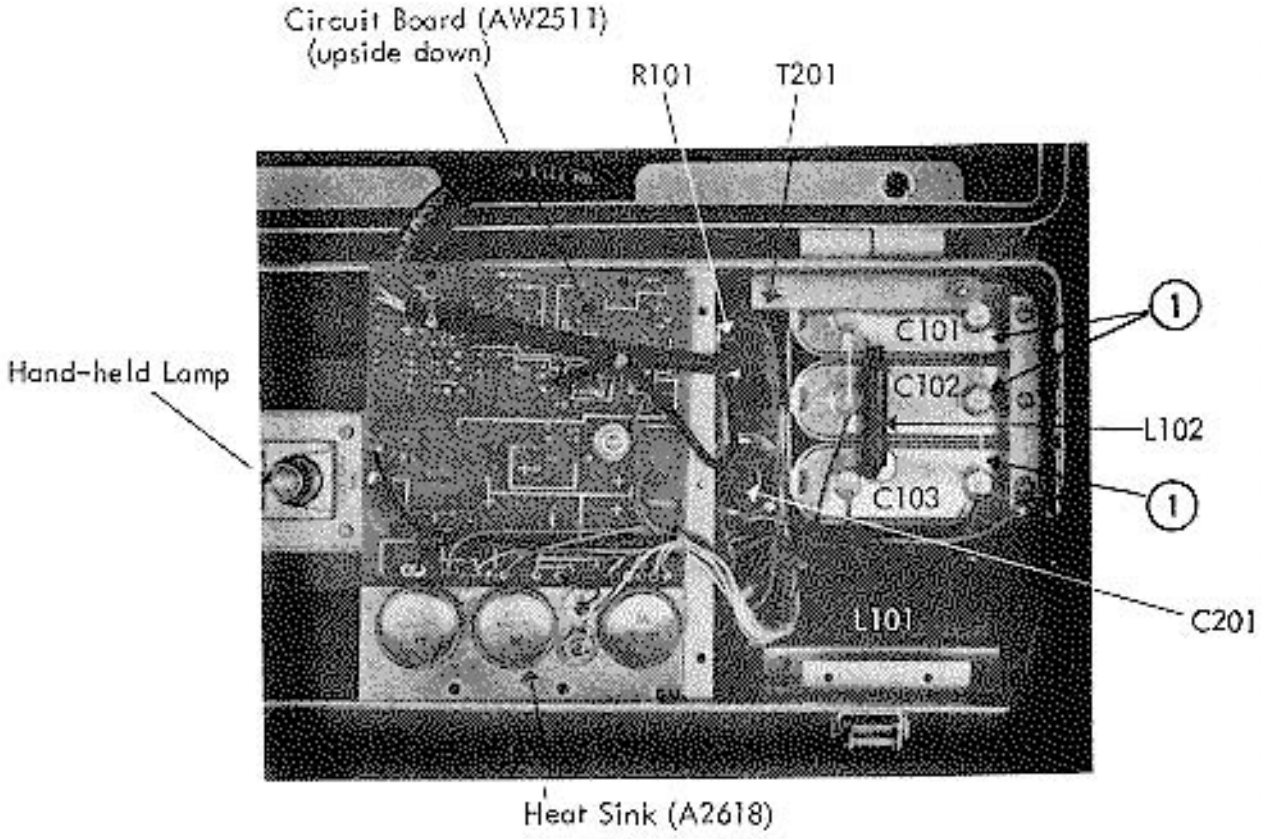


Figure 9-2. Circuit Compartment with Circuit Board Removed.

Item	Qty	Part No. (on circuit diagram)	C-H Part No.	Description
15.	1		A1436-1	Lens (flat plastic plate)
16.	1		B2726	Diode Package (includes Pulse Transformer)
17.	1		B2669	Reflector Assembly, Basic
18.	1		A2510	Extrusion, Lamp clamp
19.	1		A2604	Tube Clamp Adaptor
20.	3		A2047	Spring, Lamp clamp
21.	1	L 301	A2670-1	Coil, 1u henry
22.	1	C301		Capacitor, ceramic disc, .01/u@ 1KV
23°	1	S 301		Lamp handle (includes switch S301) Cutler Hammer NAF 1174-1
24.	1	R 302		500K pot, Bourns 3501S-1-504
25.	1	R 301		2.5K pot/switch
26.	1	R 303		47K ±10% 1/4W, composition. Allen Bradley GSIG 056S252UA
27.	1			Multi-turn Dial, Amphenol 3141.
28.	1	R102		10K pot, Clarostat, RV6 LAYSA 103A.

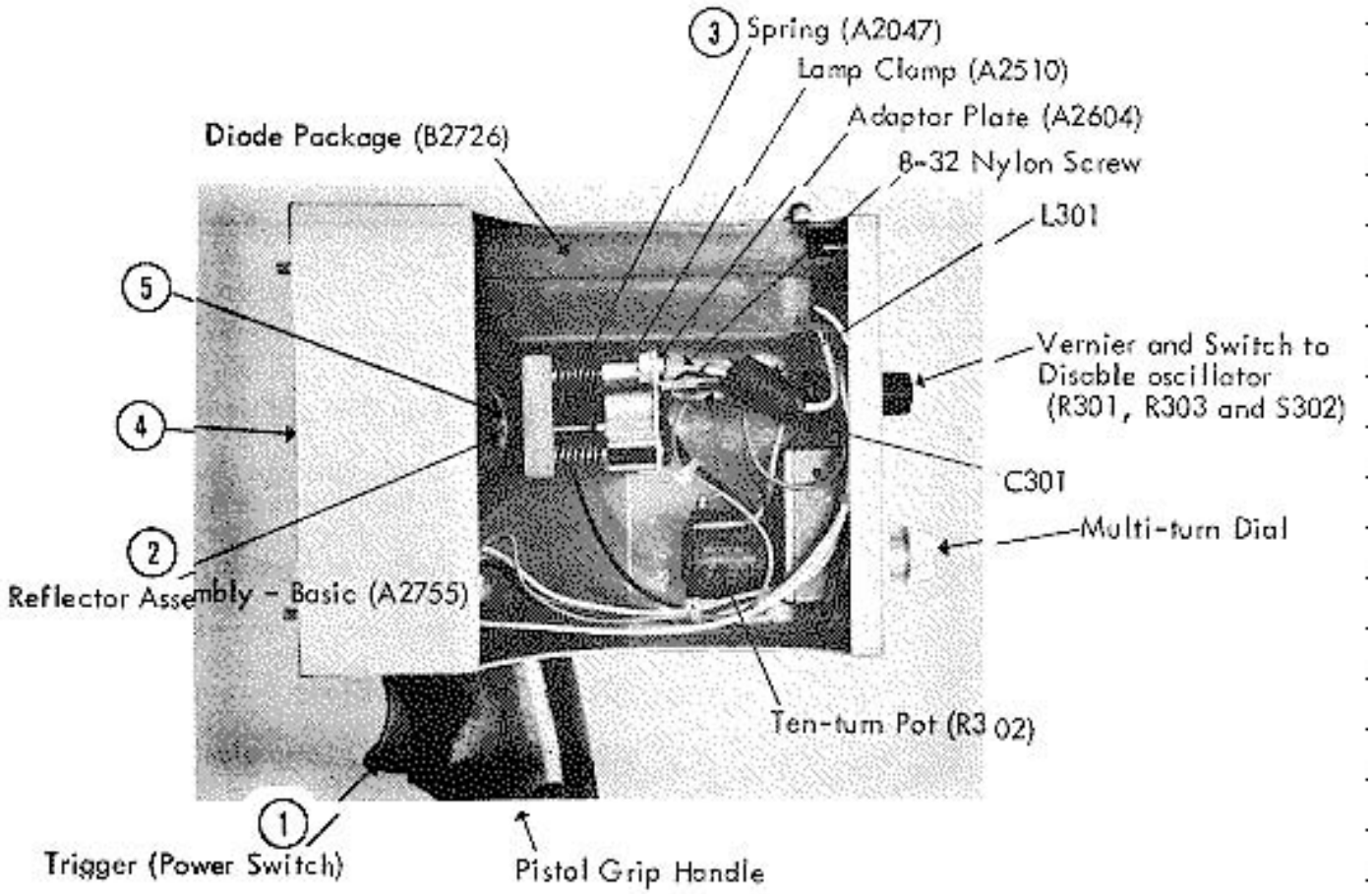


Figure 9-3. Lamp Assembly - Cutaway View

Qty.	Description	Part Number
1	Flash Tube	35 S (NSN 6240-019-5835)
1	Diode' Package	B2726
1	SCR	2N4172
1	Reflector Assembly - basic	A2755
1	Lens	A1436-1
2	Transistors	2N1099
2	Transistors	2N3906
2	Transistors	2N3904
1	Transistor	2N4870
2	Capacitor, 10/u 600V	702012-3001
2	Diodes	SCE-6
2	Diodes	1 N456A
1	Power Cable Assembly	A2788
1	Signal Cable Assembly	A2789
	(Installation instruction shipped with Cables)	

APPENDIX A

REFERENCES

A-1. Dictionaries of Terms and Abbreviations.

AR 310-25 ..... Dictionary of United States Army Terms
AR 310-50 ..... Authorized Abbreviations and Brevity Codes

A-2. Publication Index.

DA PAM 310-1 ..... Index of Administration Publications
DA PAM 310-2 ..... Index of Blank Forms
DA PAM 310-4 ..... Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders

A-3. Logistics and Storage.

TM 740-90-1 ..... Administrative Storage of Equipment
TM 743-200-1 ..... Storage and Materials Handling

A-4. Maintenance of Supplies and Equipment.

AR 750-1 ..... Army Material Maintenance Concepts and Policies
TM 38-750 ..... The Army Maintenance Management System (TAMMS)
TM 43-0139 ..... Painting Operations Instructions for Field Use

A-5. Other Publications.

AR 420-90 ..... Fire Prevention and Protection
AR 55-38 ..... Reporting of Transportation Discrepancies in Shipments
AR 700-58 ..... Packaging Improvement Report
DA PAM 310-13 ..... Military Publications Posting and Filing
FM 21-11 ..... First Aid for Soldiers
TB 43-180 ..... Calibration Requirements for the Maintenance of Army Materiel
TM 750-244-1-4 ..... Procedures for the Destruction of Aviation Ground Support Equipment (FSC 4920) to Prevent Enemy Use

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. Maintenance Allocation Chart.

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels: Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as.

AVUM which corresponds to the O code in the Repair Parts and Special Tools List (RPSTL).
AVIM which corresponds to the F code in the Repair Parts and Special Tools List (RPSTL).
Depot which corresponds to the D code in the Repair Parts and Special Tools List (RPSTL).

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM).AVUM activities will be staffed and equipped to perform high frequency "On-Equipment" maintenance tasks required to retain or return equipment to a serviceable condition. The maintenance capability of the AVUM will be governed by the MAC and limited by the amount and complexity of support equipment, facilities required, and number of spaces and critical skills available The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignment of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements).

(a) Company Size Aviation Units. Perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of equipment operational readiness. Perform maintenance inspections and servicing to include daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, Built-In-Test Equipment (BITE), installed instruments, or easy to use Test Measurement and Diagnostic Equipment (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs. Perform servicing, functional adjustments, and minor repair/replacement. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units. Aviation elements organic to brigade, group, battalion headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by the aircraft crew chief or assigned aircraft repairman will normally be limited to preventive maintenance inspections, servicing, spot painting, spot drilling, minor adjustments, module/component fault diagnosis and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM). AVIM provides mobile, responsive "One Stop" maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance) Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. Establishes the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, tests, diagnoses, repairs, adjusts,

calibrates, and aligns system modules/components. Module/component disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings and items of common hardware. Unserviceable reparable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform special inspections which exceed AVUM capability. Provides quick response maintenance support, on-the-job-training, and technical assistance through the use of mobile maintenance contact teams. Maintenance authorized operational readiness float. Provides collections and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting non-divisional AVIM unit).

B-2. Use of the Maintenance Allocation Chart.

a. The MAC assigns maintenance functions to the lowest level of maintenance based on past experience and the following considerations:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest level of maintenance authorized to perform a maintenance function is indicated. If the lowest level of maintenance cannot perform all tasks of any single maintenance function (e.g., test, repair), then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

c. A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Authority to requisition, stock, or otherwise secure necessary repair parts will be as specified in the repair parts and special tools list appendix.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer to the level of maintenance to which the function is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Organizational through depot maintenance of the US Army Electronics Command equipment will be performed by designated US Army Electronics Command personnel.

h. Changes to the MAC will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities

B-3. Definitions.

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical and electrical characteristics with established standards.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents and air.

d. Adjust. To rectify to the extent necessary to bring into proper operating range.

e. Aline. To adjust specified variable elements of an item to bring to optimum performance.

f. Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect

and adjust any discrepancy in the accuracy of the instrument or test equipment being compared with the certified standard.

g. Install. To set up for use in an operational environment such as an emplacement, site or vehicle.

h. Replace. To replace unserviceable items with serviceable assemblies, subassemblies or parts.

i. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

j. Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards prepared and published for the specific item to be overhauled.

k. Rebuild. To restore an item to a standard as nearly as possible to the original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

B-4. Functional Groups. Standard functional groupings are not considered feasible for aviation ground support equipment due to variation and complexity. Therefore, variations to functional groupings may occur.

B-5. Maintenance Categories and Work Times. The maintenance categories (levels) AVUM, AVIM, and DEPOT are listed on the Maintenance Allocation Chart with individual columns that indicate the work times for maintenance functions at each maintenance level. Work time presentations such as 0.1 indicate the average time it requires a maintenance level to perform a specified maintenance function. If a work time has not been established, the columnar presentation shall indicate "---". Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

SECTION II

MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
4010							
08	STROBEX BLADE TRACKER	INSPECT	-•-				
		SERVICE	-•-				
		TEST	-•-				
		ADJUST	-•-				
		REPAIR		-•-			
		OVERHAUL		-•-			
0801	ELECTRONIC ASSEMBLY	INSPECT	-•-				
		SERVICE	-•-				
		TEST	-•				
		ADJUST	-•				
		REPAIR		-•-			
		OVERHAUL		-•-			
0802	LAMP ASSEMBLY	INSPECT	-•-				
		SERVICE	-•-				
		TEST	-•-				
		REPLACE	-•-				
		REPAIR		-•-			
0803	CABLE ASSEMBLY	INSPECT	-•-				
		TEST	-•-				
		REPLACE		-•-			
		REPAIR		-•-			
0804	CASE ASSEMBLY	INSPECT	-•-				
		REPAIR	-•-				

APPENDIX C

REPAIR PARTS AND SPECIAL TOOLS LIST

(Current as of 12 September 1980)

Section I. INTRODUCTION

C-1. Scope. This appendix lists repair parts; required for operation and performance of Aviation Unit Maintenance (AVUM), and Aviation Intermediate Maintenance (AVIM), and Depot Maintenance of the light, strobe, P/N 135M9.

NOTE

For detailed explanation of the Three Levels of Maintenance Concept, see Appendix A to this Section

C-2. General. This Repair Parts and Special Tools List is divided into the following sections:

a. Section II. Repair Parts List. A list of repair parts authorized for use in the performance of maintenance. The section is listed in figure and item number sequence. The illustrations referenced in this section will appear in the maintenance portion of this manual.

b. Section III. Special Tools List*. Not applicable.*

c. Section IV. National Stock Number and Part Number Index. (Not applicable.)

C-3. Explanation of Columns. The following provides as explanation of columns found in the tabular listings:

***a. Illustration*.** This column is divided as follows

(1) Figure Number. Indicates the figure number of the illustration in which the item is shown.

(2) Item Number. The number used to identify each item called out in the illustration.

b. Source, Maintenance and Recoverability Codes (SMR).

(1) Source Code*.* Source codes are assigned to support items to indicate the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	Definition
PA	Item procured and stocked for anticipated or known usage.
PB	Item procured and stocked for insurance purpose because essentiality dictates that a minimum quantity be available in the supply systems.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except aircraft support items as restricted by AR 700-42.

(2) Maintenance Code. Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(a) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace and use the support item The maintenance code entered in the third position will indicate one of the following levels of maintenance':

Code	Application/Explanation
O	Support item is removed, replaced, used at the Aviation Unit Maintenance level.
F	Support item is removed, replaced, used at the Aviation Intermediate Maintenance level.
D	Support items that are removed, replaced, used at depot, mobile depot, specialized repair activity only.

(b) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete

repair (i e, all authorized maintenance functions). This position will contain one of the following maintenance codes:

Code	Application/Explanation
Z	Nonreparable. No repair is authorized.

(3) Recoverability Code. Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Code	Definition
Z	Nonreparable item. When unserviceable, condemn and dispose at the level indicated in position 3.

c. National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

d. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards and inspection requirements, to identify an item or range of items.

NOTE

When a stock numbered item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

***f. Description*.** Indicates the Federal item name and any additional description required to identify the item

g. Unit of Measure (U/M). Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item required for one assembly only, including instances when similar assemblies are broken down together. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable (e.g., shims, spacers, etc.).

C-4. Special Information. Not applicable

C-5. How to Locate Repair Parts. Not Applicable

C-6. Abbreviations. Not applicable.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION	(7) U/M	(8) QTY INC IN UNIT
			4920-00-156-9946	135N9	99866	LIGHT,STROBE		1-1
						SECTION II REPAIR PARTS LIST CABLE, LAJP AND CIRCUIT COMPARTMENT		
9-1	1	PBOZZ	5920-00-280-5066	MDX5	71400	FUSE,CARTRIDGE	EA	2
9-1	2	PBDZZ	6120-00-504-0708	7716696P9	24446	LIGHT.INDICATOR	EA	1
9-1	3	PAOZZ	6240-00-155-7836	MS25237-327	96906	LAMP.INCANDESCENT	EA	1
9-1	4	PBDZZ	5935-00-415-3885	6S3106F16-11-p	96906	CORRECTOR,PLUG,ELECTRICAL		1
9-1	5	PBDZZ	5935-00-553-3093	6S3106E1OSL45C	96906	CDNNLCTOR,PLUG,ELECTRICAL		1
						CIRCUIT COMPARTMENT		
9-2	1	PBDZ	591-00-2-5570	702012-3001	00853	CAPACITOR,FIXED,C101,C102C103	EA	3
						LAMP ASSEMBLY		
9-3	1	PBDZZ	6350-00-676-4813	NAF1174-1	80020	SWITCH.GBRIP ASSEBLY	EA	1
9-3	2	PBDZZ	6210-00-181-2602	A2755	99866	REFLECTOR.LIGHT	EA	1
9-3	3	PBDZZ	5360-00-182-5494	A2047	99866	SPRING,HELICAL,COMPRESSION	EA	3
9-3	4	PBFZZ	6210-00-181-2556	A1436-1	99866	LENS,LIGHT	EA	1
9-3	5	PBOZZ	240-00-019-5835	355	99866	LAMP,FLASHTUBE	EA	1
						CIRCUIT BOARD ASSEMBLY		
9-4	1	PBDZZ	5961-00-856-6156	2R4172	80131	SEMICONDUCTOR DEVICE, Q12	EA	1
9-4	2	PBDZZ	5961-00-044-5749	2N2079A	81349	TRANSISTOR,Q1,02.03	EA	3
9-4	3	PBDZZ	5961-00-892-8706	2N3904	81349	TRANSISTOR.04,06.07,011	EA	4
9-4	4	PBDZZ	5961-00-831-0372	2N3906	80131	TRSISTR,5,Q,10,013	EA	4
9-4	5	PBDZZ	5961-00-054-2904	JAN1N3613	81349	SEMICONDUCTOR DEV1CE,D3,D4.D5,D6,D7,DB,D9,D10,D12, D26.D27,D26.	EA	12
9-4	6	PBDZZ	5961-00-892-0734	1483D	81349	SEMICONDUCTOB DEVICE,D14,D15,D16, D17,0 .D19,D22	LA	7
9-4	7	PBDZZ 5	961-00-493-5784	2N4870	60131	TRARSITOR,Q9	EA	1
						SECTION III SPECIAL TOOLS LIST (Not Applicable)		
						SECTION IV NATIONAL STOCK RUMBER AND PART NUMBER INDEX (Not Applicable)		

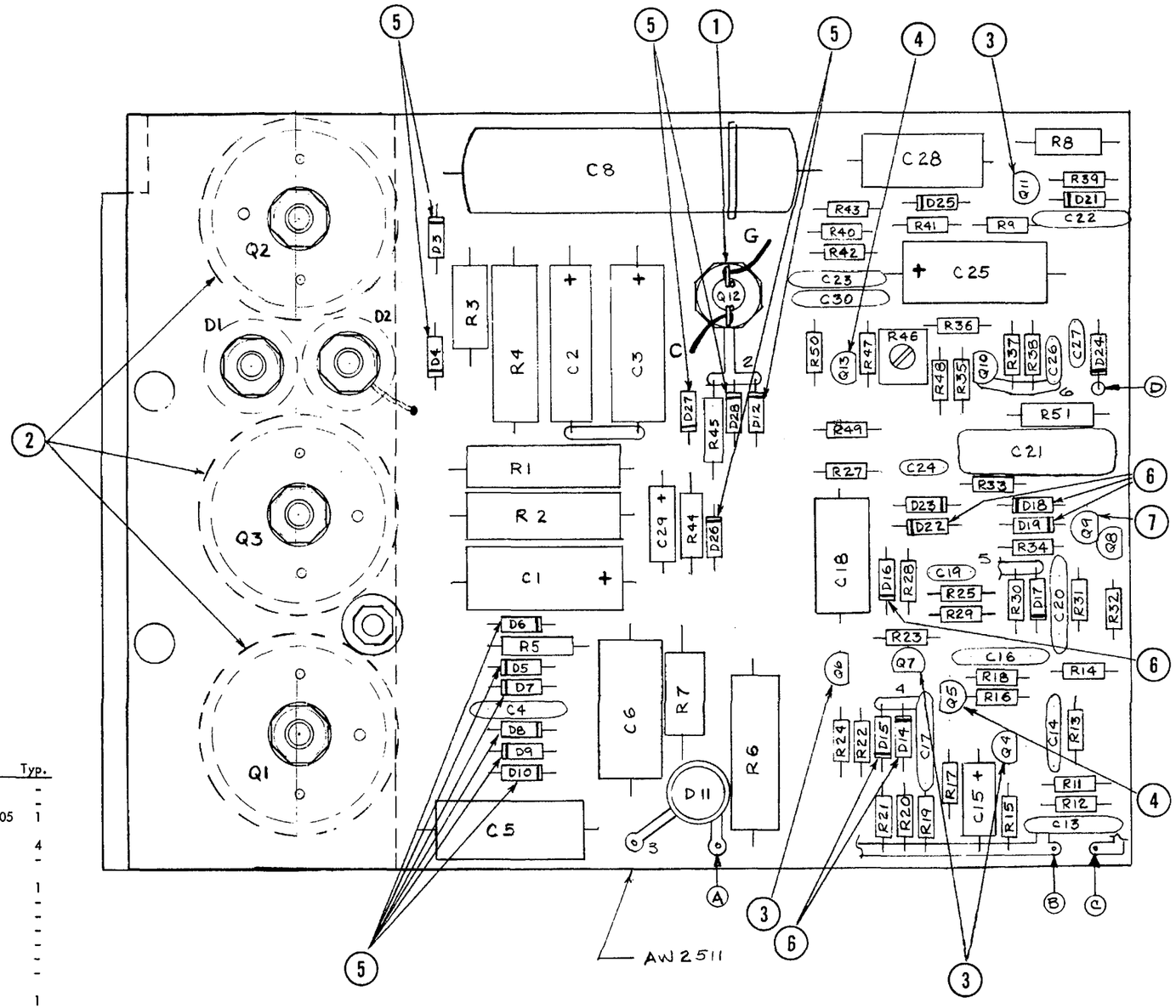
No.	Description	Typ.
R1	250 ohm ±10% 5W WW	1
R2	33 ohm ±10% 5W WW	1
R3	22 ohm ±10% 3W WW	1
R4	1K ±10% 5W WW	1
R5	56 ohm ±10% 1/2W comp.	1
R6	15K ±10% 5W WW	1
R7	100K ±10% 1W comp.	1
R8	390 ohm ±10% 1/2W comp.	1
R9	560 ohm	1
R10	N/A	
R11	10K	10
R12	10K	-
R13	100K	5
R14	47K	1
R15	22K	3
R16	10K	-
R17	22K	-
R18	100 ohm	2
R19	1K	3
R20	100K	-
R21	100K	-
R22	10K	-
R23	10K	-
R24	2.2K	2
R25	220K	2
R26	N/A	
R27	3.3K	1
R28	100K	-
R29	10K	-
R30	10K	-
R31	1K	-
R32	10 ohm	1
R33	2.2K	-
R34	22 ohm	1
R35	22K	-
R36	100 ohm	-
R37	220K	-
R38	10K	-
R39	1K	-
R40	10K	-
R41	33K	1
R42	5.6K	1
R43	180 ohm	1
R44	1.8K ±10% 1/2W comp.	1
R45	1M ±10% 1/2W comp.	1
R46	10K pot CTS 340PC 103B	1
R47	820 ohm	1
R48	10K	-
R49	100K	-
R50	470K	1
R51	1K ±1% RN60D dep. carb.	1

Unless otherwise noted
resistors 1/4W ±10% comp.

No.	Description	Typ.
C1	25 µ/50V ET Aerovox PTT-95	1
C2	5 µ/50V ET Aerovox PTT-95	1
C3	50 µ/25V ET Aerovox PTT-85	2
C4	.01 µ/1KV CD Sprague 5GA-S10	8
C5	.47 µ/250V M. Poly Amerex 3418947WD7	2
C6	.47 µ/250V -	-
C7	N/A	
C8	.25 µ/400V P Sprague 4TM-P25	1
C9	N/A	
C10	N/A	
C11	N/A	
C12	N/A	
C13	.01 µ/1KV	-
C14	.005 µ/1KV CD Sprague 5GA-D50	1
C15	4.7 µ/50V Tant. Comp. Inc. CS13BG475K	2

No.	Description	Typ.
D1	1N1199A	1
D2	1N2987 RB	1
D3	SCE-6	12
D4	SCE-6	-
D5	SCE-6	-
D6	SCE-6	-
D7	SCE-6	-
D8	SCE-6	-
D9	SCE-6	-
D10	SCE-6	-
D11	1N5001	1
D12	SCE-6	-
D13	N/A	
D14	1N456A	9
D15	1N456A	-
D16	1N456A	-
D17	1N456A	-
D18	1N456A	-
D19	1N456A	-
D20	N/A	
D21	1N722	1
D22	1N456A	-
D23	1N456A	-
D24	1N964B	1
D25	1N456A	-
D26	SCE-6	-
D27	SCE-6	-
D28	SCE-6	-
Q1	2N1099	3
Q2	2N1099	-
Q3	2N1099	-
Q4	2N3904	4
Q5	2N3906	4
Q6	2N3904	-
Q7	2N3904	-
Q8	2N3906	-
Q9	2N4870	1
Q10	2N3906	-
Q11	2N3904	-
Q12	2N4172	1
Q13	2N3906	-

No.	Description	Typ.
C16	.01 µ/1KV	-
C17	.01 µ/1KV	-
C18	1 µ/100V Mylar IMB XV2B105	1
C19	.001 µ/1KV CD Sprague 5GA4D10	4
C20	.01 µ/1KV	-
C21	.2 µ/100V ±1% Mylar Elmenco IMD 3-204F	1
C22	.01 µ/1KV	-
C23	.01 µ/1KV	-
C24	.001 µ/1KV	-
C25	50 µ/25V	-
C26	.001 µ/1KV	-
C27	.001 µ/1KV	-
C28	.1 µ/200V MP Aerovox P8292ZN10	1
C29	4.7 µ/50V	-
C30	.01 µ/1KV	-



FO-1. Circuit Board Assembly

COMPONENT LOCATION

NOS. 1-99 — CIRCUIT BD. ASSM
NOS. 101-199 — CASE ASSM.
NOS. 201-299 - TRANS/CAP BRKT. ASSM.
NOS. 301-399 - LAMP ASSM

EXCEPT WHERE NOTED:
ALL RESISITORS IN K OHMS
ALL CAPACITORS IN MFD.
ALL DIODES SCEG, *IN456A

NOTES:
① SELECTED IN FINAL TEST

FO-2. Circuit Diagram

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General, United States Army
Chief of Staff

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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