

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT  
MAINTENANCE MANUAL

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

CONVERTER, TELEGRAPH-TELEPHONE

SIGNAL CV-425/U

(PART OF TERMINAL TELEGRAPH-TELEPHONE AN/TCC-29)

This copy is a reprint which includes current  
pages from Change 1.

**WARNING**

**HIGH VOLTAGE**

is used in the operation of this equipment

**DEATH ON CONTACT**

may result if personnel fail to observe safety precautions.

Learn the areas containing high voltage in each piece of equipment.

Be careful not to contact high-voltage connections when installing or operating this equipment.

Before working inside the equipment, turn power off and ground points of high potential before touching them.

CHANGE

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, DC, 15 January 1986

No. 1

**DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL**

**CONVERTER, TELEGRAPH-TELEPHONE SIGNAL CV-425/U  
(NSN 5805-00-985-9088)**

TM 11-5805-356-34-2, 13 October 1972, is changed as follows:

1. Title of the manual is changed as shown above.
2. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

*Remove pages*

*Insert pages*

None .....	A through D
i and ii .....	i and ii
1-1 .....	1-1/(1-2 blank)
2-3 through 2-5 .....	2-3 through 2-6
3-1 through 3-8 .....	3-1 through 3-8
4-3 through 4-5 .....	4-3 through 4-6
A-1 .....	A-1/(A-2 blank)
B-1 through B-21 .....	None
Figure FO-1 .....	Figure FP-1/(FP-2 blank)
None .....	Figure FP-3/(FP-4 blank)

2. File this change sheet in the front of the publication for reference purposes.

By Order of the Secretary of the Army:

**JOHN A. WICKHAM JR.**  
*General, United States Army*  
*Chief of Staff*

Official:

**MILDRED E. HEDBERG**  
*Brigadier General, United States Army*  
*The Adjutant General*

DISTRIBUTION:

To be distributed in accordance with DA Form 12-51 literature requirements for CV-425/U.



**5**

**SAFETY STEPS TO FOLLOW IF SOMEONE  
IS THE VICTIM OF ELECTRICAL SHOCK**

**1**

**DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL**

**2**

**IF POSSIBLE, TURN OFF THE ELECTRICAL POWER**

**3**

**IF YOU CANNOT TURN OFF THE ELECTRICAL  
POWER, PULL, PUSH OR LIFT THE PERSON TO  
SAFETY USING A WOODEN POLE OR A ROPE OR  
SOME OTHER INSULATING MATERIAL**

**4**

**SEND FOR HELP AS SOON AS POSSIBLE**

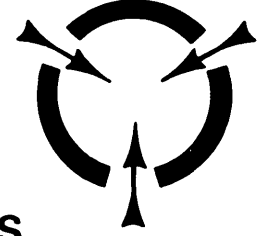
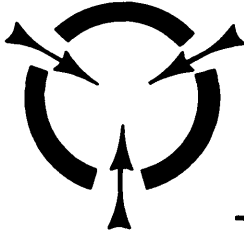
**5**

**AFTER THE INJURED PERSON IS FREE OF  
CONTACT WITH THE SOURCE OF ELECTRICAL  
SHOCK, MOVE THE PERSON A SHORT DISTANCE  
AWAY AND IMMEDIATELY START ARTIFICIAL  
RESUSCITATION**

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

# CAUTION



**THIS EQUIPMENT CONTAINS PARTS  
AND ASSEMBLIES SENSITIVE TO  
DAMAGE BY ELECTROSTATIC DISCHARGE (ESD).  
USE ESD PRECAUTIONARY PROCEDURES  
WHEN TOUCHING, REMOVING OR INSERTING  
PRINTED CIRCUIT BOARDS.**

## ESD CLASS 1

### GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES
- KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE
- GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT
- PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM
- USE ONLY METALIZED SOLDER SUCKERS
- HANDLE ESDS ITEMS ONLY IN PROTECTIVE AREAS

### MANUAL GROUNDING PROCEDURES

- MAKE CERTAIN EQUIPMENT IS POWERED DOWN
- TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS
- TOUCH PACKAGE OF REPLACEMENTS ESDS ITEM TO GROUND BEFORE OPENING
- TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS

### ESD PROTECTIVE PACKAGING AND LABELING

- INTIMATE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM- OR -HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER METALIZED LAYER
- LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE

**CAUTION**

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

**CAUTION**

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

- STEP  
1 Turn off and/or disconnect all power and signal sources and loads used with the unit.
- STEP  
2 Place the unit on grounded conductive work surfaces.
- STEP  
3 Ground the repair operator using a conductive wrist strap or other device using a 1-M series resistor to protect the operator.
- STEP  
4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.
- STEP  
5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.
- STEP  
6 When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.
- STEP  
7 When not being worked on wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.
- STEP  
8 Do not handle these devices unnecessarily or remove from their packages until actually used or tested.



**DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL**

**CONVERTER, TELEGRAPH-TELEPHONE SIGNAL CV-425/U  
 (NSN 5805-00-985-9088)**

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007.

In either case, a reply will be furnished direct to you.

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\* This manual together with TM 11-5805-35-34-1, 13 October 1972, supersedes TM 11-5805-356-35, 9 December 1966, including all changes.

\*\* Portions of this manual pertaining to repair parts and special tools list are superseded by TM 11-5805-356-34P-2, dated 9 December 1976.

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## CHAPTER 1

### INTRODUCTION

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#### Section I. GENERAL

##### 1-1. Scope

This manual covers direct support and general support maintenance for Converter Telegraph-Telephone Signal CV-425/U. This section outlines pertinent administrative information. Section II describes purpose, use, and mechanical configuration of the equipment and lists electrical specifications. Chapter 2 provides detailed circuit analysis. Chapters 3 and 4 contain information appropriate to direct support maintenance and general support maintenance respectively.

##### 1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

##### 1-3. Maintenance Forms, Records, and Reports

*a. Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, Maintenance Management Update.

*b. Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430.3F.

*c. Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.9D/DLAR 4500.15.

##### 1-4. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. We'll send you a reply.

##### 1-4.1. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Repacking of equipment for shipment or limited storage are covered in SB 38-100.

##### 1-4.2. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

##### 1-4.3. Calibration

Pertinent publications on calibration of this equipment shall be referenced as required.

#### Section II. DESCRIPTION AND DATA

##### 1-5. Description

Refer to TM 11-5805-356-12 for purpose, use, and photographs of the equipment.

##### 1-6. Tabulated Data

Refer to TM 11-58,05-356-12 for list of technical characteristics of the equipment.

CHAPTER 2

FUNCTIONING OF CV-425/U

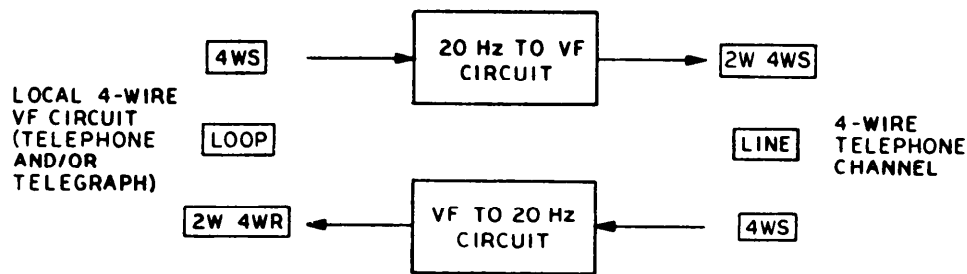
Section I. BLOCK DIAGRAM ANALYSIS

2-1. General

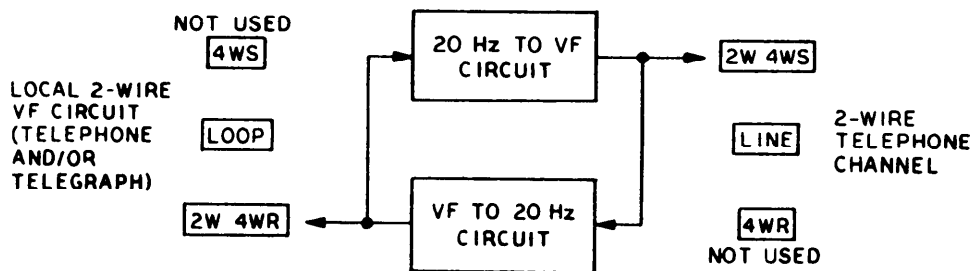
(fig. 2-1)

20-Hz ringing signals, used on metallic telephone channels, will not transverse radio-telephone or other carrier telephone channels. For carrier-type channels, vf ringing signals are used (1232.5 Hz for vf telegraph applications and 1600 Hz for telephone applications). Where a metallic circuit is connected to a carrier channel, a ringing-signal converting device is required. The CV-425/U converts 20-Hz ringing signals to vf ringing signals and vice versa. The CV-425/U is inserted in the vf signal path between the local

vf circuit and the telephone channel. It monitors the outgoing line for 20-Hz ringing signals and the incoming line for vf ringing signals. While it is detecting a 20-Hz ringing signal, the CV-425/U injects a vf ringing signal into the outgoing telephone channel. While detecting a vf ringing signals, the CV-425/U injects a 20-Hz ringing signal into the incoming vf circuit. Figure 2-1 shows the basic configuration for 4- and 2-wire interfacing. Paragraph 2-2 provides a detailed block diagram analysis. Section II describes various circuit stages on a schematic diagram basis.



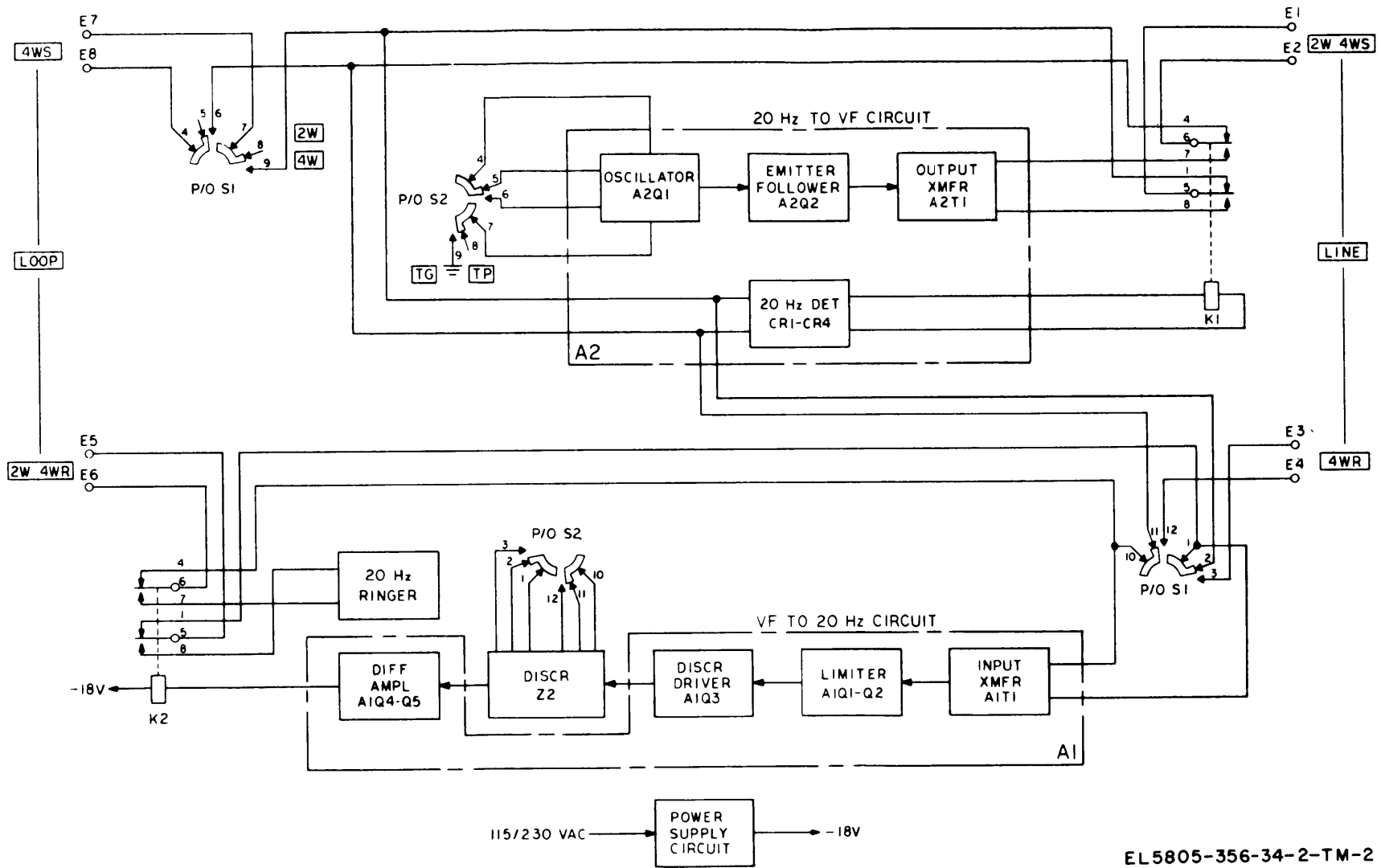
A. 4-WIRE CONFIGURATION



B. 2-WIRE CONFIGURATION

EL5805-356-34-2-TM-1

Figure 2-1. Converter, Telegraph-Telephone Signal CV-425/U, simplified block diagram.



EL5805-356-34-2-TM-2

Figure 2-2. Converter, Telegraph-Telephone Signal CV-425/U, detailed block diagram.

## 2-2. Detailed Block Diagram

(fig. 2-2)

### a. 20 Hz to Vf Circuit.

(1) *4-wire operation.* With 2W-4W switch S1 set to 4W for 4-wire operations, the outgoing vf telegraph or telephone signal couples from the local vf circuit through 4WS binding posts E7-E8, S1-7-9 and S1-4-6, K1-4-6 and K1-1-5, and 2W-4WS binding posts E1-E2 to the telephone channel. When a 20-Hz ringing signal occurs, ring detector A2CR1-CR4 rectifies it to produce a dc voltage that energizes relay K1. When K1 is energized it connects output transformer A2T1 to the outgoing channel via K1-7-6 and K1-8-5. The vf signal generated by oscillator A2Q1 then couples through emitter follower A2Q2, A2T1, and K1 to the outgoing channel. The frequency of the vf ringing signal produced by oscillator A2Q1 may be selected by the TG-TP switch. The TG (telegraph) position selects 1232.5 Hz and the TP (telephone) position selects 1600 Hz.

(2) *2-wire operation.* With 2W-4W switch S1 set to 2W for 2-wire operation, the circuit function is the same except the outgoing vf signal couples from the local vf circuit through 2W-4WR binding posts E5-E6, K2-6-4, and K2-5-1, S1-1-2 and S1-10-11, and K1-1-5 and K1-4-6 to 2W-4WS binding posts E1-E2.

### b. Vf to 20-Hz circuit.

(1) *4-wire operation.* With 2W-4W switch S1 set to 4W for 4-wire operation, the incoming vf ringing signal couples from the telephone channel through 4WR binding posts E3-E4, S1-3-1 and S1-12-10, K2-4-6 and K2-1-5, and 2W-4WR binding posts E5-E6 to the local vf circuit. The incoming signal also couples through input transformer A1T1, limiter A1Q1-Q2, and discriminator driver A1Q3 to discriminator Z2. When a vf ringing signal occurs, Z2 detects it and responds by applying a dc level through differential amplifier A1Q4-Q5 to energize relay K2. When energized, K2 connects the 20-Hz 180v output of the 20-cycle ringer to binding posts E5-E6 via K2-8-5 and K2-7-6.

(2) *2-wire operation.* With 2W-4W switch S1 set to 2W for 2-wire operation, the circuit function is the same except the incoming vf signal couples from the telephone channel through 2W-4WS binding posts E1-E2, K1-6-4 and K1-5-1, S1-2-1 and S1-11-10, K2-4-6 and K2-1-5, and 2W-4WR binding posts E5-E6 to the local vf circuit.

c. *Power Supply.* The CV-425/U contains an internal power supply that converts 115 vac or 230 vac to - 18 vdc to operate the active circuits and relays.

## Section II. SCHEMATIC DIAGRAM ANALYSIS

### 2-3. VF to 20-Hz Circuits

(fig. FO-1.1 or -1.2)

a. *20-Cycle Ringer.* This circuit, which produces the 20-Hz ringing signal for application to the loop, is a sealed unit that constantly generates a 20-Hz signal. The signal is coupled to the loop, however, only when K2 is operated. The ringer output signal is 180 volts,  $\pm 10$  percent, peak-to-peak at 20-Hz, when operating into a normal telegraph or telephone line impedance.

### b. Limiter A1Q1-A1Q2,

(1) The vf input signal is applied through resistors A1R1 and A1R2 and capacitors A1C1 and A1C2 to the primary winding of input transformer A1T1. Transformer A1T1 couples the line to the receive circuits and maintains a high-bridging input impedance. Resistors A1R1, A1R2, and A1R3 enable the transformer to present the required high impedance (8,000 ohms) to the line.

(2) The signal across the secondary of

transformer A1T1 is coupled through capacitor A1C4 to the base of transistor A1Q1. This transistor, together with transistor A1Q2, forms a limiter-amplifier. When the applied input signal is large, it is clipped on one-half cycle by transistor A1Q1 and on the other half cycle by diode A1CR1. The clipped signal is then direct-coupled to transistor A1Q2, where additional amplification takes place, producing an output at the collector of transistor A1Q2. Small-amplitude signals are linearly amplified by A1Q1, then further amplified and clipped by transistor A1Q2. A degenerative feedback voltage from transistor A1Q2 is developed across resistor A1R11 and fed back through resistor A1R5 to the base of transistor A1Q1. This feedback stabilizes the amplifier gain against temperature effects and differences in transistor characteristics.

*Figures FO-1.1 and FO-1.2, Converter, Telegraph-Telephone Signal CV-425/U, Schematics.*

**(Located in back of manual.)**

(3) Resistors R1 and R2, capacitor C2, and SENSITIVITY switch S3 provide two levels of input sensitivity for the receive circuits by changing the degeneration produced in the emitter circuit of Q1. When switch S3 is at HIGH, resistors R1 and R2 are bypassed by capacitor C2. When switch S3 is at LOW, only resistor R2 is bypassed, providing negative feedback to reduce the gain, thereby reducing the sensitivity.

(4) Resistor A1R8 is the collector load for transistor A1Q1. Resistors A1R4 and A1R6, with capacitor A1C3, provide bias and decoupling at the base of transistor A1Q1. Capacitor A1C5 prevents oscillation by reducing the amplifier gain at high frequencies. Resistor R9, across which the limiter output is developed, is the collector load for transistor A1Q2.

*c. Discriminator Driver A1Q3.* This circuit amplifies the vf input and applies it to the discriminator transformer. The input signal is coupled through capacitor A1C7 and current-limiting resistor A1R12, and then developed across base bias resistor A1R13. The voltage across resistor A1R13 is applied to transistor A1Q3 where it is amplified and developed across the primary windings of discriminator transformer Z2. The primary of transformer Z2 resonates at two frequencies, which are selected by switch S2. Resistor A1R14 limits emitter current in the driver.

*d. Discriminator Transformer Z2.*

(1) Discriminator transformer Z2 is an assembly containing two magnetically isolated transformers having tuned transformer primaries series-connected to the driving signal developed by discriminator driver A1Q3. The primary of the upper transformer shown on the schematic diagram is tuned to a higher frequency than the primary of the lower transformer. When TP-TG switch S2 is set to TP, an internal capacitor resonates the primary winding between terminals 6 and 8 to 1,900 Hz and another internal capacitor resonates the primary winding between terminals 1 and 3 to 1,600 Hz, this latter frequency corresponding to the telephone ringing frequency. When the TP-TG switch is operated to TG, additional windings on the primary are connected into the circuit, increasing the inductance and lowering the resonant frequency. For this position of the switch, the winding between terminals 5 and 8 is connected across the one internal capacitor to resonate that transformer primary at 1,317 Hz (corresponding to the mark

vf frequency); the winding between terminals 1 and 4 is connected across the other internal capacitor to resonate that transformer primary at 1,232 Hz (corresponding to the space vf frequency).

(2) With the primaries series-connected, the greater voltage will be developed across the primary whose resonant frequency is closer to that of the incoming vf signal's. When TP-TG switch S2 is set to TG and a mark is received, the upper transformer primary develops the greater voltage. With a space frequency (corresponding also to the ring signal), the lower transformer primary develops the greater voltage. Similarly, when the switch is operated to TP, the lower primary develops the greater voltage when the ring frequency used for telephone is received.

(3) The voltage across the secondary of either transformer is a function of the primary voltage. Accordingly, with the TP-TG set to TG, the voltage developed between discriminator transformer output terminals 10 and 11 is greater than the voltage developed between output terminals 9 and 11 when a mark frequency is received, and is less than the latter when a space frequency (ring signal) is received. (When the equipment is set up for telephone ringing, the lesser voltage is also developed between terminals 10 and 11 when receiving the ring signal frequency.) The voltages developed across the secondaries are applied to discriminator A1CR2-A1CR3.

*e. Discriminator A1CR2-41CR3.* Discriminator A1CR2-A1CR3 develops a positive dc voltage with respect to ground across resistor A1R15 corresponding to the amplitude of the secondary voltage across terminals 10 and 11 of discriminator transformer Z2, and a negative dc voltage with respect to ground across resistor A1R16 corresponding to the amplitude of the secondary voltage across terminals 9 and 11 of the discriminator transformer. The algebraic sum of the two dc voltages is applied to integrator A1CR4-A1CR5. Accordingly, when a ring frequency is received, the discriminator output is negative. When a mark frequency is received during telegraph operation, the output of the discriminator is positive. At other times, random vf signals, which will mostly be far removed from the resonant frequencies of the discriminator transformer primaries, will produce a zero dc voltage at the output of the discriminator. Capacitors

A1C8 and A1C9 serve as filters to smooth the dc voltages produced by the discriminator.

*f. Integrator. A1CR4-A1CR5.* Integrator A1CR4-A1CR5 builds up a negative charge across capacitor A1C10 whenever the output from the discriminator is negative, and discharges the capacitor when the output goes positive. When the discriminator output is negative, which occurs when the vf ring frequency is received, diodes A1CR4-A1CR5 do not conduct and capacitor A1C10 charges to the discriminator output voltage through resistor A1R17. When the output goes positive, the diodes conduct, and capacitor A1C10 discharges. Diode A1CR5 insures that a reverse polarity is never applied to capacitor A1C10. The voltage across the capacitor is applied to the base of A1Q4 of differential amplifier A1Q4-A1Q5.

*g. Differential Amplifier A1Q4-A1Q5.* In the circuit of differential amplifier A1Q4-A1Q5, the base of transistor A1Q5 is tied to a negative reference voltage, causing the transistor to conduct. The conduction of transistor A1Q5 produces a voltage drop across resistor A1R19 that keeps transistor A1Q4 cut off unless a negative voltage is applied to the base to overcome the cutoff bias. This negative voltage is developed across capacitor A1C10 as the capacitor charges. The capacitor develops sufficient charge to make transistor A1Q4 conduct after a negative output has been developed at the discriminator for approximately 0.5 second. When transistor A1Q4 conducts, relay K2, in the collector circuit of the transistor, is energized, causing the output of the 20-cycle ringer to be connected to the loop circuit.

## 2-4. 20-Hz to VF Circuits

(fig. FO-1.1 or 1.2)

*a. Ring Detector A2CR1-A2CR4.* The ring detector consists of a full-wave bridge rectifier. With an ac voltage greater than 50 volts peak-to-peak applied to it, the rectifier produces sufficient dc output (11 volts) to operate K1. Only the 20-Hz ring signal from the loop circuit is of sufficient amplitude to cause the relay to operate and apply a VF (TG-TP) signal to the line binding posts (E1-E2).

*b. Oscillator A2Q1-A2Q2, Discrete Components (fig. FO-1.1).* Oscillator A2Q1-A2Q2 is a modified Colpitts oscillator using two cascaded emitter followers. The oscillator operates at either of two frequencies selected by TP-TG switch S2. When used for telephone ringing, switch S2 is operated to TP and the oscillator generates 1,600 Hz; when used for telegraph ringing, switch S2 is operated to TG and the

oscillator generates 1232.5 Hz. The change in frequency is accomplished by adding capacitors A2C1, A2C3, A2C5, and A2C6 in parallel with capacitors A2C2, A2C4, A2C7, and A2C8 when switch S2 is operated to TG, lowering the frequency from 1,600 Hz to 1232.5 Hz. When operating at the lower frequency, the Q of the tank circuit is less. To maintain the output of the oscillator at the same level at the lower frequency, resistor R4 in the emitter circuit of transistor A2Q2 is removed when switch S2 is set to TG, increasing the feedback to transistor A2Q1.

*c. Oscillator A2A1, Sealed Unit (fig. FO-1.2).* The oscillator operates at either of two frequencies selected by TP-TG switch S2. When used for telephone ringing, switch S2 is operated to TP and the oscillator generates 1,600 Hz; when used for telegraph ringing, switch S2 is operated to TG and the oscillator generates 1232.5 Hz. To maintain the output of the oscillator at the same level at the lower frequency, resistor R4 is removed when switch S2 is set to TG.

*d. Output Transformer A2T1 Circuit.* This circuit couples the oscillator output signal through relay K1 contacts to the LINE terminals. The output signal is fed through coupling capacitor A2C11 and developed across a resistive T-network. The output from this network is applied through transformer A2T1 to contacts 7 and 8 of relay K1. When the relay is operated by a 20-Hz ring signal in the loop circuit, the oscillator output is connected to the line.

## 2-5. Power Supply Circuit

(fig. FO-1)

*a. Power Transformer T1.* Power transformer T1, which steps down the 115- or 230-volt input voltage to 56 volts, consists of two primary windings and a secondary winding. For an input voltage of 115 volts, the primary windings are parallel-connected by strapping terminals 1 and 2 and 3 and 4. For an input voltage of 230 volts, the windings are series-connected by strapping terminals 2 and 3. The 56-volt secondary voltage is developed in both cases.

*b. Rectifier A2CR5-A2CR6.* This circuit rectifies the 56-volt ac output voltage of transformer T1 to produce a pulsating negative dc voltage that is applied to the input of filter C1 and voltage regulator Q1-A2CR7.

*c. Voltage Regulator Q1-A2CR7.* This circuit regulates the output voltage from the rectifier after it has been smoothed through the action of capacitor C1. The action maintains a constant -18 volts dc for the circuits of the CV-425/U.



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The voltage developed across Zener diode A2CR7 is a constant  $-18$  volts with respect to ground. Transistor Q1 is connected as an emitter follower, with the constant voltage maintained by the Zener diode applied to its base. The output voltage taken from the emitter of transistor Q1 follows the constant voltage of  $-18$  volts maintained at the base.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

**3-1. Scope of Direct Support Maintenance**

Direct support maintenance consists of troubleshooting the CV-425/U down to the pc board or a chassis mounted part. The procedures contained herein are not complete in themselves, but supplement the procedures for organizational maintenance given in TM 11-5805-356-12. Whenever possible, the organizational maintenance procedures.

**3-2. Voltage and Resistance Measurements**

*a. Voltage Data.* Voltage data for chassis-mounted components are provided by figure 3-1. The following paragraphs provide voltage data for parts mounted on pc boards and for test points. All voltage data were obtained using the ME-26B/U. The conditions under which the data were obtained are specified. When comparing actual measurements with the published data

for transistor voltages, it must be considered that voltages measured at the emitter and base terminals of transistors may vary by as much as 20 percent. Collector voltages, however should not vary by more than 10 percent. The bias (emitter-to-base) voltage should remain close to that obtained from the listed values.

(1) *Transistor voltage.* The following chart lists two voltages for each transistor element of transistors used in the receive circuit. The top voltage is measured with a vf ring signal (1232 at 0 dbm) applied to the receive circuits. The bottom voltage is measured with no vf ring signal applied. Two voltages for each element are also listed for transistor 3Q1. The top voltage is measured with the power supply supplying its normal load; the bottom voltage is measured without a load on the power supply (pc boards removed from the CV-425/U).

Transistor	Voltage to ground		
	Emitter	Collector	Base
3A1Q1 (PNP) .....	-0.77 -1.25	-4.3 -3.6	-0.65 -1.25
3A1Q2 (PNP) .....	-6.2 -3.5	-10.0 -12	-4.3 -3.6
3A1Q3 (PNP) .....	-1.0 -1.5	-18 -17	+0.1 0
3A1Q4 (PNP) .....	-2.3 -2.45	-7.2 -17	-1.9 +0.1
3A1Q5 (PNP) .....	-2.3 -2.45	-18 -6.8	-1.25 -2.6
3A2Q1 (PNP) (when applicable) .....	-12	-18	-12
3A2Q2 (PNP) (when applicable) .....	-12.0	-18	-12
3Q1 (PNP) .....	-18 -18	-35 -41	-18 -18

(2) *Additional voltage data.*

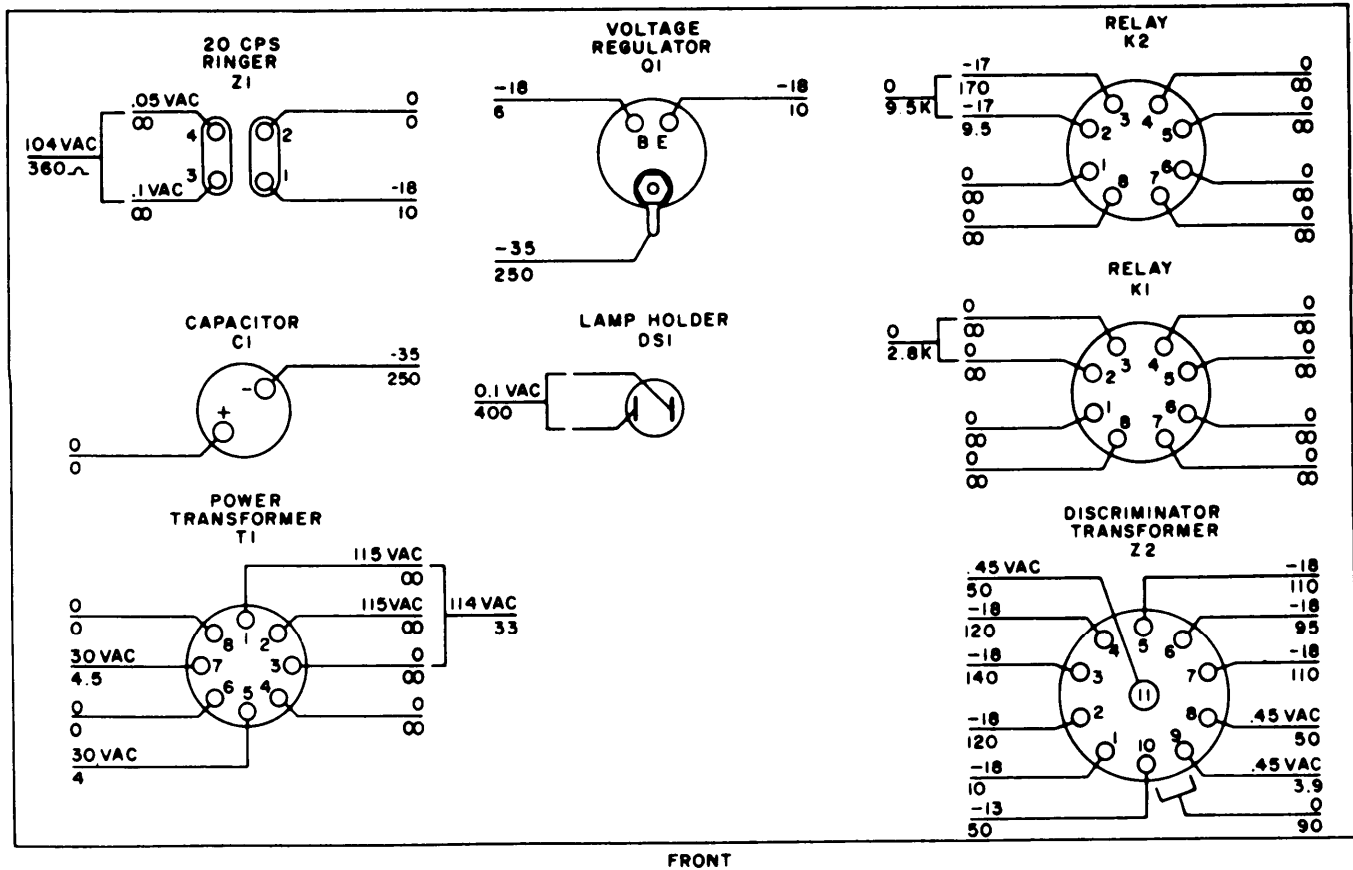
Parts or circuit	Vtvm connection		Voltage (volts)	Condition
	1	2		
Relay 3K1 .....	2	3	+11	20-Hz input at LOOP terminals.
Relay 3K2 .....	2	3	+15	Vf input at LINE terminals.
Test point .....	A1TP1	ground	= 0.75	Incoming vf voltage.

Parts or circuit	Vtvm connection		Voltage (volts)	Condition
	A1TP1	ground		
Test point	A1TP1	ground	-1.35	No incoming vf voltage.
Test point	A1TP2	ground	-11.4	Incoming vf voltage.
Test point	A1TP2	ground	-12.8	No incoming vf voltage.
Test point	A1TP3	ground	+3.2	Incoming vf ring voltage.
Test point	A1TP3	ground	+0.03	No incoming vf ring voltage.
Power transformer 3T1	5	ground	30 vac	None.
Power transformer 3T1	7	ground	30 vac	None.

b. DC Resistance of Transformer, Inductor, and Relay Armature Windings. The following chart lists the ohmic resistance of transformer, inductor, and relay armature windings.

Designation	Terminals	Resistance (ohms)
3A1T1	1-2	400 ± 80
	3-4	270 ± 54
3A2T1	1-2	50 ± 10
	3-4	50 ± 10
3A2L1 (when applicable)	1-2	526 ± 53
	3T1	62 ± 9.3
3T1	2-4	67 ± 10
	5-7	9 ± 1.4
3K1	2-3	2,300 * minimum
3K2	2-3	1,000 ± 000

\* Negative meter lead connected to terminal 3.



FRONT

- NOTES:
1. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
  2. UNLESS OTHERWISE SHOWN, VOLTAGES AND RESISTANCES ARE MEASURED TO GROUND. DC VOLTAGE READINGS TAKEN WITH A 20,000 OHMS-PER-VOLT METER.
  3. -C INDICATES MEASUREMENTS ARE MADE ACROSS THESE POINTS.
  4. RESISTANCE MEASUREMENTS MADE WITH NEGATIVE LEAD AT GROUND.

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Figure 3-1. Chassis voltage and resistance diagram.

### 3-3. Continuity Tests

The following continuity test checks that the appropriate line terminal connections are established for settings of the 2W-4W switch. Addi-

tional tests within the equipment may be required when troubleshooting. Such additional tests should be made in accordance with the wiring diagram, figure FO-2, after removing the pc boards.

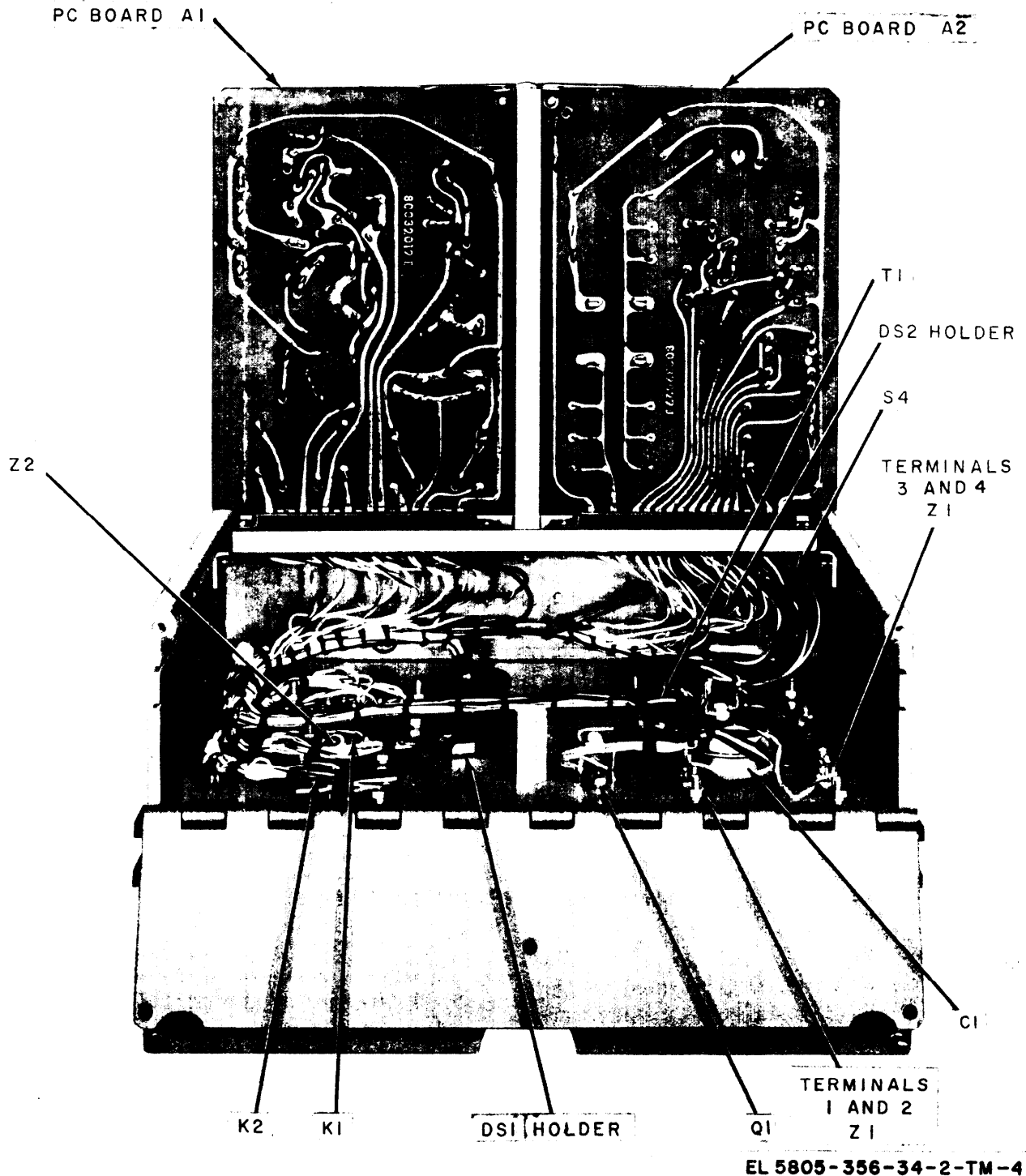


Figure 3-2. Chassis rear view with pc in test position

**CAUTION**

In making continuity and resistance checks independently without following a prescribed procedure, make sure not to apply a potential between transistor elements that could destroy the transistor. The battery contained in the TS-352B/U can destroy transistors by causing excessive current through them. In some instances, 0.1 volt applied between base and emitter in the reverse direction can destroy a surface barrier transistor. Never make any continuity checks with power applied to the CV-425/U.

*Figure FO-2. Wiring diagram.*  
(Located in back of manual.)

**3-4. Bench Testing**

The maintenance procedures require access to the interior of the CV-425/U and, in many instances, to points on or below the pc boards. Proceed as follows:

*a. Removal of Chassis from Case.* Loosen the

three camlock screws on the unit front panel by turning them one-quarter turn counterclockwise; pull the chassis forward from the case.

*b. Removal of PC Boards.*

(1) Loosen the three screws on the hinged panel at the rear of the chassis (fig. 3-2), and lower the panel.

(2) Use the extractor handle to pull out the pc boards from the chassis mounting rails.

*c. Adjusting PC Board to Test Position.*

(1) Remove both pc boards from the chassis (b above).

(2) On both sides of the chassis, loosen the screw that holds the harness board connector mounting bracket.

(3) Rotate the harness board connector bracket upward so that the slotted center piece is straight up.

(4) Reinsert the pc boards in the harness board connector.

*d. Restoration for Operation.* To restore the CV-425/U for operation after maintenance procedures have been completed, reverse the procedures used in preparing the CV-425/U for maintenance.

**Section II. TOOLS AND TEST EQUIPMENT**

The following chart lists the test equipment and tools required for direct support maintenance.

Test equipment and tools	Associated technical
Electronic Counter TD-1209/U . . . . .	TM 11-6625-2782-148P
Multimeter ME-26 B/U . . . . .	TM 11-6625-200-15
Multimeter TS-352B/U . . . . .	TM 11-6625-366-10
Oscilloscope AN/USM-281C . . . . .	TM 11-6625-2658-14
Test Set AN/USM-181B . . . . .	TM 11-6625 -602-12-1

Test equipment and tools	Associated technical manual
Electronic Equipment Tool Kit TK-105/G	Not applicable
Telegraph-Telephone Terminal AN/TCC-29	TM 11-5806-356-12
Telephone Set TA-312/PT . . . . .	TM 11-5805-201-12
Capacitor, 5- μf, 200-WVDC	
Resistor, 1500-ohm, 2-watt . . . . .	

**Section III. TROUBLESHOOTING**

**3-5. Introduction**

Trouble in the CV-425/U is isolated in three stages. The procedure starts by making operational tests on the unit to identify the malfunction, which is then referred to under a symptom in the troubleshooting chart. The troubleshooting chart lists probable troubles that can cause the noted symptom. Probable troubles are eliminated, and the trouble causing the symptom is identified by utilizing additional data supplied. The additional data comprise voltage and resistance measurements (fig. 3-1), the schematic di-

agram (FO-1), the wiring diagram (FO-2), and the military standard color code markings (FO-3). Reference may also be made to the circuit descriptions in chapter 2. If the trouble is isolated to a chassis-mounted part, repairs are authorized at direct support. If the trouble is isolated to a part mounted on a pc board, the pc board must be replaced. A notation should then be made stating the defect for which the pc board was replaced; this notation should accompany the pc board when it is forwarded to higher maintenance category for repair. After comple-

tion of repairs on the CV-425/U, the operational test must be repeated.

FO-3. Military standard color code markings.

(Located in back of manual.)

**NOTE**

Adjustment of the output frequency of the oscillator on send card 3A2 is not authorized for direct support maintenance. When adjustment is required, replace send card 3A2 and forward to higher maintenance category with notation.

**3-6. Operational Tests**

Perform the following operational tests in the sequence in which they are given. The tests are to be performed with the CV-425/U chassis removed from its case and pc boards erected in the test position (para 3-4). Each test provides an indication that will be obtained when the circuit is operating normally. So long as the normal indications are obtained, continue with the operational tests. Upon completion of a test, disconnect the test equipment before continuing with the next test. When a normal indication is not obtained for one of the tests, locate the symptom that describes the failure in the troubleshooting chart (para 3-7). Investigate the probable causes associated with the noted symptom and take the corrective action suggested in the chart for the cause. Upon completion of the corrective action, make sure that the trouble has been corrected by repeating the operational test and noting that a normal indication is now obtained.

**NOTE**

In the following operational tests, controls for which no setting is specified in the procedure may be left in any position. Use of either the TA-312/PT or TH-22/TG to produce the 20-Hz ringing signal is optional.

*a. Power Supply Output Voltage Test.*

(1) Operate the POWER switch to OFF.

(2) Connect the CV-425/U to a power source.

(3) Operate the POWER switch to ON. Note that the POWER indicator lights.

(4) Use the ME-26(\*)/U (set to measure -18 volts dc) to measure the voltage between ground and test point A2TP3 (fig. 3-3.1) or terminal P, (fig. 3-3.2) if the 3A2 circuit card utilizes a sealed VF OSC unit (A1). The meter should indicate  $-18 \pm 1.8$  volts dc.

*b. 20 Hz to Vf Circuit Output Frequency Test.*

(1) Operate the CV-425/U front panel control as follows:

<i>Control</i>	<i>Position</i>
POWER.....	ON
TP-TG.....	TG
2W-4W.....	2W
SENSITIVITY.....	HIGH

(2) Connect the TA-312/PT to LOOP 2W-4WR binding posts of the CV-425/U under test.

(3) Connect COUNTER INPUT of an AN/TSM-16 to the LINE 2W-4WS binding posts of the CV-425/U under test.

(4) Operate the TA-312/PT to produce a 20-Hz ringing signal. TD-1209/U should read  $1232.5 \pm 10$  Hz.

(5) Set TP-TG switch to TP and operate TH-22/TG to produce a 20-Hz ringing signal. TD-1209/U should read  $1600 \pm 10$  Hz.

*c. 20 Hz to Vf Circuit Output Level Test.*

(1) Operate the CV-425/U front panel controls as follows:

<i>Control</i>	<i>Position</i>
POWER.....	ON
TP-TG.....	TG
2W-4W.....	2W
SENSITIVITY.....	HIGH

(2) Connect the INPUT of an ME-22/PCM to the LINE 2W-4WS binding posts of the CV-425/U under test.

(3) Connect the TA-312/PT binding posts to LOOP 2W-4WR binding posts of the CV-425/U under test.

(4) Operate the TA-312/PT to produce a 20-Hz ringing signal. ME-22/PCM should indicate  $0 \pm 2$  dbm.

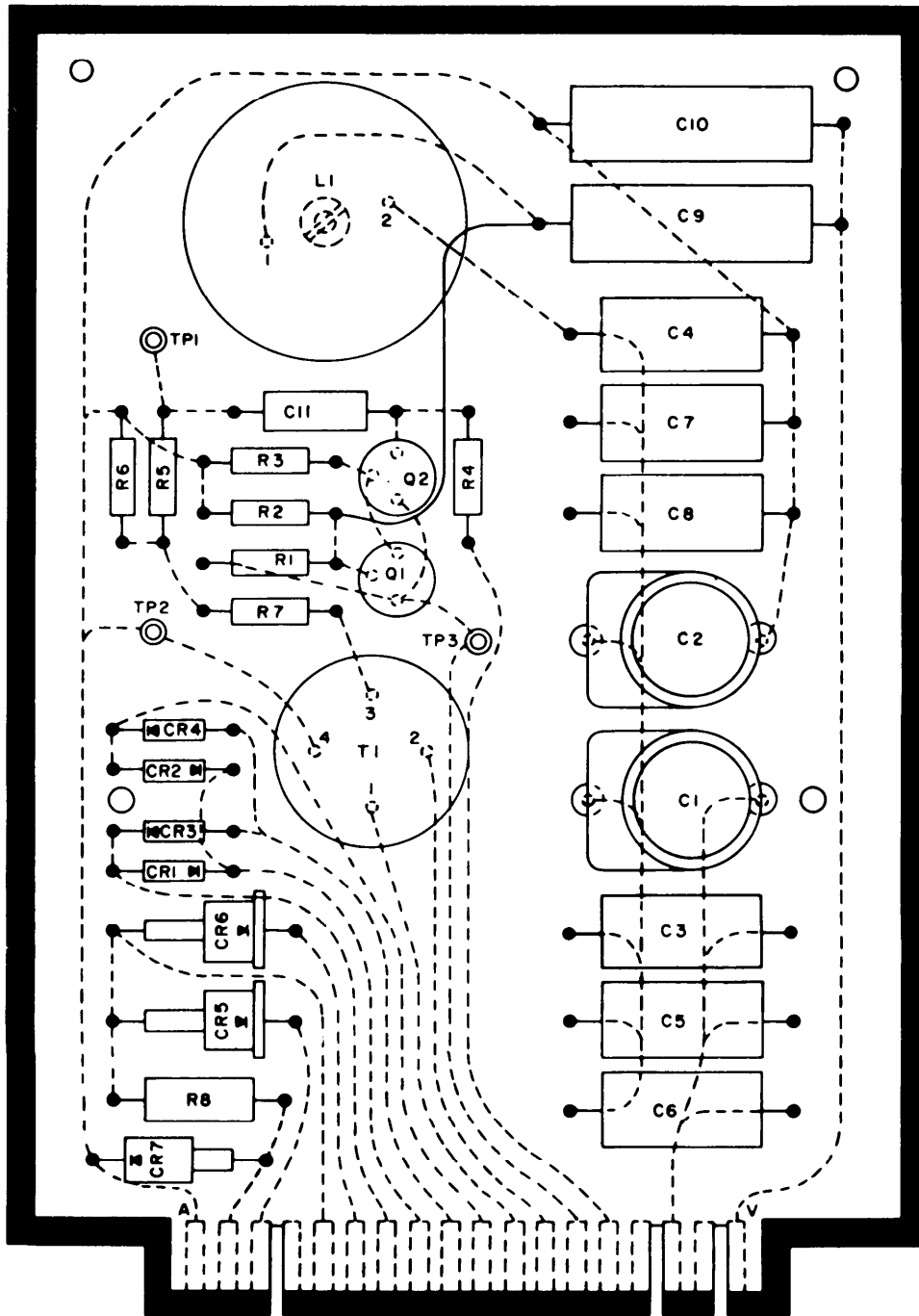
(5) Set TP-TG switch to TP and operate TH-22/TG to produce a 20-Hz ringing signal. ME-22/PCM should indicate  $0 \pm 2$  dbm.

*d. Vf to 20-Hz Circuit Frequency Sensitivity Test.*

(1) Operate the CV-425/U front panel controls as follows:

<i>Control</i>	<i>Position</i>
POWER.....	ON
TP-TG.....	TG
2W-4W.....	2W
SENSITIVITY.....	LOW

(2) Connect the 1500-ohm resistor and the 5- $\mu$ f capacitor (series connected) load to the LOOP 2W-4WR binding posts of the CV-425/U under test. Also connect the input of the AN/USM-281 C to the LOOP 2W-4WR binding posts.



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Figure 3-3.1. 20-Hz to vf card 3A2 component layout and wiring diagram (discrete components.)

(3) Connect the OUTPUT of an SG-15/PCM to the LINE 2-W-4WS binding posts of the CV-425/U under test.

(4) Slowly change the SG-15/PCM frequency from 1195 through 1260 Hz while maintaining the output level of  $0 \pm 2$  dbm. The AN/USM-281C should

display a  $20 \pm 3$  Hz signal of 90 V minimum peak-to-peak.

(5) Set TP-TG switch to TP and slowly change output of SG-15/PCM from 1570 Hz through 1630 Hz. AN/USM-281C should display a  $20 \pm 8$  Hz signal of 90V minimum peak-to-peak.

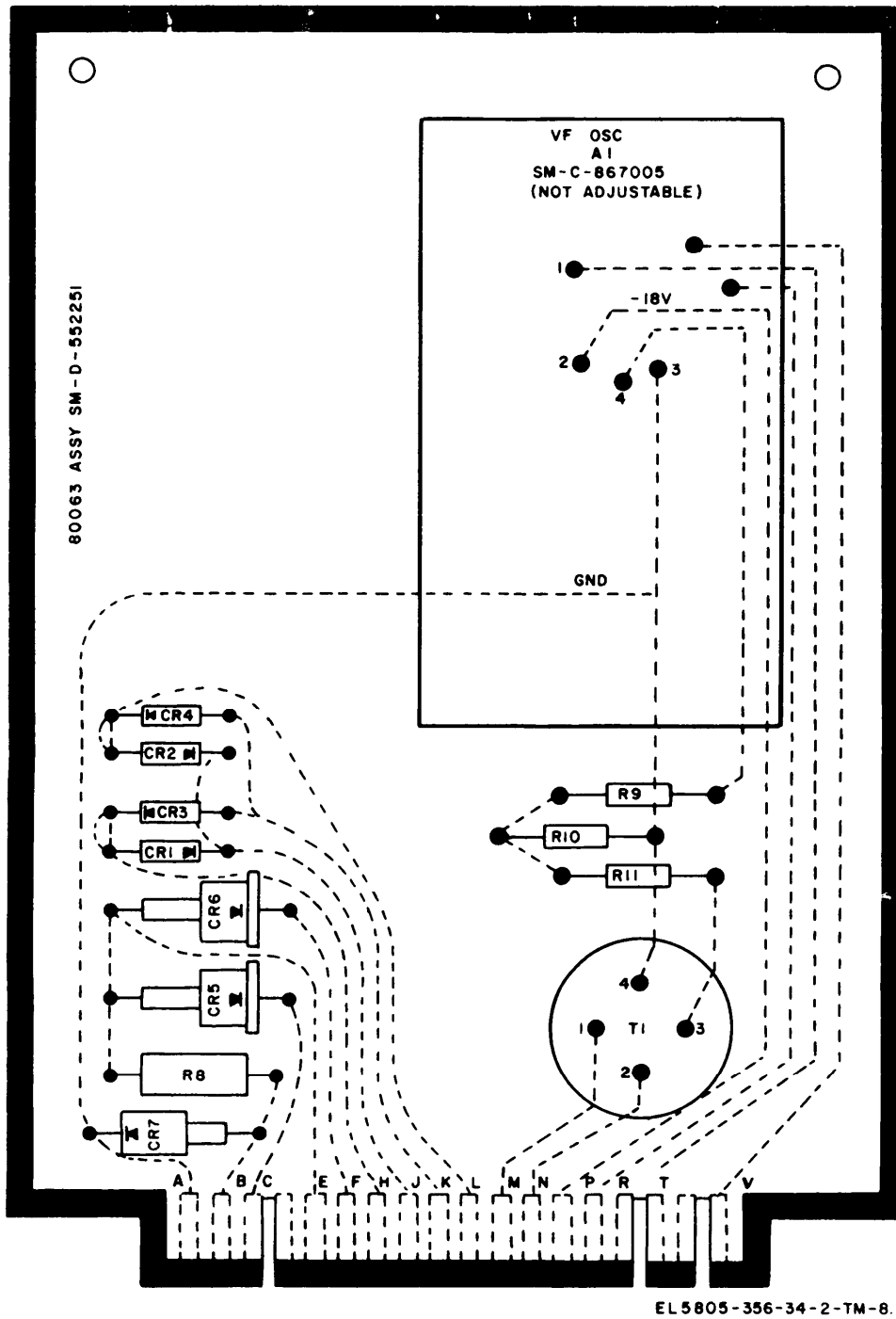


Figure 3-3.2. 20-Hz to vf card 3A2 component layout and wiring diagram (sealed VF-OSC).





*e. Vf to 20-Hz Circuit Vf Sensitivity Test.*

(1) Operate the CV-425/U front panel controls as follows:

<i>Control</i>	<i>Position</i>
POWER.....	ON
TP-TG.....	TG
2W-4W.....	2W
SENSITIVITY	HIGH

(2) Connect the 1500 -ohm resistor and the 5- $\mu$ f capacitor (series connected) load to the LOOP 2W-4WR binding posts of the CV-425/U under test. Also connect the input of the AN/USM-281C to the LOOP 2W-4WR binding posts.

(3) Connect the OUTPUT of an SG-15/PCM to the LINE 2W-4WS binding posts of the CV-425/U under test.

(4) Adjust SG-15/PCM for a 1232.5-Hz -45 dbm output. AN/USM-281C should display a  $20 \pm 3$  Hz signal of 90 V minimum peak-to-peak with the TP-TG switch in TG position.

(5) Adjust SG-15/PCM for a 1600-Hz -30 dbm output. AN/USM-281C should display a  $20 \pm 3$  Hz signal of 90 V minimum peak-to-peak in TP and LOW

*b. Troubleshooting Chart.*

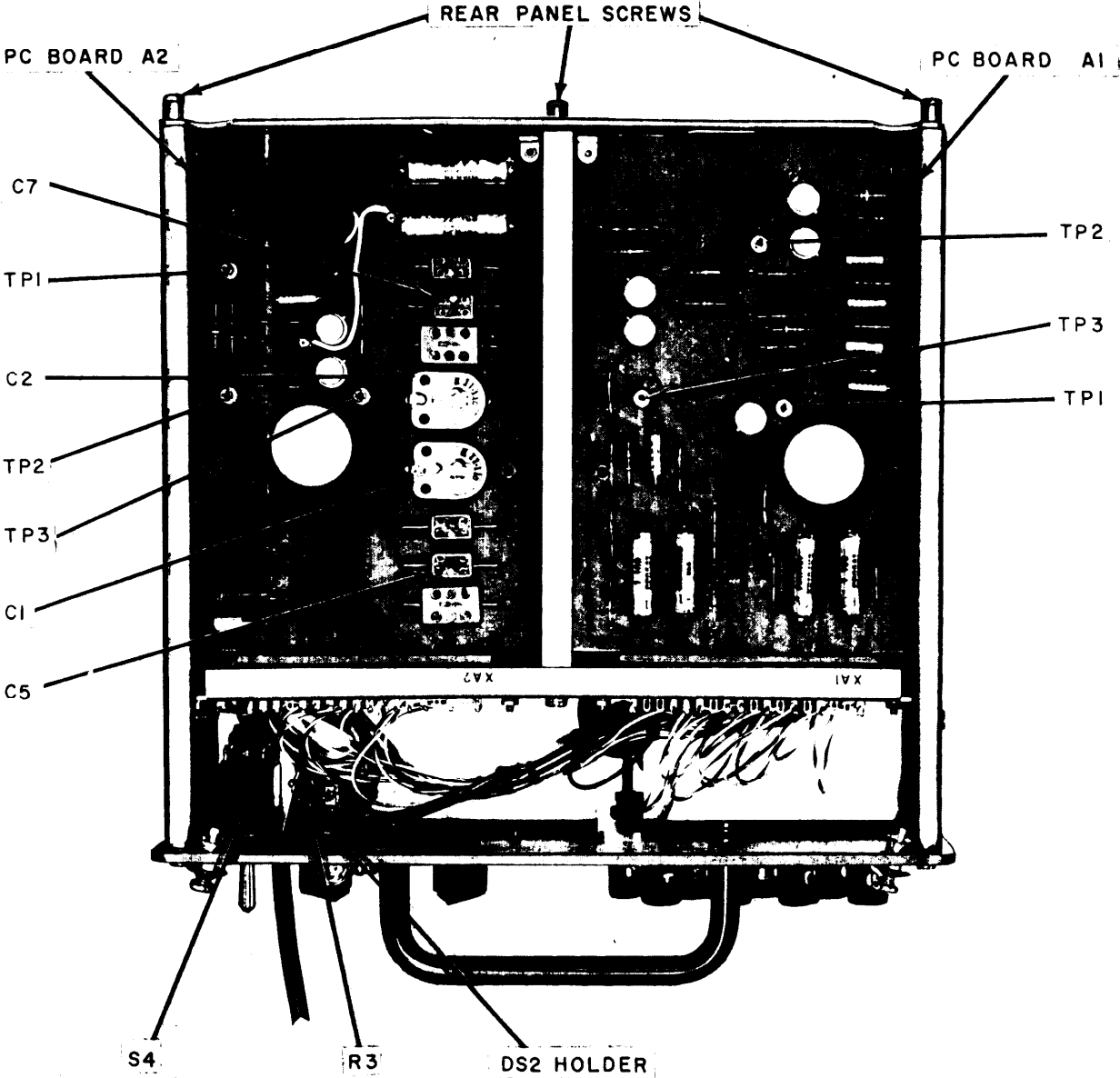
Item	Symptom	Probable trouble	Correction
1	Voltage measured at test point 3A2TP3 (or card terminal P where sealed VF OSC unit (A1) is used) is not -18 volts dc $\pm 1.8$ and/or POWER indicator lamp does not glow.	<ul style="list-style-type: none"> <li>a. Defective resistor 3R3 (fig. 3-4)</li> <li>b. Defective POWER switch 3S4, power cord, or power plug (fig. 3-4).</li> <li>c. Defective capacitor 3C1 (fig. 3-2)</li> <li>d. Defective power transformer 3T1 (fig. 3-2).</li> <li>e. Defective voltage regulator 3Q1-3A2CR7 (fig. 3-2).</li> <li>f. Defective rectifier 3A2CR5-3A2CR6.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check resistance of 3R3 and replace if defective.</li> <li>b. Perform continuity test and replace defective part.</li> <li>c. Check 3C1 for short and replace TP if defective.</li> <li>d. Perform voltage test (fig. 3-1) and replace if defective.</li> <li>e. Perform voltage test to determine defect. Replace transistor 3Q1 or send card 3A2, as required.</li> <li>f. Replace defective send card 3A2.</li> </ul>
2	No 20-Hz output when vf input of correct amplitude and frequency is applied to the LINE terminals. (Correct amplitude is greater than -45 dbm when SENSITIVITY switch is at HIGH, -30 dbm when at LOW. Correct frequency is 1,232.5 Hz when TP-TG switch is at TG; 1,600 Hz when at TP.)	<ul style="list-style-type: none"> <li>a. Defective 20-Hz ringer 3Z1 (fig. 3-2).</li> <li>b. Defective ballast lamp 3DS1 or holder (fig. 3-5).</li> <li>c. Defective 2W-4W switch 3S1, relay 3K1, or relay 3K2 (fig. 3-5).</li> <li>d. Defective receive card 3.41 (fig. 3-2).</li> <li>e. Defective discriminator transformer 3Z2 (fig. 3-2).</li> <li>f. Defective TP-TG switch 3S2 (fig. 3-5).</li> </ul>	<ul style="list-style-type: none"> <li>a. Check for 20-Hz output at terminals 3 and 4 of 20-Hz ringer and replace if defective.</li> <li>b. Perform continuity test on ballast lamp and holder and replace if defective.</li> <li>c. Perform continuity test to determine defective part. Replace defective part.</li> <li>d. Replace receive card 3A1.</li> <li>e. Replace discriminator transformer 3Z2.</li> <li>f. Check switch and replace if defective.</li> </ul>

SENSITIVITY switch position on the CV-425/U.

**3-7. Localizing Trouble**

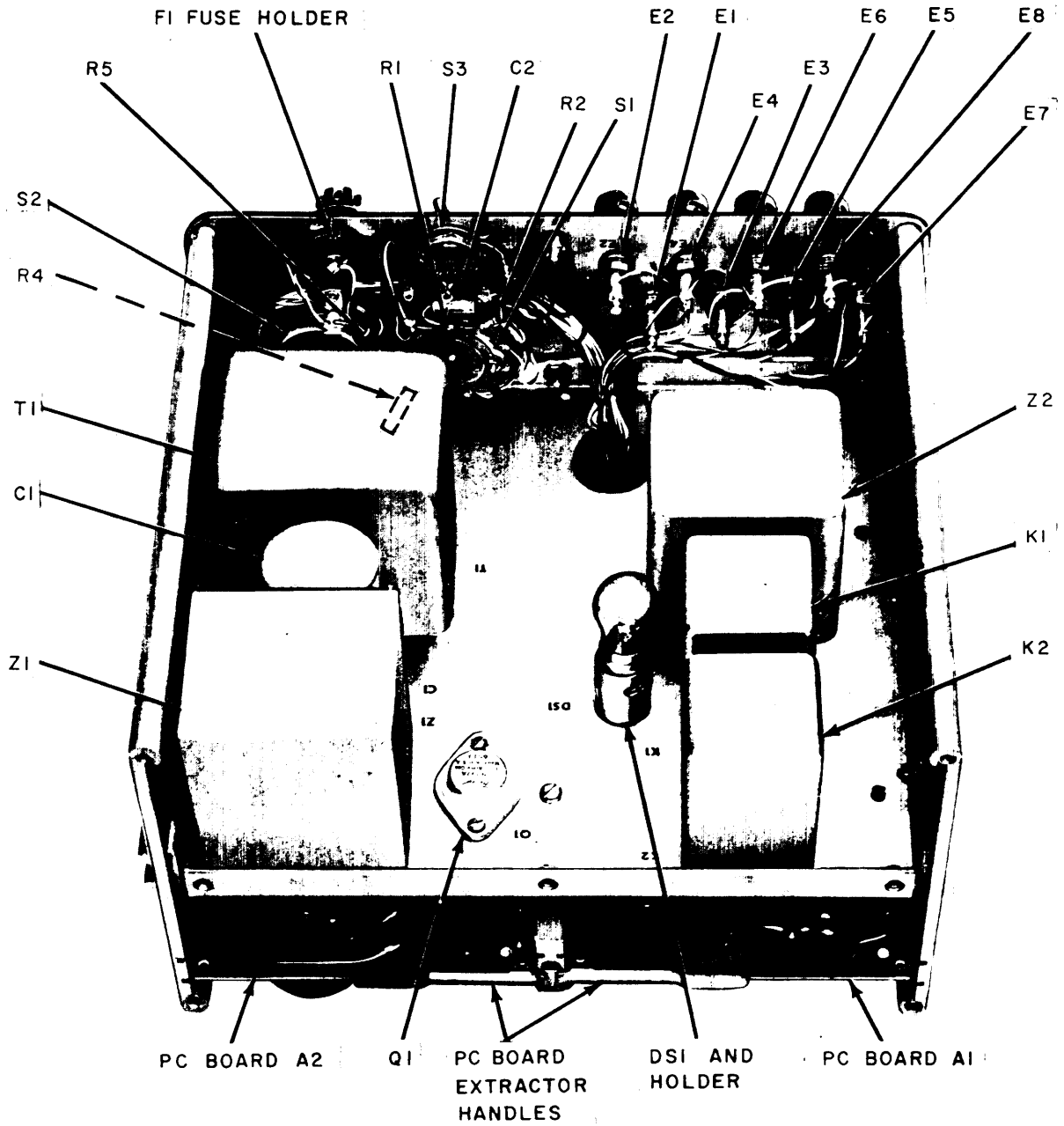
*a. General.* Procedures are outlined in the troubleshooting chart (b below) for localizing troubles to the individual circuit or component. The procedures are initiated as a result of failing to obtain the indicated results when performing the operational tests (para 3-6). When the procedure results in tracing the trouble to a pc board, replace the board. If the trouble is traced to a stage on the chassis, use voltage and resistance measurements as required to isolate the trouble to a defective part. Voltage and resistance data are provided in paragraph 3-2 and in figure 3-1. In the chart, the component reference designation indicates its physical location in the CV-425/U as follows: 3 indicates the chassis assembly; 3A1 indicates receive card 3A1; and 3A2 indicates send card 3A2. The physical location of components and test points is illustrated in figure 3-2 through 3-6.

Item	Symptom	Probable trouble	Correction
3	Sensitivity does not change when SENSITIVITY switch position is changed.	a. Defective SENSITIVITY switch 3S3 (fig. 3-5). b. Defective capacitor 3C2 (fig. 3-5)	a. Check switch 3S3 and replace if defective. b. Check capacitor and replace if defective.
4	Guard circuit slow or inoperative (vf ring signal produces 20 Hz after being present for more than 2 seconds).	Defective receive card 3A1 (fig. 3-2)	Replace receive card.
5	20-Hz output level low	Defective 20-Hz ringer 3Z1 (fig. 3-5)	Replace 20-Hz ringer.
6	20-Hz output at all times	a. Defective receive card 3A1 (fig. 3-2). b. Defective relay 3K2 (fig. 3-2)	a. Replace receive card. b. Check relay and replace if defective.
7	No vf output when 20-Hz input is applied to LOOP terminals.	a. Defective send card 3A2 (fig. 3-2). b. Defective relay 3K1 or diode 3CR1 (fig. 3-2).	a. Replace send card. b. Check relay and diode and replace if defective.
8	Low vf output	Defective send card 3A1 (fig. 3-2)	Replace send card.
9	Incorrect output frequency for telephone and telegraph operation.	Oscillator improperly adjusted	Replace send card 3A2 (fig. 3-2).
10	Incorrect output frequency for telegraph operation only.	a. Defective send card 3A2 (fig. 3-2) b. Defective switch 3S2 (fig. 3-5)	a. Replace send card. b. Check switch and replace if defective.
11	Vf output when there is no 20-Hz input.	Defective relay 3K1 (fig. 3-2)	Replace relay.
12	Unit not responsive to 20-Hz voltage down to 50 volts peak-to-peak.	a. Defective relay 3K1 (fig. 3-2) b. Defective 20-Hz detector 3A2CR1 to 3A2CR4.	a. Check relay and replace if defective. b. Replace send card 3A2 (fig. 3-2).
13	Signal loss through unit exceeds 0.5 db.	a. Defective relay 3K1 or relay 3K2 (fig. 3-2). b. Defective 2W-4W switch 3S1 (fig. 3-5). c. Defective input transformer 3A1T1 or associated components in primary of transformer on receive card 3A1.	a. Check relays and replace if defective. b. Check switch and replace if defective. c. Replace receive card (fig. 3-2).



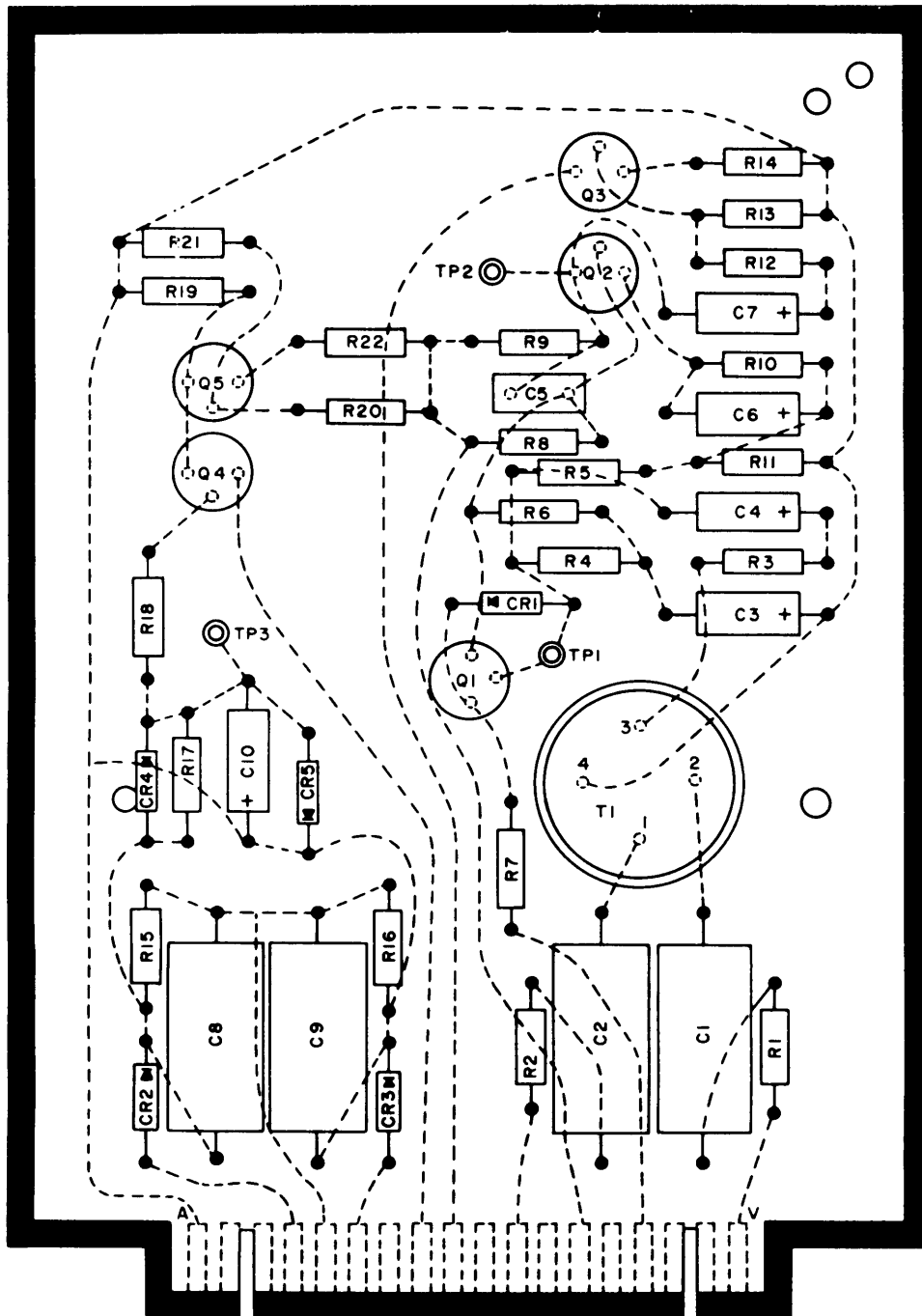
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Figure 3-4. Chassis, top view.



EL 5805-356-34-2-TM-6

Figure 3-5. Chassis, bottom view.



EL5805-356-34-2-TM-7

Figure 3-6.  $V_f$  to 20-Hz card 3A1 component layout and wiring diagram.

## CHAPTER 4

### GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

#### Section I. GENERAL

##### 4-1. Scope of General Support Maintenance

a. General support maintenance consists of testing (b below) the CV-425/U and its component pc boards. Troubleshooting is performed using the information supplied for direct support maintenance.

b. General support maintenance testing procedures consist of complete final testing procedures for the CV-425/U. These procedures determine the acceptability of repaired equipment by testing the equipment against specific requirements. The repaired equipment must meet these requirements before it is returned to the using organization. The general support testing pro-

cedures are covered in paragraphs 4-5 through 4-9.

##### 4-2. Fabrication of Test Cable

a. *General.* To perform the general support maintenance tests, fabricate a 600-ohm hookup cable.

b. *600-ohm hookup cable.*

- (1) Cut two 2-foot lengths of hookup wire.
- (2) Strip 1/2 inch of insulation from both ends of each wire.
- (3) Connect and solder one wire to each 600-ohm resistor lead.
- (4) Tape exposed wires.

#### Section II. TOOLS AND TEST EQUIPMENT

##### 4-3. Test Equipment and Tools Required, General Support Maintenance

The following chart lists the test equipment and tools required for general support maintenance.

Test equipment and tools	Associated technical manual
Decade capacitor, FSN 6625-220-9441, part of Laboratory Standards AN/URM-2A	Commercial literature
Frequency Meter AN/TSM-16	TM 11-6625-218-12
Multimeter ME-26B/U	TM 11-6625-219-12
Multimeter TS-352B/U	TM 11-5527
Oscilloscope AN/USM-81	TM 11-6625-219-12
Test Set TS-140/PCM	TM 11-6625-251-15
Consisting of:	
Decibel Meter ME-22/PCM	
Signal Generator SG-15/PCM	

Test equipment and tools	Associated technical manual
Teletypewriter Test Set AN/GGM-1	TM 11-6625-422-12
Transistor Test Set TS-1836/U	TM 11-6625-539-15
Electronic Equipment Tool Kit TK-100/G	Not applicable
Electronic Equipment Tool Kit TK-105/G	Not applicable
Telegraph-Telephone Terminal AN/TCC-29	TM 11-5805-356-12

##### 4-4. Material Required, General Support Maintenance

The material required for general support maintenance consists of 25 feet of No. 20 insulated copper hookup wire and one 2-watt, 600-ohm  $\pm$  5 percent carbon resistor.

#### Section III. TROUBLESHOOTING

Refer to Chapter 3, Section III.

**Section IV. MAINTENANCE OF CV-425/U**

**4-5. Repair Procedures**

The general support repair procedures consist of replacing parts and repair of the pc boards of the CV-425/U. These procedures require the use of Electronic Equipment Tool Kits TK-100/G and TK-105/G. Follow the procedures in *a* below when replacing transistors, *b* below when replacing parts, and *c* below when repairing pc boards.

*a. Transistor Replacement.*

(1) Use a pencil-type soldering iron with a 25-watt maximum capacity.

**CAUTION**

Never bring the soldering iron into direct contact with the transistor body or any heat conductor which is in direct contact with the transistor body. The excessive temperature will destroy the transistor.

(2) When soldering transistor leads, solder quickly; use a heat sink (such as a long-nose pliers) between the soldered joint and the transistor.

(3) Use approximately the same length and dress for transistor leads as used originally.

*b. Part Replacement.*

(1) Remove the part by cutting the leads approximately one-sixteenth of an inch from the printed circuit board.

**CAUTION**

Never bring the soldering iron into direct contact with the printed circuit. Excessive heat will damage the printed circuit.

(2) Remove the leads from the printed circuit by applying the iron to the lead until the solder melts at the junction.

(3) Remove the excess solder from the junction on the printed circuit board with a small drill. Always drill from the printed circuit side of the board to prevent loosening of the printed circuit foil.

(4) Use approximately the same length and dress for part leads as was used originally.

(5) Solder the component leads to the printed circuit by applying the soldering iron to the component lead and removing the iron as soon as the solder flows into the junction.

*c. PC Board Repair.* Proceed as follows if the foil of the pc board is loose or broken.

(1) Remove the loose or broken foil by cutting it as close to the board as possible.

(2) Cut a piece of tinned 20-gage copper wire one-half inch longer than the span of the removed section of foil.

(3) Bend each end of the copper wire one-quarter inch from the ends until its shape resembles a staple.

(4) Drill a small hole in the board at each end of the span where the loose or broken foil was removed. If the foil at each end of the span is one-quarter inch or more in width, drill the holes directly into the foil.

(5) Insert the ends of the copper wire from the component side of the board and bend the ends across the foil.

(6) Solder the junctions of the foil and copper wire by applying the soldering iron to the copper wire.

**Section V. GENERAL SUPPORT TESTING PROCEDURES**

**4-6. Physical Test and Inspection**

*a. Test Equipment and Materials.* None required.

*b. Test Connections and Conditions.* Remove the CV-42WU from its case.

*c. Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	N/A	<i>a. Inspect all controls and assemblies for missing screws, bolts, and nuts.</i>	<i>a. Screws, bolts, and nuts are tight; none missing.</i>



Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p>b. Inspect all connectors, sockets, and receptacles, including the fuse-holder, for looseness and damage.</p> <p>c. Inspect case and chassis for damage, missing parts, condition of finish, and panel lettering.</p> <p><b>Note.</b> Touch-up painting is recommended in lieu of refinishing whenever practicable. Screwheads, binding posts, receptacles, and plated fastener parts will not be painted or polished with abrasives.</p>	<p>b. No looseness or damage evident.</p> <p>c. No damage or missing parts evident. External surfaces intended to be painted do not show bare metal. Panel lettering legible.</p>
2	N/A.....	N/A.....	<p>Check pc board assembly, that has been disturbed and repaired, for missing epoxy coating.</p>	<p>All repaired or disturbed components and surfaces are covered.</p> <p><b>Note.</b> Equipment surfaces that had no coating do not require treatment during general support repair.</p>
3	N/A.....	N/A.....	<p>Check the equipment for applicable modification work orders.</p>	<p>None.</p>

**4-7. Oscillator Frequency Adjustment**

**NOTE**

This adjustment is not applicable for cards with sealed VF-OSC units (fig. 3-3.2).

*a. Test Equipment and Materials.*

- (1) Frequency Meter TD-1209/U.
- (2) Telephone Set TA-312/PT.
- (3) Hookup wire (10 ft.).

*b. Test Connections and Conditions.*

- (1) Connect the TA-312/PT 4WS TEL terminals to the CV-425/U 4W-S loop terminals.
- (2) Connect the CV-425/U 4W-S LINE terminals to the TD-1209/U counter input.

*c. Procedure.*

(1) Set the CV-425/U controls as follows:

Control	Position
POWER .....	ON
TP-TG .....	TP
2W-4W .....	4W

**NOTE**

The send oscillator output becomes available at the CV-425/U LINE terminals only when a 20-Hz ring signal

is applied to the LOOP terminals. Throughout this procedure, operate the TA-312/PT ringer whenever the oscillator output is required.

(2) While operating TA-312/PT ringer, adjust capacitor A2C2 (fig. 3-4) to obtain an indication of  $1600 \pm 10$  Hz on the TD-1209/U.

(3) Set the CV-125/U TP-TG switch to TG.

(4) While operating TA-312/PT ringer, adjust capacitor A2C1 (fig. 3-1) to obtain an indication of  $1232.5 \pm 10$  Hz on the TD-1209/U.

**4-8. 2-Wire Operational Test**

*a. Test Equipment and Materials.*

- (1) Terminal Telegraph TH-22/TC (2).
- (2) Converter Telegraph-Telephone Signal CV-425/U.
- (3) Hookup wire (24 ft).

*b. Test Connections and Conditions.* Using three pairs of hookup wires (designated 2-wire test hookup wire), connect two standard TH-22/TC's, one standard CV-425/U, and the CV-425/U under test as shown in figure 4-1. Omit all other hookup wires shown.

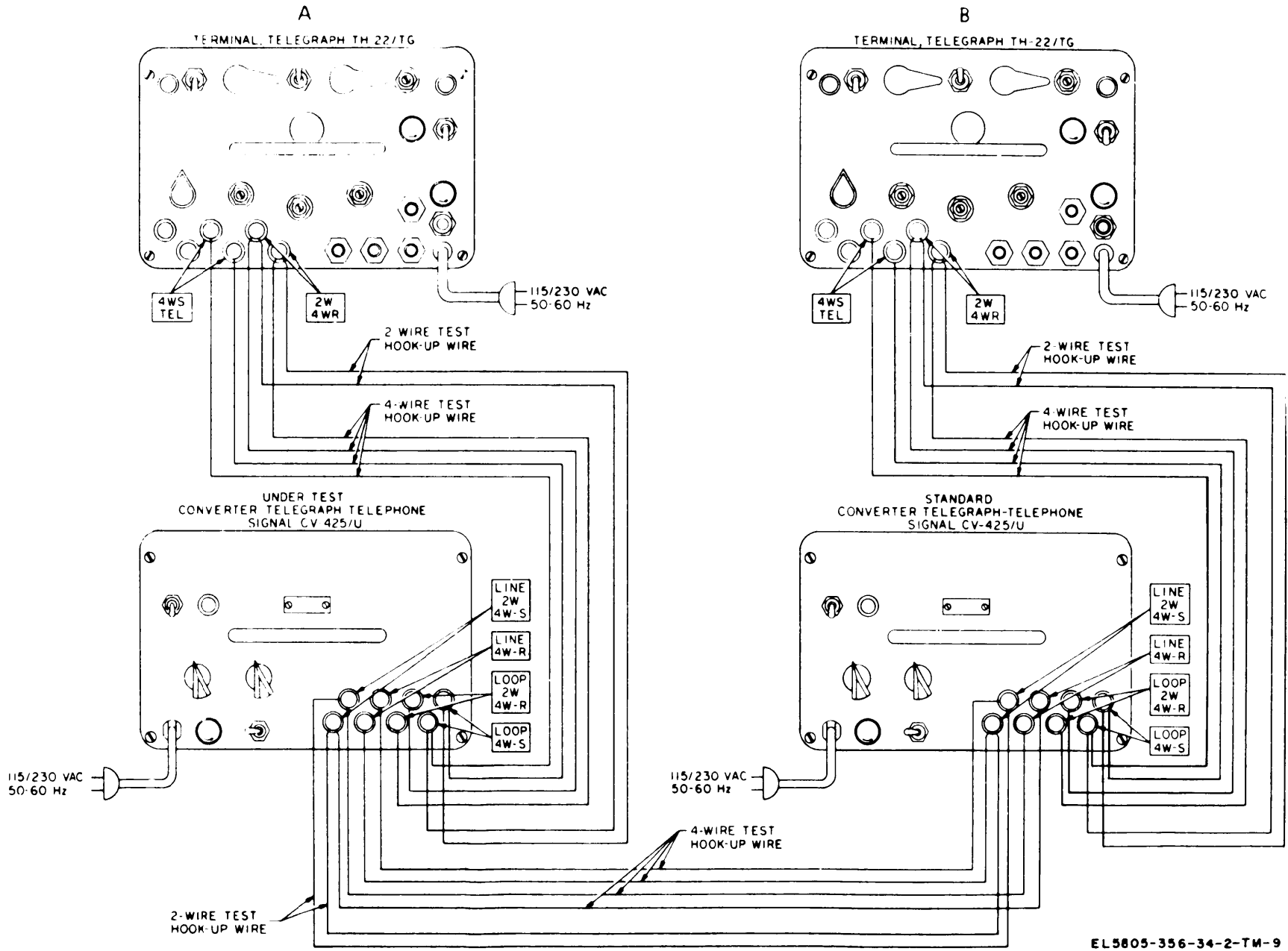


Figure 4-1. Operational Test Setup.

c. Initial Test Equipment Settings. None.

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	CV-425/U (standard) 2W-4W: 2W TP-TG: TG Sensitivity: LOW Power: ON TH-22/TC(2) ON-OFF: ON 4W-2W-TEL: 2W Norm-Rec-Send: Norm VF-20~: 20~	CV-425/U 2W-4W: 2W TP-TG: TG Sensitivity: LOW Power: ON	Depress TH-22/TC (A) RING switch.	TH-22/TC (B) speaker produces audible tone.
2	Same as above except: TP-TG: TP.	Same as above except TP-TG: TP.	Same as above	TH-22/TC (B) Speaker produces audible tone.  <b>NOTE</b> On some equipment, when using the short-wire hookup of figure 4-1, a break-in condition at position A TH-22/TG will occur as the RING switch is released. This produces an audible tone in both speakers. Operate the position A TH-22/TG RESET switch to silence the speakers and return the equipment to normal.
3	Same as 1 above	Same as 1 above	Depress TH-22/TC (B) RING switch.	TH-22/TC (A) Speaker produces audible tone.
4	Same as 1 above except TP-TG: TP.	Same as 1 above except TP-TG: TP.	Depress TH-22/TC (B) RING switch.	TH-22/TC (A) Speaker produces audible tone.  <b>NOTE</b> On some equipment, when using the short-wire hookup of figure 4-1, a break-in condition at position B TH-22/TG will occur as the RING switch is released. This produces an audible tone in both speakers. Operate the position B TH-22/TG RESET switch to silence the speakers and return the equipment to normal.

**4-9. 4-Wire Operational Test**

a. Test Equipment and Material.

- (1) Terminal Telegraph TH-22/TC (2).
- (2) Converter Telegraph-Telephone Signal CV-425/U.
- (3) Hookup wire (42 ft).

b. Test Connections and Conditions. Using 6 pairs of hookup wires (designated 4-wire test hookup wire) connect two standard TH-22/TC's, one standard CV-425/U and the CV-425/U under test as shown in figure 4-1. Omit all other hookup wires shown.

c. Initial Test Equipment Settings. None

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	CV-425/U (standard) 2W-4W: 4W TP-TG: TG Sensitivity: Low Power: ON TH-22/TC (2) ON-OFF 4W-2W-TEL: 4W NORM-REC-SEND: NORM VF-20~: 20~	CV-425/U 2W-4W: 4W TP-TG: TG Sensitivity: Low Power: ON	Depress TH-22/TC (A) RING switch.	TH-22/TC (B) Speaker produces audible tone.
2	Same as above except TP-TG: TP.	Same as above except TP-TG: TP.	Same as above	TH-22/TC (B) Speaker produces audible tone.
3	Same as 1 above	Same as 1 above	Depress TH-22/T TH-22/TC (B) RING switch.	TH-22/TC (A) Speaker produces audible tone.
4	Same as 1 above except TP-TG: TP.	Same as above except TP-TG: TP.	Depress TH-22/TC (B) RING switch.	TH-22/TC (A) Speaker produces audible tone.

## APPENDIX A

## REFERENCES

Following is a list of useful references available to the repairman of the CV-425 U.

AR 380-40	Policy for Safeguarding and Controlling COMSEC Information (U).
AR 735-11-2	Reporting of Transportation Discrepancies in Shipment.
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS),
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TM 11-2044	Attenuators TS-402/U and TS-402A/U.
TM 11-2208	Test Sets TS-2AB/TG (Teletypewriter Signal Distortion) (NSN 6625-00-243-5173).
TM 11-5805-201-12	Operator and Organizational Maintenance Manual: Telephone Set TA-312/PT (NSN 5805-00-543-0012).
TM 11-5805-201-20P	Organizational Maintenance Repair Parts and Special Tools Lists for Telephone Set TA-312/PT (NSN 5805-00-543-0012).
TM 11-5805-201-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Telephone Set TA-312/PT (NSN 5805-00-543-0012).
TM 11-5805-201-35	Direct Support, General Support, and Depot Maintenance Manual: Telephone Set TA-12/PT (NSN 5805-00-543-0012).
TM 11-5805-356-12	Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools List): Terminal Telegraph-Telephone AN/TCC-29 (NSN 5805-00-902-3087) (Including Terminal, Telegraph TH-22/TG (5805-00-907-8300) and Converter, Telegraph-Telephone Signal CV-425/U (5805-00-985-9088)).
TM 11-6625-200-15	Operator's Organizational, Direct Support, General Support, and Depot Maintenance Manual: Multimeters ME-26A/U (NSN 6625-00-360-2493), ME-26B/U, ME-26C/U (6625-00-646-9409) and ME-26D/U (6625-00-913-9781).
TM 11-6625-251-15	Organizational, Direct Support, General Support, and Depot Maintenance Manual: Test Set TS-140/PCM; Signal Generators SG-15/PCM and SIG-15 A/PCM and Decibel Meters ME-22/PCM and ME-22A/PCM.
TM 11-6625-366-10	Operator's Manual for Multimeter TS-352B/U (NSN 6625-00-553-0142).
TM 11-6625-366-15	Operator's Organizational, Direct Support, General Support, and Depot Maintenance Manual: Multimeter TS-352B/U (NSN 6625-00-553-0142).
TM 11-6625-422-12	Organizational Maintenance Manual Including Repair Parts List: Test Sets, Teletypewriter AN/GGM-1 AN/GGM-2, AN/GGM-3, AN/GGM-4, and AN/GGM-5.
TM 11-6625-539-15	Operator, Organizational, Field, and Depot Maintenance Manual: Transistor Test Set TS-1836/U (NSN 6625-00-168-0954).
TM 11-6625-602-12-1	Operator's and Organizational Maintenance Manual for Test Set, Telephone AN/USM-181B.
TM 11-6625-2658-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Oscilloscope AN/USM-281C (NSN 6625-00-106-9622).
TM 11-6625-2782-14&P	Operator's, Organizational, Direct Support and General Support Maintenance for Electronic Counter Mainframe TD-1209/U (NSN 6625-00-024-7066) and Electronic Counter Module TD-1211/U (6625-00-298-9676).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

## APPENDIX B

### DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS

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#### Section I. INTRODUCTION

##### B-1. General

This appendix contains a list of repair parts required for the performance of direct support, general support, and depot maintenance for Converter, Telegraph-Telephone Signal CV-425/U.

##### NOTE

No special tools, test, and support equipment are required.

##### B-2. Explanation of Sections

This repair parts list is divided into four principal sections.

*a. Repair Parts for Direct Support, General Support, and Depot Maintenance Section II.* A list of repair parts authorized for the performance of maintenance at direct support, general support and depot.

*b. Federal Stock Number Cross-Reference to Index Number-Section III.* An index of Federal stock numbers and manufacturer's part number to index numbers.

*c. Figure and Item Number Cross-Reference to Index Number-Section IV.* An index of illustrated items to line items by index numbers. The line item index numbers appear in the SMR code column of the repair parts list directly under the code letters in ascending sequence for each item. The index number for an item will be the same for that item in all repair parts lists of this equipment.

*d. Reference Designation Cross-Reference to Index Number-Section V.* An index of reference designations to index numbers.

##### B-3. Explanation of Columns

The following is an explanation of the columns in Section II:

*a. Source, Maintenance, and Recoverability Codes (SMR), Column 1.* The first column on the left of the repair parts list contains the source,

maintenance, and recoverability (SMR) codes, where applicable, and an index number listed below the SMR codes in ascending order. The index number is related to automatic data processing in supply functions, but may also be used as a locator for the line item, when reference designations are not in alphanumerical sequence. The SMR codes used in this list are-

(1) *Source code.* The source code is the letter appearing on the left in the SMR column. It indicates the source from which the item is obtained in accordance with the following:

<i>Code</i>	<i>Explanation</i>
P....	Applies to repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.
M.....	Applies to repair parts which are not procured or stocked but are to be manufactured at indicated maintenance categories.
X1.....	Applies to repair parts which are not procured or stocked, the requirement for which will be supplied by use of next higher assembly or component,
X2.....	Applies to repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain such parts through cannibalization. If they are not obtainable through cannibalization, such repair parts will be requisitioned with supporting justification through normal supply channels.
G.....	Applies to major assemblies that are procured with PEMA funds for initial issue only to be used as exchange assemblies at DSU and GSU category. These assemblies will not be stocked above DSU and GSU category or returned to depot supply category.

(2) *Maintenance code.* The maintenance code is the letter appearing in the center of the SMR column. It indicates the lowest category of maintenance authorized to install the listed item. The codes are as follows:

<i>Code</i>	<i>Explanation</i>
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

(3) *Recoverability code.* The right-hand letter in the SMR column indicates whether the item should be returned for recovery or salvage. Recoverability codes are as follows:

**NOTE**

When no code is indicated in the recoverability column, the part will be considered expendable.

<i>Code</i>	<i>Explanation</i>
R	Applies to repair parts and assemblies which are economically repairable at DSU and GSU activities and normally are furnished by supply on an exchange basis.
U	Applies to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value, and reusable casings or castings.

*b. Federal Stock Number, Column 2.* The Federal stock number for the item is indicated in this column.

*c. Description, Column 3.* This column indicates the Federal item name and any additional description of the item required. A part number or other reference number is followed by the applicable five-digit Federal Supply Code for Manufacturers. When an item is repeated several times in the list, only the first appearance carries a description. For subsequent appearances of the item, the description column will read "Same as" followed by the index number of the first appearance; for example, RESISTOR, FIXED COMPOSITION : SAME AS A298.

**NOTE**

Usable on code column is not used.

*d. Unit of Issue, Column 4.* The unit used as a basis of issue (e.g., ea, pr, ft, yd, etc) is noted in this column.

*e. Quantity Incorporated in Unit Pack, Column 5.* Not used.

*f. Quantity Incorporated in Unit, Column 6.* The quantity of repair parts in an assembly is indicated in this column. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF."

*g. Maintenance Allowances, Column and 8.*

(1) The allowance columns are divided into subcolumns. The total quantity of items authorized for the number of equipments supported is indicated in each subcolumn opposite the first appearance of each item. Subsequent appearances of the same item will have no entry in the allowance columns but will have a reference, in the description column, to the first appearance of the item. Items authorized for use as required but not for initial stockage are identified with an asterisk(\*) in the allowance column.

(2) The quantitative allowances for DS/GS categories of maintenance will represent initial stockage for a 30-day period for the number of equipments supported.

*h. One-Year Allowances Per 100 Equipment/Contingency Planning Purposes, Column 9.* Opposite the first appearance of each item, the total quantity required for distribution and contingency planning purposes is indicated when applicable. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for 1 year.

*i. Illustrations, Column, 11.*

(1) *Figure number, column 11a.* The figure number of the illustration in which the item is shown, and the maintenance-level suffix number of the technical manual in which the illustration appears is included in this column. *For example,* if the illustration in which the item is shown in figure 1-13 of the operator's (-10) manual, the manual suffix -10 appears on the first line and the illustration number 1-13 on the second line.

(2) *Item or symbol number, column 11b.* The callout number used to reference the item in the illustration is indicated in this column.

**B-4. Location of Repair Parts**

*a.* This appendix contains three cross-reference indexes (sec. III, IV, and V), to be used to locate a repair part when either the Federal

stock number, reference number (manufacturer's part number), figure number, or reference designation and or item number is known. The first column in each cross-reference index is prepared, as applicable, in numerical or alphanumeric sequence. The last column of each cross-reference index lists the index number assigned to the part.

b. Refer to the appropriate cross-reference index (para B-2b, c, d) and note the index number in the last column: then refer to the repair parts list to locate the index number which is listed in ascending order in column 1.

**B-5. Federal Supply Codes**

This paragraph lists the Federal supply code and the associated manufacturer's name,

<i>Code</i>	<i>Manufacturer</i>
06540	Amathon Electronic Hardware Co., Inc.
13057	The Goshier Mfg. Co., Inc.
16677	Delco Mfg. and Sales Co., Inc.
28520	Heyman Mfg. Co.
54715	Shure Bros. Inc.
71468	ITT Cannon Electric Inc.
78189	Shakeproof Division of Illinois Tool Works Inc.
79963	Zierick Mfg. Corp.
80063	Army Electronics Command Procurement and Production Directorate
80064	Naval Ship Systems Command
81073	Grayhill Inc.
81349	Military Specifications
81350	Joint Army-Navy Specifications
92701	Harry B. Davies
94375	Automatic Metal Products Co.
95263	Leecraft Mfg. Co., Inc.
95987	Wechesser Co., Inc.
96238	Stelma Inc.
96906	Military Standards
98291	Sealectro Corp.



Section II. REPAIR PARTS, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT

(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCV	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
GROUP 3 C1-425/U															
G-O-S A001	5805-985-9088	CONVERTER, TELEGRAPH TELEPHONE SIGNAL CV-425/U: D544560003; 96238	ea		1	*	*	*	*	*	*			-12 1-7	
P-O-S A002	5805-999-5034	CASE, ELECTRICAL, EQUIPMENT CABINET: SM-D-98303GR3; 80063	ea		1	*	*	*	*	*	*	4	1	-12 1-7	MF1
P-O-S A003	5805-999-5031	COVER ASSEMBLY: SC-C-98314GR3; 80063	ea		1	*	*	*	*	*	*	4	1	-12 1-7	MF1A
P-O A004	5340-356-4895	STRAP, WEBBING: SC-B-983168; 80063	ea		1	*	*	*	*	*	*	4	1	-12 1-7	MF2
GROUP 34 COMPONENT BOARD A1															
P-O A005	5805-999-5035	SUBASSEMBLY, PRINTED CIRCUIT BOARD: D8003210; 96238	ea		1	2	4	8	2	2	2	100	75	-34 3-5	A1
P-H A006	5961-087-6047	SEMICONDUCTOR DEVICE, DIODE: 1N645; 81350	ea		1				2	2	2		16	-34 3-5	A1CR1
P-H A007	5961-669-6884	SEMICONDUCTOR DEVICE, DIODE: 1N277; 81350	ea		4				2	2	2		12	-34 3-5	A1CR2, A1CR3, A1CR4, A1CR5, A1C1, A1C2
P-H A008	5910-688-2822	CAPACITOR, FIXED, PAPER CP05A1K3104K; 81349	ea		4				2	2	2		12	-34 3-5	A1C3, A1C4
P-H A009	5910-892-7671	CAPACITOR, FIXED ELECTROLYTIC C813AK150K; 81349	ea		4				2	2	3		18	-34 3-5	A1C5
P-H A010	5910-984-7588	CAPACITOR, FIXED, MICA: CM05F101003; 81349	ea		1				*	*	2		3	-34 3-5	A1Q1, A1Q4
P-H A488	5910-892-7871	CAPACITOR, FIXED ELECTROLYTIC SAME AS A009	ea		REF									-34 3-5	A1Q5
P-H A012	5910-688-2822	CAPACITOR, FIXED, PAPER: SAME AS A008	ea		REF								3	-34 3-5	A1R1, A1R2
P-H A013	5910-060-7609	CAPACITOR, FIXED ELECTROLYTIC C813AK330K; 81349	ea		1				*	*	2		20	-34 3-5	A1R3
P-H A014	5961-752-5229	TRANSISTOR: 2R404; 81349 2N404; 81349	ea		4				2	2	3			-34 3-5	A1R4
P-H A015	5961-851-5923	TRANSISTOR: 2N1309; 81349	ea		1				*	*	2		3	-34 3-5	A1R5
P-H A016	5960-752-5229	TRANSISTOR: SAME AS A014	ea		REF									-34 3-5	A1R6
P-H A017	5905-725-6995	RESISTOR, FIXED, COMPOSITION: RC07GF271J; 81349	ea		2				2	2	2		9	-34 3-5	A1R7
P-H A018	5905-686-9994	RESISTOR, FIXED, COMPOSITION: RC07GF122J; 81349	ea		1				*	*	2		3	-34 3-5	A1R8
P-H A019	5905-686-3903	RESISTOR, FIXED, COMPOSITION: RC07GF333J; 81349	ea		2				*	2	2		6	-34 3-5	A1R9
P-H A020	5901-681-8853	RESISTOR, FIXED, COMPOSITION: RC07GF683J; 81349	ea		2				*	2	2		6	-34 3-5	A1R10
P-H A021	5905-686-3903	RESISTOR, FIXED, COMPOSITION: SAME AS A019	ea		REF									-34 3-5	
P-H A022	5905-683-7720	RESISTOR, FIXED, COMPOSITION: RC07GF510J; 81349	ea		2				*	2	2		6	-34 3-5	
P-H A023	5905-687-0002	RESISTOR, FIXED, COMPOSITION: RC07GF223J; 81349	ea		1				*	*	2		3	-34 3-5	
P-H A024	5905-683-2238	RESISTOR, FIXED, COMPOSITION: RC07GF103J; 81349	ea		4				2	2	2		12	-34 3-5	
P-H A025	5905-682-4100	RESISTOR, FIXED, COMPOSITION: RC07GF622J; 81349	ea		1				*	*	2		3	-34 3-5	

Section II. REPAIR PARTS, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT

(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCTY	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H A026	5905-683-7720	RESISTOR, FIXED, COMPOSITION: SAME AS A022	ea		REF									-34 3-5	AIR11
P-H A027	5905-683-2238	RESISTOR, FIXED, COMPOSITION: SAME AS A024	ea		REF									-34 3-5	AIR12
P-H A028	5905-686-3370	RESISTOR, FIXED, COMPOSITION: RC07GF202J; 81349	ea		1				*	2	2		6	-34 3-5	AIR13
P-H A029	5905-279-1890	RESISTOR, FIXED, COMPOSITION: RC20GF391J; 81349	ea		1				*	*	2		3	-34 3-5	AIR14
P-H A030	5905-683-2238	RESISTOR, FIXED, COMPOSITION: SAME AS A024	ea		REF									-34 3-5	AIR15, AIR16
P-H A031	5905-681-8853	RESISTOR, FIXED, COMPOSITION: SAME AS A020	ea		REF									-34 3-5	AIR17
P-H A032	5905-681-6462	RESISTOR, FIXED, COMPOSITION: RC07GF102J; 81349	ea		1				*	2	2		6	-34 3-5	AIR18
P-H A033	5905-279-3513	RESISTOR, FIXED, COMPOSITION: RC20GF221J; 81349	ea		1				*	*	2		3	-34 3-5	AIR19
P-H A034	5905-683-2238	RESISTOR, FIXED, COMPOSITION: SAME AS A024	ea		REF									-34 3-5	AIR20
P-H A035	5905-682-4097	RESISTOR, FIXED, COMPOSITION: RC07GF302J; 81349	ea		1				*	*	2		3	-34 3-5	AIR21
P-H A036	5905-195-6806	RESISTOR, FIXED, COMPOSITION: RC200GF102J; 81349	ea		1				*	*	2		3	-34 3-5	AIR22
P-H A037	5950-945-6534	TRANSFORMER, AUDIOFREQUENCY: A43001002; 96238	ea		1				*	*	2		3	-34 3-5	AIT1
P-H A038	5305-576-5793	SCREW, MACHINE: MS35233-28; 96906	ea		1				2	2	2		14	-34 3-5	AIMP1
P-H A039	5935-767-8187	JACK, TIP: 31-1; 81073	ea		3				2	2	3		18	-34 3-5	AITP1, AITP2, AITP3
X2-H A040		BOARD, PRINTED CIRCUIT: C80032011; 96238  GROUP 3B COMPONENT BOARD A2	ea		1									-34 3-2	AIMP2
P-O A041	5805-999-5033	BOARD, PRINTED CIRCUIT: D8C032020; 96238	ea		1	2	4	8	2	2	2	100	75	-34 3-6	A2
P-H A042	5910-945-6333	CAPACITOR, VARIABLE: A42020002; 96238	ea		2				*	2	2		6	-34 3-5	A2C1, A2C2
A-H A043		CAPACITOR, ASSORTMENT: C42000031; 96238	ea		6										A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A044	5910-946-5440	CAPACITOR, FIXED, MICA: CM20FF161GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A045	5910-947-3401	CAPACITOR, FIXED, MICA: CM20FF181GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A046	5910-945-7412	CAPACITOR, FIXED, MICA: CM20FF201GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8

Section II. REPAIR PARTS, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT

(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCTY	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H AC47	5910-945-7426	CAPACITOR, FIXED, MICA: CM20FF221GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A048	5910-945-7419	CAPACITOR, FIXED, MICA: CM20FF241GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A049	5910-926-2391	CAPACITOR, FIXED, MICA: CM20FF271GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A050	5910-926-2390	CAPACITOR, FIXED, MICA: CM20FF301GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A051	5910-949-5307	CAPACITOR, FIXED, MICA: CM20FF331GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A052	5910-926-2428	CAPACITOR, FIXED, MICA: CM20FF361GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A053	5910-926-2427	CAPACITOR, FIXED, MICA: CM20FF391GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A054	5910-926-2426	CAPACITOR, FIXED, MICA: CM20FF431GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A055	5910-926-2429	CAPACITOR, FIXED, MICA: CM20FF471GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A056	5910-948-6460	CAPACITOR, FIXED, MICA: CM20FF511GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A057	5910-926-2430	CAPACITOR, FIXED, MICA: CM20FD561GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A058	5910-926-2431	CAPACITOR, FIXED, MICA: CM20FD621GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8

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(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCTY	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H A059	5910-947-3402	CAPACITOR, FIXED, MICA: CM20FF102GN3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A060	5910-901-8949	CAPACITOR, FIXED, MICA: CM20CH300JN3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A061	5910-892-9904	CAPACITOR, FIXED, MICA: CM20CH390JN3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A062	5910-864-8702	CAPACITOR, FIXED, MICA: CM20FD470JN3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A063	5910-901-8796	CAPACITOR, FIXED, MICA: CM20FD560G03; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A064	5910-932-5724	CAPACITOR, FIXED, MICA: CM20FF680JW3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A065	5910-832-5722	CAPACITOR, FIXED, MICA: CM20FF750JW3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A066	5910-932-2738	CAPACITOR, FIXED, MICA: CM20FF820JW3; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A067	5910-772-1217	CAPACITOR, FIXED, MICA: CM20FF910003; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A068	5910-717-0169	CAPACITOR, FIXED, MICA: CM20FD101G03; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A069	5910-766-8788	CAPACITOR, FIXED, MICA: CM20FD111G03; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A070	5910-725-1992	CAPACITOR, FIXED, MICA: CM20FD121G03; 81349	ea		6				*	*	6		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8

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(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCP	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H A071	5910-765-6316	CAPACITOR, FIXED, MICA: CM30FD120GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A072	5910-727-4005	CAPACITOR, FIXED, MICA: CM30FD152GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A073	5910-951-7590	CAPACITOR, FIXED, MICA: CM20FD821GP3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A074	5910-951-7075	CAPACITOR, FIXED, MICA: CM35FD512GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A075	5910-774-7591	CAPACITOR, FIXED, MICA: CM35FD562GN3; 81349	ea		6				*	*	2		3	-34 3-6	A2C3, A2C4, A2C5, A2C6, A2C7, A2C8
P-H A076	5910-818-9758	CAPACITOR, FIXED, PAPER: CP05A1KB224X3; 81349	ea		2				*	*	2		6	-34 3-6	A2C9, A2C10
P-H A077	5910-892-7871	CAPACITOR, FIXED, ELECTROLYTIC: SAME AS A009	ea		1									-34 3-6	A2C11
P-H A078	5960-087-6047	SEMICONDUCTOR DEVICE, DIODE: SAME AS A006	ea		4				*	2	2		2	-34 3-6	A2CR1 A2CR2' A2CR3, A2CR4
P-H A079	5960-577-6214	SEMICONDUCTOR DEVICE, DIODE: 1N538W; 81349	ea		2				*	2	2		6	-34 3-6	A2CR5, A2CR6
P-H A080	5961-853-1065	SEMICONDUCTOR DEVICE, DIODE: 1N3026B; 80064	ea		1				*	*	2		3	-34 3-6	A2CR7
P-H A081	5950-945-6426	REACTOR: A43010001; 96238	ea		1				*	*	2		3	-34 3-6	A2L1
P-H A082	5305-576-5793	SCREW, MACHINE SAME AS A038	ea		6									-34 3-6	A2MP1
P-H A083	5960-752-5229	TRANSISTOR: SAME AS A014	ea		2									-34 3-6	A2Q1, A2Q2
P-H A084	5905-686-3368	RESISTOR, FIXED, COMPOSITION RC07GF203; 81349	ea		2				*	2	2		6	-34 3-6	A2R1, A2R2
P-H A085	5905-683-2241	RESISTOR, FIXED, COMPOSITION RC07GF512; 81349	ea		1				*	*	2		3	-34 3-6	A2R3
P-H A086	5905-683-2235	RESISTOR, FIXED, COMPOSITION: RC07GF680; 81349	ea		1				*	*	2		3	-34 3-6	A2R4
P-H A087	5905-682-4108	RESISTOR, FIXED, COMPOSITION: RC070GF241; 81349	ea		1				*	*	2		3	-34 3-6	A2R5
P-H A088	5905-683-2242	RESISTOR, FIXED, COMPOSITION: RC07GF471; 81349	ea		1				*	*	2		3	-34 3-6	A2R6
P-H A089	5905-725-6995	RESISTOR, FIXED, COMPOSITION: SAME AS A017	ea		1									-34 3-6	A2R7
P-H A090	5905-473-5251	RESISTOR, FIXED, COMPOSITION: RC32GF102; 81349	ea		1				*	*	2		3	-34 3-6	A2R8

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(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCTY	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H A091	5950-999-8712	TRANSFORMER, AUDIOFREQUENCY: A43001001; 96238	ea		1				*	*	2		3	-34 3-6	A2T1
P-H A092	5305-576-5793	SCREW, MACHINE SAME AS A038	ea		REF										A2MF0
P-H A093	5935-767-8187	JACK, TIP: SAME AS A039	ea		3									-34 3-6	A2TP1, A2TP2, A2TP3
X2-H A024		BOARD, PRINTED CIRCUIT: C8CG32021; 96238  GROUP 10 CHASSIS ASSEMBLY  NOTE: THIS GROUP COVERS ALL PARTS EXCEPT THOSE MOUNTING ON PRINTIN CIRCUIT BOARDS A1 & A2.	ea		1									-34 3-2	A2MP3
K-D-S A095		CHASSIS ASSEMBLY: D90C32001; 96238	ea		1									-34 3-4	3
X1-H A096		PANEL ASSEMBLY, FRONT: D900320C2	ea		1										3A
P-H A097	5305-558-2865	SCREW, MACHINE: MS35233-30; 96906	ea		15				2	3	4	46	30		3MP1
P-H A098	5305-579-0969	SCREW, MACHINE: MS35233-31; 96906	ea		4				*	2	2	16	8		3MP2
P-H A099	5310-043-1745	WASHER, LOCK: MS35337-79; 96906	ea		28				2	2	3	44	28		3MP3
P-H A100	5905-209-1965	RESISTOR, FIXED, COMPOSITION: RC20GF301J; 81349	ea		1				*	*	2	8	3	-34 3-3	3R3
P-H A101	5930-655-1507	SWITCH, TOGGLE: MS25100-22; 96906	ea		1				*	*	2	8	3	-34 3-3	3S4
P-H A102	5940-258-2120	LUG, TERMINAL: 379; 79963	ea		2				*	*	2	5	2		3MP4
P-H A103	6240-155-7836	LAMP, INCANDESCENT: MS25237-327; 96906	ea		1				2	2	2	19	10	-34 3-3	3DS2
P-H A104	6220-806-8845	LIGHT, INDICATOR MS25256-2; 96906	ea		1				*	*	2	8	3	-34 3-3	3XDS2
P-H A105	5930-947-9676	SWITCH, ROTARY: A46020030; 96238	ea		2				*	2	2	13	6	-34 3-4	3S1
P-H A106	5905-806-0636	RESISTOR, FIXED, COMPOSITION: RC07GF330J; 81349	ea		1				*	*	2	8	3	-34 3-4	3R4
P-H A107	5905-801-6444	RESISTOR, FIXED, COMPOSITION: RC07GF911J; 91349	ea		1				*	*	2	8	3	-34 3-5	3R5
P-H A108	5930-947-9676	SWITCH, ROTARY: SAME AS A105	ea		REF									-34 3-4	3S2
P-H A109	5355-508-7753	KNOB: SM-B-552258; 80063	ea		2	*	*	*	*	*	*	5	2	-34 3-3	3MP5
P-H A110	5920-280-8344	FUSE, CARTRIDGE: F02A250V1/2AS; 81349	ea		1	*	11	20	3	4	5	242	200	-12 1-2	3F1
P-H A111	5920-556-0144	FUSEHOLDER: FHN20G; 81349	ea		1				*	*	2	8	3	-34 3-4	3XF1
P-H A112	5920-823-3246	CAP, ELECTRICAL: 34200HSA-2; 81349	ea		1				*	*	2	8	3	-34 3-4	3XF1A
P-H A113	5910-892-7871	CAPACITOR, FIXED, ELECTROLYTIC: SAME AS A009	ea		1									-34 3-3	3C2
P-H A114	5905-681-6462	RESISTOR, FIXED, COMPOSITION: SAME AS A032	ea		1									-34 3-4	3R1

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						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H A115	5905-686-3372	RESISTOR, FIXED, COMPOSITION: SAME AS A028	ea	1										-34 3-4	3R2
P-H A116	5930-050-2638	SWITCH, TOGGLE: MS25100-23; 96906	ea	1					*	*	2	8	1	-34 3-4	3S3
P-H A117	5940-258-2120	LUG, TERMINAL: SAME AS A102	ea	REF											3MP18
P-H A118	5040-223-5293	POST, BINDING: U-106/U; 94375	ea	8					2	2	3	38	24	-34 3-4	3E1, 3E2, 3E3, 3E4, 3E5, 3E6, 3E7, 3E8
P-O A119	5940-254-2244	CAP, ELECTRICAL: SC-C-76202-3; 80063	ea	8					2	2	3	48	4	-34 3-3	3E1A
P-H A120	5310-270-8810	NUT, PLAIN, HEXAGON: MS35650-104; 96906	ea	8					2	2	2	28	16		3MP6
P-H A121	5310-619-1148	WASHER, FLAT: MS15795-308; 96906	ea	8					2	2	2	16	8		3MP7
P-H A122	5310-058-2951	WASHER, LOCK: MS35337-81; 96906	ea	10					2	2	2	19	10		3MP8
P-H A123	5330-950-1514	WASHER, NONMETALLIC: NW10-4374; 95987	ea	8					2	2	2	16	8		3MP9
P-H A124	5310-930-5289	WASHER, SHOULDER: SW-10; 95987	ea	1					*	*	*	4	1		3MP10
P-H A125	5995-832-5164	CABLE ASSEMBLY, POWER, ELECTRICAL: B74000001-2; 96238	ea	1					*	*	2	8	3	-34 3-3	3W1
P-H A126	5975-926-3073	BUSHING, STRAIN RELIEF: SR-5L-1; 28520	ea	1					*	*	*	5	2		3MP11
P-H A127	5325-081-7748	STUD ASSEMBLY, TURNLINK: SM-B-552121; 80063	ea	3					2	2	2	18	9	-34 3-3	3MP12
K-D A128		HANDLE, BOW: SM-B-552122; 80063	ea	1										-34 3-3	3MP13
P-H A129	5305-059-3658	SCREW, MACHINE: MS35234-62; 96906	ea	2					*	*	2	10	4		3MP14
P-H A130	5310-058-2951	WASHER, LOCK: SAME AS A122	ea	REF											3MP15
K-D A131		PLATE, IDENTIFICATION: A57030035; 96238	ea	1											3MP16
P-H A132	5305-253-5615	SCREW, MACHINE: MS21318-21; 96906	ea	2					*	*	2	10	4		3MP17
M-D A133		PANEL, FRONT: D900320069; 96238	ea	1										-34 3-4	3MP19
M-D A134		PANEL, REAR: C90030006; 96238	ea	1										-34 3-2	3MP2C
P-H A134	5305-054-6655	SREW, MACHINE: B50400001-1; 96-38	ea	3					*	2	2	13	6		3MP21
P-H A136	5305-576-5793	SCREW, MACHINE: SAME AS A038	ea	REF											3MP22
P-H A137	5305-558-2865	SCREW, MACHINE: SAME AS A097	ea	REF											3MP23
P-H A138	5310-043-1754	WASHER, LOCK: SAME AS A099	ea	REF											3MP24
P-H A139	5935-936-5518	PANEL, CONNECTOR: B90030007; 96238	ea	1					*	*	2	8	3		3MP25

Section II. REPAIR PARTS, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT

(1) SMR INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCV	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION		
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H A140	5305-558-2865	SCREW, MACHINE: SAME AS A097	ea		REF											3MP26
P-H A141	5935-046-0080	CONNECTOR, RECEPTACLE, ELECTRICAL; B48000004; 96238	ea		2				*	2	2	13	6			3XA1, 3XA2
P-H A142	5310-271-4642	NUT, PLAIN, HEXAGON: MS35649-44; 96906	ea		4				2	2	2	13	8			3MP27
P-H A143	5305-543-2767	SCREW, MACHINE: MS35233-18; 96906	ea		4				2	2	2	16	8			3MP28
P-H A144	5310-058-2949	WASHER, LOCK: MS35337; 96906	ea		4				*	*	2	10	4			3MP29
P-H A145	5805-947-1675	CARD GUIDE, CENTER: B90030008; 96238	ea		1				*	*	*	5	2	-34 3-3		3MP30
P-H A146	5305-558-2865	SCREW, MACHINE: SAME AS A097	ea		REF											3MP31
P-H A147	5310-043-1754	WASHER, LOCK: SAME AS A039	ea		REF											3MP32
K-D A148		PANEL, SIDE: C90030005-01; 96238	ea		1									-34 3-4		3MP33
P-H A149	5305-558-2865	SCREW, MACHINE: SAME AS A097	ea		REF											3MP34
K-D A150		PANEL, SIDE: C90030005-02; 96238	ea		1									-34 3-4		3MP35
P-H A151	5305-558-2865	SCREW, MACHINE: SAME AS A097	ea		REF											3MP36
K-D-D A152		CHASSIS, EQUIPMENT, ELECTRICAL: D90032003; 96238	ea		1									-34 3-4		3B
P-H A153	910-890-9670	CAPACITOR, FIXED, ELECTROLYTIC: CE41C221G 81349	ea		1				*	*	2	8	3	-34 3-4		3C1
P-H A154	5805-947-3396	RINGER, 20 CYCLE A48092000; 96238	ea		1				*	*	2	8	3	-34 3-4		3ZI
P-H A155	5310-291-4644	NUT, PLAIN, HEXAGON MS35649-64; 96906	ea		16				2	3	4	46	32			3MP37
P-H A156	5310-043-1745	WASHER, LOCK: SAME AS A099	ea		REF											3MP38
P-H A157	5960-752-0218	TRANSISTOR: 2N297A; 81349	ea		1				*	*	2	8	3	-34 3-4		3Q1
P-H A158	5945-945-7478	RELAY, ARMATURE: A46006001; 96238	ea		1				*	*	2	8	3	-34 3-4		3K2
P-H A159	5310-291-4644	NUT, PLAIN, HEXAGON: SAME AS A155	ea		REF											3MP39
P-H A160	5310-043-1754	WASHER, LOCK: SAME AS A099	ea		REF											3MP40
P-H A161	5945-945-7477	RELAY, ARMATURE: A46006002; 96238	ea		1				*	*	2	8	3	-34 3-4		3K1
P-H A162	5310-291-4644	NUT, PLAIN, HEXAGON: SAME AS A155	ea		REF											3MP41
P-H A163	5310-043-1754	WASHER, LOCK: SAME AS A099	ea		REF											3MP42
P-O A164	6240-143-3060	LAMP, INCANDESCENT: MS15567-1; 96906	ea		1	2	2	2	*	2	2	19	10			3DS1
P-H A165	6250-947-7035	LAMPHOLDER: 12-30XP-13; 95263	ea		1				*	*	2	8	3	-34 3-4		3XDS1
P-H A166	5950-945-7476	TRANSFORMER, DISCRIMINATOR: A43006001; 96238	ea		1				*	*	2	8	3	-34 3-4		3Z2



Section II. REPAIR PARTS, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT

(1) SMR CODE INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE  USABLE ON CODE	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY DS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CNTGCTY	(10) DEPOT MAINT ALW PER 100 EQUIP	(11) ILLUSTRATION		
						(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H A167	5310-291-4644	NUT, PLAIN, HEXAGON: SAME AS A155	ea		REF											3MP43
P-H A168	5310-043-1745	WASHER, LOCK: SAME AS 099	ea		REF											3MP44
P-H A169	5940-642-3900	LUG, TERMINAL: 2104-06-00; 78189	ea		1				*	*	2	8	3			3MP45
P-H A170	5950-945-7479	TRANSFORMER, POWER, STEP DOWN: A43000037; 96238	caa		1				*	*	2	8	3	-34 3-4		3T1
P-H A171	5310-291-4644	NUT, PLAIN, HEXAGON	ea		REF											3MP46
P-H A172	5310-043-1754	WASHER, LOCK: SAME AS A099	ea		REF											3MP47
P-H A173	5325-926-5342	GROMMET, RUBBER: SMB434346; 80063	ea		1				*	*	*	5	2	-34 3-4		3MP48
P-H A174	5325-947-9683	GROMMERT, RUBBER: 429; 13057	ea		1				*	*	*	5	2			3MP49
P-H A175	5340-957-2353	NUT, SLEEVE: 8577-A-0632-1B; 06540	ea		1				*	*	*	5	2			3MP50
P-H A176	5305-576-5793	SCREW, MACHINE: SAME AS A038	ea		REF											3MP51
P-H A177	5310-043-1754	WASHER, LOCK: SAME AS A099	ea		REF											3MP52
		CHASSIS, EE: D62000053; 96238	ea		1											3MP53

Section III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE  
TO INDEX NUMBER

FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.
5325-926-5342	A173	5940-223-5293	A118
5325-947-9683	A174	5945-945-7477	A161
5355-508-7753	A109	5945-945-7478	A158
5805-985-9088	A001	5950-945-6426	A081
5805-999-5031	A003	5950-945-6534	A037
5805-999-5033	A041	5950-945-7476	A166
5805-999-5034	A002	5950-945-7479	A170
5805-999-5035	A005	5950-999-8712	A091
5905-299-1965	A100	5961-087-6047	A006
5905-473-5251	A090	5961-752-5229	A014
5905-682-4100	A025	5961-851-5923	A015
5905-682-4108	A087	5961-853-1065	A080
5905-683-2235	A086	<u>REFERENCE NO.</u>	<u>INDEX NO.</u>
5905-683-2242	A088	C80032011	A040
5905-801-6444	A107	C80032021	A094
5905-806-0636	A106	D62000053	A178
5910-818-9758	A076	D90032001	A095
5920-280-8344	A110	D90032002	A096
5930-050-2638	A116	D90032003	A152
5930-947-9676	A105	D90032006	A133

Section IV. INDEX-FIGURE AND ITEM NUMBER CROSS  
REFERENCE TO INDEX NUMBER

FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.	FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.
-12	3DS1	A164		3XDS2	A104
1-2	3F1	A110	-34	3	A095
-12	MP1	A002	3-4	3-3	A152
1-7	MP1A	A003		3C1	A153
	MP2	A004		3E1 thru	A118
-34	3MP20	A134		3E8	
3-2	A1MP2	A040		3K1	A161
	AZMP3	A094		3K2	A158
-34	3C2	A113		3MP19	A133
3-3	3DS2	A103		3MP33	A148
	3E1A	A119		3MP35	A150
	3MP5	A109		3MP48	A173
	3MP12	A127		3Q1	A157
	3MP13	A128		3R1	A114
	3MP30	A145		3R2	A115
	3R3	A100		3R4	A106
	3S4	A101		3R5	A107
	3W1	A125		3S1	A105

FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.	FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.
	3S2	A108		A1CR5	
	3S3	A116		A1Q1,	A014
	3T1	A170		A1Q2,	
	3XDS1	A165		A1Q3	
	3XF1	A111		A1Q4	A015
	3XF1A	A112		A1Q5	A016
	3Z1	A154		A1R1, A1R2	A017
	3Z2	A166		A1R3	A018
-34	A1	A005		A1R4	A019
3-5	A1C1, A1C2	A008		A1R5	A020
	A1C3, A1C4	A000	-34	A1R9	A024
	A1C5	A010	3-5	A1R10	A025
	A1C6,	A011		A1R13	A028
	A1C7			A1R14	A029
	A1C8	A012		A1R15	A030
	A1CR1	A006		A1R16	
	A1CR2,	A007		A1R17	A031
	A1CR3,			A1R18	A032
	A1CR4,			A1R19	A033

FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.	FIG . NO.	ITEM NO. OR REFERENCE DESIGNATION	INDEX NO.
	A1R20	A034		A2R6	A088
	A1T1	A037		A2R8	A090
	A1TP1 ,	A039		A2T1	A091
	A1TP2 ,				
	A1TP3				
-34	AZ	A041			
3-6	A2C6	A043			
	A2C9 ,	A076			
	A2C10				
	A2CR1 ,	A078			
	A2CR2				
	A2CR6	A079			
	A2CR7	A080			
	A2L1	A081			
	A2R1	A084			
	AZR3	A085			
	A2R4	A086			
	A2R5	A087			

Section V. INDEX-REFERENCE DESIGNATION CROSS  
REFERENCE TO INDEX NUMBER

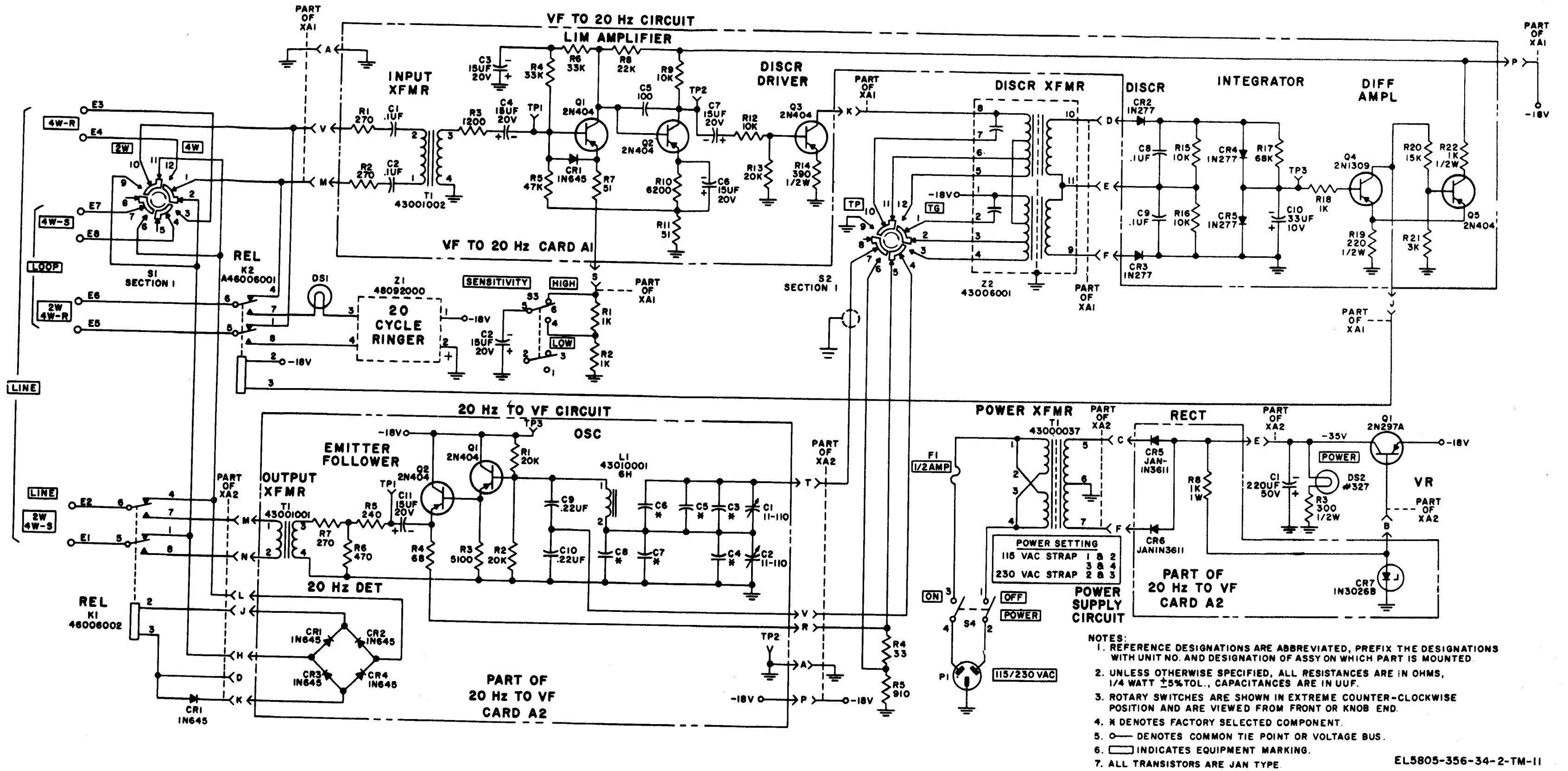
REFERENCE DESIGNATION	INDEX NO.	REFERENCE DESIGNATION	INDEX NO.
GROUP 3 CONVERTER, TELEGRAPH-TELEPHONE SIGNAL CV-425/U		A1GR4,	
		A1CR5	
MP1	A002	A1MP1	A038
MP1A	A003	A1MP2	A040
MP2	A004	A1Q1,	A014
GROUP 3a COMPONENT BOARD A1		A1Q2,	
		A1Q3	
A1	A005	A1Q4	A015
A1C1,	A008	A1Q5	A016
A1C2		A1R1	A017
A1C3,	A009	A1R2	
A1C4		A1R3	A018
A1C5	A010	A1R4	A019
A1C6,	A011	A1R5	A020
A1C7		A1R9	A024
A1C8	A012	A1R10	A025
A1CR1	A006	A1R13	A028
A1CR2,	A007	A1R14	A029
A1CR3,		A1R15,	A030

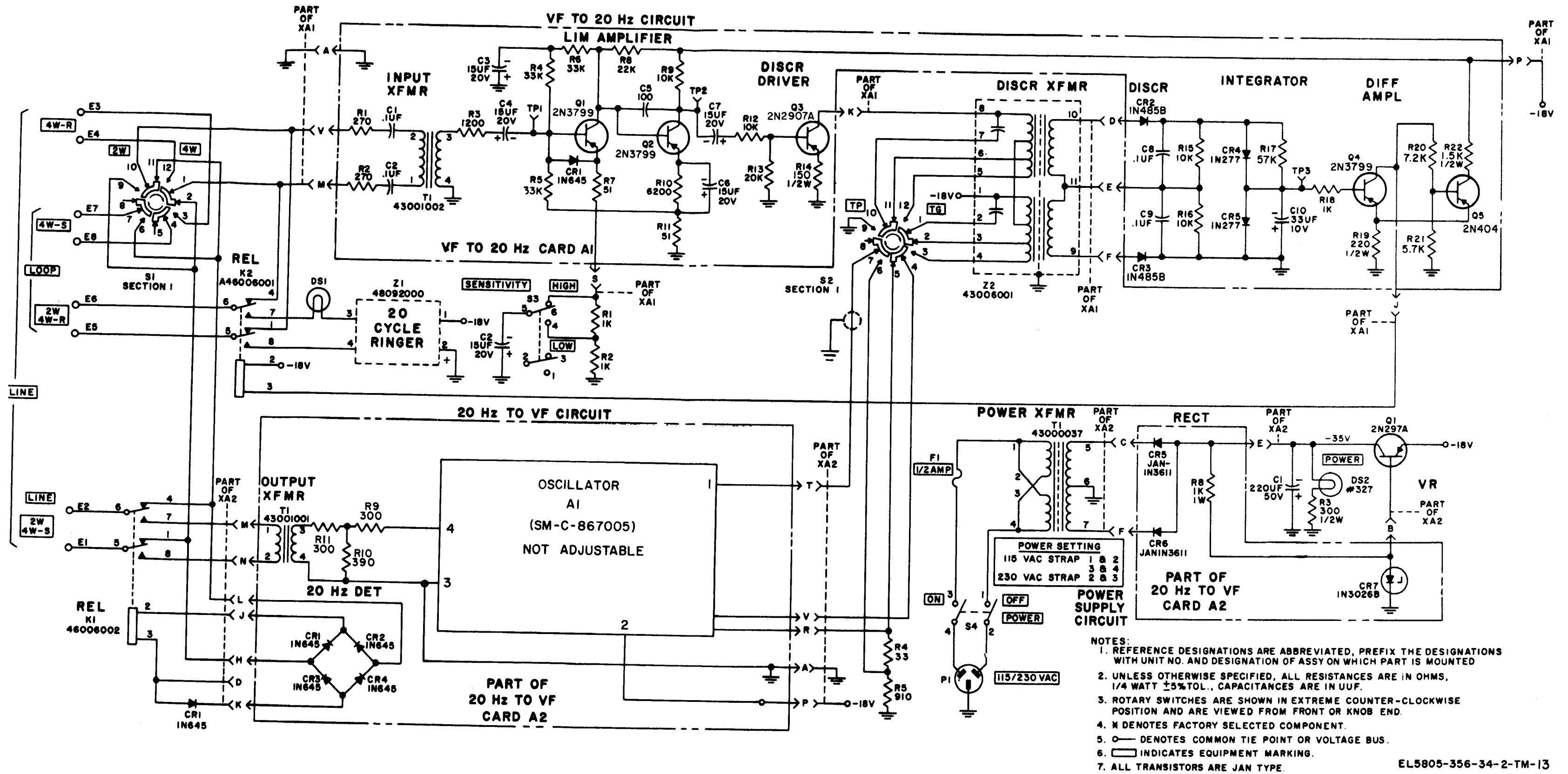
REFERENCE DESIGNATION	INDEX NO.	REFERENCE DESIGNATION	INDEX NO.
A1R16		A2R3	A085
A1R17	A031	A2R4	A086
A1R18	A032	A2R5	A087
A1R19	A033	A2R6	A088
A1R20	A034	A2R8	A090
A1T1	A037	A2T1	A091
A1TP1,	A039	GROUP 3c CHASSIS ASSEMBLY	
A1TP2,		3	A095
A1TP3		3A	A096
GROUP 3b COMPONENT BOARD		3B	A152
A2	A2	3C1	A153
A2C6	A041	3C2	A113
A2C9,	A043	3DS1	A164
A2C10	A076	3DS2	A103
A2CR1,	A078	3E1A	A119
A2CR2		3E1,	A118
A2CR6	A079	3E2,	
A2CR7	A080	3E3,	
A2L1	A081	3E4,	
A2MP2	A092	3E5,	
A2MP3	A094	3E6,	
A2R1	A084	3E7,	
		3E8	

REFERENCE DESIGNATION	INDEX NO.	REFERENCE DESIGNATION	INDEX NO.
3F1	A110	3MP20	A134
3K1	A161	3MP21	A135
3K2	A158	3MP22	A136
3MP1	A097	3MP23	A137
3MP2	A098	3MP24	A138
3MP3	A099	3MP25	A139
3MP4	A102	3MP26	A140
3MP5	A109	3MP27	A142
3MP6	A120	3MP28	A143
3MP7	A121	3MP29	A144
3MP8	A122	3MP30	A145
3MP9	A123	3MP31	A146
3MP10	A124	3MP32	A147
3MP11	A126	3MP33	A148
3MP12	A127	3MP34	A149
3MP13	A128	3MP35	A150
3MP14	A129	3MP36	A151
3MP15	A130	3MP37	A155
3MP16	A131	3MP38	A156
3MP17	A132	3MP39	A159
3MP18	A117	3MP40	A160
3MP19	A133	3MP41	A162



REFERENCE DESIGNATION	INDEX NO.	REFERENCE DESIGNATION	INDEX NO.
3MP42	A163	3W1	A125
3MP43	A167	3XA1	A141
3MP44	A168	3XA2	
3MP45	A169	3XDS1	A165
3MP46	A171	3XDS2	A104
3MP47	A172	3XF1	A111
3MP48	A173	3XF1A	A112
3MP49	A174	3Z1	A154
3MP50	A175	3Z2	A166
3MP51	A176		
3MP52	A177		
3MP53	A178		
3Q1	A157		
3R1	A114		
3R2	A115		
3R3	A100		
3R4	A106		
3R5	A107		
3S1	A105		
3S2	A108		
3S3	A116		
3S4	A101		
3T1	A1 70		





EL5805-356-34-2-TM-13

Figure FO-1.2. Converter, Telegram-Telephone Signal CV-425/U, schematic diagram (Sealed VF-OSC).

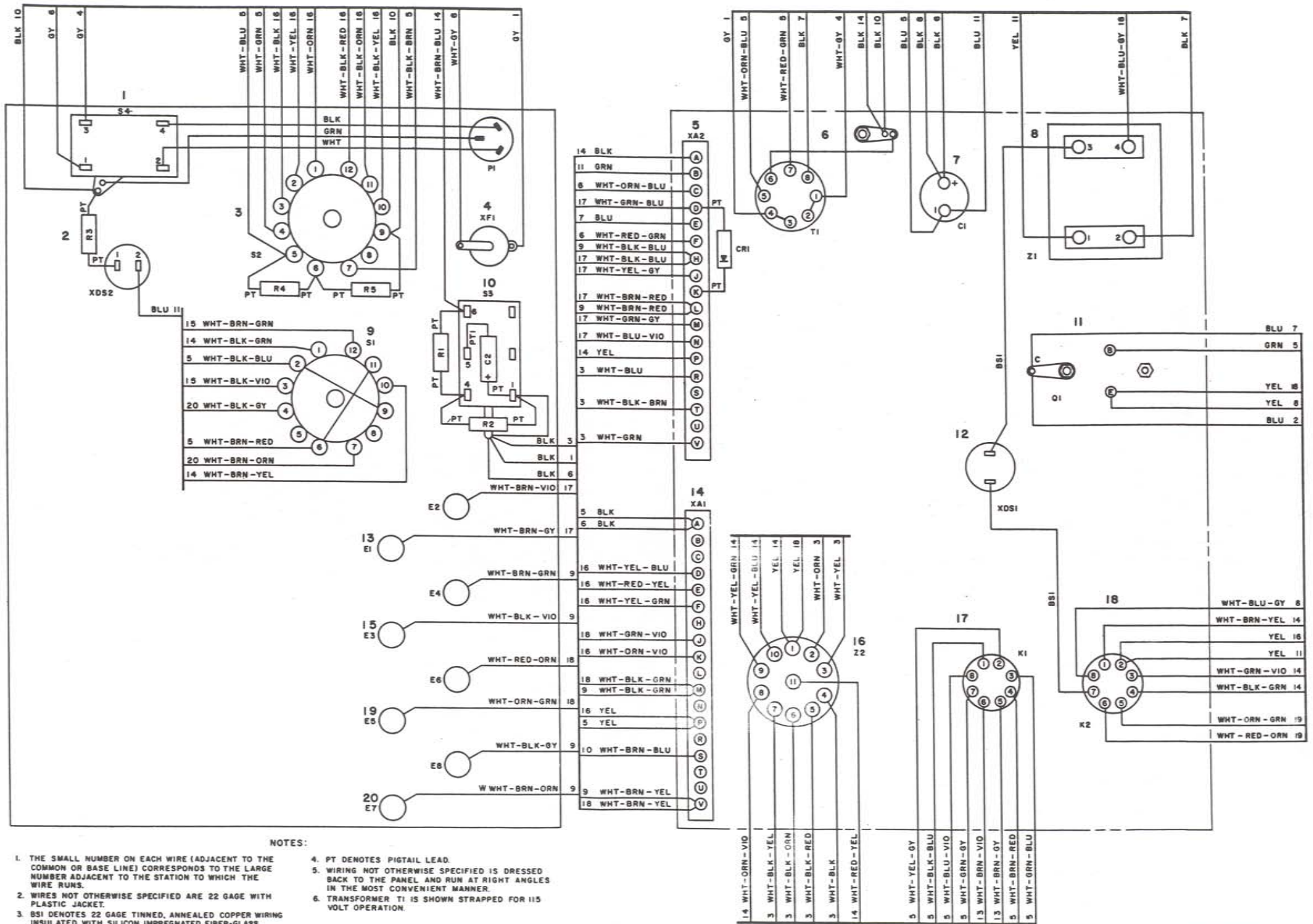


Figure FO-2. Converter, Telegraph-Telephone Signal CV-425/U, wiring diagram.

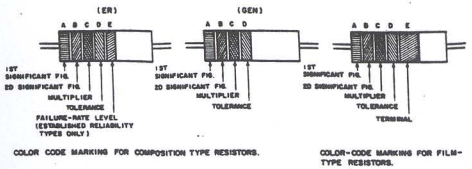
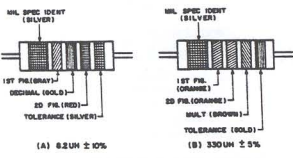


TABLE 1  
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL
BLACK	0	BLACK	0	BLACK	1	BROWN	±10 (COM. TYPE ONLY)	BROWN	100,000
BROWN	1	BROWN	1	BROWN	10	RED	±2	BROWN	100,000
RED	2	RED	2	RED	100	ORANGE	±3	ORANGE	100,000
ORANGE	3	ORANGE	3	ORANGE	1,000	YELLOW	±4	YELLOW	100,000
YELLOW	4	YELLOW	4	YELLOW	10,000	GREEN	±5	GREEN	100,000
GREEN	5	GREEN	5	GREEN	100,000	BLUE	±6	BLUE	100,000
BLUE	6	BLUE	6	BLUE	1,000,000	PURPLE (VIOLET)	7	PURPLE (VIOLET)	100,000
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7	SILVER	±10 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)	WHITE	±8	WHITE	100,000
WHITE	8	WHITE	8	SILVER	±10	SILVER	±10	SILVER	100,000
				GOLD	±5	GOLD	±1	GOLD	100,000



COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKER IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

TABLE 2  
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE		10	
SILVER		10	
GOLD	DECIMAL POINT	5	

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CH, CY, AND CB.

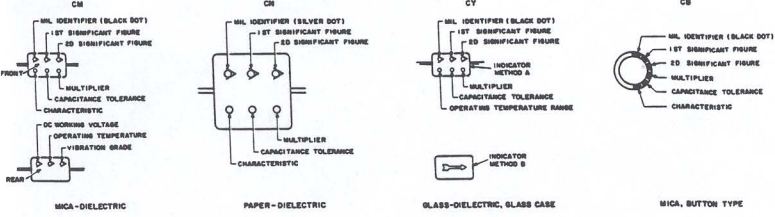


TABLE 3 - FOR USE WITH STYLES CM, CH, CY AND CB.

COLOR	MIL ID	1ST FIG	2ND FIG	3RD FIG	MULTIPLIER	CAPACITANCE TOLERANCE				CHARACTERISTIC	DC WINDING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
						CM	CH	CY	CB				
BLACK	0	0	1	1	1	20%	20%			A		-55° to 125°	D-50 (M)
BROWN	1	1	1	10						B	E		
RED	2	2	100	10%	10%	10%	10%	10%	10%	C	D		
ORANGE	3	3	1,000	10%	10%					D	D	300	
YELLOW	4	4	10,000	10%	10%					E			
GREEN	5	5	100,000	15%	15%					F		500	
BLUE	6	6											
PURPLE (VIOLET)	7	7											
GRAY	8	8											
WHITE	9	9											
GOLD					0.1	10%	20%	10%	20%				
SILVER	CM					10%	20%	10%	20%				

BAND A - THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH).

BAND B - THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C - THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NORMAL RESISTANCE VALUE.)

BAND D - THE RESISTANCE TOLERANCE.

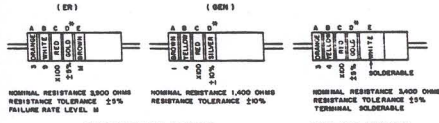
BAND E - WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS) OR FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATED TYPE OF TERMINAL.

RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODES)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE: R57 = 5.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED. IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS. B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

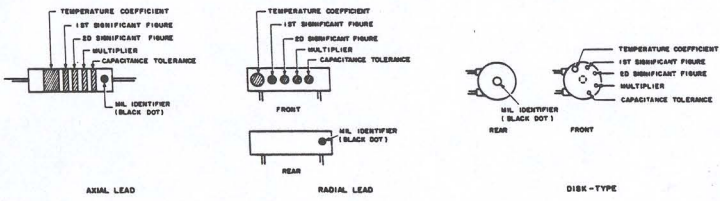


TABLE 4 - TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT	1ST FIG	2ND FIG	MULTIPLIER	CAPACITANCE TOLERANCE		MIL ID
					OVER 10 UUF	10 UUF OR LESS	
BLACK	0	0	0	1		±0.5 UUF	CC
BROWN	-30	1	1	10	2%		
RED	-40	2	2	100	2%	±0.25 UUF	
ORANGE	-60	3	3	1,000	2%		
YELLOW	-120	4	4				
GREEN	-330	5	5		2%	±0.3 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GRAY	-100	8	8	0.01			
WHITE	-100	9	9	0.1	±10%		
GOLD	+100					±0.5 UUF	
SILVER							

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (100) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESCRIBED IN APPLICABLE SPECIFICATIONS: MIL-C-89, MIL-C-120, MIL-C-1187, AND MIL-C-1093C RESPECTIVELY.
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESCRIBED IN MIL-C-11018D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

Figure FO-3. MIL-STD color code markings for resistors, inductors, and capacitors.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS  
*General, United States Army*  
*Chief of Staff*

Official:

VERNE L. BOWERS  
*Major General, United States Army*  
*The Adjutant General*

Distribution:

Active Army:

USASA (2)	TOAD (14)
CNGB (1)	LEAD (7)
ACSC-E (2)	NAAD (6)
Dir of Trans ( 1 )	SVAD (5)
COE (1)	ATAD (10)
TSG (1)	Gen Dep (2)
DCSLOG (1)	Sig Sec Gen Dep (5)
USAARENBD (2)	Sig Dep (10)
USAMB (10)	Sig FLDMS (2)
USACDC (2)	ATS (1)
USACDC Agcy (1)	USAERDAA (2)
AMC (1)	USAERDAW (5)
CONARC (5)	USACRREL (2)
ARADCOM (2)	MAAG (1)
ARADCOM Rgn (2)	USARMIS (1)
OS Maj Cored (4)	USAOC&S (2)
USARYIS (4)	USATSCH (2)
LOGCOMDS (5)	USAQMS (2)
MICOM (4)	USAAESWBD (2)
TECOM (2)	Units org under fol TOE:
USASTRATCOM (4)	(2 cys each)
USAESC (70)	11-15
MDW (1)	11-17
Armies (2)	11-32
Corps (2)	11-38
1st Cav Div (3)	11-45
Svc Colleges (2)	11-46
USASCS (20)	11-97
USASESS (20)	11-98
USAADS (2)	11-117
USAFAS (2)	11-127
USAARMS (2)	11-158
USAIS (2)	11-215
USAINTS (3)	11-216
WRAMC (1)	11-217
USACDCEC (10)	11-218
USASTRATCOM-EUR (10)	11-225
USASTRATCOM-PAC (10)	11-227
USASTRATCOM-SO (5)	11-228
USASTRATCOM-A (5)	11-237
USASTRATCOM SIG GP-T (5)	11-247
Instl (2) except	11-302
Ft Gordon (10)	11-327
Ft Huachuca (10)	11-347
WSMR (3)	11-367
Ft Carson (10)	11-500 (AA-AC)
Ft Richardson (ECOM Oft) (2)	29-1
Army Dep (2) except	29-5
LBAD (14)	29-6
SAAD (30)	29-11

**TM 11-5805-356-34-2**

29-15	29-137
29-16	29-139
29-21	29-205
29-25	29-206
29-26	29-207
29-35	29-216
29-36	29-216
29-51	29-217
29-56	29-246
29-106	29-246
29-134	29-600
29-136	

NG & USAR: None

For explanation of abbreviations used, see AR 310-50.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



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