TM 11-2669

WAR DEPARTMENT TECHNICAL MANUAL

KEYER
KY-7/FRT

WAR DEPARTMENT *29 SEPTEMBER 1945*

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This manual supersedes TM 11-2669, 5 June 1945

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WAR DEPARTMENT,
WASHINGTON 25, D. C., 1945

TM 11-2669, Keyer KY-7/FRT, is published for the information and guidance of all concerned.

[AG 300.7 (Oct. 11, 1945)]

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Refer to FM 21-6 *for explanation of distribution formula.*

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN— When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT — 1. Smash — Tubes, switches, resistors, capacitors, and all relays.

2. Cut — wires and cables.

3. Burn — Technical manuals and debris.

4. Bend — Switches, capacitors, and relays.

5. Bury or scatter — All of the above after breaking.

DESTROY EVERYTHING

WARNING

HIGH VOLTAGE

is used in the operation
of this equipment.

DEATH ON CONTACT

may result if personnel fail
to observe safety precautions.

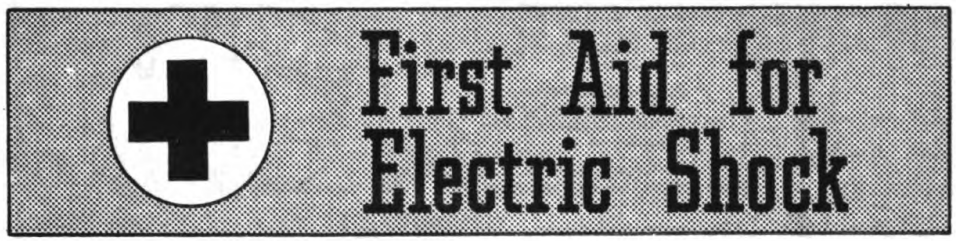
Be sure that high-voltage plate circuits and 115-volt a-c input connections are dead before performing preventive maintenance on this equipment.

High-voltage capacitors in power supplies must be discharged manually before performing preventive maintenance operations.

EXTREMELY DANGEROUS POTENTIALS

exist in the following units:

POWER TRANSFORMERS
TERMINAL STRIPS
FILTER CAPACITORS and CHOKES
RESISTORS
TUBE SOCKET CONTACTS



RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

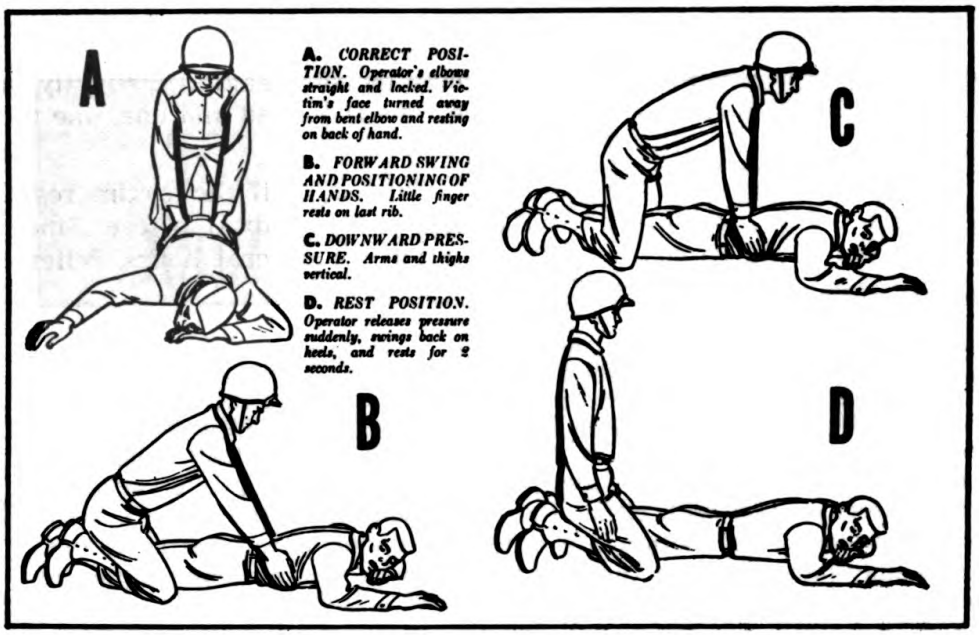
b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately At the same time send for a medical officer, if assistance is available Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open,



with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4 seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence

of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

TL 15338C

This manual supersedes TM 11-6629, 5 June 1945

PART ONE

INTRODUCTION

SECTION I. DESCRIPTION

1. GENERAL.

Keyer KY-7/FRT (fig. 1) is a unit designed to adapt any type of keyed radio transmitting equipment to tone-keying operation. The keyer is intended for use with a 500-ohm keying line. This line feeds a keyed tone into the input transformer of the keyer. The transformer has a center tap for simplex control. A keying tone of approximately 1,000 cycles at an input level between —15 and +10 decibels (6-milliwatt reference level) is required for dependable keying. The keyer provides a keyed negative output voltage of from 0 to 115 volts. It also contains a polarized keying relay which, controlled by the keyed tone input, can be used to key the associated radio transmitting equipment.

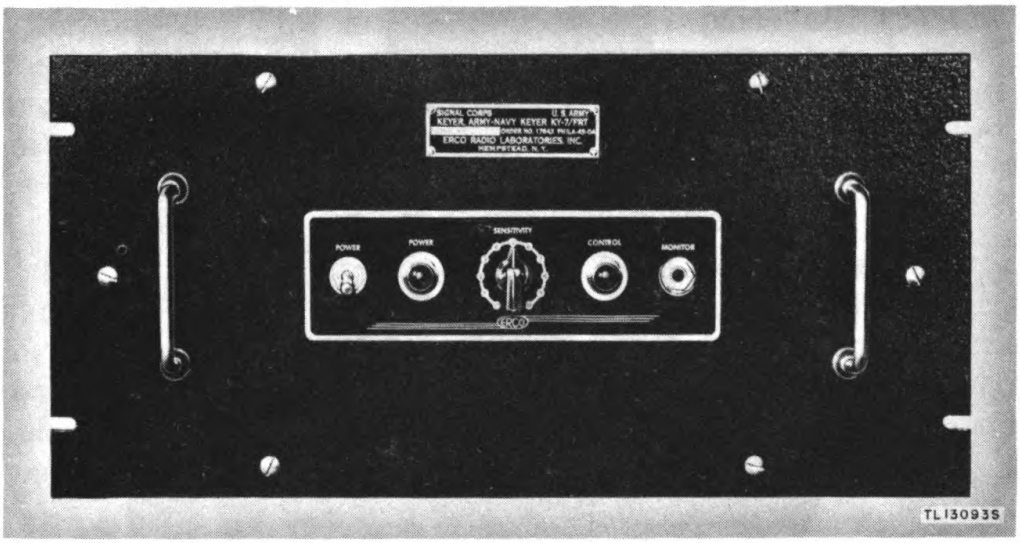


Figure 1. Keyer KY-7/FRT.

2. TECHNICAL CHARACTERISTICS.

Input impedance	500 ohms
Number of tubes	5
Control relay contact rating	3 amp
Available keyed output voltage	0 to 115 volts
Power supply requirements	115- or 230-volt 60-cycle
Primary supply fuse rating	2 amp

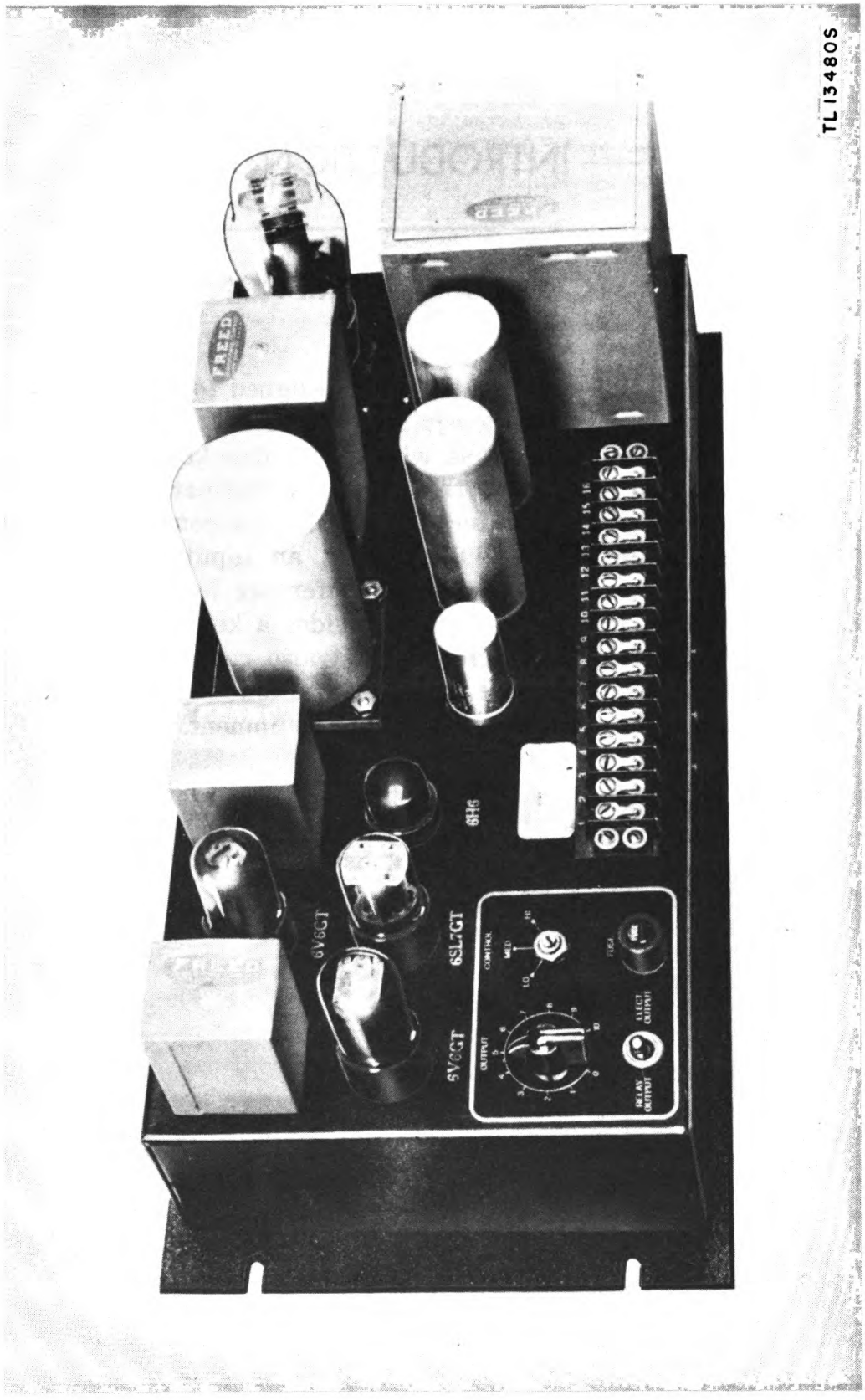


Figure 2. Keyer KY-7/FRT, rear.

3. TABLE OF COMPONENTS.

Component	Required number	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Keyer unit	1	8-3/4	9-13/16	19	0.94	28.3
Polarized relay WE255A	1	5-3/4	2-9/16	2-9/16	0.02	1.5
Tube JAN-6V6GT	2	3-1/4				0.12
Tube JAN-6H6	1	1-3/4				0.12
Tube JAN-6SL7GT	1	3-5/16				0.12
Tube JAN-5U4G	1	5-5/16				0.18
TM 11-2669	2	1/8	8-1/2	5-1/2	0.0034	0.2

NOTE: This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

4. PACKAGING DATA.

NOTE: Items may be packaged in a different manner from that shown, Fig. 3, depending upon supply channels.

Keyer KY-7/FRT and associated spare parts and tubes are packed in a wooden box 25-1/4 inches long, 13-1/2 inches wide, and 13-1/2 inches deep. The set, together with box and packing material, weighs 67 pounds and has a volume of 2.67 cubic feet.

5. DESCRIPTION.

The keyer consists of a chassis, dish-mounted on a front panel. The panel is punched for rack mounting. The main operating controls and pilot-lamp indicators are located on the front panel (fig. 1). The equipment terminal strip, tubes, transformers, polarized keying relay, and adjustment controls are on the outside rear face of the chassis (fig. 2).

SECTION II. INSTALLATION

6. UNPACKING AND CHECKING.

Use particular care when unpacking or handling Keyer KY-7/FRT. Keyer KY-7/FRT with its associated spare parts and tubes is shipped in a wooden box. To unpack, set the box (fig. 3) right side up and clip the steel band. Use a nail puller to remove the top of the box; do not pry it off. Tear open the waterproof

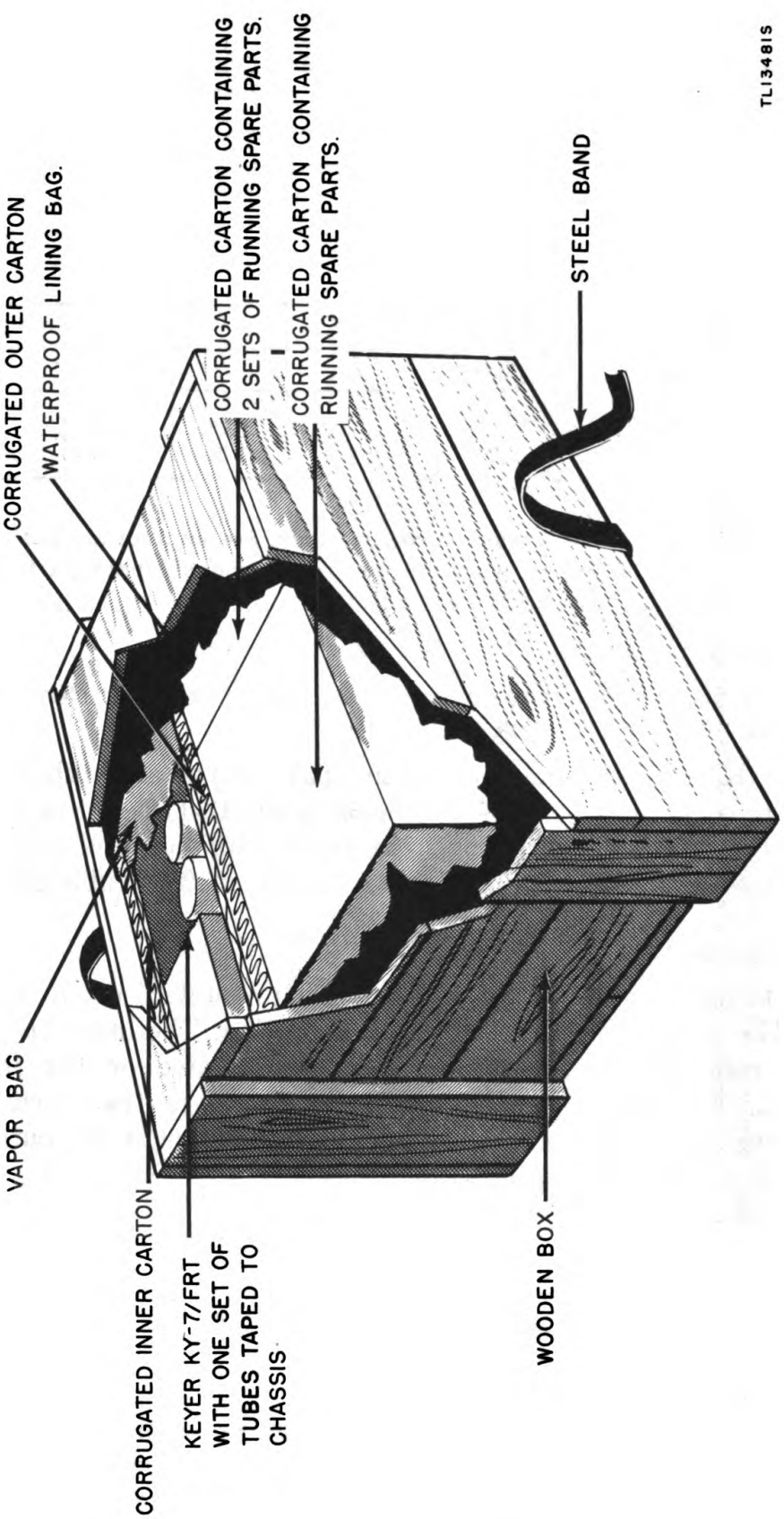


Figure 3. Keyer KY-7/FRT, packaging.

lining bag and lift out the largest of the three corrugated paper cartons. It contains Keyer KY-7/FRT. Tear open the outer corrugated carton and lift out the inner corrugated carton which is wrapped in a vapor bag. After removing the vapor bag, tear open the inner corrugated carton and remove the tube cartons which are taped to the chassis. Remove each tube from its carton. After removing the keyer from its carton, two bags of moisture absorbent (silica-gel) will be found. These may be disposed of. Do not open the two remaining corrugated cartons until necessary. One contains running spare parts; the other contains two sets of running spare tubes. Open these only when parts are needed for replacement. Running spare parts and tubes are packed individually in moisture-sealed bags. Each bag is stamped with name of part that it contains. If it is contemplated that the equipment will have to be removed save the packing material and box for repacking.

7. CONNECTIONS AND INTERCONNECTIONS.

a. Before attempting to put the keyer into operation, be sure to determine the value and frequency of the available alternating current (a-c) supply voltage. The primary of the power transformer is designed for operation at either 115 or 230 volts at 50 to 60 cycles. Change-over selection is accomplished by patching on terminal strip TS2 as shown in figure 4 and the following legend:

Patch wire	115-volt operation	230-volt operation
Brown	Terminal 1	Terminal 2
Orange	Terminal 3	Terminal 2

b. Terminal strip TS1 provides all of the necessary terminals for connecting to the external equipment, telephone line, and a-c power source. Details of these connections are shown in figure 5 and the following legend:

Terminal	Connect to
1, 2	Telephone line, 500-ohm
3	Electronic output voltage, positive
4	Electronic output voltage, negative
5, 6, 7	Keying relay contacts
8 to 13	Control relay contacts
14, 15	115- or 230-volt power source
16	Good ground connection

NOTE: For proper selection of the relay contacts see figure 13.

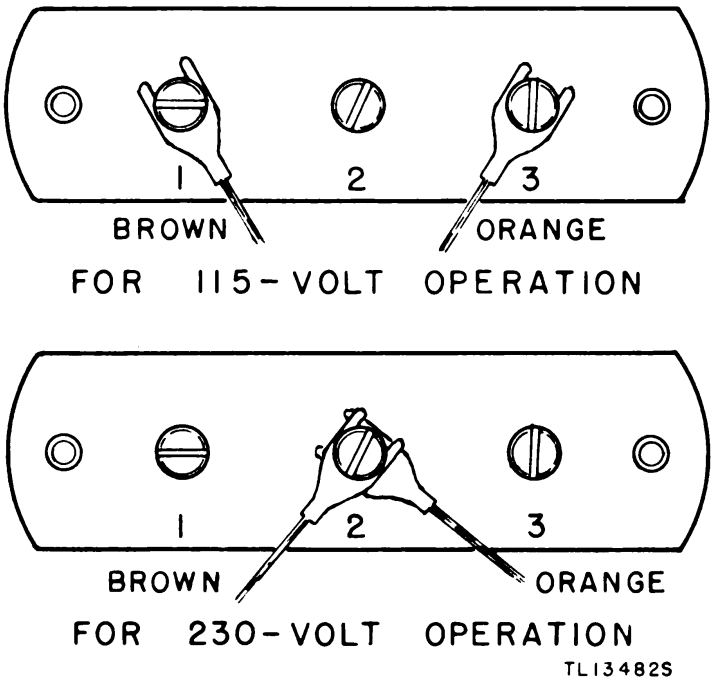


Figure 4. Keyer KY-7/FRT, supply voltage connections on terminal strip TS2.

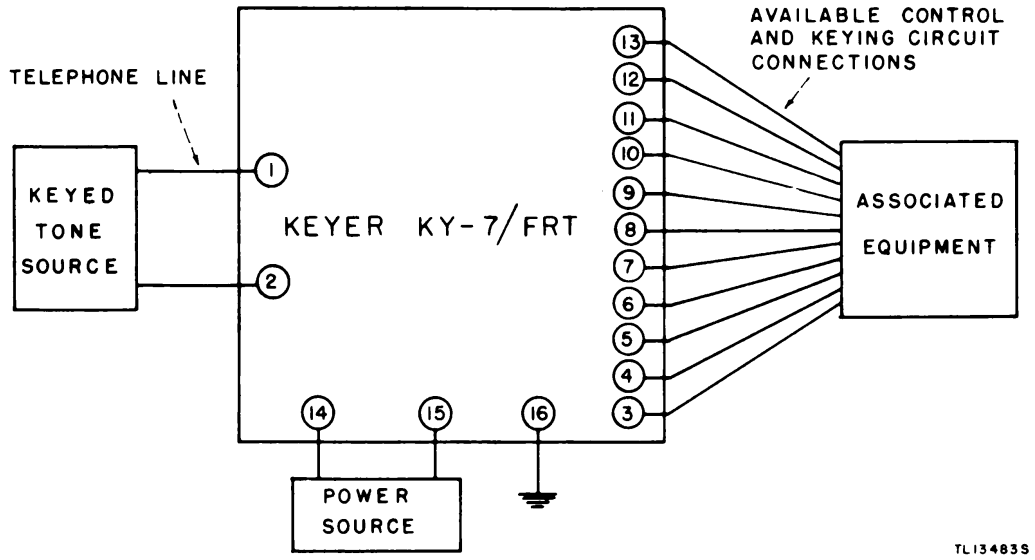


Figure 5. Keyer KY-7/FRT, interconnection diagram.

8. INSTALLATION OF TUBES.

Remove tubes from their packing cases. Make certain that all tubes are in good physical condition. Figure 2 shows the proper location of each tube in the keyer. Tube type numbers are stamped at the side of the tube socket. When inserting the tubes in their respective sockets, align the guide of the tube pin with the slot in the tube socket and push the tube straight down.

PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III. CONTROLS AND THEIR USE

9. FRONT PANEL CONTROLS.

The main operating controls (fig. 6) of Keyer KY-7/FRT are on the front panel. The controls from left to right are:

a. POWER Switch. POWER switch SW2 is a single-pole single-throw toggle switch located in the primary circuit of power transformer T3. It controls plate, filament, and bias voltages of the keyer.

b. POWER Pilot Lamp. POWER pilot lamp PL1 is a red-jewelled panel lamp which serves as a visual indication of the presence of power in the keyer.

c. SENSITIVITY Control. SENSITIVITY control R1 is a 50,000-ohm, 1/2-watt potentiometer in the grid circuit of the audio-frequency (a-f) amplifier. It is used to manually regulate the a-f voltage input.

d. CONTROL Pilot Lamp. CONTROL pilot lamp PL2 is a green-jewelled panel lamp which serves as a visual indication of the operation or excitation of the control relay.

e. MONITOR Jack. The MONITOR jack JK may be used for aural monitoring of the audio tone. It is across the primary of the input transformer.

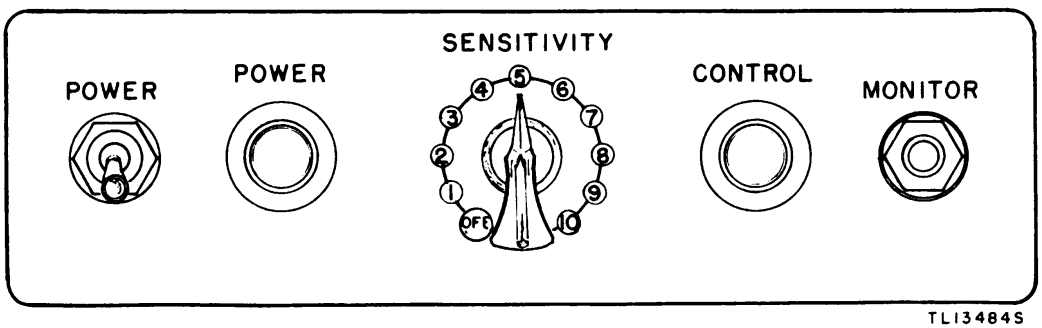


Figure 6. Keyer KY-7/FRT, panel controls.

10. CHASSIS CONTROLS.

Another set of controls (fig. 7) of Keyer KY-7/FRT is located on the rear left corner of the chassis. These controls are used for adjustment of the keyer to a particular set of operating conditions.

a. OUTPUT Voltage Control. OUTPUT voltage control R11 is a 20,000-ohm, 1-watt potentiometer in the plate circuit of the output tube (d-c amplifier). It is used to manually adjust the amount of output voltage during electronic-output operation. It is not used during relay-output operation.

b. CONTROL Voltage Switch. CONTROL voltage switch SW3 is a rotary switch in the control-relay circuit. Three positions of this switch are used to provide LO, MED, and HI voltages for exitation of the control-relay coil. The switch has a slotted shaft designed for screwdriver adjustment and is set to meet any particular set of existing line conditions.

c. RELAY OUTPUT-ELECT. OUTPUT Switch. RELAY OUTPUT-ELECT. OUTPUT switch SW1 is a double-pole single-throw toggle switch which allows for connection of the coils of the keying relay across the plate load of the output tube. This permits selection of either direct output (ELECT. OUTPUT) or output through the keying relay (RELAY OUTPUT).

d. FUSE Holder. The FUSE holder houses a cartridge fuse which is connected in the primary circuit of the power transformer as a protective measure in the event of component failure.

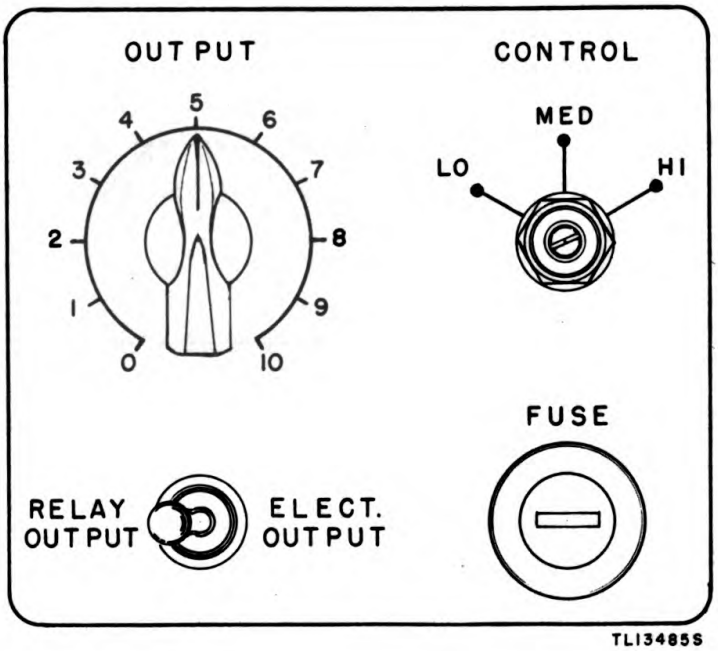


Figure 7. Keyer KY-7/FRT, chassis controls.

SECTION IV. OPERATION

11. STARTING.

To start the keyer, throw the POWER switch on (up). When this is done the POWER pilot lamp should light up.

12. OPERATING ADJUSTMENTS.

a. After all connections have been made to the terminal strip and the POWER switch has been turned on, allow 30 seconds for the tubes to warm up. Apply an approximate 1,000-cycle keyed-tone source to terminals 1 and 2 at a level between —15 and +10 decibels (db). For preliminary adjustment of the SENSITIVITY control R1, throw the RELAY OUTPUT-ELECT. OUTPUT switch to RELAY OUTPUT and advance the SENSITIVITY control until the relay operates reliably. For a more comprehensive method of setting the SENSITIVITY control, connect a d-c voltmeter (1,000 ohms per volt) across the electronic output terminals, negative to terminal 4 and positive to terminal 3. Turn the RELAY OUTPUT-ELECT. OUTPUT switch to ELECT. OUTPUT. With the SENSITIVITY control set at zero and the OUTPUT control advanced to maximum (10), the voltmeter will indicate approximately 115 volts. Advance the SENSITIVITY control slowly while watching the voltmeter. A threshold setting will be reached at which point the meter will drop to zero volts. A good reliable SENSITIVITY control setting is 1/2 to 1 division higher than this threshold point.

b. Adjust the OUTPUT control to vary the negative electronic output voltage to meet the individual requirements of the associated equipment. This voltage is continuously adjustable from 0 to 115 volts.

c. CONTROL switch SW3 must be adjusted to compensate for voltage changes caused by the many variables in the control circuit. The total resistance of the telephone line loop and series ground resistance has a direct effect on the value of the voltage which appears across the coil of control relay RY2. Since the relay coil excitation voltage must use a ground path for its return, the connection at terminal 16 of terminal strip TS1 must be to a good ground. After the keyer has been connected to its remote control location through the telephone line circuits, close the transmitter control switch at the remote location and adjust the CONTROL switch on the keyer for reliable control of relay operation. Use the lowest of the three switch positions, LO, MED, or HI, which will meet these requirements.

NOTE: The contacts of the control relay carry a maximum of 3 amperes of 115-volt, 60-cycle alternating current.

d. The red indicator lamp PL1, on the front panel, lights when power switch SW2 is on, and the green indicator lamp PL2 lights when the control relay is excited.

e. The setting of the RELAY OUTPUT-ELECT. OUTPUT switch and any other operating procedures will depend entirely on the particular associated equipment with which the keyer is used.

f. The panel-mounted MONITOR jack can be used for aural monitoring of the line tone. A 500- to 600-ohm headset equipped with the proper plug will operate in this jack.

13. STOPPING.

Placing the POWER switch in the off position (down) disconnects the power from the equipment and both pilot lamps go out.

SECTION V. EQUIPMENT PERFORMANCE CHECK LIST

14. PURPOSE AND USE OF CHECK LIST.

a. General. The equipment performance check list (par. 15) will help the operator to determine whether Keyer KY-7/FRT is functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures that the operator can take. Item 1 is checked when starting, items 2 to 5 during operation, and item 6 when stopping.

b. Action or Condition. For some items the information given in the action or condition column consists of the settings of various switches and controls under which the item is to be checked. For other items it represents an action that must be taken in order to check the normal indication given in the normal indication column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those

that the operator can make without turning the equipment in for repairs. Reference to part five in the table indicates that the correction of the trouble cannot be effected during operation and that trouble shooting by an experienced repairman is called for. If the keyer is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the keyer is not completely inoperative, the operator must maintain the keyer in operation as long as it is possible to do so.

e. Item 1. Item 1 should be checked each time the keyer is put into operation.

f. Items 2 to 5. Items 2 to 5 represent general operating characteristics of the keyer. The operator must become familiar with these during normal operation. He must use that knowledge as a basis for recognizing changes in audible and visible indications, such as relay clicks, tone, etc., when the keyer is not operating properly.

g. Item 6. Item 6 is checked each time the keyer is taken out of operation. Any abnormal indications at this time are probably caused by trouble in the keyer and should be corrected before the next expected period of operation.

15. EQUIPMENT PERFORMANCE CHECK LIST.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	1	POWER switch	Turn switch on.	POWER pilot lamp and all tube heaters light.	Replace fuse or POWER pilot lamp. Check supply voltage at terminals 14 and 15 on terminal strip TS1.
EQUIPMENT PERFORMANCE	2	Control relay.	Control relay coil excited.	CONTROL pilot lamp lights. Relay is heard.	Replace pilot lamp or refer to part five.
	3	MONITOR jack.	Headset connected and tone source on.	Tone is heard.	Check MONITOR jack contacts and tone source connections.
	4	SENSITIVITY control.	Set to operating position with switch SW1 at RELAY OUTPUT.	Relay is heard.	Increase SENSITIVITY control or refer to part five.
	5	OUTPUT control.	Vary from 0 to 10 with SENSITIVITY control at 0 and switch SW1 at ELECT. OUTPUT.	Output voltage at terminals 3 and 4 varies from 0 to 115 volts.	Refer to part five.
STOP	6	POWER switch.	Turn switch off.	Pilot lamps and tube heaters go out.	

PART THREE

MAINTENANCE INSTRUCTIONS

SECTION VI. PREVENTIVE MAINTENANCE TECHNIQUES

16. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish preventive maintenance from trouble shooting, and repair. The prime function of preventive maintenance is to *prevent break-downs* and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. A system of radio communication depends on the performance of every set. It must be *ready* to go on the air when it is needed, and it *must* operate efficiently. Therefore, it is vitally important that radio operators and repairmen maintain their radio sets properly.

NOTE: The operations in sections VI and VII are first and second echelon (organization operators and repairmen) maintenance. Some operations in section IX are higher echelon maintenance.

17. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. General. Most of the electrical parts used in Keyer KY-7/FRT require routine preventive maintenance. This preventive maintenance varies. Some parts require a different kind of maintenance than others. Some require more, some less. Hit-or-miss techniques cannot be applied. Definite and specific instructions must be followed. This section of the manual contains these specific instructions to guide personnel assigned to perform the six basic maintenance operations: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F — Feel.
I — Inspect.
T — Tighten.
C — Clean.
A — Adjust.
L — Lubricate.*

* The Lubricate operation does not apply to Keyer KY-7/FRT.

The first two operations show if the other four are needed. Selection of operations is based on a knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-downs when it is needed most.

b. Feel. The feel operation is used most often to determine whether transformers, large capacitors, and bushings are overheated and whether electrical connections carrying more than 5 amperes are overheated. The maintenance man *must* become familiar with the normal operating temperatures of the various electrical parts to recognize signs of overheating.

NOTE: It is important to perform the feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. Inspect. Inspection is the most important operation in preventive maintenance. A careless observer will overlook the evidences of minor trouble. Although these defects may not at the moment interfere with the performance of the equipment, invaluable time and effort can be saved if they are corrected *before* they lead to major and costly break-downs. To be able to recognize the signs of a defective set, make every effort to become thoroughly familiar with indications of *normal* functioning. Inspection consists of *carefully* observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all recesses in the units for accumulation of dust, especially between connecting terminals and binding posts. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity areas, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. Tighten, Clean, and Adjust. These operations explain themselves. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

> **CAUTION: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.**

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section IX for details of moistureproofing and fungiproofing.

18. VACUUM TUBES.

> **NOTE:** Do not work on tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

a. Inspect (I).

(1) Inspect glass and metal tube envelopes for accumulation of dirt and for corrosion.

(2) Inspect the firmness of tubes in their sockets. Press the tubes down in the sockets and test them in that position, *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of a tube tends to weaken the pins in the base and unnecessarily spread the contacts in the socket. Inspect the tube sockets at the time the tubes are removed.

(3) Be careful when removing a tube from its socket. Never jar a warm tube.

b. Tighten (T). If the connections to the tube sockets are dirty or corroded, clean them before tightening.

c. Clean (C).

(1) Clean the tubes when inspection shows cleaning to be necessary. Tubes operating at low voltages and not having exposed grid and plate caps do not require frequent cleaning. However, do not permit dirt to accumulate.

(2) Remove dust and dirt from the glass or metal envelopes with a clean, lint-free, dry cloth.

(3) When tube sockets are cleaned and the contacts are accessible, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

19. RESISTORS.

a. General. Various types of resistors are used in Keyer KY-7/FRT. The connections to the various resistors are either of the pigtail or solder-lug type.

b. Inspect (I). Inspect the coating of the vitreous-enameled resistors for signs of cracks and chipping, especially at the ends.

Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

c. Clean (C).

(1) Clean all carbon resistors with a small brush.

(2) Vitreous-enameled resistors will ordinarily be wiped with a dry cloth. However, if the dirt deposit is unusually hard to remove, use Solvent, Dry-cleaning.

(3) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Trouble-shooting procedures are described in part five.

NOTE: When fungiproofed resistors are heated, a harmless brown stain may appear.

20. CAPACITORS.

a. Inspect (I).

(1) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape. See that the terminals of the capacitors are not cracked or broken.

(2) Thoroughly inspect the case of each large fixed capacitor for leaks, bulges, and discoloration.

b. Tighten (T). Carefully tighten loose terminals, mountings, and connections on the capacitors when necessary.

c. Clean (C). Clean the cases of fixed capacitors, the insulated bushings, and all connections that are dirty or corroded. Use a dry cloth. If the deposit of dirt is hard to remove, moisten the cloth in dry-cleaning solvent (SD).

21. TERMINAL STRIPS.

a. Inspect (I).

(1) Inspect the terminal strips for cracks, breakage, dirt, loose connections, and loose mounting screws.

(2) Carefully examine the connections for mechanical defects, dirt, and corrosion.

b. Tighten (T). Tighten loose screws, lugs, and mounting bolts. When tightening screws, be sure to select a screwdriver of correct size. Do not exert too much pressure. Tighten loose connections.

c. Clean (C). Clean terminal strips when they require it, with a dry brush. When necessary, use a cloth moistened with dry-cleaning solvent (SD). Thoroughly wipe the terminal strip with a cloth and then brush it to remove lint.

22. RELAYS.

Relays are considered normal if the exterior is free from dirt or dust; the contacts are not burned, pitted, or corroded; the contacts are lined up and correctly spaced; the moving parts travel freely and function in a satisfactory manner; the connections to the relay are tight; the wire insulation is not frayed or torn; the relay assembly is securely mounted; and the field coil shows no signs of overheating.

CAUTION: No maintenance is to be performed inside the container of relay RY1. Because of the critical adjustments of this relay, it must not be tampered with.

a. Inspect (I).

(1) Inspect the relay for defects. Examine the contacts with the aid of a flashlight and mirror.

(2) Check the mechanical action of the relays to make certain that when the moving and stationary contacts come together they make positive contact and are directly in line with each other.

b. Tighten (T). Tighten all loose connections and mounting screws, but do not apply enough force to damage the screws or to break the parts they hold.

c. Clean (C).

(1) Relay Exterior. Brush the exterior of the relay with a soft brush. If it is very dirty, clean it with a brush dipped in dry-cleaning solvent (SD). If connections are dirty or corroded, remove the leads and clean them. Replace carefully.

(2) Relay Contacts. Clean the contacts by drawing a strip of thin clean cloth or paper between them while holding them together. In some cases, it may be necessary to moisten the cloth with dry-cleaning solvent (SD). Use a dry cloth or paper strip for polishing. Clean corroded, burned, or pitted contacts with a point file or burnishing tool and crocus cloth.

d. Polar Relays. Polar relays such as relay RY1 in Keyer KY-7/FRT require special maintenance techniques.

(1) Relay Mounting. Inspect the entire relay for dirt, dust,

oil, grease, or fungus growth. Clean with a small paint brush or a clean, lintless cloth. Retighten any loose screws or bolts on the mountings.

(2) Contacts. Thoroughly inspect the contacts and contact springs for alignment, spacing, straightness, and state of cleanliness. Cleaning and adjusting of contacts and springs is the same as for telephone type relays.

(3) Armature. The armature must not bind on its bearings or stick to the pole pieces. On polar relays the armature must be adjusted so that it is equidistant from each of the pole pieces. Adjust the armature or the pole pieces, depending on the type of polar relay in question. *These adjustments should be performed only by authorized personnel.*

(4) Electrical Wires and Connections. Inspect all terminals or connections for looseness or breaks. Tighten or repair when needed. Check all wiring for broken or frayed insulation and, when necessary, repair or replace it. If any of the wiring is dirty or if fungus growth is present, clean with brush or cloth.

(5) Coil. The coil or coils must be tight in their mountings. If they are loose, retighten them but be careful not to damage the coil or mounting by applying too much pressure to the mounting screws. Examine the wiring of the coil to determine whether any wires are broken or frayed.

23. JACKS.

Jacks require very little attention, and then only at infrequent intervals. Occasionally it will be necessary to tighten the mounting nut, clean the contacts, or increase the spring tension. Remove dirt with a brush and carbon tetrachloride; remove corrosion with a piece of crocus cloth followed by a clean cloth. Increase spring tension when necessary. Try the action of the jack after each adjustment. Be sure to keep all soldered connections intact.

24. POTENTIOMETERS.

a. Inspect (l).

(1) Inspect the mechanical condition of potentiometers. The arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing which supports it.

(2) Inspect the assembly and mounting screws, setscrews, and nuts.

(3) Examine the insulating body of potentiometers for dust, dirt, cracks, and chipped places.

(4) Examine all metallic parts for dust, dirt, and corrosion.

b. Tighten (T). Tighten loose assembly or mounting screws and nuts.

c. Clean (C).

(1) Clean exposed contact surfaces and connections of potentiometers when they are dirty or corroded.

(2) Remove grease and dirt from potentiometer parts with carbon tetrachloride.

(3) If contact surfaces are corroded, clean them with crocus cloth.

(4) Clean contact surface of the arm by inserting a strip of crocus cloth between the arm and the resistance element and drawing the cloth back and forth.

(5) Clean the body of potentiometers with a brush or cloth.

25. SWITCHES.

a. Inspect (I). Inspect the mechanical action of each switch and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually; in others, the action of the switch is checked by flipping the control knob or toggle, and noting the freedom of movement and amount of spring tension. The wiping action of switch contacts usually removes any dirt at the point of contact. Inspect tightness of mounting.

b. Tighten (T). Tighten any loose mounting bolts and any loose connections to switch terminals after cleaning.

c. Clean (C). Clean the exterior surfaces of switches with a stiff brush moistened with dry-cleaning solvent (SD).

26. TRANSFORMERS AND CHOKES.

a. Feel (F). Feel transformers and chokes for indications of overload.

b. Inspect (I). Inspect transformers and chokes for general cleanliness. Examine for tightness of connections, terminals, and mountings. Inspect transformers and chokes for signs of overheating indicated by the presence of insulating compound on the under side of the cases.

c. Tighten (T). Tighten all loose mounting screws or connections. Do not disturb the placement of the wires. If it is necessary to remove wires to tighten mounting screws, tag the wires before unsoldering so that they can be restored to their original positions. Clean terminals before tightening.

d. Clean (C). Clean the cases of transformers and chokes with a dry cloth. In some instances it may be necessary to use dry-cleaning solvent (SD) to remove foreign matter. Corroded contacts or connections can be sandpapered and wiped clean.

27. PILOT LAMPS.

Pilot lamps are used to indicate when power has been applied to a circuit. They are easily removed and replaced.

a. Inspect (I). Inspect the pilot-lamp assemblies for loose lamps, loose mounting screws, and loose, dirty, or corroded connections.

b. Tighten (T).

(1) Tighten loose mounting screws and resolder any loose connections. If the connections are dirty or corroded, clean them before soldering.

(2) Screw loose lamps tightly into their sockets.

c. Clean (C). Keep pilot jewels and connections clean.

SECTION VII. ITEMIZED PREVENTIVE MAINTENANCE

28. INTRODUCTION.

For ease and efficiency of performance, preventive maintenance on Keyer KY-7/FRT will be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the keyer at the specified time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section VI. These general instructions are not repeated in this section. When performing preventive maintenance, refer to section VI if more information is required for the following items. Perform all work with the power removed from the equipment. After preventive maintenance has been performed on a given day, put the equipment into operation and check it for satisfactory performance. (See paragraph 15, Equipment Performance Check List.)

29. PREVENTIVE MAINTENANCE TOOLS AND MATERIALS.

The following preventive maintenance tools and materials will be needed:

Common hand tools.

Clean cloth.

#0000 sandpaper.
Crocus cloth.
Fine file or relay burnishing tool.
Polish, Metal, Paste (Signal Corps stock No. 6G1516).
Dry-cleaning solvent (SD).
Contact burnishing tool.

NOTE: Gasoline will not be used as a cleaning fluid for any purpose. Dry-cleaning solvent (SD) is available as a cleaning fluid through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

30. ITEM 1, FRONT PANEL (fig. 8).

OPERATIONS.

ITC	Jack.
ITC	Potentiometer.
ITC	Switch.
IC	Pilot lamps.

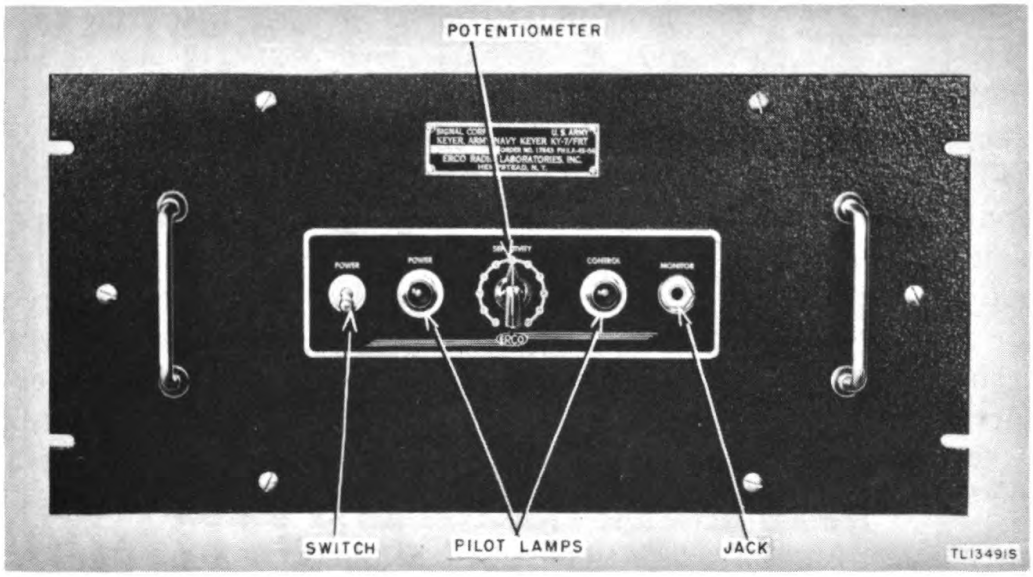


Figure 8. Keyer KY-7/FRT, panel, maintenance.

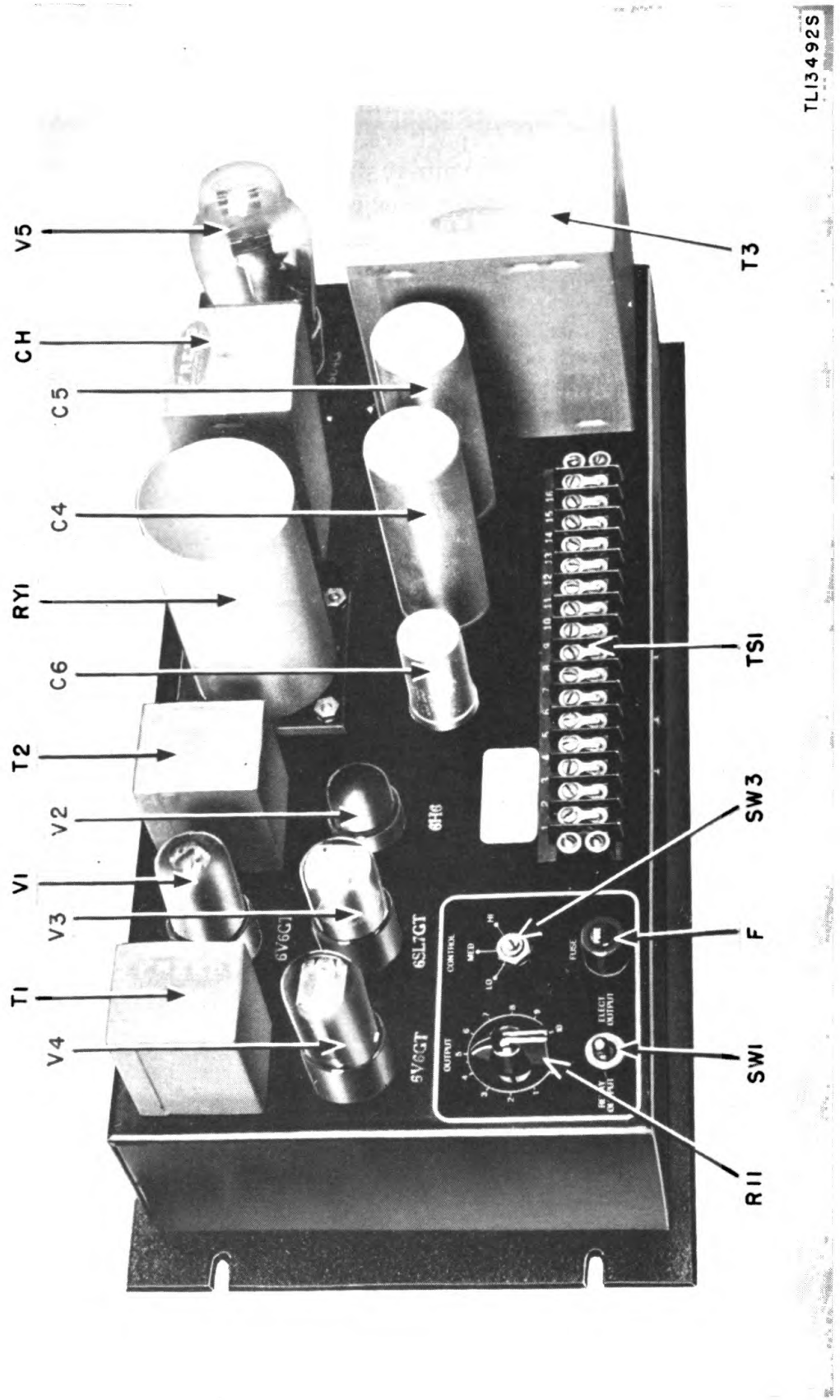


Figure 9. Keyer KY-7/FRT, outside chassis, maintenance.

31. ITEM 2, OUTSIDE CHASSIS (fig. 9).

OPERATIONS.

IC	Vacuum tubes.
IC	Capacitors.
ITC	Terminal strip.
ITC	Relay (see caution, par. 22).
ITC	Potentiometer.
ITC	Switches.
FIC	Transformers and chokes.

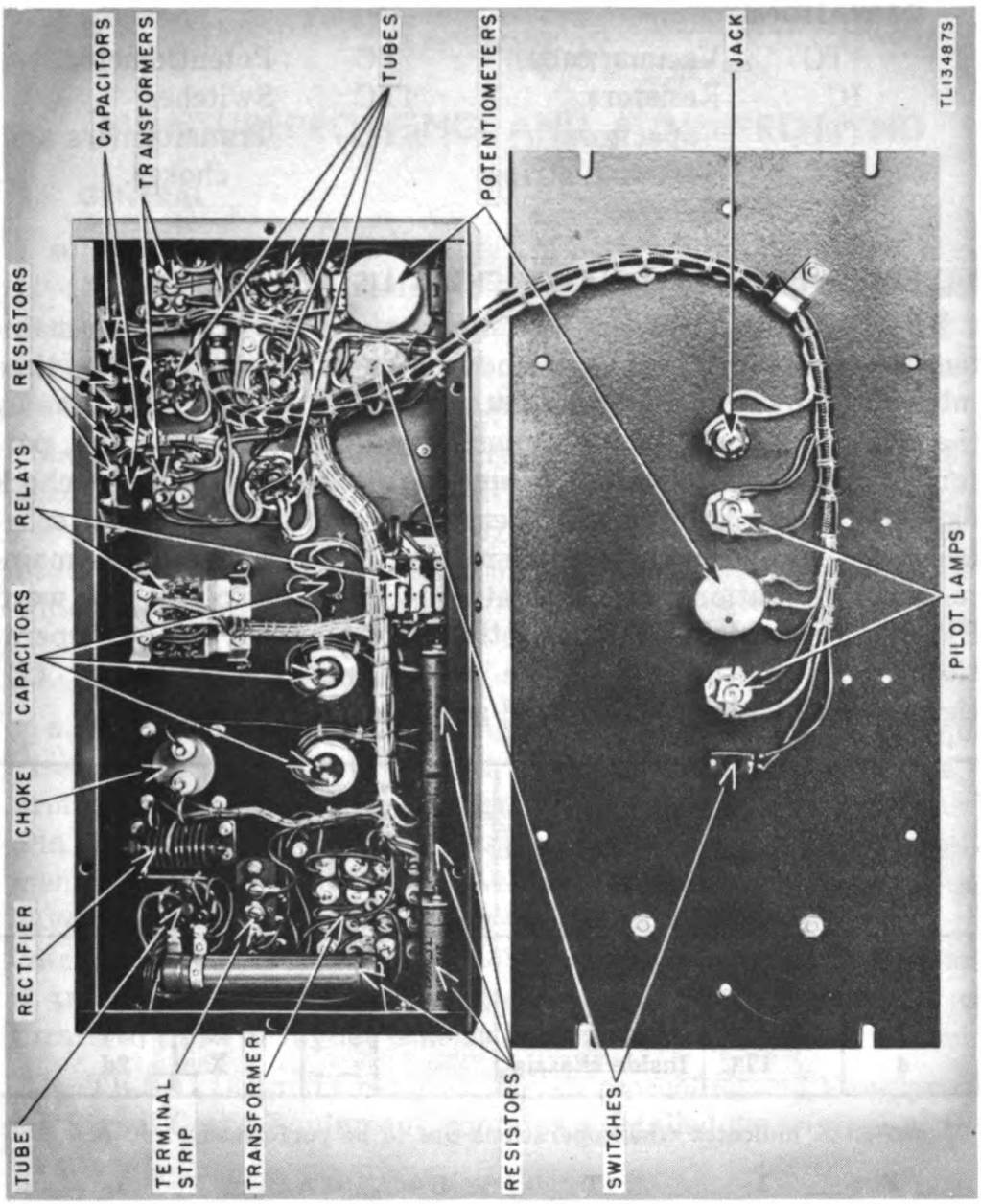


Figure 10. Keyer KY-7/FRT, inside chassis and panel, maintenance.

32. ITEM 3, REAR OF PANEL (fig. 10).

PRELIMINARY STEPS. Remove the six binding-head screws which fasten the chassis to the front panel and carefully fold back the panel to avoid damage to the panel cable.

OPERATIONS.

ITCA	Jack.	ITC	Switch.
ITC	Potentiometer.	ITC	Pilot lamps.

33. ITEM 4, INSIDE CHASSIS (fig. 10).

OPERATIONS.

ITC	Vacuum tubes.	ITC	Potentiometer.
IC	Resistors.	ITC	Switches.
ITC	Capacitors.	ITC	Transformers and chokes.
ITC	Terminal strips.		
ITC	Relays.		

34. PREVENTIVE MAINTENANCE CHECK LIST.

The following check list is a summary of the preventive maintenance operations to be performed on Kayer KY-7/FRT. The time intervals shows on the check list may be reduced at any time by the local commander. For best performance of the equipment, perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the "Operations" column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

Item No.	Operations	Item	When performed			Echelon
			Daily	Weekly	Monthly	
1	ITC	Front panel	X			1st
2	FITC	Outside chassis		X		1st
3	ITCA	Rear of panel			X	2d
4	ITC	Inside chassis			X	2d

NOTE: X indicates when operations are to be performed.

F	I	T	C	A	L
Feel	Inspect	Tighten	Clean	Adjust	Lubricate*

* The Lubricate operation does not apply to Keyer KY-7/FRT.

SECTION VIII. LUBRICATION

35. LUBRICATION.

No lubrication is required for Keyer KY-7/FRT.

SECTION IX.

MOISTUREPROOFING AND FUNGIPROOFING

36. GENERAL.

a. When equipment is operated in highly humid climates, excessive failure of parts and decreased operating efficiency are usually caused by the accumulated effects of moisture, rather than by inferior parts. Rapid temperature changes accompanied by fog, rain, dew, or high humidity promote such failures.

b. The effects of moisture on resistors, capacitors, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, flash-overs, and crosstalk. Moisture also accelerates fungus growth which increases these effects.

37. REDUCING FAILURES.

a. A moisureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture- and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface. Equipments which have been treated have been marked with the letters MFP and the date of treatment. Equipments not marked should be examined, and if treatment has not been applied, the equipment should be returned to third or higher echelon maintenance units for treatment.

b. TB SIG 13 (and Changes), Moistureproofing and Fungiproofing Signal Corps Equipment, contains a detailed description of this treatment.

c. Re-treatment may be required after a period of use. Need for this re-treatment is indicated by excessive failures or by the effects listed in paragraph 36.

38. TREATING KEYER KY-7/FRT.

To treat Keyer KY-7/FRT, use the procedure outlined in TB SIG 13 (and Changes) together with the following information. Refer to paragraph 51 of this manual for disassembly information.

a. Polar type relays should *not* be treated with moistureproofing and fungiproofing lacquer or varnish. Volatile (organic) fumes given off by moistureproofing and fungiproofing lacquers and other materials will cause erosion and cratering of the armature contact. When treating equipment containing polar type relays with a moistureproofing and fungiproofing lacquer or varnish, remove relays from the equipments and do not replace them until lacquer or varnish has thoroughly dried.

b. However, volatile fumes given off by the lacquer will be present in equipments for considerable time following the lacquer treatment, and excessive contact erosion may result. This difficulty can be prevented by installing gas-absorber units inside each polar relay. Prevent needless exposure of the relay to the heavy vapor concentrations present in equipments during the moistureproofing and fungiproofing treatment. When polar relays are removed from equipment before application of fungiproofing lacquer, install or replace the gas-absorber units in each relay. Equipments which have been treated in accordance with early moistureproofing and fungiproofing field instructions should be inspected for lacquer coating inside the polar relay covers. Thoroughly remove this coating and allow the covers to dry before replacing. Gas-absorber assemblies (Signal Corps stock No. 6Z60) should be ordered from depot stocks. Further information on tropical treatment of polar relays can be found in TB SIG 172, Gas Absorber Units for Polar Relays (Western Electric 255-A, D-164816, D-163119-A, and D-168651).

39. TREATING EQUIPMENT AFTER REPAIRS.

If the coating of protective varnish has been punctured or broken during repair and if complete treatment is not needed to reseal the equipment, brush-coat the affected part. Be sure the break is completely sealed.

PART FOUR

AUXILIARY EQUIPMENT

NOT USED

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, an Army Air Forces Form No. 54 (Unsatisfactory Report).

SECTION X. THEORY OF EQUIPMENT

40. BLOCK DIAGRAM OF KEYER KY-7/FRT.

a. The primary of the line input transformer is designed for use with a 500-ohm telephone pair and has a center tap for simplex control of the associated equipment. A keying tone of 1,000 cycles at a line level of —15 to +10 decibels is required for reliable keying.

b. The keyed audio tone is amplified in the a-f amplifier (fig. 11) and then rectified in the a-f rectifier to produce d-c pulses having the same time constants as the input tone signals consisting of marks and spaces. These pulses are then peak-leveled in the clipper-trigger tube and operate the d-c amplifier tube which provides output directly or through a polarized keying relay.

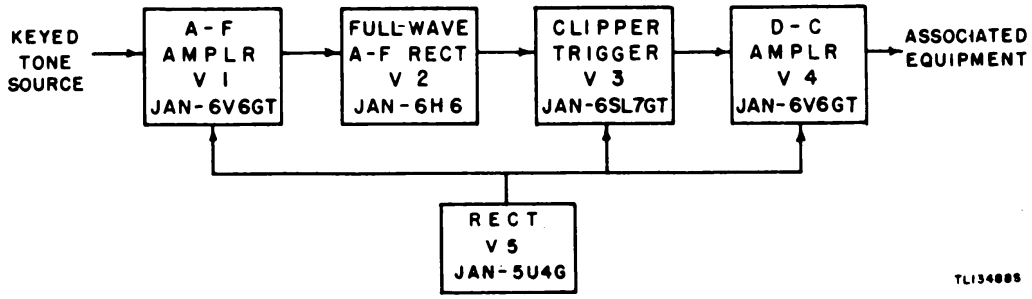


Figure 11. Keyer KY-7/FRT, block diagram.

41. CONTROL RELAY CIRCUIT.

The circuit in figure 12 shows a typical application of the control relay circuit and relay power source to a telephone line. Rotary

switch SW3 selects the amount of a-c voltage to be rectified and applied as a d-c control voltage for relay RY2 coil excitation. The relay operates reliably through 6 miles or less of No. 19 gauge cable with a total ground resistance of 100 ohms or less. The line-side winding of the coupling transformers is center tapped to permit an equal distribution of the d-c component in each side of the line. Under these conditions of line balance, the a-c tone component remains undistorted. The return path for the d-c control voltage is through the ground or earth.

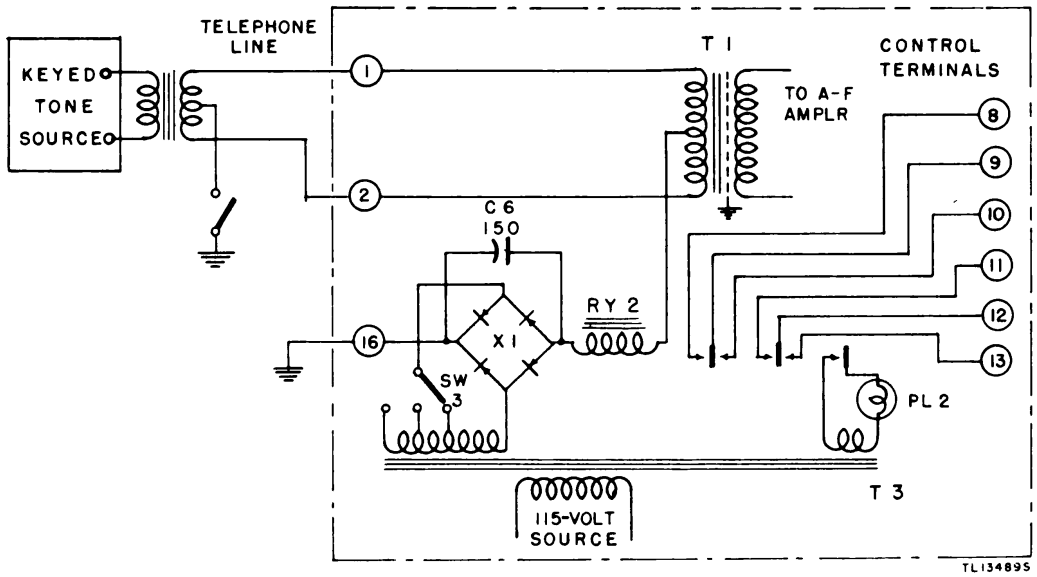


Figure 12. Keyer KY-7/FRT, typical control circuit diagram.

42. A-F AMPLIFIER.

Input transformer T1 is designed for coupling a center tapped balanced 500-ohm telephone line into the grid of the a-f amplifier tube V1 (JAN-6Y6GT). SENSITIVITY control R1 is used to attenuate high level tone inputs, thus preventing serious grid overdrive. Cathode resistor R2 provides the necessary grid bias for class A operation. Screen-dropping resistor R3, together with bypass capacitor C2, makes up the screen decoupling network. The primary winding of transformer T2 and capacitor C1 act as plate load for the audio frequency amplifier. Capacitor C1 acts as a bypass to attenuate all audio frequencies above approximately 1,000 cycles. Resistor R4 is a plate- and screen-dropping resistor used to reduce the applied d-c voltage to this stage.

43. FULL-WAVE A-F RECTIFIER.

Transformer T2 has a step-down ratio and couples the keyed audio tone to the full-wave a-f rectifier V2 (JAN-6H6) for conversion into d-c pulses. Load resistor R5 and filter capacitor C3

are across the output of this rectifier tube and provide sufficient filtering without introducing a serious time constant.

44. CLIPPER TRIGGER.

Voltage divider resistors R6 and R7 supply correct grid and plate voltages to the clipper-trigger tube V3 (JAN-6SL7GT). With no applied input tone as on SPACE, this tube has sufficient negative grid bias to prevent plate current flow and no voltage drop appears across its plate load resistor R9. On MARK, the rectified voltage developed across resistor R5 is of a positive sign thus overcoming the normal fixed negative bias. This permits the tube to draw plate current through resistor R9.

45. D-C AMPLIFIER.

a. Resistor R9 is also the grid resistor for the d-c amplifier tube V4 (JAN-6V6GT). Resistors R6, R7, R9, and R10 supply the correct fixed grid, screen and plate voltages to the tube. Any voltage drop across resistor R9 will appear as grid voltage. This grid voltage variation is of such value that it will completely cut off plate current flow on MARK and permit normal plate current flow on SPACE. An adjustable potentiometer R11, the OUTPUT control, together with resistor R10 forms the d-c amplifier plate load. Adjustment of resistor R11 allows the selection of any SPACE or output voltage from 0 to 115 volts with the positive side at ground. This electronic output voltage is available at terminals 3 and 4 when switch SW1 is the ELECT. OUTPUT position.

b. When switch SW1 is in the RELAY OUTPUT position, the control winding of relay RY1 shunts plate load resistors R11 and R10 causing the greatest portion of the tube plate current to flow through this winding. In addition to this operation, the second pole of switch SW1 applies voltage to the bias winding of the relay. Adjustment of the relay bias voltage is obtained from the power supply bleeder resistors R12 and R13. The field of the bias winding holds the armature of the keying relay to one side during MARK. As current flows through the control winding of the keying relay during SPACE, the field of the bias winding is overcome and the keying relay armature swings to the other side. This action provides alternately closed circuits between terminals 5 and 6 and terminals 6 and 7 for polarized keying of the associated equipment.

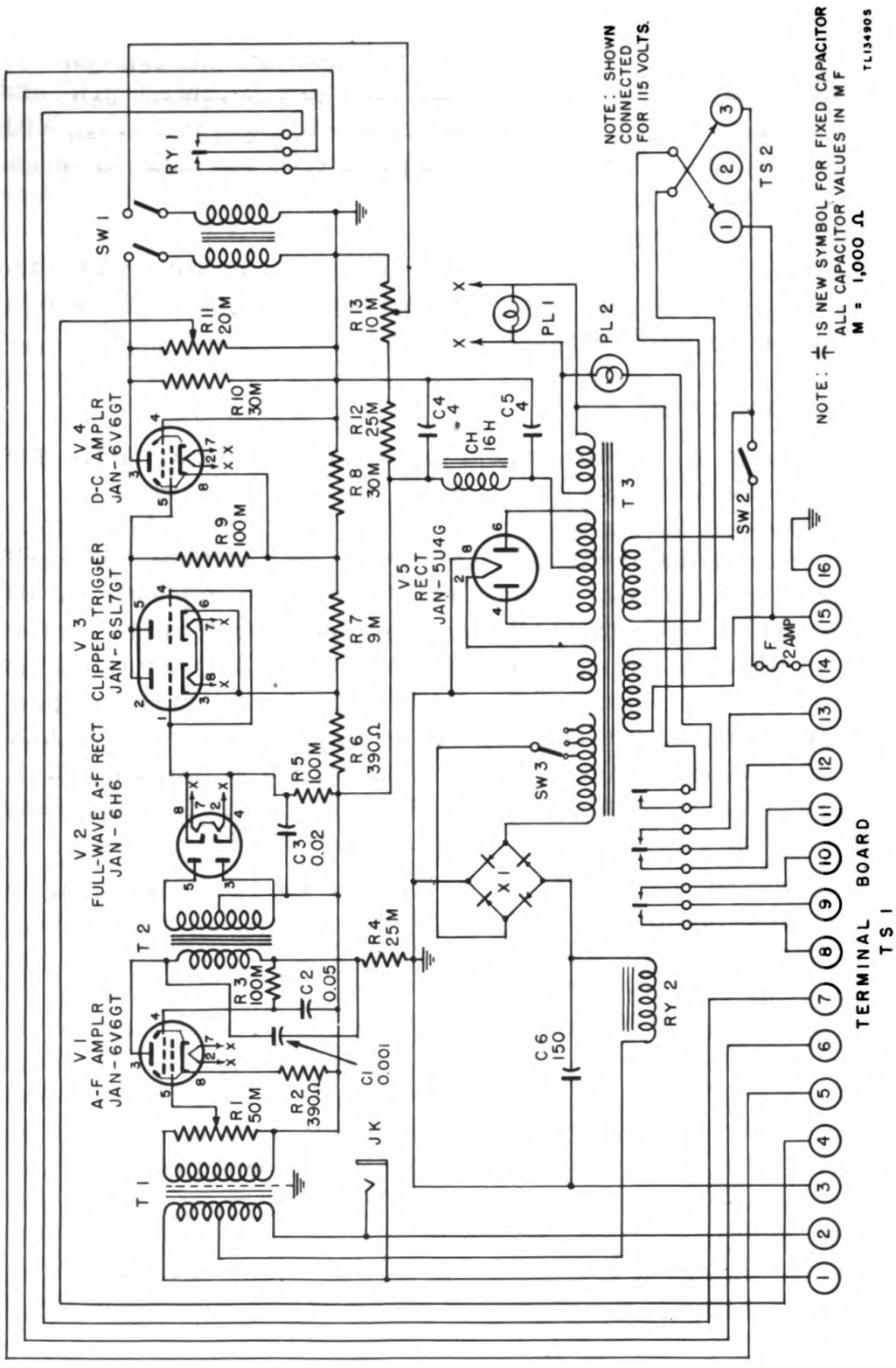


Figure 13. Keyer KY-7/FRT, schematic diagram.

46. RECTIFIER.

CAUTION: Keyer KY-7/FRT utilizes a power supply in which the positive lead (B+) is grounded to the chassis. This causes the plate and screen circuits to be at relatively low voltages with respect to ground. However, the grid and cathode voltages are at a high potential with respect to ground. A severe shock will result if the chassis and a cathode or a grid circuit are touched simultaneously.

a. Transformer T3, which supplies all necessary voltages for the entire keyer, is energized by either a 110- to 115-volt or a 220- to 230-volt, 60-cycle a-c power source. The transformer has two primary windings which are connected in parallel for 110- to 115-volt operation and are connected in series for 220- to 230-volt operation. Primary connections are made on terminal strip TS2 (par. 7a).

b. Tube JAN-5U4G (V5) is connected as a full-wave rectifier. The filament lead (B+) is directly grounded to the chassis, and the power transformer plate winding center tap (B—) is connected to the filter system. The filter comprises capacitors C4 and C5 and choke CH. The negative return is connected to the grid and cathode resistors of the tubes in the keyer just as in a conventional power supply. The B+ lead, which is grounded, is connected in the plate and screen grid circuits of the tubes in the keyer. The tube elements, therefore, receive proper voltages with proper polarity, just as in a conventional circuit. Capacitors C4 and C5 charge to the peak of the rectified pulse from tube V5 and discharge into choke

Legend for figure 13

Resistance wattage rating
R1 —1/2 w
R2 — 1 w
R3 — 1 w
R4 — 25 w
R5 — 1 w
R6 — 1 w
R7 — 25 w
R8 — 1 w
R9 — 1 w
R10 — 1 w
R11 — 1 w
R12 — 25 w
R13 — 50 w

Capacitor voltage rating
C1 — 500 v
C2 — 600 v
C3 — 600 v
C4 — 600 v
C5 — 600 v
C6 — 50 v

Choke current rating
CH — 60ma

CH when the peak has passed. Choke CH further resists changes in the current. The result is a smooth d-c output with little a-c ripple. Resistors R12 and R13 act as a bleeder resistor and voltage divider for the output voltage.

c. CONTROL pilot lamp PL2 and POWER pilot lamp PL1 are both connected across the heater winding of transformer T3. Pilot lamp PL1 lights as soon as POWER switch SW2 is turned on; pilot lamp PL2 lights only when the control relay is excited.

d. D-c voltage for the operation of control relay RY2 is obtained by use of a bridge-type selenium rectifier X1 and filter capacitor C6. Switch SW3 selects the amount of a-c voltage applied to the selenium rectifier.

SECTION XI. TROUBLE SHOOTING

47. GENERAL TROUBLE-SHOOTING INFORMATION.

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in the important duty of trouble shooting.

a. Trouble-shooting Data. Take advantage of the material supplied in this manual to help in the rapid location of faults. Consult the following trouble-shooting data:

(1) Block diagram of Keyer KY-7/FRT (fig. 11).

(2) Complete schematic diagram (fig. 13).

(3) Voltage and resistance data for all socket connections (fig. 14).

(4) Illustrations of components. Front, back, and inside views which aid in locating and identifying parts (figs. 15 and 16).

b. Trouble-shooting Steps. The first step in servicing a defective keyer is to sectionalize the fault. Sectionalizing means tracing the fault to the component or *circuit* responsible for the abnormal operation of the keyer. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, fuses, etc., can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

c. Sectionalization. Careful observation of the performance of the keyer, while turning it on and off, often sectionalizes the fault.

d. Voltage Measurements. Voltage measurements are an almost indispensable aid, for most troubles either *result* from abnormal voltages or *produce* abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

(1) The voltages listed on the voltage chart (fig. 14) are measured between the indicated points and B negative (the red wire on line input transformer T1).

(2) Always begin by setting the voltmeter on the *highest* range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

(3) When checking cathode voltage, remember that a high-voltage reading will be obtained if the cathode resistor is actually open, unless the internal resistance of the meter is approximately equal to the resistance of the cathode resistor. The resistance of most Signal Corps voltmeters is many times the value of the cathode resistance. If the resistance of the voltmeter acts as a cathode resistor, a normal reading will be obtained, although the cathode resistor is open. A sure method is to make a resistance check with a cold circuit to determine whether the cathode resistance is normal.

e. Precautions Against High Voltage. Certain precautions must be followed when measuring voltage above a few hundred volts. High voltages are dangerous and can be fatal. When it is necessary to measure high voltages, observe the following rules:

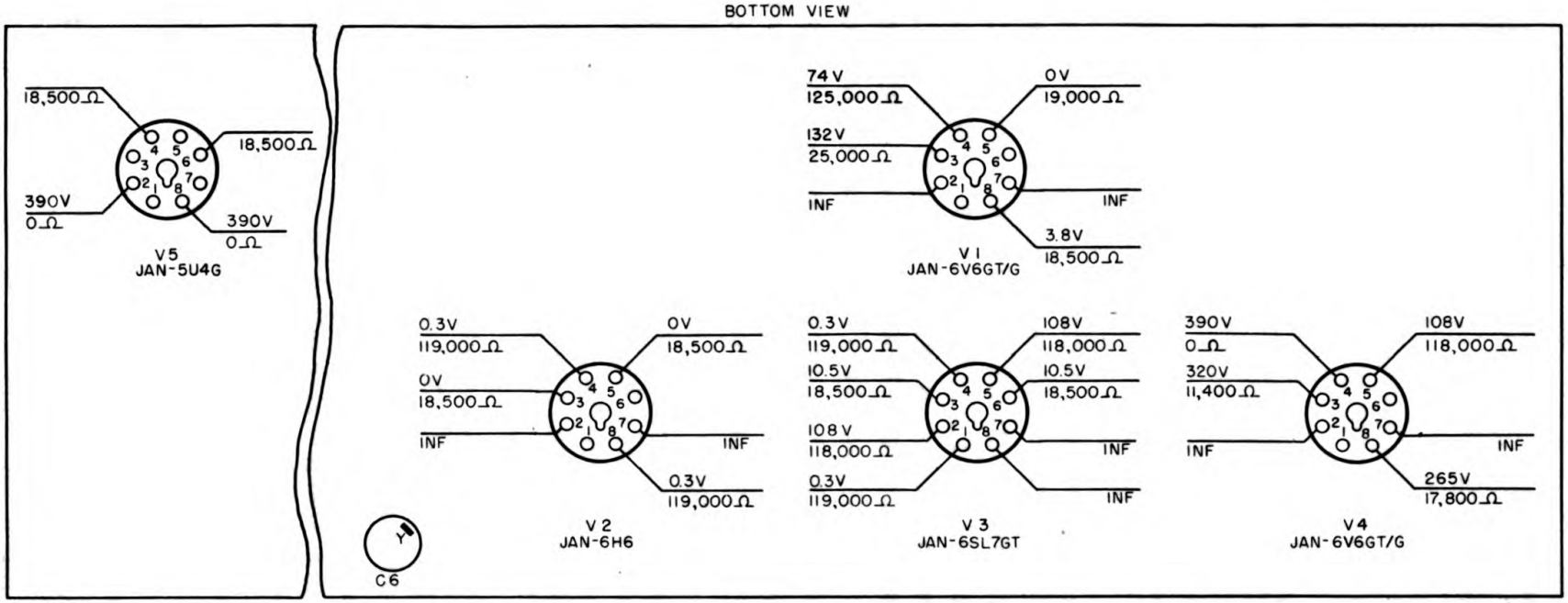
(1) Connect the B negative lead (red wire on transformer T1) to the negative side of the voltmeter.

CAUTION: The chassis of the keyer is grounded to the positive terminal of the power supply. Do not touch the chassis when connecting to the B negative lead.

(2) Place one hand in your pocket. This will eliminate the possibility of making accidental contact with *either ground* or another part of the circuit thus causing the electricity to travel from one hand to the other through the body.

(3) If the voltage is less than 300 volts, connect the test lead to the terminal to be measured.

(4) If the voltage is greater than 300 volts, shut off the power, connect the lead to the terminal to be measured, step away from the voltmeter, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points which are above ground.



NOTES:
ALL VOLTAGE MEASUREMENTS MEASURED TO B NEGATIVE (RED WIRE ON LINE INPUT TRANSFORMER) WITH A 1,000-OHM-PER-VOLT D-C METER.

ALL RESISTANCE MEASUREMENTS MADE TO CHASSIS WITH POWER DISCONNECTED AND TUBES REMOVED.

SENSITIVITY CONTROL AT NO. 10
SW1 IN ELECT OUTPUT.
OUTPUT CONTROL ON 10.
SW3 ON HI.

NO LOAD DC OUTPUT OF RECTIFIER X1
MEASURED FROM TERMINAL Y ON C6 TO CHASSIS.

POSITION OF SW3	VOLTS
LO	22
MED	27
HIGH	34

TL 12927S

Figure 14. Keyer KY-7/FRT, voltage and resistance chart.

f. Voltmeter Loading. Voltmeter resistance must be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is nearly equal to the circuit resistance, the voltmeter will indicate a voltage *lower* than the actual voltage present when the voltmeter is removed from the circuit.

(1) The resistance of a voltmeter on any range can be calculated by this simple rule: Resistance of the voltmeter equals its ohms per volt multiplied by the full-scale range in volts. For example: The resistance of a 1,000-ohm-per-volt meter on the 300-volt range is 300,000 ohms (R = 1,000 ohms per volt times 300 volts = 300,000 ohms).

(2) To minimize voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale), the electrical accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the visual inaccuracy which results from reading only a small deflection on the voltmeter scale.

(3) Close observation of the meter when switching voltage ranges will show if the voltmeter is loading the circuit under test.

(a) Extremely heavy loading is indicated when the deflection of the pointer (not the voltage reading) is nearly the same for different ranges.

(b) Appreciable loading is indicated when the voltage readings (not the deflection) for different ranges do not agree.

(c) Negligible loading is indicated when the voltage readings (not the deflection) for different ranges do agree.

(4) The ohm-per-volt sensitivity of the voltmeter used to obtain the readings recorded on the voltage chart in this manual is printed on the chart. Use a meter having the same ohm-per-volt sensitivity.

48. TROUBLE-SHOOTING PROCEDURES.

The accompanying trouble-shooting charts, if properly used, simplify trouble shooting. There are two types of charts. The first chart covers the sectionalization of trouble in Keyer KY-7/FRT. This chart lists the various symptoms that may be easily recognized by the operator, and gives the probable location for the existing trouble as well as the recommended correction. By proper use of the chart the trouble can be isolated to a particular component of the equipment and thus save time that might otherwise be lost in

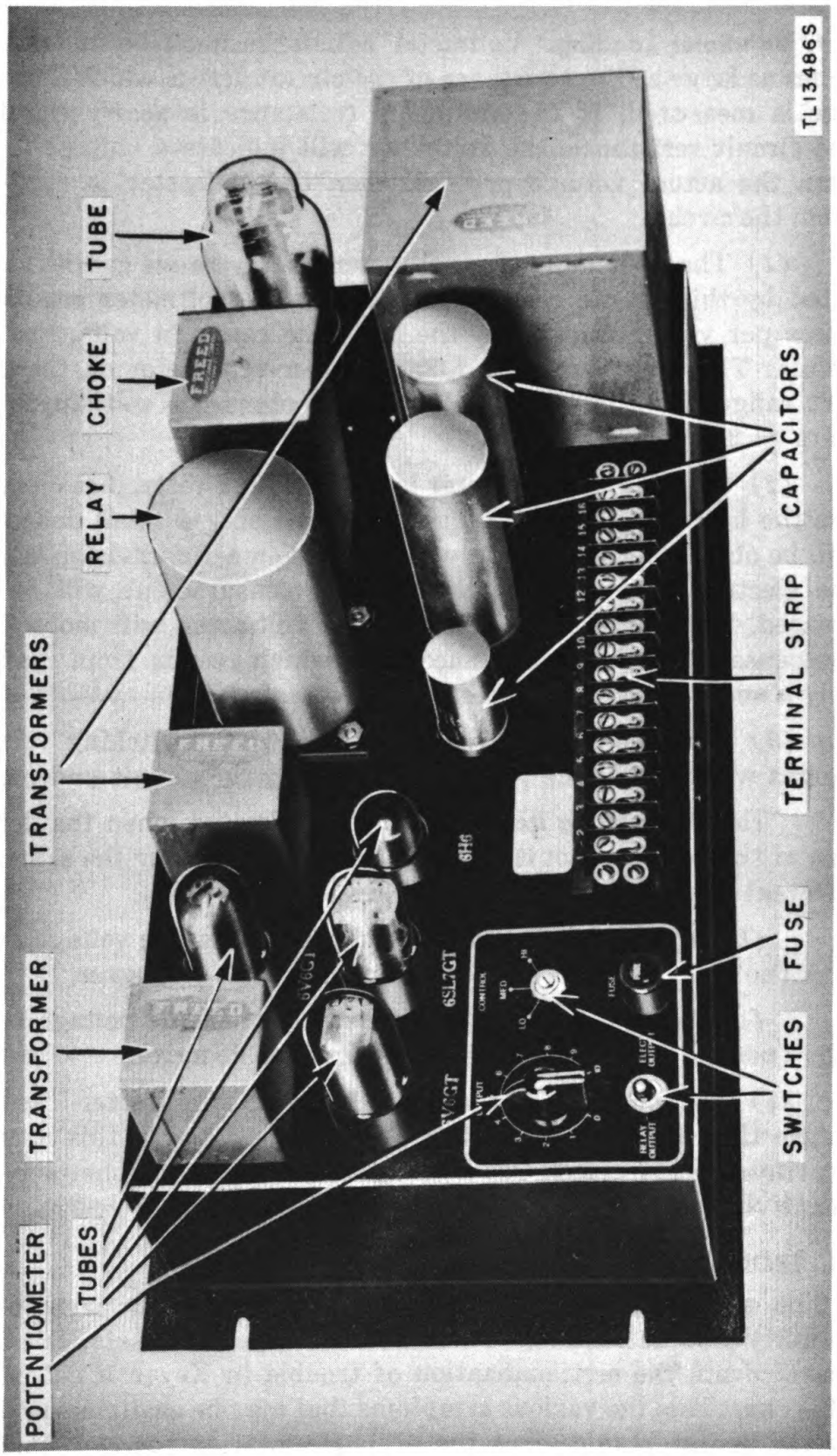


Figure 15. Keyer KY-7/FRT, outside chassis, component parts.

checking components that are not defective. The second chart localizes the trouble to the particular part in the stage which is causing the trouble. The first chart covers troubles of a more general nature and will be used principally by the operator. The second chart covers trouble shooting using voltage and resistance checks and will be used primarily by the repairman.

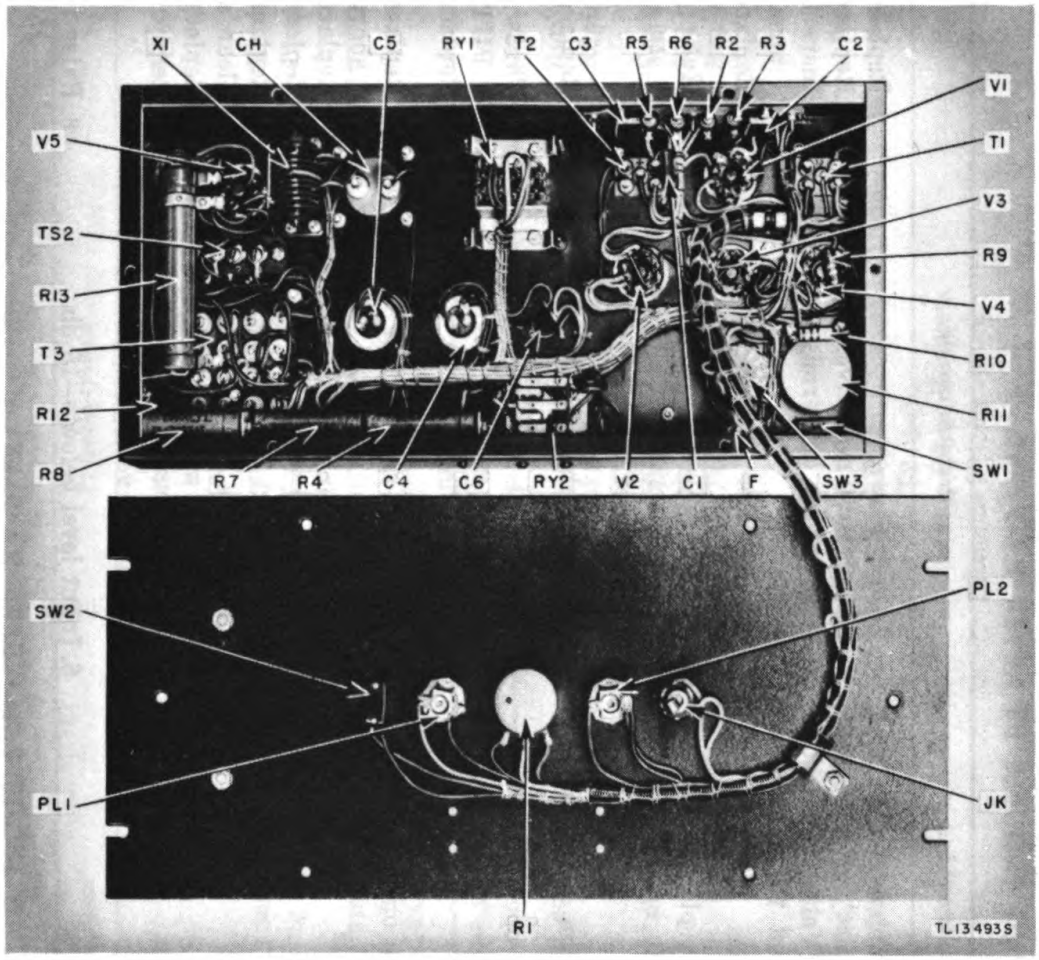


Figure 16. Keyer KY-7/FRT, inside chassis, component parts.

49. SECTIONALIZING TROUBLE IN KEYER KY-7/FRT.

Symptoms	Probable trouble	Corrections
1. Keyer dead, pilot lamps PL1 and PL2 on panel not lighted, tubes will not light. (Voltage correct at terminals 14 and 15 of terminal strip TS1.)	1. Fuse F blown. Switch SW2 defective. Connections on terminal strip TS2 faulty. Transformer T3 defective.	1. Replace fuse F. Replace switch SW2. Inspect and tighten connections on terminal strip TS2. Replace transformer T3.
2. Tubes light dimly, plate voltage is low.	2. Connections on terminal strip TS2 made for 220 volts when using 115-volt power source.	2. Make proper connections on terminal strip TS2 (fig. 4).
3. Plate voltage low on all tubes.	3. Rectifier Tube JAN-5U4G gassy.	Replace Tube JAN-5U4G.
4. Relay RY1 fails to operate. (All tube voltages normal.)	4. Switch SW1 not closed. Relay winding open.	4. Throw switch SW1 to RELAY OUTPUT position. Replace relay.
5. Relay RY2 fails to operate. (Pilot lamp PL1 and tubes lighted.)	5. Primary of transformer T1 open or shorted to ground. Relay winding open. Rectifier X1 defective. Switch SW3 defective. Relay sticks. Energizing winding on transformer T3 open. Insufficient voltage applied to relay.	5. Replace transformer T1, or remove short. Replace relay. Replace rectifier X1. Replace switch SW3. Clean and adjust relay. Replace transformer. Readjust switch SW3.
6. Keying erratic.	6. Input level below —15 db.	6. Raise input level to minimum of —15 db.

49. SECTIONALIZING TROUBLE IN KEYER KY-7/FRT (contd).

Symptoms	Probable trouble	Corrections
	Tube defective.	Check tubes and replace defective ones.
7. Electronic keying satisfactory, polarized relay keying inoperative.	7. Switch SW1 defective. Relay RY1 sticks.	7. Replace switch SW1. Clean and adjust relay.

50. LOCALIZING TROUBLE IN KEYER KY-7/FRT.

Symptoms	Probable trouble	Corrections
1. Electronic output contains a-c ripple.	1. Filter capacitor C4 or C5 open. Filter choke CH shorted.	1. Replace defective capacitor. Replace choke CH.
2. No plate voltage on tubes V1, V2, V3, or V4.	2. Filter capacitor C4 or C5 shorted. Filter choke CH open. Rectifier Tube JAN-5U4G burned out.	2. Replace defective capacitor. Replace choke CH. Replace Tube JAN-5U4G.
3. Tube V1.		
a. No voltage at cathode, pin 8.	*a*. Cathode resistor R1 open.	*a*. Replace.
b. No voltage at plate, pin 3.	*b*. Resistor R4 or primary of transformer T2 open.	*b*. Replace.
c. No voltage at screen, pin 4.	*c*. Resistor R3 or R4 open. Capacitor C2 shorted.	*c*. Replace. Replace.

50. LOCALIZING TROUBLE IN KEYER KY-7/FRT (contd).

Symptoms	Probable trouble	Corrections
4. Tube V2.		
a. Infinite resistance reading pin 3 to pin 5.	*a.* Secondary of transformer T2 open.	*a.* Replace transformer T2.
b. Zero or low resistance reading, pin 8 to ground.	*b.* Capacitor C3 shorted.	*b.* Replace.
5. Tube V3.		
a. No voltage at pin 4 or 5.	*a.* Resistor R8 or R9 open.	*a.* Replace.
b. No voltage on cathodes, pins 3 and 6.	*b.* Resistor R7 open.	*b.* Replace.
6. Tube V4.		
a. No voltage on grid, pin 5.	*a.* Resistor R8 or R9 open.	*a.* Replace.
b. No voltage on screen, pin 4.	*b.* Power supply defective.	*b.* See symptom 7 below.
c. No voltage at plate, pin 3.	*c.* Resistors R10 and R11 open.	*c.* Replace.
7. Tube V5.		
a. No voltage at pin 2 or 8.	*a.* Defective tube V5. Shorted capacitor C4 or C5 Choke CH open.	*a.* Replace. Replace. Replace.

SECTION XII. REPAIRS

51. REPLACEMENT OF PARTS.

All the parts in Keyer KY-7/FRT are readily accessible and are easily replaced if they are found to be faulty. Carefully tag all wires before removing the defective part from the equipment to avoid misconnection when the new part is installed.

a. To remove the front panel from the keyer, unscrew the six panel fastening screws and fold back the panel in a manner that will prevent chaffing or damage to the interconnecting cable (fig. 16).

b. If any of the transformer or filter choke components are found to be defective, be very careful in soldering and handling the ceramic terminals. Be sure to note the rotation of terminal markings while removing the defective part so that the replacement can be installed accordingly.

c. If either filter capacitor C4 or C5 requires replacement it is not necessary to note polarity in wiring. For removing and replacing the fastening locknut use a box wrench. Do not exert too much wrench pressure when installing replacement.

52. RUSTPROOFING AND REPAINTING.

When the finish on Keyer KY-7/FRT has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces as follows:

a. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

CAUTION: The use of steel wool, although permitting rapid removal of rust, is not recommended. Minute particles of steel wool 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. When numerous scars and scratches warrant complete repainting, remove the chassis. Apply paint with small brush to entire panel. Do not paint over either the instrument plate or the name plate. Remove rust by cleaning corroded metal with dry-cleaning solvent (SD). In severe cases it may be necessary to use dry-cleaning solvent (SD) to soften the rust, and sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

53. UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W. D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D.C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

WAR DEPARTMENT
UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps — MATÉRIEL		DATE: 1 Feb 45
FROM	ORGANIZATION: 175 Signal Repair Co		STATION: APO 102
TO	NEXT SUPERIOR HEADQUARTERS: Supply Sec, Hq Fourth Army Sig Sv	STATION: APO 110	TECHNICAL SERVICE: Signal Corps

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL	
Radio Transmitter BC-123-A	Ground, vehicular	A	
MANUFACTURER	**U. S. A. REG. No.**	**SERIAL No.**	**DATE RECEIVED**
American Radio Corp	Order No. 1234-Phila-45	12345	5 Jan 45

EQUIPMENT WITH WHICH USED (*If applicable*): Radio Set SCR-456-A in Tank, Medium, M4

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART No.	TYPE	MANUFACTURER	DATE INSTALLED
Sig C Stk No. 3E47-2	Capacitor C20; fixed; 1-mf; 500 vdcw	American Radio Corp	When manufactured

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (*If additional space is required, use back of form*)
Capacitor C20 shorts out due to humid operating conditions

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
15 Jan 45	-	-	-	0	0	5		-	-

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN
Operation in tropics; heavy rainfall. Was replaced and set given moistureproofing and fungiproofing treatment, 20 Jan 45.

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS (*If additional space is required, use back of form*)
POOR	FAIR	GOOD	
		X	Substitute capacitor designed for tropical operation

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
E.A. Wilson, 1st Lt, Sig C 175 Signal Repair Co	E.A. Wilson

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in material. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in material, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of material.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of material resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in A.R. 750-10 (change No. 2).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to ensure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

W. D., A. G. O. Form No. 468
20 August 1944

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

U. S. GOVERNMENT PRINTING OFFICE 16—41800-1

TL 19589C

Figure 17. W.D., A.G.O. Form No. 468 with sample entries.

APPENDIX

SECTION XIII. REFERENCES

NOTE: For availability of items listed, check FM 21-6 and ASF catalog SIG 2. Also see FM 21-6 for applicable technical bulletins, supply bulletins, modification work orders, and changes.

54. ARMY REGULATIONS.

AR 380-5	Safeguarding Military Information.

55. SUPPLY PUBLICATIONS.

SIG 1	Introduction to ASF Signal Supply Catalog.
SIG 3	List of Items for Troop Issue.
SIG 4-1	Allowances of Expendable Supplies.
SIG 4-2	Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5	Stock List of All Items.
SIG 10	Fixed Plant Maintenance Lists.
SB 11-8	Chests for Running Spares.
SB 11-10	Signal Corps Kit and Materials for Moisture and Fungi-Resistant Treatment.
SB 11-17	Electron Tube Supply Data.

56. TECHNICAL MANUALS ON TEST EQUIPMENT.

TM 11-303	Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.
TM 11-321	Test Set I-56-E.
TM 11-2613	Voltohmmeter I-166.
TM 11-2626	Test Unit I-176.
TM 11-2627	Tube Tester I-177.

57. PAINTING, PRESERVING, AND LUBRICATION.

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TB SIG 172	Gas Absorber Units for Polar Relays (Western Electric 255-A, D-164816, D-163119-A, and D-168651).

58. SHIPPING INSTRUCTIONS.

U.S. Army Spec. No. 100-14A.	Army-Navy General Specification for Packaging and Packing for Overseas Shipment.

59. DECONTAMINATION.

TM 3-220	Decontamination.

60. DEMOLITION.

FM 5-25	Explosives and Demolitions.

61. CAMOUFLAGE.

FM 5-20	Camouflage, Basic Principles.

62. OTHER PUBLICATIONS.

FM 24-18	Radio Communication.
TB SIG 5	Defense Against Radio Jamming.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Ground 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.
TM 1-455	Electrical Fundamentals.
TM 11-227	Signal Communication Equipment Directory, Radio Communication Equipment.
TM 11-310	Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11-314	Antennas and Antenna Systems.
TM 11-453	Shop Work.
TM 11-455	Radio Fundamentals.
TM 11-462	Reference Data.
TM 11-483	Suppression of Radio Noises.
TM 11-499	Radio Propagation.
TM 37-250	Basic Maintenance Manual.

63. FORMS.

W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report).
Army Air Forces Form No. 54 (Unsatisfactory Report).

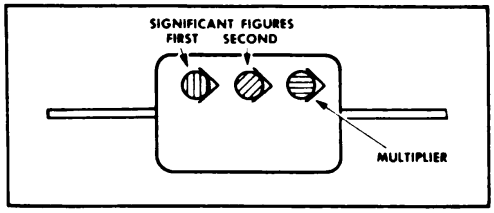
64. ABBREVIATIONS.

a-c	alternating-current.
a-f	audio-frequency.
amp	amperes.
cu ft	cubic feet.
db	decibels.
d-c	direct-current.
ELECT.	electronic.
HI	high.

in.	inch.
JAN	Joint Army-Navy.
lb	pound.
LO	low.
ma	milliampere.
MED	medium.
No.	number.
W.D., A.G.O.	War Department, Adjutant General's Office.
Ω	ohm.

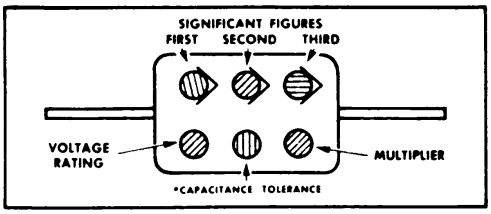
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

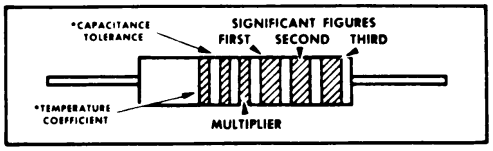


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



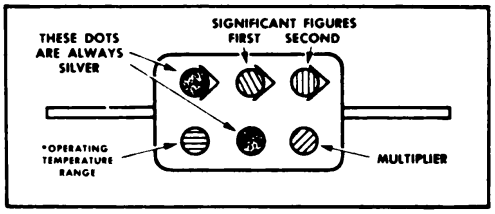
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army Navy

Note: These color codes give all capacitances in micromicrofarads.

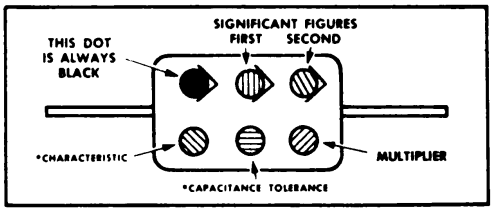
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel.

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



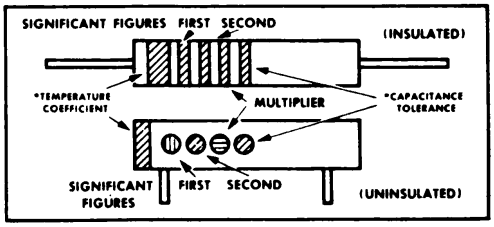
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



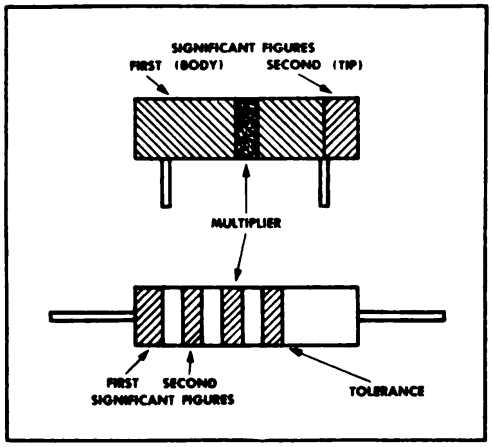
Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

TL 13417 A

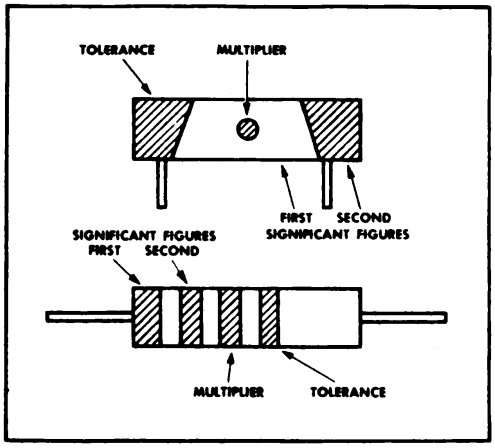
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA Radio Manufacturers Association
JAN Joint Army-Navy

TL 13418 A

JOINT ARMY-NAVY TYPE DESIGNATION CODES FOR ELECTRICAL COMPONENTS

INTRODUCTION: Fixed and variable resistors and fixed capacitors manufactured under JAN specifications may be labeled with a *type designation code* instead of a color code or actual electrical value. For resistors and capacitors marked with the JAN type designation code, electrical values and other data can be determined by consulting the following information.

RESISTORS

FIXED, COMPOSITION

COMPONENT: RC signifies *fixed, composition resistor.*

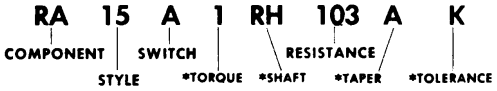
STYLE: A two-digit symbol indicates power rating and physical size.

Resistor style	Wattage
RC10, RC15, RC16	¼ WATT
RC20, RC21, RC25	½ WATT
RC30, RC31, RC35, RC38	1 WATT
RC40, RC41, RC45	2 WATTS
RC65	4 WATTS
RC75, RC76	5 WATTS

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the third digit gives the number of zeros which follow the first two figures.

RESISTORS

VARIABLE, WIRE-WOUND



COMPONENT: RA signifies *variable, wire-wound resistor.*

STYLE: A two-digit symbol indicates power rating and physical size and shape.

SWITCH: Symbol A indicates no switch. Symbol B indicates a switch turned ON at start of clockwise rotation.

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the final digit gives the number of zeros which follow the first two figures. The letter *R* may be substituted to represent a decimal point; but when *R* is used, the last digit of the group becomes significant.

RHEOSTATS

WIRE-WOUND, POWER-TYPE

COMPONENT: RP signifies all *rheostats.*

STYLE: Same as for variable, wire-wound resistors.

OFF POSITION:

Numeral	OFF position
1	None.
2	At end of counterclockwise rotation.
3	At end of clockwise rotation.

RESISTANCE: Same as for variable, wire-wound resistors.

*Items starred are of interest primarily to depot and higher echelon repair personnel.

TL 18141

CAPACITORS

FIXED, MICA-DIELECTRIC

COMPONENT: CM signifies *fixed, mica-dielectric capacitor.*

CASE: A two-digit symbol identifies a physical case size and shape.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the final digit gives the number of zeros which follow the first two figures. When more than two significant figures are required, additional digits may be used, the last digit always indicating the number of zeros.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance range	Vdcw
CM20	5-510 mmf	500
CM25	5-1,000 mmf	500
CM30	470-3,300 mmf	500
CM35	470-6,200 mmf	500
	6,800-10,000 mmf	500
CM40	3,300-8,200 mmf	500
	9,100-10,000 mmf	300

NOTE: Working voltages for capacitors above CM40 are stamped on the case.

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, MOLDED, PAPER-DIELECTRIC†

COMPONENT: CN signifies *fixed, molded, paper-diclectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the third digit gives the number of zeros which follow the first two figures.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance	Vdcw
CN35	3,000 mmf	800
	6,000 mmf	600
	10,000 mmf	400
CN36	3,000 mmf	400
	6,000 mmf	400
	10,000 mmf	300
CN40	3,000 mmf	400
	6,000 mmf	300
	10,000 mmf	300
CN41	3,000 mmf	600
	6,000 mmf	600
	10,000 mmf	400

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, CERAMIC-DIELECTRIC

COMPONENT: CC signifies *fixed, ceramic-dielectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: Same as for fixed, molded, paper-dielectric capacitors.

NOTE: All fixed, ceramic-dielectric capacitors have a working voltage of 500 volts, d-c.

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*Items starred are of interest primarily to depot and higher echelon repair personnel.

†This is not a JAN specification. These capacitors are covered by AWS C75/221.

TL 18142

SECTION XIV. MAINTENANCE PARTS

65. MAINTENANCE PARTS FOR KEYER KY-7/FRT.

The following information was compiled on 18 March 1945. The appropriate pamphlet of the ASF Signal Supply Catalog for Keyer KY-7/FRT is:

Fixed plant maintenance list

SIG 10-432.1, Keyer KY-7/FRT

For an index of available catalog pamphlets, see the latest issues of ASF Signal Supply Catalog SIG 2.

65. MAINTENANCE PARTS FOR KEYER KY-7/FRT (contd).

Ref. symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
	2C2262-7	**KEYER, tone operation:** input 115/230 v ac, 50/60 cps, input impedance 500 ohms, tone input — 15 db	KY-7/FRT (E18)
C1	3K3010221	**CAPACITOR, mica:** 0.001 mf, 500 vdcw	CM30B-102K
C2	3DA50-57.1	**CAPACITOR, paper:** 0.05 mf, 600 vdcw	345-22 (M2)
C3	3DA20-45	**CAPACITOR, paper:** 0.02 mf, 600 vdcw	345-9 (M2)
C4, 5	3DB4-208	**CAPACITOR, paper:** oil, 4 mf, 600 vdcw	6EC-400 (C75)
C6	3DB150-5	**CAPACITOR, electrolytic:** 150 mf, 50 vdcw	WPO62 (M1)
C-H	3C323-6V	**COIL, filter-choke:** 15 h @ 60 ma	12652 (F16)
CK	2Z5786.77	**KNOB, round:** 1-1/8" diam x 9/16" high, for 1/4" shaft	S-17-1L (K6)
FH	3Z3275	**HOLDER, fuse**	1075 (L3)
F	3Z1927	**FUSE, cartridge:** non-renewable, 2 amp, 250 v	1042 (L3)
JK	2Z5534A	**JACK:** single open ckt	SC-1A (M1)
PL-1	2Z5991-32	**LAMPHOLDER:** miniature bayonet, with green jewel	857-BS (D2)
PL-2	2Z5991-33	**LAMPHOLDER:** miniature bayonet, with red jewel	857-BS (D2)
P	2Z5952	**LAMP:** LM-52, 6-8 v, 0.15 amp	47 (T10)
X-1	3H4855-2	**RECTIFIER, selenium:** input 36 v ac, output 80 ma dc	2B2CV1 (F1)
R-1	3Z7498-50.20	**RESISTOR, pot:** carbon, 0.5 meg, 1/2 w	1010207 (G15)
R2, 6	3RC30BE391K	**RESISTOR, carbon:** 390 ohm, 1 w	RC30BE391K
R-3, 5, 9	3RC30BE104K	**RESISTOR, carbon:** 100,000 ohm, 1 w	RC30BE104K

65. MAINTENANCE PARTS FOR KEYER KY-7/FRT (contd).

Ref. symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
R-4, 12	3Z6625-155	**RESISTOR, w-w:** 25,000 ohm, 25 w	A25K (C10)
R-7	3Z6590-21	**RESISTOR, w-w:** 9,000 ohm, 25 w	A25K (C10)
R-8, 10	3RC20BE303J	**RESISTOR, carbon:** 30,000 ohm, 1 w	RC30BE303J
R-11	2Z7281.104	**RESISTOR, pot:** w-w, 20,000 ohm, 3 w	P58-20000 (C10)
R-13	3Z6610-189	**RESISTOR, slider:** w-w, 10,000 ohm, 50 w	A50N (C10)
RY-1	2Z7585-18	**RELAY, keying:** SPDT	WE255A (W5)
RY-2	2Z7591-37	**RELAY, pwr:** 3PDT	KLD-7 (P27)
SC-1	2Z8799-137	**SOCKET, tube:** octal	S8 (A13)
SC-2	4T6927	**SOCKET, relay:** (for WE 255A relay)	18B (W5)
SW-1	3Z9849.137	**SWITCH, toggle:** DPST	ST52K8823K5 (C18)
SW-2	3Z9863-42A	**SWITCH, toggle:** SPST	ST42A8803K6 (C18)
T-1	2Z9637.55	**TRANSFORMER, AF:** input, pri 500 ohm impedance ct, sec 80,000 ohm impedance	12650 (F16)
T-2	2Z9632.380	**TRANSFORMER, AF:** rectifier, pri 7,000 ohm impedance, sec 500 ohm impedance, ct	12651 (F16)
T-3	2Z9613.413	**TRANSFORMER, power:** pri 115/230 v 60 cps, sec No. 1, 6.3 v @ 2 amp, sec No. 2, 5 v @ 3 amp, sec No. 3, 700 v ct @ 60 ma, sec No. 4, 26 v tapped @ 21, 17, and 13 v, @ 70 ma	12653 (F16)
V-1, 4	2J6V6GT	**TUBE:** type 6V6GT	JAN-6V6GT
V-2	2J6H6	**TUBE:** type 6H6	JAN-6H6
V-3	2J6SL7GT	**TUBE:** type 6SL7GT	JAN-6SL7GT
V-5	2J5U4G	**TUBE:** type 5U4G	JAN-5U4G

66. LIST OF MANUFACTURERS.

Code	*Name*
A 13	American Phenolic Corp.
C 10	Clarostat Mfg. Co., Inc.
C 18	Cutler-Hammer, Inc.
C 75	Capacitron, Inc.
D 2	Dial Light Co. of America, Inc.
E 18	Erco Radio Laboratories, Inc.
F 1	Federal Telephone & Radio Corp.
F 16	Freed Transformer Co.
G 15	Globe Union, Inc.
K 6	Kurz-Kasch, Inc.
L 3	Littelfuse, Inc.
M 1	Mallory, P. R., & Co.
M 2	Micamold Radio Corp.
P 27	Potter & Brumfield Mfg. Co.
T 10	Tung Sol Lampworks, Inc.
W 5	Western Electric Co.

Order No. 17643-Phila-45-04; 1225 copies, July 45.