KEYER KY-77/U

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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
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TM 11–1092/ TO 16–35KY77–5 is published for the information and guidance of all concerned.

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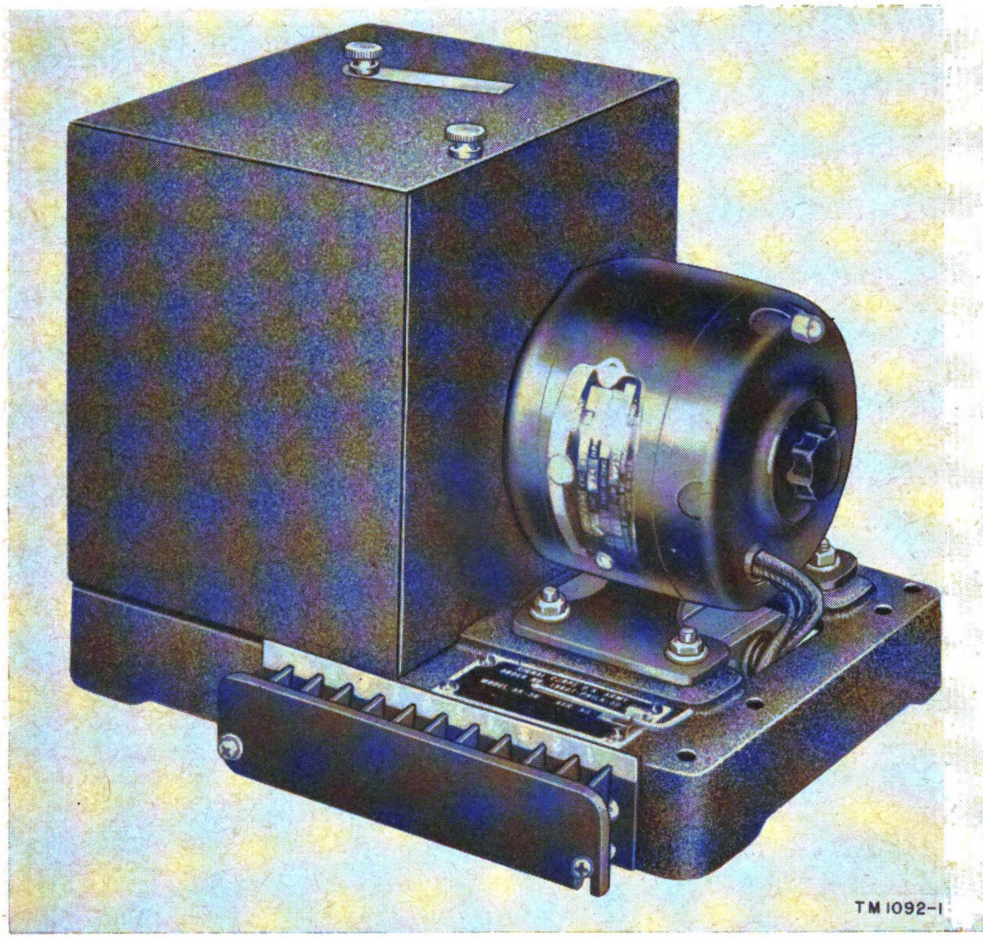


Figure 1. Keyer KY–77/U.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual is published for the information and guidance of the personnel to whom this equipment is issued. It contains information for the installation, operation, maintenance, and repair of Keyer KY–77/U. In addition to these instructions, there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army matériel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71–4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA AGO Forms 11–252 and 11–253, Operator, first, second and third echelon maintenance checklist for Signal Corps equipment, will be prepared in accordance with instructions on the back of the form.

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Keyer KY–77/U is a motor-driven timing mechanism which is designed to provide coded identification keying for a radio beacon (aerophare). The keyer motor power can be supplied from any 110-volt, a-c (alternating current), 50- to 60-cycle source. The keyer can be adjusted to provide any combination of three-letter identification signals. Some combinations of four-letter identifications can be used, providing the total character count does not exceed the mechanical

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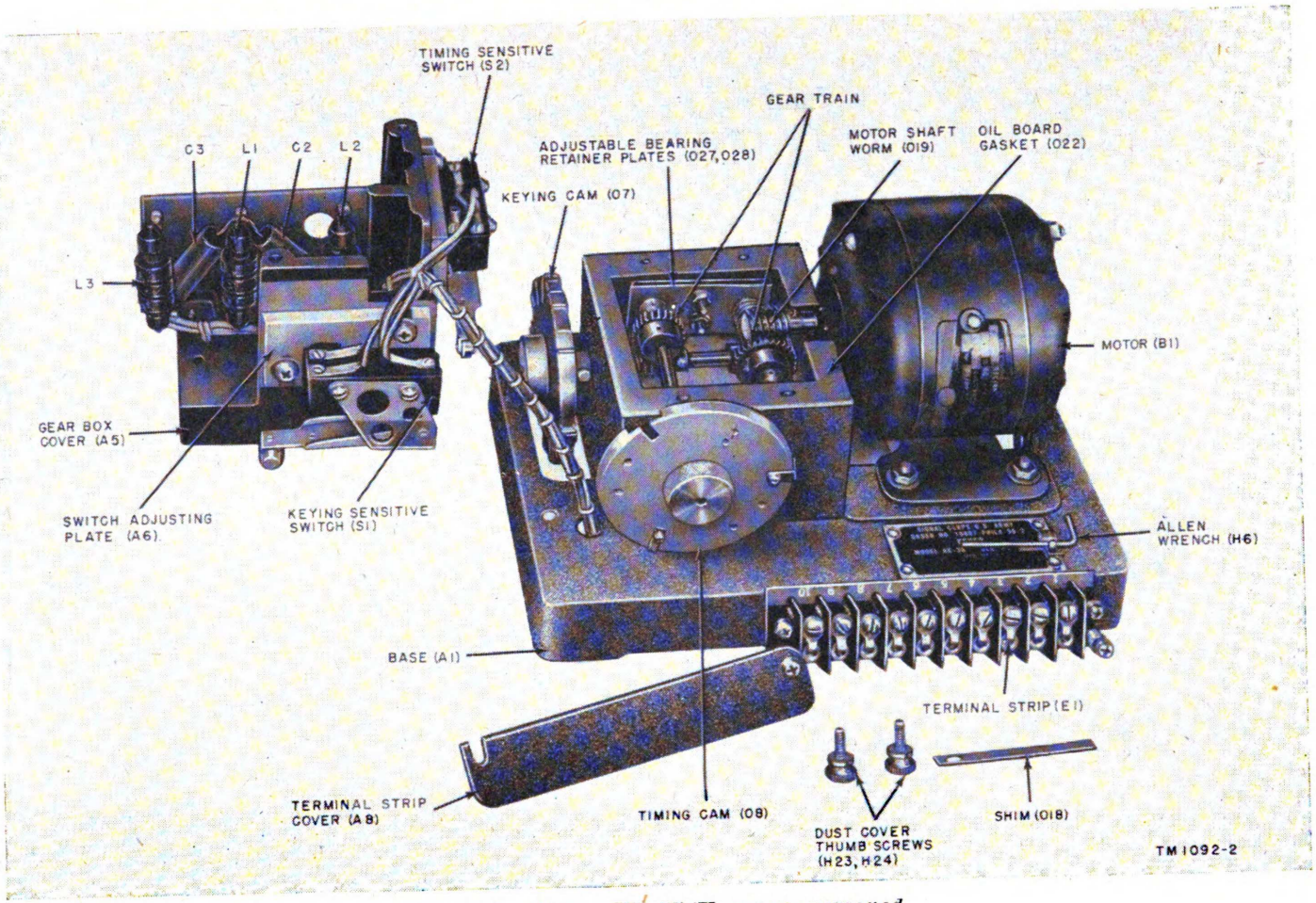


Figure 2. Keyer KY-77/U, covers removed.

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limitations of the keying cam assembly (fig. 5). Adjustments may be made with this equipment to silence the long-dash interval between identification keying. By adjusting the timing and keying cams, the operator can secure the signal characteristics required. The keyer must then be connected properly to the radio beacon to obtain the desired identification transmission.

4. Description of Components

The major components of Keyer KY–77/U (fig. 2) are the motor, gear train, timing cam, keying cam, sensitive switches with cam rider assemblies, and filter assembly. These components are mounted on a ripple finish cast-aluminum base and, with the exception of the motor, are protected by a removable dust cover. A barrier type terminal strip, for external electrical connections, is mounted on the base. Figure 2 shows the unit with the dust cover removed and the cast-aluminum gearbox cover set to one side to show the internal components. The keyer operates from a 110-volt a-c external power supply controlled from the power source. A No. 6 Allen wrench, for adjustment of the worm gear set screws, is fastened to the base by a Fahnestock clip. For application of this tool, see figure 6. A detailed description of the separate components and electrical circuits is contained in paragraphs 28 through 32. The keyer is 9 inches long, 7 inches high, and 6 inches wide and has a volume of 378 cubic inches; it weighs 11 pounds.

5. Technical Characteristics

Motor:	
Input	95 to 130 volts ac, 50 to 60 cycles, single phase, .24 ampere.
Horsepower	1/100.
Motor speed	1,400 to 1,700 rpm (revolutions per minute).
Continuous operating temperature range.	50 to −35° F.[1]
Keying cam speed	1/150 of motor shaft speed.
Timing cam speed	1/1,800 of motor shaft speed.
Type signal keyed	Intermittent coded identification.
Timing characteristics using 30° timing staples.	Call sent out once, followed by a long dash (or silent period) equal to 1, 2, 3, 5, or 11 revolutions of the keying cam, depending on the number of 30° staples installed.
Sensitive keying switch gap setting.	0.022 to 0.023 inch.
Keying capacity:	
50-cycle input:	
1 revolution of keying cam.	6.2 seconds.
1 revolution of timing cam.	74 seconds.

[1] See paragraph 15 for operation under unusual conditions at lower air temperatures.

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Keying capacity—Continued	
60-cycle input:	
1 revolution of keying cam.	5.2 seconds.
1 revolution of timing cam.	62 seconds.

6. Packaging Data

When packed for export shipment, the keyer is placed in a moisture proof-vaporproof container and is packed in a wooden export crate (fig. 3). The export crate is 20 inches long, 16 inches wide, and 16 inches in depth, and its volume of 5,120 cubic inches. The weight of the unpacked unit is 11 pounds and the total weight packed for export is 55 pounds.

Note. Items may be packaged in a manner different than that shown depending on the supply channel.

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CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF KEYER KY–77/U

7. Siting

a. Install the keyer on a support which is level, free from vibration, and sufficiently rigid to carry the required load. Place the unit as near the associated equipment as possible, providing adequate space to make the necessary connections between the equipments. The keyer should be mounted in a position where inspection and adjustments of the cams and sensitive switches and lubrication of the cams can be accomplished. It is important to select a location where the air temperature does not exceed 50° C. for any length of time.

b. Note that provision is made to mount the terminal strip on either side of the base. Locate the keyer to provide the best accessibility to the cams and sensitive switches. If the terminal strip is not accessible, remove the end screws which secure the strip and attach it at the tapped holes in the other side of the base. The internal wires attached to the strip are of adequate length to make this change without removing any wires.

8. Uncrating, Unpacking, and Checking New Equipment

Equipment may be shipped in oversea packing cases or in domestic packing cases and, sometimes, in its own carrying case. When the equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. Figure 3 shows the keyer packed for export shipment. The procedure for unpacking the keyer is as follows:

a. Clip the two metal bands that bind the wooden box.
b. Pull out the nails and remove the cover.
c. Remove the contents from the box.
d. Tear open the heavy waterproof paper.
e. Lift out the cardboard box.
f. Open the four flaps on the side of the cardboard box.
g. Pull out the contents and remove the Kimpak layer.
h. Remove the vaporproof barrier.
i. Open the four flaps on the top of the inner cardboard box.
j. Remove the Kimpak layer and the bags of desiccant which are inside the cardboard box.

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k. Lift the keyer from the cardboard box.

l. Check the contents of the packing case against the master packing slip.

m. Inspect the keyer for damaged or missing parts.

9. Installation of Equipment

In preparing the keyer for use, follow the procedure outlined below:

a. Remove all dust and dirt from the equipment with a clean dry cloth.

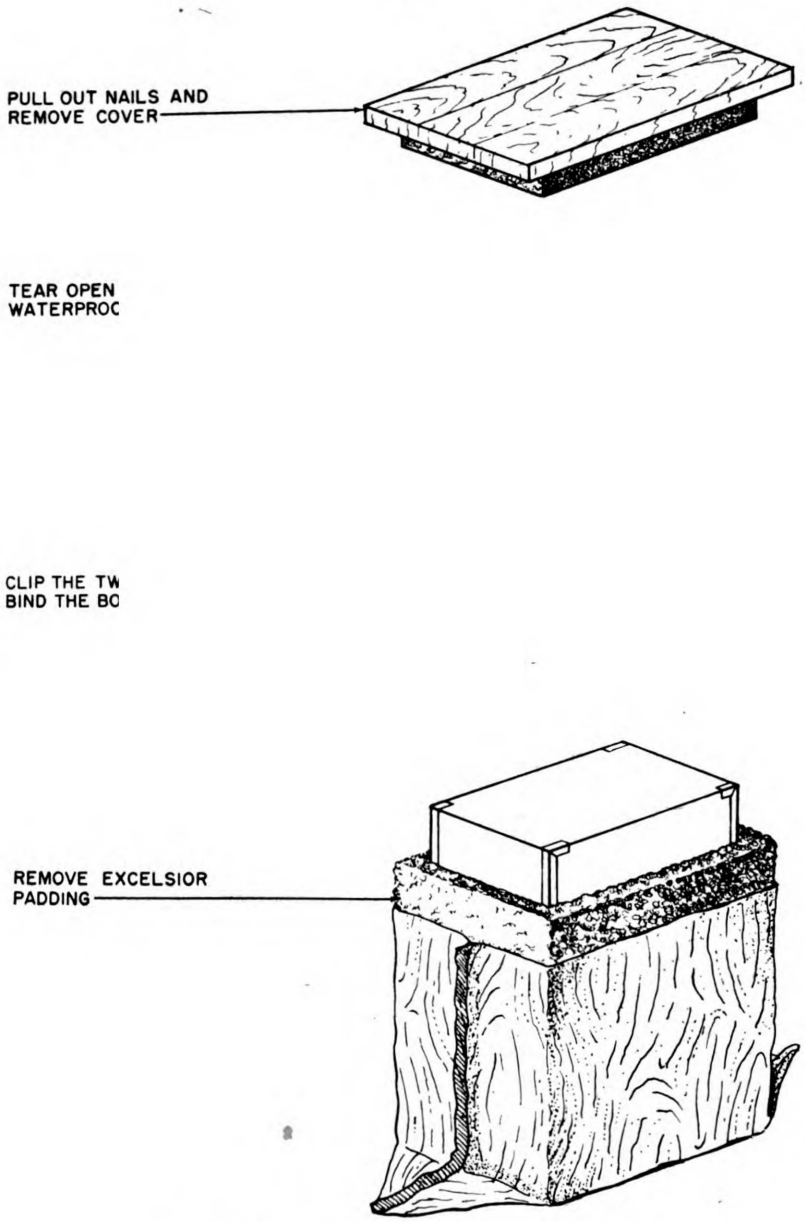


Figure 3. Keyer packed for export.

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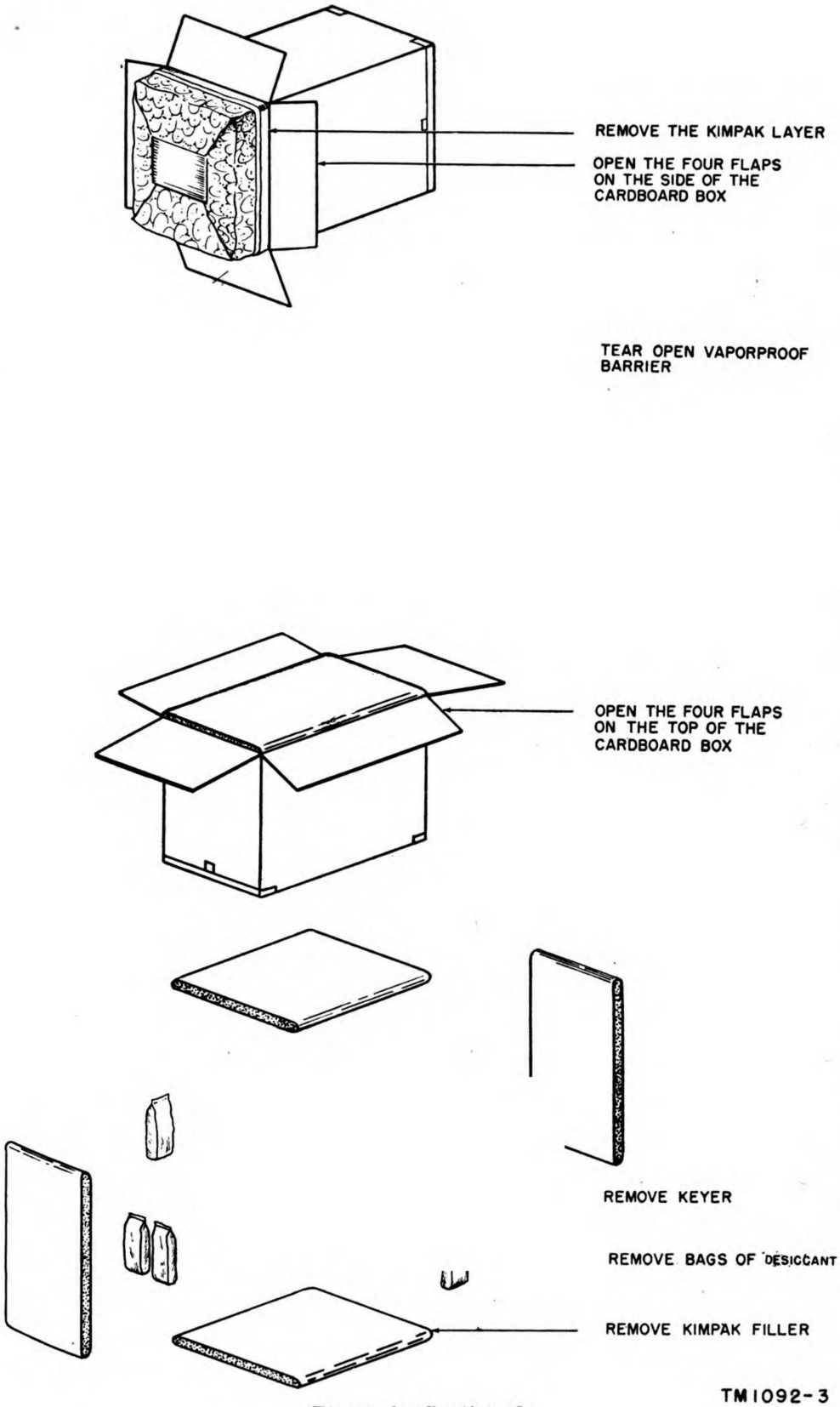


Figure 3—Continued.

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b. Place the removable timing and keying staples on their respective cams in proper sequence to produce the desired keying (fig. 5).

c. Adjust the position of the sensitive switches so that contact is made when the cam follower is raised 0.022 to 0.023 inch from the surface of the cam. Figure 4 shows the switch adjusting screws. Use the brass shim (fig. 2) that is secured to the dust cover by the thumbscrew.

d. Set the timing cam (par. 12) so that the timing sensitive switches make contact when the keying cam follower is at the midpoint of the interval (between the end of one keying sequence and the beginning of another).

e. Before completing this step, check to see that a-c power is removed from the beacon transmitter and from the power leads to the keyer. Connect the external power supply to the terminal strip at terminals 9 and 10.

f. If a silent interval following the identification keying is desired, connections for the circuit to be keyed should be made to terminals 3 and 4 on the terminal strip. Connect the internal wire from terminal 4 to the normally open contact of the timing sensitive switch (fig. 10). This places the normally open contacts of the keying and timing sensitive switches in series.

g. To have a dash follow a call, connections for the circuit to be keyed must be made to terminals 2 and 3 on the terminal strip. Connect a jumper wire between terminals 4 and 3. Connect the internal wire from terminal 4 to the normally closed contact of the timing sensitive switch (fig. 9). This places the normally open contact of the keying sensitive switch in parallel with the normally closed contact of the timing sensitive switch.

h. Apply a thin film of Grease, aircraft and instruments (spec. MIL–G–3278) to the ball bearing follower and to the periphery of the timing and keying cams while the keyer is operating (par. 19).

i. Replace the dust cover immediately after making adjustments. Failure to do so may result in dirt collecting on the cams and ball bearings, thus causing excessive wear.

10. Adjustment of Keying

Keyer KY–77/U has 21 dot staples and 10 dash staples mounted around the periphery of the keying cam. Follow the steps outlined below to obtain the desired keying sequence.

a. Insert the dot staples into the radial grooves on the cam. Mount the dash staples between the radial grooves (fig. 5) to produce the keying sequence.

b. Mount the cam on the wheel and secure it with the knurled nut, turned fingertight.

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11. Adjustment of Timing

The timing cam is provided with the proper number of 30° timing staples to provide the desired timing characteristic. Understanding the function of the timing cam staples entails the visualization of the relative cam speeds and the open or closed position of the sensitive switches across the keying line. The timing cam sensitive switch is either in parallel or in series with the keying sensitive switch. Therefore, the timing sensitive switch determines whether the keying line will be closed or open during the operation of the keying sensitive switch. Since the timing cam revolves once for every 12 revolutions of the keying cam, a timing staple will hold the timing sensitive switch closed or open for 1 revolution of the keying cam, resulting in either a steady dash being sent or a period of silence. Refer to paragraph 5 for the various timing combinations which are obtainable by using different quantities of timing staples. Install the timing staples as follows:

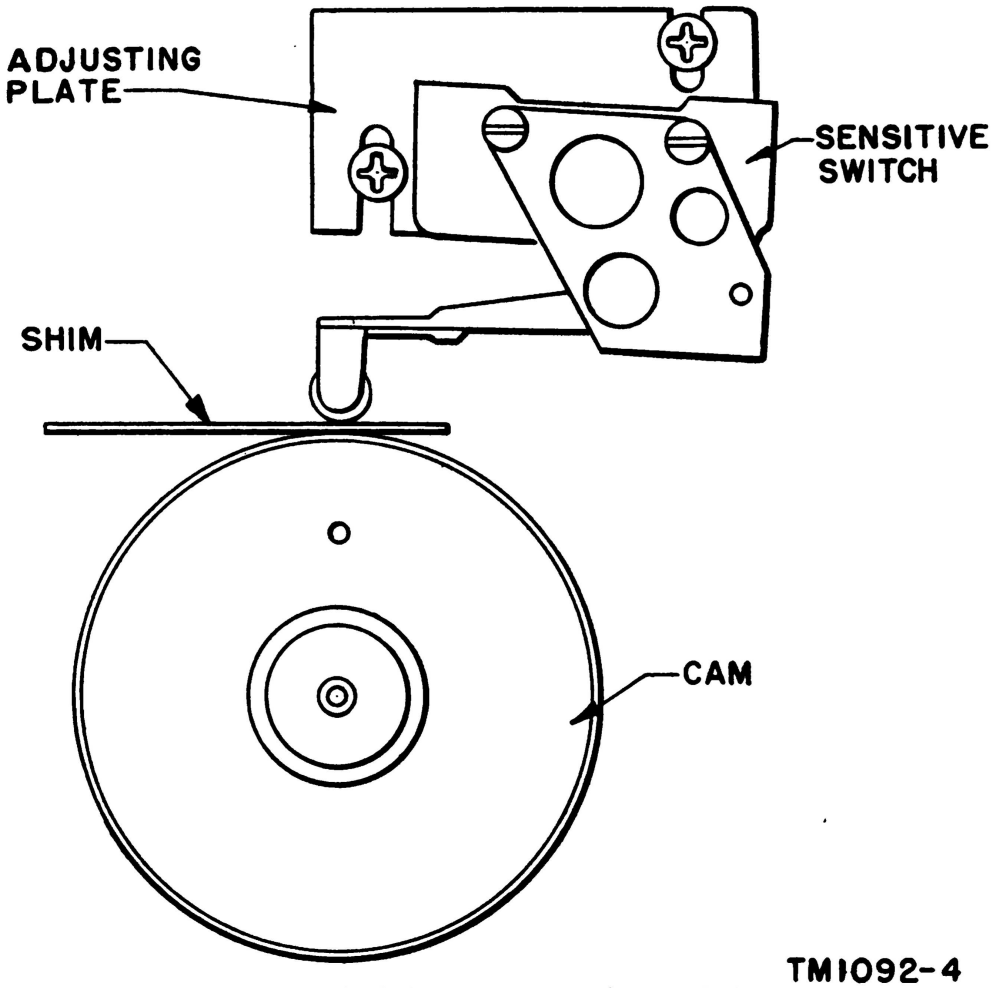


Figure 4. Adjustment of sensitive switch.

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a. Release the cam by removing the knurled nut which secures the cam to the hub.

b. Remove the nut, lockwasher, and bolt which hold the timing staples to the periphery of the cam.

c. Install the timing staples in the desired places.

d. Remount the cam on the hub, taking care that the alining stud on the cam engages the hole drilled in the face of the hub. Finger-tighten the knurled nut.

Caution: Hold the cam when loosening or tightening the knurled nut to prevent excessive twisting strain on the shaft.

12. Synchronizing Keying and Timing Cams

The hub which supports the keying cam is secured to its shaft by means of a set screw. The end of the set screw bears against a flat

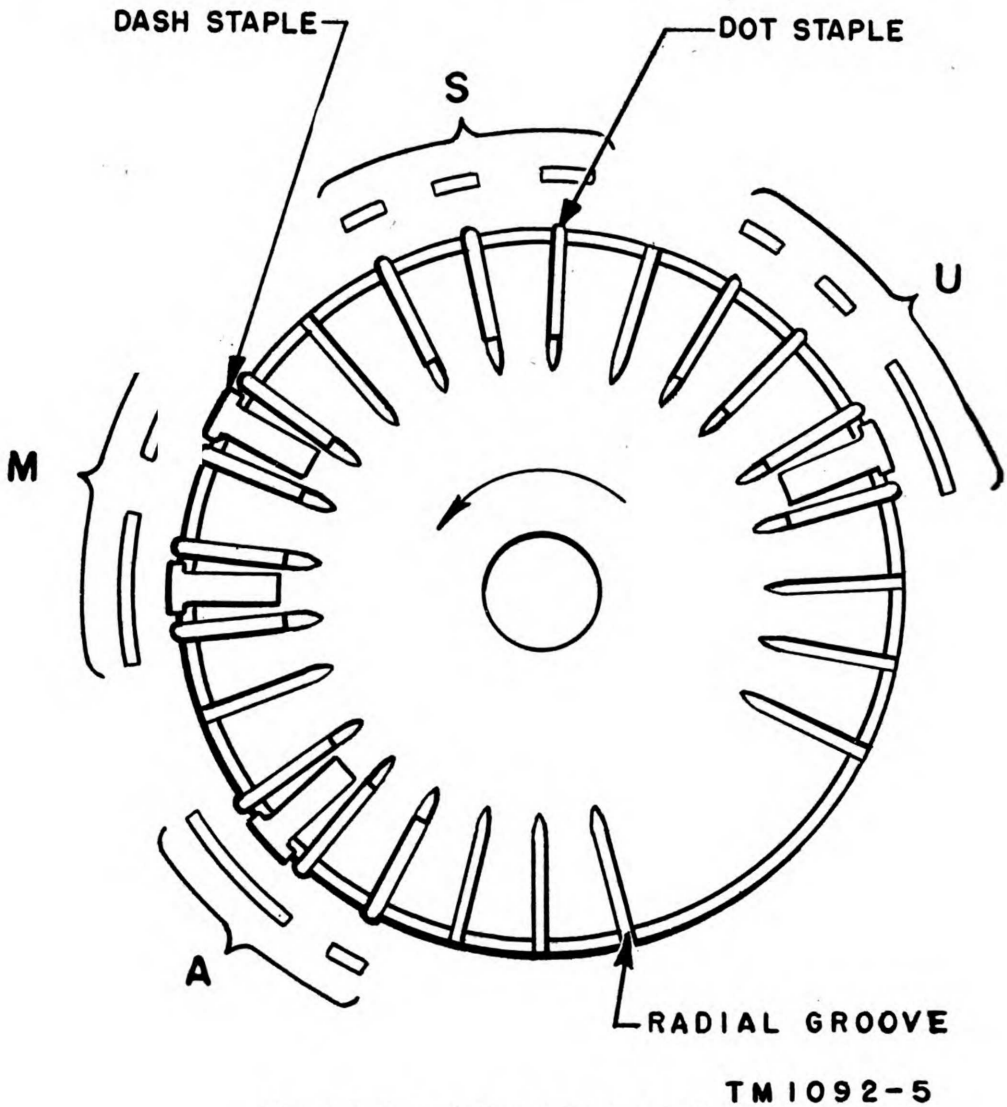


Figure 5. Installation of keying staples.

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surface on the shaft; therefore, this hub has only one possible angular position on the shaft. The hub which supports the timing cam (fig. 11) is also secured to its shaft by means of a set screw. The end of this set screw bears against a split bronze sleeve which, in turn, bears against the round timing shaft which is not flatted. This permits the hub on the timing shaft to be secured in any angular position, thus making it possible to synchronize the timing and keying cycles (par. 9*d*).

13. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 8 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in wiring of the equipment. If any changes in wiring have been made, note the changes in this manual, preferably on the schematic diagram.

c. If lubrication is required, refer to the lubrication instructions (pars. 18 through 20).

d. Perform the installation instructions given in paragraphs 9 through 12.

Section II. OPERATION

14. Operation Under Usual Conditions

When the keyer has been installed and all connections and adjustments made as described in paragraphs 7 through 12, the equipment is ready for operation. Turning the radio beacon transmitter on or off simultaneously energizes or deenergizes the motor (fig. 8). To operate the equipment, turn the radio beacon transmitter switch to ON. No further supervision is necessary except to see that the equipment is functioning properly. Refer to the equipment performance checklist (par. 24) for a routine check of the operation of the keyer.

15. Operation Under Unusual Conditions

The operation of the keyer may be difficult in regions where extreme cold, heat, humidity, and sand conditions prevail. Features have been incorporated in the keyer to combat the effects of these adverse conditions. Gearboxes and sealed motor bearings are lubricated with a grease adequate for use during high or low temperature conditions. Filter chokes and capacitors have been sprayed with a moistureproof-fungiproof coating, and the metals used are either inherently rust and corrosion resistant or treated with a plating giving them these desired qualities. In the following paragraphs, instructions are given on procedures for minimizing the effect of unusual operating conditions.

a. Operation in Arctic Climates.

(1) Handle the equipment carefully.

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(2) Keep the equipment warm and dry.

(3) When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and continue to do so until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

(4) Refer to paragraph 21 for cold weather lubrication instructions.

b. Operation in Tropical Climates. When operated in tropical climates, this equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than is normal in the tropics. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

c. Operation in Desert Climates.

(1) Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

(2) The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of the equipment, such as the motor and gear train. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

(3) Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

(4) Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (par. 17). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease will damage the equipment.

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CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

16. Tools and Materials Supplied With Equipment

Only one tool, a No. 6 Allen wrench, is supplied with the keyer. This tool is fastened to the base of the keyer by a Fahnestock clip. The wrench is used to adjust the set screws that secure the worm gears and thrust collars (fig. 6) to their shafts.

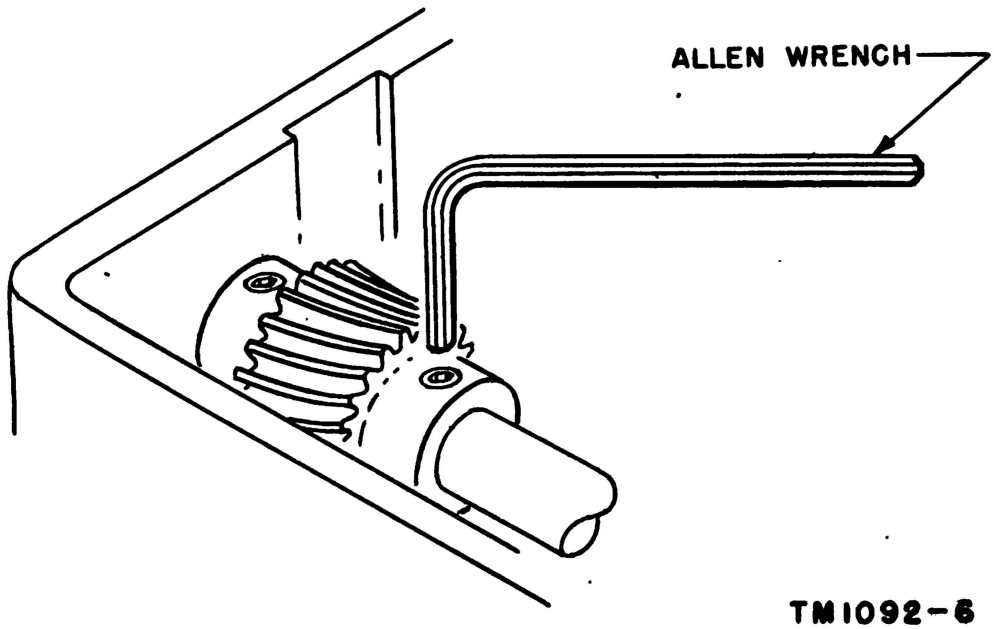


Figure 6. Method of using Allen wrench.

17. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5. No special preventive maintenance techniques are required for the keyer because of its inherent simplicity. Performance of the following general preventive maintenance services at frequent intervals will contribute toward trouble-free operation.

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a. Use No. 000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, dry-cleaning (SD), then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal abrasion, shorting, and grounding of circuits.

Section II. LUBRICATION

18. Gearbox

Keyer KY–77/U, as received from the manufacturer, has the gearbox filled with a low-temeprature grease. If the keyer is operated continuously it will be necessary to relubricate every 3 years. To lubricate, proceed as follows:

a. Remove the keyer dust cover; then remove the gearbox cover. The gearbox cover is secured by four recessed headscrews.

b. Remove the old grease from the gearbox. Wash out the remaining old grease thoroughly, using solvent SD.

c. Refill the gearbox with grease MIL–G–3278 and replace the gearbox cover.

19. Cams and Cam Followers

Every 2 or 3 months, remove the dust cover and apply a fresh coating of grease MIL–G–3278 to the ball bearing followers and to the periphery of the timing and keying cams. Apply a thin film of grease with a brush while the keyer is operating. Apply one drop of Oil, lubricating, light (LO) (U. S. Army spec. 2–27F) to each end of the ball bearing, permitting the oil to enter the interior of the bearing.

20. Motor

The motor is fitted with ball bearings. These bearings are lubricated with a long life grease that should conform to specification MIL–G–3278 which is satisfactory for extremely low temperatures. The motor bearings are sealed and, therefore, require no additional lubrication. In case a bearing develops roughness, it should be replaced with a new, lubricated, sealed bearing.

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Section III. WEATHERPROOFING

21. General

Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

a. TROPICAL MAINTENANCE. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is fully explained in TB SIG 13 and TB SIG 72.

b. WINTER MAINTENANCE. Special precautions are necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures. These precautions are fully explained in TB SIG 66 and TB SIG 219.

c. DESERT MAINTENANCE. Special precautions are necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust. These precautions are fully explained in TB SIG 75.

d. LUBRICATION. Refer to paragraphs 18 through 20 for lubrication of the keyer. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69.

22. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

23. Scope

The trouble shooting and repair work that can be performed at the organizational level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting

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is based on the performance of the equipment and the use of the senses in determining where the trouble lies.

24. Equipment Performance Checklist

a. GENERAL. The equipment performance checklist will be used to help the operator determine whether the keyer is functioning properly. The checklist specifies the item to be checked, the action or condition under which is is to be checked, the normal indications, and the corrective measures the operator should use before turning the equipment in for repairs.

Caution: This equipment is a precision apparatus; major repairs should not be attempted except by authorized personnel. If the unit is completely inoperative, or if the recommended corrective measures do not yield results, turn the equipment over to authorized repairmen as soon as possible.

b. EQUIPMENT PERFORMANCE CHECKLIST.

Item No.	Item	Action or condition	Normal indications	Corrective measures
1	Apply power to radio beacon transmitter.	Turn switch to ON.	Motor starts and operates keyer.	Check all wiring.
2	Sensitive switch assembly.	In operation.	Contacts should close as cam follower travels over cam surface.	Refer to paragraph 9 and figure 4.
3	Keying cam----	Rotates--	Desired signal should be keyed.	Check keying staples. Refer to paragraph 10 and figure 5.
4	Timing cam----	Rotates--	Desired timing characteristics should be obtained.	Check timing cam and staples. Refer to paragraphs 11 and 12.

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CHAPTER 4

AUXILIARY EQUIPMENT

25. Radio Beacon

The identification keying provided by the keyer is utilized in the operation of several makes and models of homing and radio beacons and radio range equipments. Figures 7 and 8 show the basic component interconnections for this equipment.

26. References

For further information on typical transmitters often used with this keyer, refer to the publications in the chart which follows:

TM No.	Title	Notes
11–802	Radio Transmitters (Wilcox Electric Types 96–200A and 96–200B, and 96–200C).	Signal Corps Transmitters T–171/FR T–171A/FR, and T–171B/FR.
11–820	Radio Transmitter T–4/FRC, Radio Transmitter T–5/FRC, Power Rectifier PP–1/FRC, Modulator MD–1/FRC, Switch Panel SA–2/FRC, Oscillator O–2/FRC, Amplifier AM–2 FRC.	Used mostly with Transmitter T–5/FRC.

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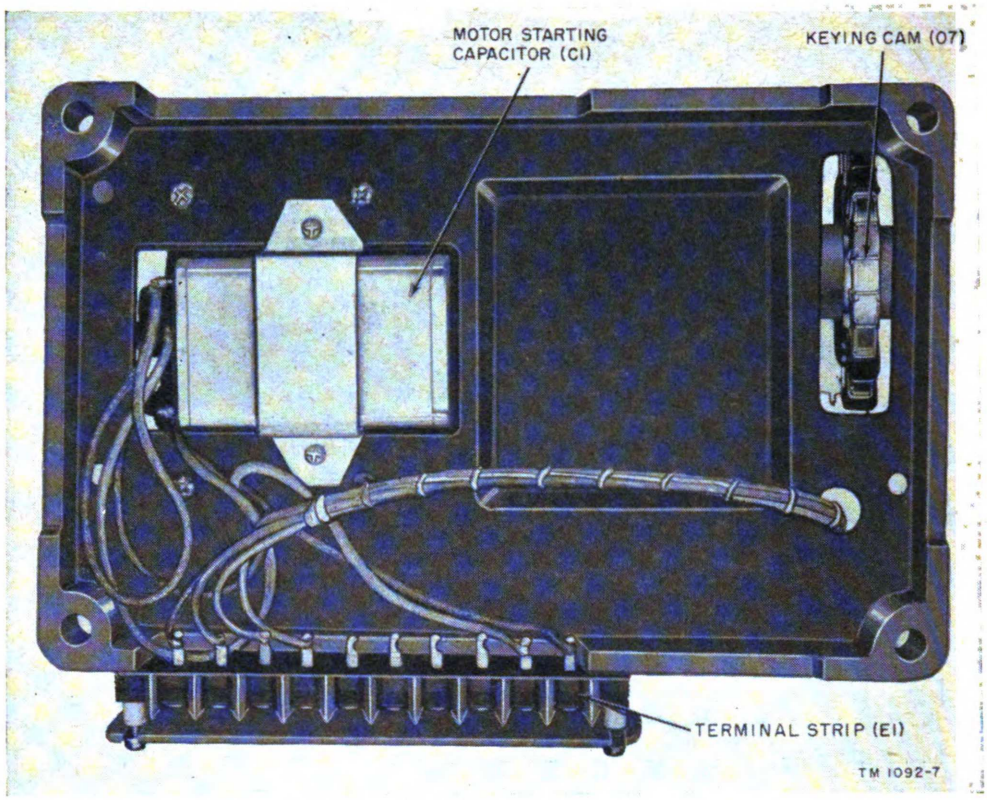


Figure 7. Keyer, bottom view.

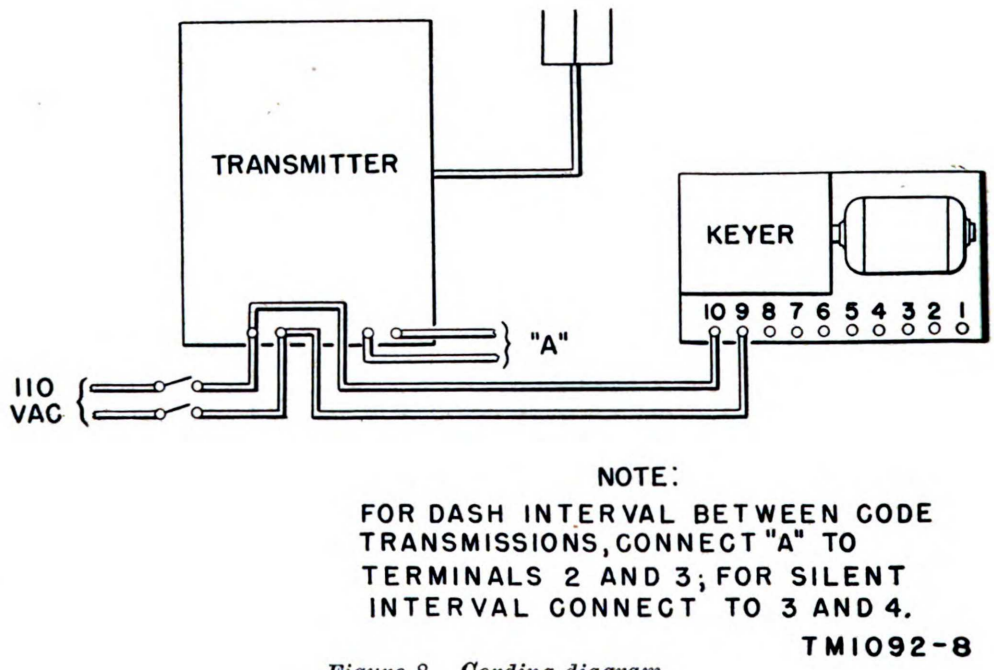


Figure 8. Cording diagram.

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CHAPTER 5

THEORY

27. Condensed Theory of Operation

Keyer KY–77/U is operated by an a-c capacitor motor which receives its power from an external source. The motor shaft, rotating at a speed of 1,400 to 1,700 rpm, drives a timing cam and a keying cam through a gear reduction train. The timing cam rotates at approximately 1 rpm, and the keying cam rotates at approximately 12 rpm (par. 5). As each cam rotates, a cam rider follows the periphery of the cam. As the cam rider passes over the projecting cam surfaces, the cam rider arm is lifted causing the contacts in the sensitive switch to close. Each contact of the keying sensitive switch closes the keying circuit in the radio beacon transmitter. Therefore, as the cam rider passes over each dot or dash staple installed on the keying cam a corresponding signal will be induced in the keying circuit of the radio beacon transmitter. The timing cam provides a means to regulate the time interval between identification transmissions. Through proper adjustment of the equipment, this time interval between transmissions can be either a continuous dash signal or a period of silence. Refer to paragraphs 9 through 12 for instructions on making these adjustments. Read the following paragraphs for details of the functions of each stage.

28. Motor

The motor (fig. 2) is a single-phase capacitor type and is connected to its load through reduction gears. The motor drives a shaft at 1,400 to 1,700 rpm.

29. Gear Train

The gear train is driven from a hardened steel worm mounted on the motor shaft. The gear train is composed of three worm gear assemblies which drive three shafts: the cross shaft, keying shaft, and timing shaft. The cross and timing shafts rotate in self-alining bronze sleeve bearings mounted in adjustable bearing retainer plates. The bronze sleeve bearings at either end of the keying shaft are mounted in housings which are an integral part of the gearbox. The gear train reduces the 1,400 to 1,700 rpm of the motor shaft to approximately 1 rpm at the timing shaft and approximately 12 rpm at

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the keying shaft. Two hubs are mounted on the projecting ends of the timing and keying shafts—one hub per shaft. The timing and keying cams are mounted on these hubs.

30. Cams

Cams are provided to operate the contacts of the sensitive switches by mechanically lifting the cam rider arm. The keying cam is equipped with keying staples (par. 10) to obtain various identification signals. The timing cam is provided to regulate the time interval (either a dash or silence) between identification keying. The rpm ratio between the cams is such that the keying cam will complete one revolution during the time required for the timing cam follower to ride over one 30° timing staple.

31. Sensitive Switch Assemblies

The two sensitive switches are mounted directly above the timing and keying cams. Inasmuch as they both perform their functions in a like manner, a description of one assembly will suffice for both.

a. Mechanical Operation. The sensitive switch assemblies (fig. 11) are activated by staples mounted on the cams. As a staple passes under a sensitive switch assembly, the cam rider is raised against the action of a spring which is a part of the switch assembly. Lifting of the cam rider causes a spring-mounted external mechanical contact to strike another internal mechanical contact which, in turn, moves up and causes an electrical contact closure. As the cam continues to rotate, the cam rider rolls off the cam staple, and the spring pushes the contact arm downward so that the cam rider follows the periphery of the cam. This allows the two mechanical contacts to open and breaks the electrical contact. Each sensitive switch is provided with two adjusting screws (fig. 4). Refer to paragraph 9 for details on adjustment.

b. Electrical Operation.

(1) The electrical connections of the keyer are variable, thus a period of silence can replace the long dash in the interval between identification transmissions (par. 9). When the equipment is adjusted for a dash between transmissions, the power leads are connected to the terminal strips at terminals 2 and 3. A jumper is connected between terminals 4 and 3. The internal wire from terminal 4 is connected to the normally closed contact of the timing sensitive switch. This results in a parallel circuit as shown in the simplified diagram in figure 9. Note that when both the timing contact and the keying contact are open the complete circuit is broken. Since the keying cam revolves approximately 12 times as fast as

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the timing cam, the keying contacts will close while the timing contacts are still open and an identification keying is made. This keying will continue until the timing contact is closed. When the timing contact is closed, a circuit is completed from terminal 3 to terminal 4 through the jumper, r-f (radio-frequency) coil L3, the timing contact, and r-f coil L1, to terminal 2; thus, a constant signal is keyed to the transmitter until the timing contact opens again.

(2) Figure 10 shows the alternate wiring method used to obtain a period of silence between transmissions. This circuit places the normally open contacts of both sensitive switches in series. Both contacts must be closed to obtain a keying signal. With the timing contact closed, a keyed signal is provided by the keying contact closing as its cam rider passes over the keying staples. When the timing cam follower drops down on the periphery of the timing cam, the circuit from terminal 3 to 4 is broken and there is a silent period until the cam rider passes over the next timing staple.

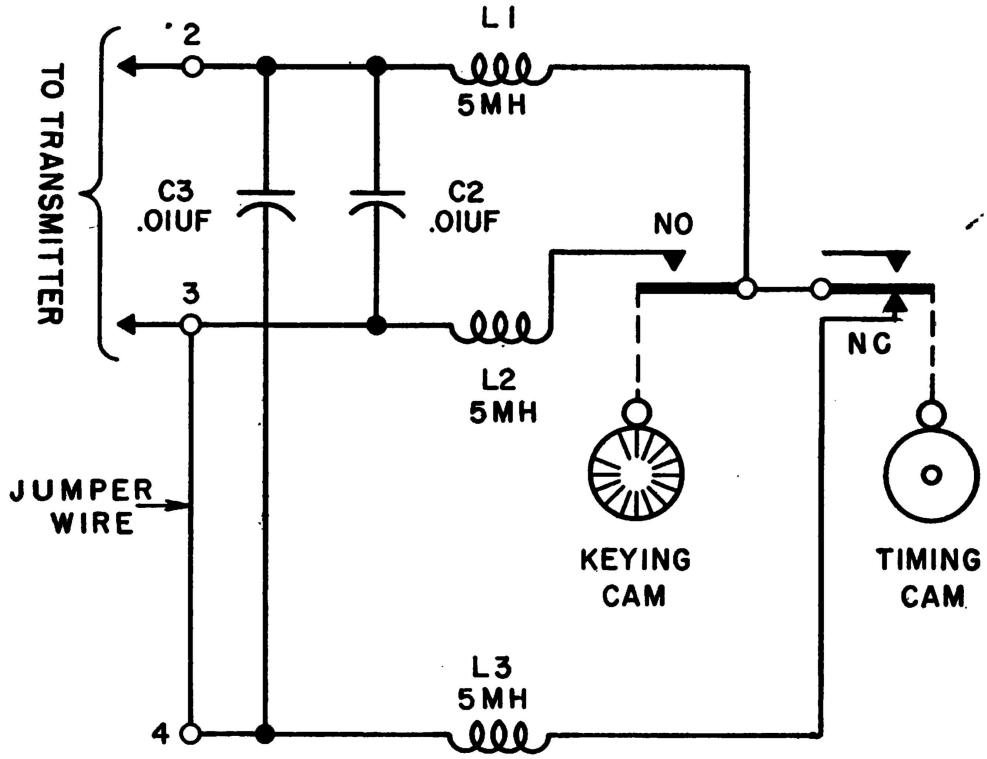


Figure 9. Parallel circuit for dash interval.

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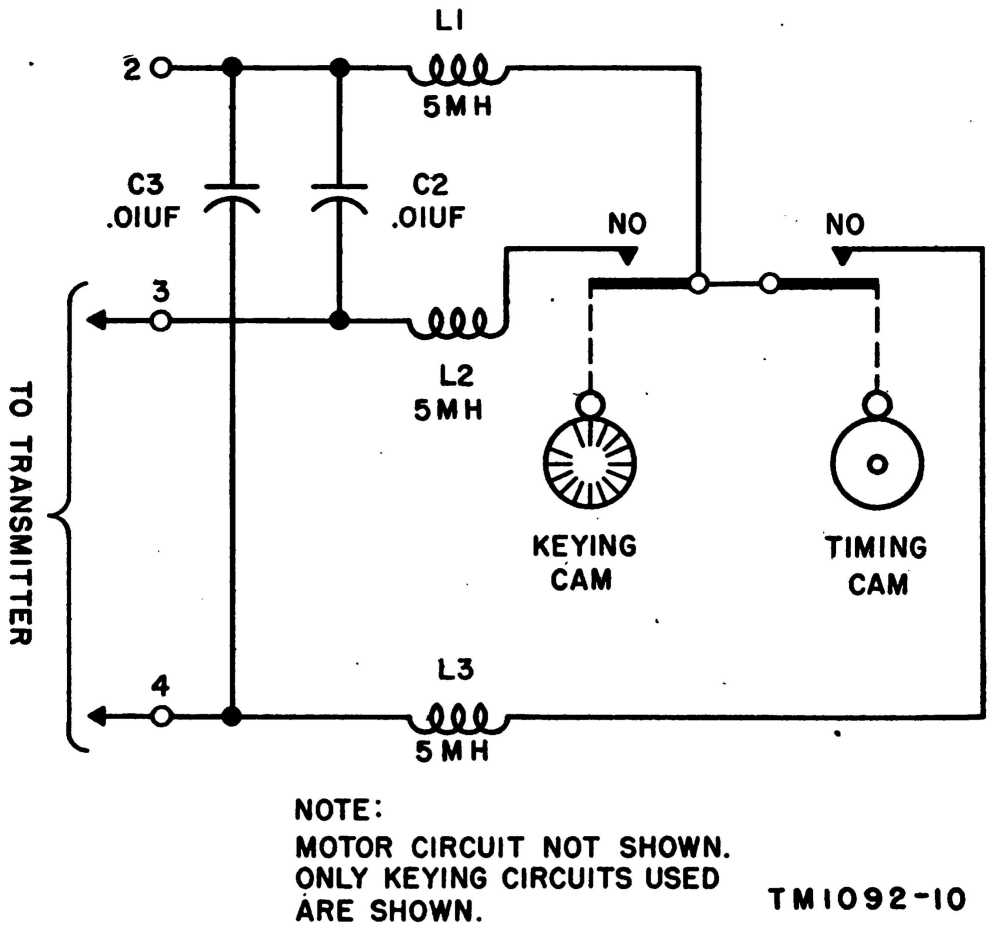


Figure 10. Series circuit for silent interval.

32. Chokes and Capacitors

Three r-f chokes, L1, L2, and L3, and two paper capacitors, C2 and C3, are connected in the keyer circuit (fig. 12) to suppress inductive interference (loud clicks in receivers). Another paper dielectric capacitor, C1, is mounted between two brackets under the motor and is used as an aid in starting the motor.

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CHAPTER 6

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limted only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

33. Scope

The first step in trouble shooting is sectionalizing the fault. Sectionalizing means tracing the fault to the defective component or circuit responsible for abnormal operation of the equipment. The second step is localizing the fault to the defective parts of the defective component. Use the equipment performance checklist in paragraph 24 and the trouble shooting chart in paragraph 36 as references for finding the defective part.

34. Localizing Electrical Troubles

a. Motor Circuit. Failure of the motor to start may be due to a defective power switch, loose or broken connections at the power terminals, a break in the power lines, or a defect in the 2-μf (microfarad) capacitor, C1. Defective wiring, broken leads, broken soldered joints, and loose connections are all trouble sources in the motor circuit. See figure 12 for the wiring schematic of the motor circuit.

b. Keying and Timing Circuits. All keying and timing circuits are wired to the terminal strip, and they are taken by lines from the terminal strip to the external equipment. Trouble in any of these circuits can be isolated easily by tracing each lead from its connection on the under side of the terminal strip to its connection to the corresponding sensitive switch. Failure or interruption of signals from either the timing or the keying circuit can be caused by broken leads, faulty connections, dirty contacts, or a defective r-f choke or capacitor. Most electrical troubles may be located by checking voltage, resistance, and continuity. Refer to the schematic diagram (fig. 12) for guidance in localizing trouble.

35. Localizing Mechanical Troubles

Mechanical troubles that might develop in the keyer usually can be located by making a systematic inspection of each assembly of the

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apparatus. Failure of the motor to start generally indicates a defective motor, a defective capacitor, or open power leads. If rotation of the assembly is not smooth and continuous, the gear trains and shafts may be worn, misalined, or not meshing properly. Poor timing characteristics generally can be attributed to misalinement of the sensitive switch follows with the timing and keying cams. The keying and timing cams should be checked for synchronized operation as explained in paragraph 9.

36. Troubleshooting Chart

The most common trouble conditions that occur in the keyer, together with a listing of the probable causes, are given in the chart below. This list is limited to the troubles common to the equipment which are apt to occur most frequently.

Symptom	Probable cause	Corrective action
1. Transmitter on, but motor does not start.	1. Faulty power connections on terminal strip.	1. Check power leads. Replace terminal strip connections if necessary.
	Defective capacitor C1.	Replace capacitor C1.
2. Faulty operation of motor.	2. Defective wiring in motor circuit.	2. Replace broken or worn wiring. Check all terminal connections for cleanliness and positive contact.
	Defective motor	Replace motor.
3. Interrupted signals	3. Defective power conditions.	3. Check power leads.
	Defective sensitive switch assembly.	Replace sensitive switch.
	Sensitive switches out of adjustment.	Adjust sensitive switch. Refer to paragraph 9.
4. Poor timing characteristics.	4. Misalinement of timing cam on shaft.	4. Aline timing cam as directed in paragraphs 9 and 12.
5. Grease leakage	5. Loose felt washers around shaft.	5. Loosen set screw on cam hubs and push assembly toward gearbox; retighten set screw.
6. Erratic operation	6. Worn or chipped gears.	6. Replace gears.
	Defective bearings	Replace bearings.
7. Excessive arcing at sensitive switch points.	7. Defective .01-μf capacitors or r-f chokes in timing or keying circuits.	7. Replace capacitors or r-f chokes.

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Symptom	Probable cause	Corrective action
8. Increased radio interferences.	8. Defective .01-μf capacitors or r-f chokes in timing or keying circuits.	8. Replace capacitors or r-f chokes.
9. Excessive gear backlash with no braking action of felt washers evident.	9. Lack of friction between cam hubs and felt washers.	9. Loosen set screw on cam hubs and push assembly toward gearbox, retighten set screw.
10. Improper gear mesh.	10. Misalinement	10. Refer to paragraph 48.

Section II. REPAIRS

37. Replacement of Parts

Most of the parts of Keyer KY–77/U are readily accessible and are easily replaced if found to be faulty. However, be careful when servicing and repairing the equipment to prevent further damage to the mechanism and circuit elements. Whenever it is necessary to disconnect a number of leads during the removal of a defective part, tag each lead so that it can be replaced in its proper location. Avoid using more solder than is necessary when making solder connections. Excess solder dropped into the equipment may short-circuit other elements. Never use substitute parts which are not identical in electrical, mechanical, and physical characteristics with the original parts. The exploded view of the keyer (fig. 11) accurately shows the correct disassembly sequence of the equipment. Use it as a supplement to the directions for replacement of parts given in paragraph 38 through 46.

38. Replacement of Motor and Worm

a. Unsolder one motor lead at the paper dielectric capacitor. Unsolder the second lead at both the capacitor and terminal 9 on the terminal strip. Unsolder the third lead at terminal 10.

b. Remove the two screws holding dust cover A4, and lift aside the dust cover.

c. Remove the four screws holding gearbox cover A4, lift the cover aside and remove oil board gasket O22.

d. Remove the four bolts that secure the motor to the frame.

e. Tilt the motor away from worm gear O9 so that the gears disengage, and lift the motor.

f. Remove felt grease retaining washer O15 on the face of the motor.

g. Drive out taper pin H20 securing worm O19 to the motor shaft and remove the worm.

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h. Install the replacement motor and worm by reversing the procedure outlined above.

Note. The procedures given in paragraphs 39, 40, and 41 must be followed in sequence to avoid damage to gears and bearings. For example, if the faulty part is in the keying assembly within the gearbox, follow the disassembly instructions given in paragraphs 39 and 40 before performing the procedures outlined in paragraph 41.

39. Replacement of Cross Shaft and Worm Gears

a. Unscrew knurled nut H22 and remove timing cam O8 to prevent interference.

b. Remove plug buttons H1 and H3 and felt washers O34 and O36 which are on each end of the shaft.

c. Loosen the set screws holding thrust collar H26 and gears O9 and O20 on the shaft.

d. Tap the shaft lightly to remove it. The thrust collars, worm gears, and thrust washer will drop off the shaft as it is removed.

e. Install the replacement assembly by reversing the procedure given above.

40. Replacement of Timing Shaft and Worm Gears

a. Unscrew knurled nut H22 and remove timing cam O8.

b. Loosen set screw H17 and remove hub O13.

c. Remove bronze bushing O23.

d. Remove felt washer O17 beneath the hub. Remove plug button H2 and felt washer O35 which are on the opposite side of the gearbox.

e. Loosen the set screws securing the two thrust collars, H25 and H27, and the worm gear, O11 on the shaft.

f. Make certain that the shaft is free, then tap the shaft lightly to remove it. The worm gear and thrust collars will drop off the shaft as it is removed.

g. Install the replacement assembly by reversing the procedure above.

41. Replacement of Keying Shaft and Worm Gears

a. Unscrew knurled nut H21 and remove keying cam O7.

b. Loosen set screw H16 and remove hub O12 and felt washer O16. Remove spring clip O24 and felt plug O14 which are on the opposite end of the keying shaft.

Note. The felt plug on the opposite end of the keying shaft is secured by a spring retainer clip that is screwed to the gearbox. It will be necessary to remove the motor before removing the spring retainer clip and felt plug.

c. Loosen the set screws securing thrust collar H28 and worm gears O10 and O21.

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d. Make certain that the shaft is free, then tap it lightly to remove it. The thrust collar, worm gears, and thrust washer will drop off the shaft as it is removed.

e. Install the replacement keying shaft and worm gears by reversing the procedure above.

42. Replacement of Bearings

a. Replacement of Self-Adjusting Bearings O1, O2, O3, and O4.

(1) Remove the cross shaft and timing shaft gear assemblies as directed in paragraphs 39 and 40.

(2) Remove the four bolt assemblies holding the adjustable bearing retainer plates to the gearbox.

(3) The bearings will drop out when the plates are detached.

(4) Replace the bearings by reversing the procedure above.

b. Replacement of Fixed Bearings. The two fixed bearings, O5 and O6, are retained by two housings which are an integral part of the gearbox. Follow the directions below for replacement of fixed bearings.

(1) Remove the motor (par. 38).

(2) Remove the gear train assembly as directed in paragraphs 38 to 41.

(3) With the keying shaft assembly removed, tap lightly around the circumference of the bearing from the outside of the gearbox until the bearing drops into the gearbox. This procedure applies for both bearings.

(4) To install replacement bearings, reverse the procedure given above.

Note. To facilitate reinstallation of the entire gear train assembly, following the instructions in the sequence given.

c. Reassembly of Unit After Bearing Replacement.

(1) Install the adjustable bearing retainer plates and bearings (O25, O26, O27, and O28, O1, O2, O3, and O4). Tighten the bolts just enough to hold the bearings in position.

(2) Install the keying shaft and the gear assembly.

(3) Install the cross shaft and the timing shaft gear assemblies.

(4) Adjust and tighten the adjustable bearing retainer plates. For adjustment details refer to paragraph 48*c* (2).

(5) Aline the gears directly over each other and tighten the Allen set screws.

(6) Adjust all thrust collars and tighten the Allen set screws.

(7) Install the felt washers, retainer buttons, spring clip, hubs, and cams.

(8) Install the motor, lubricate the gearbox, and install the oil board gasket and the gearbox cover.

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43. Replacement of Terminal Lug

a. Lay the keyer on its side, and unsolder the lead from the defective terminal.

b. Loosen the screws holding the terminal strip cover in place.

c. Lift the terminal strip cover, unscrew the defective terminal lug, and lift it out.

d. Install the replacement terminal lug, using the original screw.

e. Solder the lead to the terminal lug, using a rosin or alcohol flux. *Do not use an acid flux.*

44. Replacement of Capacitor C1

a. Turn the equipment on its side and remove the brackets, H4, that hold the capacitor in place.

b. Unsolder the leads from capacitor C1 (fig. 11); note their positions so that they may be replaced correctly.

c. Solder the leads to the replacement capacitor, using rosin or alcohol flux. *Do not use an acid flux.*

d. Replace the capacitor in the brackets and screw the brackets to the frame, using the original screws.

45. Replacement of R-f Chokes L1, L2, and L3 and Capacitors C2 and C3

a. Unsolder the leads from the defective r-f choke or capacitor (fig. 11); note their positions so that they may be replaced correctly.

b. Solder the leads of the replacement part to the proper terminals; use rosin or alcohol flux. *Do not use an acid flux.*

46. Replacement of Sensitive Switches S1 and S2

a. Remove the cam beneath the faulty switch.

b. Detach the leads from the switch (fig. 2); note their positions so that they may be replaced correctly.

c. Remove the two screws holding the switch to the adjusting plate, and remove the switch.

d. Install the replacement switch by reversing the procedure given above.

e. Adjust the timing gap (par. 9).

47. Refinishing

Badly marred metal panels and chassis assemblies will require refinishing. Refinishing instructions are contained in TM 9–2851.

48. Apparatus Adjustments

a. GENERAL. The following adjustments, if properly made, will insure trouble-free operation of the keyer. For adjustment of the

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sensitive switches, refer to paragraph 9. For adjustment of keying and timing, refer to paragraphs 11 and 12.

b. Motor Shaft Worm to Worm Gear Adjustment. Adjust worm 019 so that it is directly centered over worm gear 09. Use shim washers beneath the motor mounting feet to obtain the correct mesh between the motor shaft worm and the worm gear.

c. Cross Shaft and Timing Shaft Assembly Adjustment.

(1) Loosen the bolts securing adjustable bearing retainer plates 025, 026, 027, and 028.

(2) Adjust the positions of the cross shaft and timing shaft so that correct mesh is obtained between the worms and worm gears of the timing, keying, and cross shaft assemblies. Tighten the bolts securing the adjustable bearing retainer plates.

(3) Adjust the thrust collars so that the gears and shafts will retain their correct position.

(4) Make sure that all opposing gears are directly centered on each other and properly meshed; then tighten all set screws.

Section III. FINAL TESTING

49. Operational Test

Place the keyer in normal operation as described in the equipment performance checklist (par. 24). Perform the steps and determine whether the keyer is functioning normally. If the equipment shows signs of malfunctioning, see paragraphs 33 through 35 for trouble shooting procedures.

50. Test Equipment

The test equipment described below can be used to trace electrical trouble to a specific part after the operational tests and checks have revealed the general location of the trouble.

a. Test Set TS–26/TSM. This test set is a voltohmmeter for line testing. For specific information regarding its operation and use, refer to TM 11–2017. The test set can be used with the keyer to measure voltage and resistance in the electrical circuits. Also, it can be used in making line tests to detect grounds, crosses, shorts, and opens.

b. Test Set TS–27/TSM. This test set provides a means for testing and locating faults in wire communications lines. It may be used for direct measurement of conductor and insulation resistance and for location of grounds, crosses, and shorts. Also, it may be used to measure capacitance and to locate opens in wire lines. Refer to TM 11–2057 for specific information regarding its operation and use.

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CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

51. Disassembly

The procedure for disassembly of the keyer prior to repacking for shipment or limited storage is simple. The keyer is disconnected from its associated radio beacon transmitter by the removal of the interconnecting wires at the keyer terminal strip. There are no loose parts or items associated with the operation of the keyer, which must be packed separately.

52. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends upon the material available and the conditions under which the equipment is to be shipped or stored. For repacking, refer to paragraph 8. Reverse the instructions given to repack the equipment.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the cardboard box. Protect the boxes with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected box in a padded wooden case, providing at least 2 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATÉRIEL TO PREVENT ENEMY USE

53. General

When ordered to do so by your commander, demolish this equipment in order to prevent the enemy from using or salvaging it. However, act only upon orders from your commander. Proceed as indicated in paragraph 54.

54. Methods of Destruction

a. Smash the coils, switches, and capacitors using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut cords and wiring using axes, handaxes, or machetes.

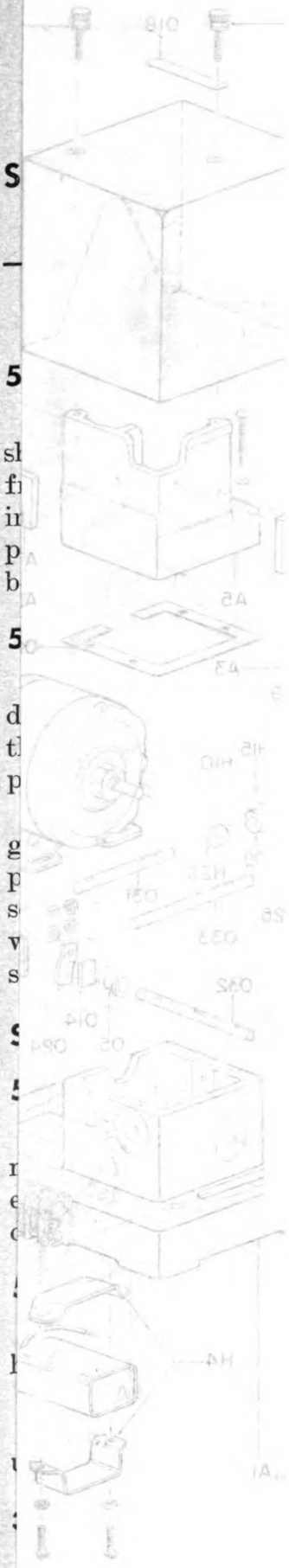
c. Burn cords, capacitors, coils, wiring, and technical manuals using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

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d. Bend or break the dust cover, gearbox, and chassis.

e. If explosives are necessary, use firearms, grenades, or TNT.

f. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy everything.

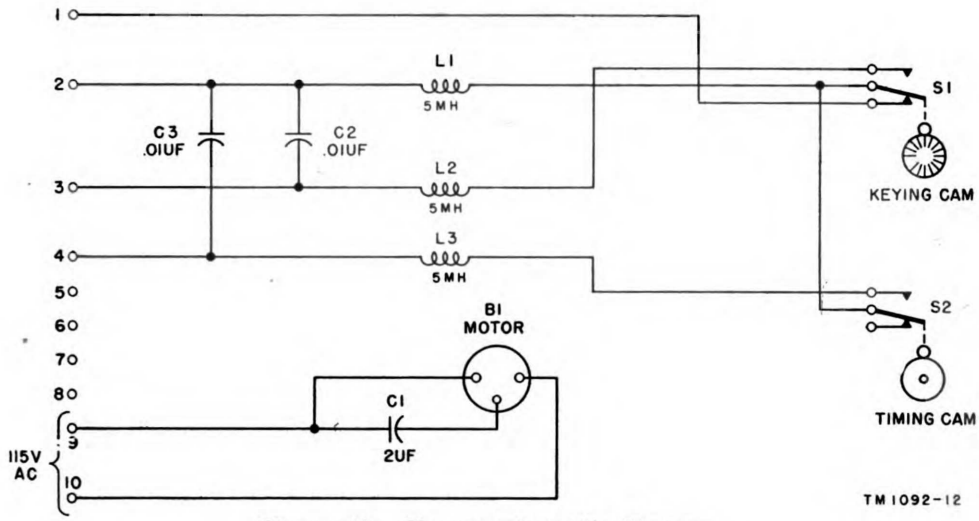


Figure 12. Keyer, schematic diagram.

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APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalogs.

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1. Army Regulations

AR 750–5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7 & 8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11–2017	Test Set TS–26/TSM.
TM 11–2057	Test Set TS–27/TSM.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Units I–176, I–176–A, and I–176–B.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Decontamination

TM 3–220	Decontamination.

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7. Demolition

FM 5–25	Explosives and Demolitions.

8. Other Publications

SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5/ AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), and AF–MC–U2 (Air Force)).
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TM 11–453	Shop Work.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.

9. Abbreviations

a-c	alternating-current
C	centigrade
F	Fahrenheit
r-f	radio-frequency
rpm	revolutions per minute
μf	microfarad

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APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8 KY–77/U. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

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2. Identification Table of Parts for Keyer KY–77/U

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	KEYER KY–77/U: cast aluminum base; 95/130 v, 50/60 cyc motor; microswitches 50 ma at 125 v; 9″ lg x 6⅝″ wd x 7″ h; 4 mtg holes ¼″ dia; 5¼″ and 8¼″ between ctr; precise and adj timing; Aerocom #AK–3B.	Code identification of radio beacon or aerophare.	4A1175
A1	BASE: c/o aluminum casting for motor mount and lower half of gear case; cast aluminum; rectangular shape w/box riser for gear case; approx 10″ lg x 6½″ wd x 4″ h o/a; Aerocom #A–1460.	Main frame, motor base, and gear case	4A30
A2, A3	BRACKET: steel, cad pl; U shaped piece w/pivoted arm; 2 holes, .166″ dia on 1″ ctr; roller bearing special; Micro Sw #AD5721R; Aerocom #A–2307.	Hold cam actuating roller	4Z2755–1
A4	COVER: aluminum sheet; 2 holes 3/16″ dia on 3¾″ mtg/c; Aerocom #A–1450.	Keeps dust off keying mechanism	4A444–2
A5	COVER: cast aluminum; 4 mtg holes, .166″ dia on ⅜″ x 1 1/16″ ctr; Aerocom #A–1452.	Gear case cover and microswitch mount	4A444–1
A6, A7	PLATE, adjusting: aluminum; 2 slotted holes 7/32″ wd x ⅝″ lg on 1⅞″ mtg/c; w/2 tapped holes #6–32 thd on 1″ mtg/c; Aerocom #A–1461.	A6: To provide adjustment for keying microswitch setting. A7: To provide adjustment for timing microswitch setting.	4A1780
B1	MOTOR, AC: capacitor-start ind type; 95/130 v, 50/60 cyc, single ph, .24 amp, 80% pf; 1/100 hp, 1700 rpm clockwise rotation looking at load end; closed frame; dustproof; worm gear pinned direct to shaft; 3 flux lead term protruding from end bell; fixed mtg base; sealed ball bearings; Rob & Myers frame #K81; Aerocom #A–6003.	Main motor drive for keying and timing cams.	3H3000A01–59

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Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C1	CAPACITOR, fixed: paper; single sect; 2 μf ±10%; 330 v AC; Dubilier #KG–3020; Aerocom #A–930.	For starting single phase motor	3DB2–267
C2, C3	CAPACITOR, fixed; paper; single sect; 10,000 μμf ±2000 μμf; 600 vdcw; Dubilier #3WLS or Sangamo "J"; Aerocom #A–926.	Used in suppressor circuit to absorb contact clicks.	3DA10–548
E1	BOARD, terminal: general purpose; 10 brass, nickel pl screw term; 7/16" between term ctr, w/barriers; 4 mtg holes 7/16" between ctr x 4 13/16"; Jones HB catalog #10–141Y.	For power and circuit connections	3Z770–10.6
E2	SUPPRESSOR, electrical noise; capacitor and choke comb; 300 ma, 250 v; Aercom #A–2934.	To suppress and prevent keying contact noise clicks.	3Z1891–79
H1, H2, H3	BUTTON, plug: brass, cad pl; Aerocom #A–1459	Prevent grease leakage from bearing holes in gear case.	2B155.1
H4	CLAMP: aluminum; designed to clamp matl. from 3/4" to 1" thk; Aerocom #A–1466.	Holds motor-starting capacitor on base	2Z2642.371
H5	STAPLE: special, used on timing cam Aerocom #A–505; brass sheet, nickel pl; Aerocom #A–502.	To provide timing signal	4A2415
H6	WRENCH, Allen: alloy steel; right angle; for Allen #6 set screws; Aerocom #A–1456.	For tightening Allen set screws	6R57400.5
L1, L2, L3	COIL, RF: soldered wire term; single wnd, 3 pie universal; unshielded; 5 uh, 300 ma, 10 ohms; Natl Co. #R–300; Aerocom #A–9142.	Part of spark suppressor	3C326–300.7
01 thru 04	BEARING, sleeve: bronze; 9/16" OD x .250" ID x 9/16" lg o/a; Aerocom #A–1306.	Self-alining bearings for cross and timing shafts.	4A35–5
05, 06	BEARING, sleeve: bronze; 1/2" OD x .250" ID x 9/16" lg o/a; Aerocom #A–1307.	Bearings for keying shaft	4A35–6
07	CAM: aluminum; cir w/radial milled slots and position pin to provide 45 dot spaces; Aerocom #A–504.	To provide an adjustable dot or dash keying signal.	4A330

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08	CAM: aluminum; cir w/position pin and 8 holes on 1⅛″ rad 4 holes 90 deg apart and 4 holes 30 deg either side of 90 deg holes; Aerocom #A–505.	To provide an adjustable timing interval for keyer.	4A330–1
09	GEAR, worm: driven from motor shaft worm; bronze; right-hand, 32 pitch double thd, 20 deg pressure angle, 30 teeth, .938″ PD; .250″ dia axial shaft hole w/#6–32 thd tapped hole for Allen set screw; Boston Gear #D1127, modified; Aerocom #A–1302.	Drives cross shaft	4A700B
010	GEAR, worm: bronze; right-hand, 32 pitch double thd, 20 deg pressure angle, 20 teeth, .750″ PD; 250″ dia axial shaft hole w/#6–32 thd tapped hole for Allen set screw; Boston Gear #D1126, modified; Aerocom #A–1303.	Drives keying cam shaft from cross shaft worm.	4A700B–1
011	GEAR, worm: bronze; right-hand, 32 pitch double thd 20 deg pressure angle, 24 teeth, .750 PD; .250″ dia axial shaft hole w/#6–32 thd tapped hole for Allen set screw; Aerocom #A–1304.	Drives timing cam shaft	4A700B–2
012	HUB: brass, nickel pl; round w/shoulder flange and screw thd shaft; secure to key shaft by means of set screw #8–32 thd x ½″ lg; Aerocom #A–1400.	For mounting of key cam on key shaft	4A1010
013	HUB, timing cam: brass, nickel pl; round w/shoulder flange and thd shaft; secured to shaft by means of #8–32 thd x ½″ lg set screw; Aerocom #A–1401.	For mounting timing cam on timing shaft	4A1010–1
014	SEAL, grease: felt; held by spring clip; Aerocom #A–1458	Seals hole in gear case against grease leakage	6Z8085–7
015	SEAL, grease: soft felt; round flat; slips over motor bearing housing; Aerocom #A–1353.	Grease seal between motor and gear case	6Z8085–8
016, 017	SEAL, grease: soft felt; round flat; slips over drive shaft; Aerocom #A–1354.	016: Grease retaining and brake between keying hubs and gear case. 017: Grease retaining and brake between timing hub and gear case.	6Z8085–9
018	SHIM: brass, shim stock; Aerocom #A–1453	Used for setting gap adjustment on cam rollers.	4A2299

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Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
019	WORM: steel, hardened; right-hand, 32 pitch double thd, 20 deg pressure angle, .438″ PD; shaft hole 7/32″ dia w/hole at right angle in hub for taper pin; Boston Gear #HDTH, modified; Aerocom #A–1300.	Main worm drive from motor	4Z10800
020, 021	WORM: steel, soft; right-hand, 32 pitch double thd, 20 deg pressure angle, .438″ PD; shaft hole .250″ dia w/#6–32 thd tapped hole for Allen set screw; Boston Gear #DTH; Aerocom #A–1301.	020: Drives keying cams shaft from cross shaft. 021: Drives timing cam shaft from keying cam shaft.	4Z10800–1
022	GASKET: oil board or equivalent; Aerocom #A–1451	Seal between gear case and cover	2Z4868.842
S1, S2	SWITCH, sensitive: form C, break-make; 10 amp, 125, 250, or 460 v AC; shorting type; roller, w/arm and bracket; Micro Sw #BZ–R special; Aerocom #A–2306.	S1: Code keying for identification of beacon transmitter. S2: Short circuits code cam switch for timing identification.	3Z9823–25

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