TECHNICAL MANUAL

GENERAL SUPPORT MAINTENANCE MANUAL

TEST SET, RADIO DATA LINK, SOUND RANGING TS-35661G RA-1 14 (NSN 5895-01-064-9740)

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y
13, AUGUST, 1984

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 DRY WOODEN POLE OR A DRY 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

120 volts ac is used in the operation of this equipment. When testing, servicing, or repairing this equipment, disconnect ac line voltage. If ac is required, be extremely careful.

DEATH ON CONTACT

May result if personnel fail to observe safety precautions.

SHOCK HAZARD EXISTS

When working inside the equipment, after the ac line voltage has been disconnected, always ground every part before touching it.
For Artificial Respiration, refer to FM 21-11.

TECHNICAL MANUAL
No. 11-5895-1096-40

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 13 August 1984

GENERAL SUPPORT MAINTENANCE MANUAL TEST SET, RADIO DATA LINK, SOUND RANGING TS-35661G RA-114 (NSN 5895-01-064-9740)

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, or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, NJ 07703.

In either case, a reply will be sent to you.

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CHAPTER 1
INTRODUCTION

Section I. General

1-1. Scope

a. This manual describes general support maintenance for Test Set, Radio Data Link, Sound Ranging TS-3566/GRA-114. It includes instructions for troubleshooting, repairing, and testing the equipment. It also lists all the tools, test equipment and materials needed for maintenance.

b. The test set and its major electronic components are functionally described in chapter 2 of this manual. Operating instructions and organizational maintenance are covered in TM 11-5895-1096-12.

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 as contained in 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/NAVMA-TINST 4355.73A/AFR 400-54/MCO 4430.3F.

c. *Discrepancy in Shipment Report (DISREP)* (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. Administrative Storage

Refer to TM 740-90-1, Administrative Storage, for instructions on preparation of equipment for storage.

1-5. Destruction of Army Materiel to Prevent Enemy Use

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

1-6. 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: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

Section II. DESCRIPTION AND DATA

1-7. Description

a. *General*. Refer to TM 11-5895-1096-12 for general description.

b. *Functiona*l. Refer to chapter 2 of this manual for functional block and circuit description.

1-8. Tabulated Data

Refer to TM 11-5895-1096-12 for tabulated data.

CHAPTER 2
FUNCTIONING OF EQUIPMENT

2-1. General

The TS-3566/GRA-114 is a highly accurate solid state digital code generator used to test the AN/GRA-114 receiver transmitter code reception and transmitter modulation capabilities. This is accomplished by using the test set code output to simulate AN/GRA-114 command transmissions, while an external probe and amplifier assembly is used to check the adjustment of the AN/GRA-114 transmitter modulation frequency. Figure 2-1 is a functional block diagram of the TS-3566/GRA-114. FO-2 is a schematic diagram showing all electrical parts and assemblies.

2-2. Block Diagram Description

(fig.2-1)

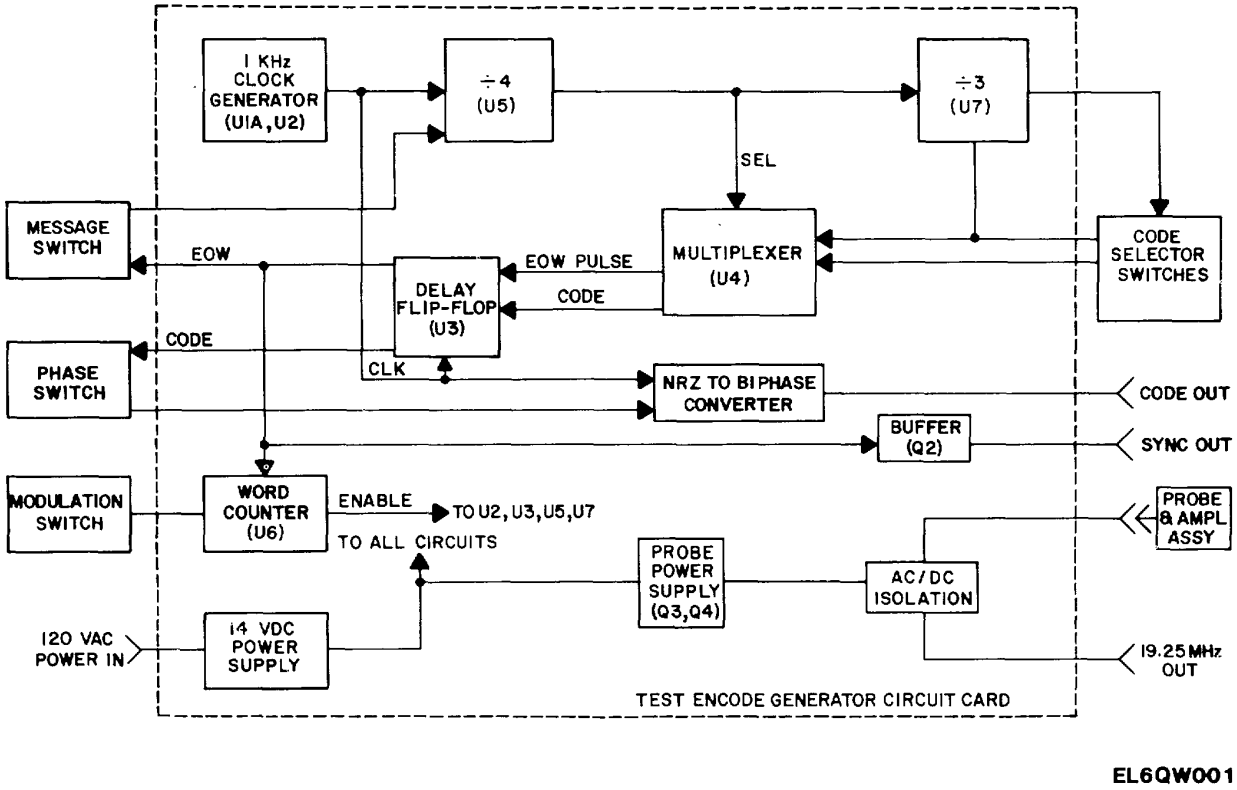


Figure 2-1. TS-3566/GRA-114 Functional Block Diagram.

a. *Message Switch.* The message switch, in SO2-STOP position, applies the end of word (EOW) pulse from the DELAY IN to the DIVIDE-BY-FOUR IC. In the SO1-START position, the circuit remains open.

b. *Phase Switch.* The phase switch selects which output (Q or Q) from the DELAY IC is provided to the Non-Return-To-Zero (NRZ) to BIPHASE CONVERTER, thus simulating a field wire polarity reversal in actual operation.

c. *Modulation Switch.* The modulation switch selects continuous code or a single burst of code information to be generated.

d. *1 KHz Clock Generator.* This generator is the heart of the encoder circuitry as it produces the I KHz clock signal which establishes all the timing sequences required for code generation.

e. *Divide-by-Four-Counter.* This counter produces the binary pulses used to generate the NRZ code. The signal, by operation of J/K flip-flops, is divided into two. One signal provides the selector address (SEL) to the multiplexer, and the other signal is used to drive the DIVIDE-BY-THREE counter.

f. *Divide-by-Three-Counter*. This counter develops the digit strobe, in conjunction with the multiplexer, to begin the sequence necessary to encode Natural Binary Coded Decimal (NBCD) data from the CODE SELECTOR switches.

g. *Multiplexer.* The multiplexer is a sequential switch which allows transmission of data from two or more sources over a common path by using different time intervals for different signals. The selector (SEL) pulse produced by the DIVIDE-BY-FOUR counter, directs the DIVIDE-BYTHREE counter as to which channel should be the source of the encoding data. The multiplexer is thus instructed to sequentially data from the CODE SELECTOR switches. The multiplexer also generates the End-of-Word (EOW) pulse at the end of each sequence.

h. *Delay Flip-Flop.* The delay flip-flop synchronizes the time-multiplexed data and the EOW pulse.

(1) The EOW pulse is applied to the DIVIDE-BYFOUR counter causing the counter to stutter for one code bit and creating the 13-bit code work only when the MESSAGE switch is in its SO2-STOP position.

(2) The NRZ, or complement CODE output is selected by the PHASE switch and applied to the NRZ TO BIPHASE CONVERTER.

i. *NRZ to Biphase Converter.* This converter converts the NRZ code output to its biphase equivalent. Biphase coding consists of a true bit and complement bit for each bit of NRZ code (i.e., the first bit of biphase code for each NRZ bit indicates the code information and the following bit is always the opposite or complement).

j. *Word Counter.* This counter initiates the code generation, controlled by counting the number of code words, when the MODULATION switch is activated.
When manual mode of operation is selected code generation is limited. When continuous mode is selected continuous code generation occurs.

k. *Buffer.* This stage provides the low impedance drive signal for the code and EOW sync pulses.

l. *14 VDC Power Supply.* The test set operates from a power source of 120 VAC which is converted by the power supply to a regulated + 14 VDC output to all circuits.

m. *Probe Power Supply.* The probe power supply provides regulated dc power to the external amplifier probe and assembly.

n. *AC/DC Isolation*. This stage protects the 14 VDC power supply in the event the probe power supply is improperly loaded. It also separates the 19.25 MHz signal (picked up by the external probe) riding on the DC supplied to the probe amplifier.

o. *Probe and Amplifier Assembly.* This external assembly is used to check the adjustment of the AN/GRA-114 transmitter modulator.

2-3. Circuit Description

(fig. FO-2, FO-3)

a. 1 KHz Clock Oscillator (U1 and U2).

(1) 512 KHz Crystal Oscillator, UIA. With pin 2 of the exclusive "OR" held high, this gate functions as an inverter to the input on pin 1. The feedback resistor R1 biases the gate to operate as a linear amplifier. Interconnected with components Y1, C1, C2, and R2, the gate forms an oscillator that provides the 512 KHz clock signal to the divider U2.

(2) *Divide-by 512 Counter (U2).* U2 is a multistage binary ripple counter. The ninth output 09 is used to produce a 2^9 division (512 ÷ 512 = 1 KHz) of the input clock frequency. The Q9 output of U2 is connected to the clock trigger input of U3A, U3B and U5B.

b. Divide-by-Four Counter (U5A and U5B). This stage is used as a ripple counter and is comprised of an interconnected dual J/K flip-flop.

(1) The KHz clock signal from U2, caused U5B to change output states with such positive-going pulse, and the signal at its (pin 14) output is a 500 Hz square wave (measured at TP2). The output is used to drive the multiplexer and USA.

(2) The 500 Hz clock signal from U5B, causes USA to change output states with each positive-going pulse, and the signal at its Q (pin 2) output is a 250 Hz square wave (measured at TPI). The output is used to drive the multiplexer and the divide-by-three stages.

(3) The operation described in (1) and (2) above occurs when the MESSAGE switch is in its SO1-START position which holds the J/K inputs of U5B HI. When the switch is in its SO2-STOP position, the EOW pulse from U3B-12 is applied to the J/K inputs. This is a negative logic pulse and inhibits the divide-by-four counter for one clock period, which causes the counter to stutter for one code bit and the multiplexer to repeat the first bit of each code word.

(4) Since the counter advances on the positive inputs and the outputs that are utilized are the complements, or negative logic, the counter actually counts in a descending order with respect to the binary value of its output.

c. Divide-by-Three Counter (U7A, U7B, UIC). This stage is comprised of a dual J/K flip-flop, and an exclusive OR wired so as to provide a divide-by-three function.

(1) The two Q outputs from U7B-15 and U7A-1 provide the tens and units strobes respectively, and sequence through the three combinations as shown in table 2-1.

(2) Hundreds strobe decoder U1C, decodes the 0-0 state of U7B-15 and U7A-1 and provides the hundreds strobe as shown in table 2-2.

d. *Code Selector Switches.* (fig. 2-2). To generate the serial code, a time division multiplexing concept is used.
Each of the front panel CODE SELECTOR switches is sequentially strobed, and the resulting NBCD data from each switch is sequentially selected producing the 12-bit (13 bit if in S02-STOP position) serial code. Each NRZ code word is subdivided into three numbers and each number contains four binary bits of NBCD data. Each selector switch is a 10 position rotary switch with one common pole as shown in table 2-3. Each of the four outputs from each selector switch is logically OR'ed by a diode arrangement, located on the selector switches, to the four inputs (8, 4, 2, and 1) of the multiplexer.

Table 2-1. U7 Output Table

Counter State	U7B-15	U7A-1
0 (hnds)	0	0
1 (tens)	1	0
2 (units)	0	1

Table 2-2. U7, UI Truth Table

Counter State	U7B-15	U7A-2	U1C-11
0	0	1	1
1	1	1	0
2	0	0	0

Table 2-3. Code Selector Switch Truth Table.

Switch Position	A	B	C	D
0				
1	X			
2		X		
3	X		X	
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X

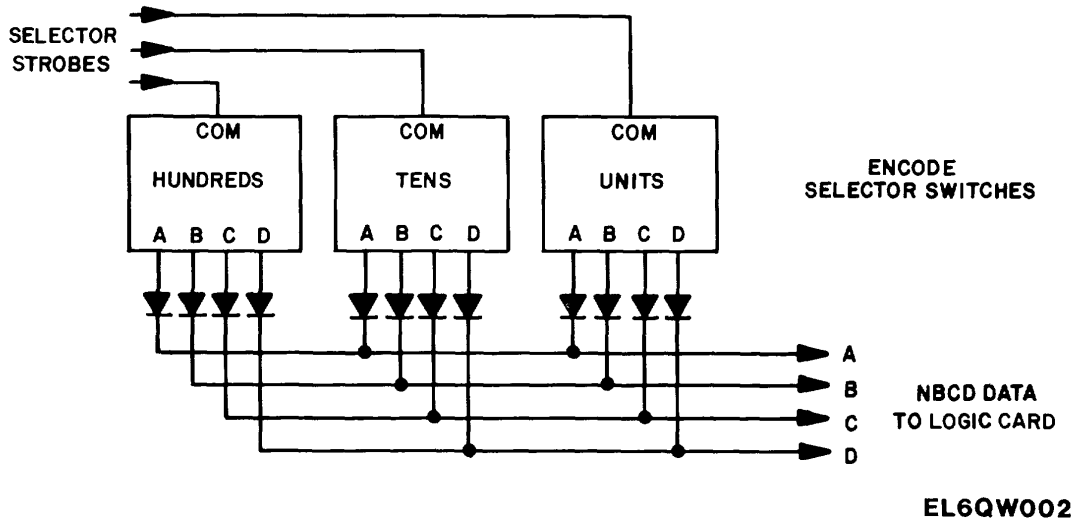


Figure 2-2. Code Selector Switch Diagram.

e. *Multiplexer*, (U4) (fig. 2-3). This IC is a dual four bit multiplexer. It operates as a two pole, four position switch that is capable of passing a signal in either direction. The position that the multiplexer selects is determined by the binary value of the A and B inputs (pins 10 and 9).

(1) The first half of the U4 is used to sequentially select the four bits of NBCD data coming from the selector switches. The A and B inputs to U4 are the outputs from the divide-by-four counter (U5A, U5B) that are counting in descending order. These inputs control the sequence of U4, causing U4 to commutate in the descending order of Y3 to YO that is wired to select the NBCD data A to D. The output Y from U4 will be NRZ code as selected on the front panel CODE SELECTOR switches.

(2) This serial code is generated by the combination of the multiplexer and the divide-by-three switch strobes that provide the following sequence:

(a) While the hundreds switch is enabled by the hundreds strobe, the multiplexer will sample each of the four data bits in the 1, 2, 4, and 8 bit sequence, then the tens digit switch is enabled and the multiplexer will sample the four new data bits. This sequence will continue for the units digit, then repeat.

(b) Since U4 is a bilateral device, it will pass a signal in either direction. R17, the load resistor for the switch mounted diodes, is connected to the output Y. Due to interconnect wiring capacitance and the NBCD data filters R7 through R10 and C3 through C6, the NRZ word at U4-13 will not be an ideal signal. Many glitches will be present and the waveform edges will be rounded.

(3) The remaining half of U4 is wired to provide the AND function of the D data bit and the units digit. The X output will be a positive pulse indicating the last data bit of each code word.

f. *Delay Flip-flop U3A and U3B*. This IC is a dual D (data type) flip-flop and is used to synchronize the two outputs from the multiplexer. This has the effect of restoring these signals to the ideal digital waveforms.

(1) U3A is used to restore the NRZ code word from U4-3. U3-1 and 2 will be delayed one clock period and bit period by operation of the D flip-flop U3A.

(2) U3B provides synchronization of the EOW pulse from U4-13. This pulse is also delayed one clock period by U3B, and the output from U3B-13 will be a positive pulse that identifies the first data bit of each code word.

g. *NRZ to Biphase Converter.* The NRZ code output from U3A-1, or its complement from U3A-2providesthe input signal to U1B-8. The exclusive OR operation of U1B creates the biphase code word from the NRZ input and the clock signal UIB-9.

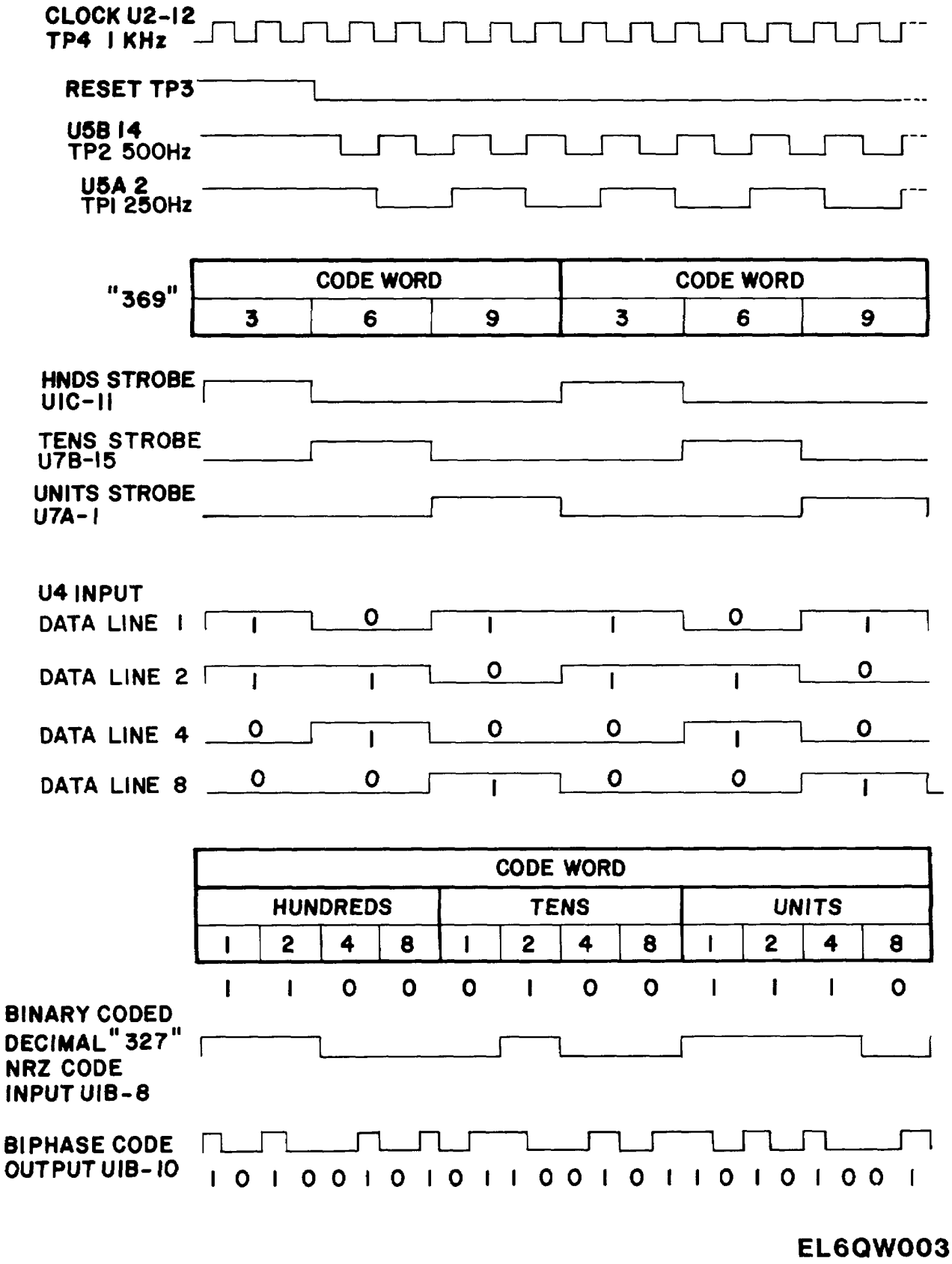


Figure 2-3. TS-3566/GRA-114 Waveforms.

h. Word Counter (U6). This IC is a decoded divide-by ten counter, used to control the operation of the encoder and transmitter functions. During its "0" condition it will generate an encode transmission. Code generation is initiated by application of a positive pulse on the reset input U6-15. This reset pulse returns the divide-by-ten counter to its "0" state. As the encoder generates the code words, the word start pulse from U3B-12 is counted until the tenth count or the Q9 output goes to a logic "I". With the Q9 output connected in a feedback loop to the clock enable input U6-13, the counter will stop and hold the Q9 output "HI".

i. Buffer (Q1, Q2). The common collector configuration of transistors Q1 and Q2 provides the low-source impedance drive signal for the code output and EOW sync pulse.

j. 14 VDC Power Supply. All circuits in the test set are powered by this full wave rectifier circuit. The supply consists of a transformer T1, with a center-tapped secondary, mounted on the panel assembly with the remainder of the components located on the circuit board. These components include two diodes, CR3 and CR4, which provide full wave rectification. Capacitors C12, C13, C14, and resistor R20 form the filter network while diode CR2 provides shunt regulation.

k. Probe Power Supply. The probe power supply provides dc power to a BNC connector mounted on the test set front panel. DC power for the connector is obtained from the 14 VDC power supply through an inductor (L2), and a two transistor (Q3 and Q4) current limiter that protects the 14 VDC supply if the probe supply is improperly loaded.

I. Probe and Amplifier Assembly. The external probe and amplifier assembly picks up the 19.25 MHz signal from the AN/GRA-114 transmitter modulator.

(1) 19.25 MHz signal pickup is accomplished by a 2 /2 turn coil on the end of a small probe. This signal is amplified by a two stage junction-field-effect-transistor (JFET) amplifier (fig. FO-2) and then transferred to the test set by a short length of coaxial cable.

(2) Interconnection between the test set and the external probe and amplifier assembly is accomplished by the use of cable W1 of Maintenance Kit MK-1752/GRA114. This cable supplies the DC power to the assembly and transfers the 19.25 MHz to the test set where it is separated from the DC and coupled to the test set 19.25 MHz OUT jack.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. GENERAL

3-1. Scope of General Support Maintenance

This chapter contains the following general support maintenance functions for the test set: bench testing, troubleshooting, voltage measurements, waveform measurements, continuity measurements, disassembly, cleaning, initial inspection, repair and replacement, reassembly, repainting and refinishing, and general support performance testing procedures. The general support maintenance procedures supplement the maintenance procedures contained in TM 11-5895-1096-12.

3-2. Organization of General Support Maintenance

General support maintenance procedures are listed below, together with references to the paragraphs covering the specific maintenance function.

a. Voltage Measurements (para 3-3).
   (1) General.
   (2) Main assembly.
   (3) Probe amplifier assembly.
b. Waveform Measurements (para 3-4).
c. Continuity Measurements (para 3-5).
d. Bench Tests (para 3-6).
   (1) General.
   (2) Main assembly.
   (3) Probe amplifier assembly.
e. Test Set Troubleshooting (sect. III).
   (1) General troubleshooting information (para 3-9).
   (2) Troubleshooting procedures (para 3-10).
      (a) General.
      (b) Voltage measurements.
      (c) Intermittent troubles.
      (d) Test points.
   (3) Troubleshooting tables (para 3-11).
      (a) General.
      (b) Main assembly and probe amplifier.
      (c) Encode generator circuit card.

f. Maintenance of Test Set (para 3-12).
g. Inspection (para 3-13).
h. Cleaning (para 3-14).
i. General Repair Procedures (para 3-15).
j. Disassembly (para 3-16).
k. Parts Replacement (para 3-17).
l. Circuit Card Repairs (para 3-18).
m. Repainting and Refinishing (para 3-19).
n. Reassembly (para 3-20).
o. Testing Procedures (sect. V).
   (1) General (para 3-21).
   (2) Physical tests and inspection (para 3-22).
   (3) TS-3566/GRA-1 14 performance test (para 3-23).
   (4) 19.25 MHz amplifier performance test (para 3-24).

3-3. Voltage Measurements

WARNINGS

When making voltage measurements on this equipment, be extremely careful. 120 volts AC is present in the power supply circuit. DEATH ON CONTACT may result if safety precautions are not followed. Do not make internal connections alone. Always have another person to help in case of an accident.

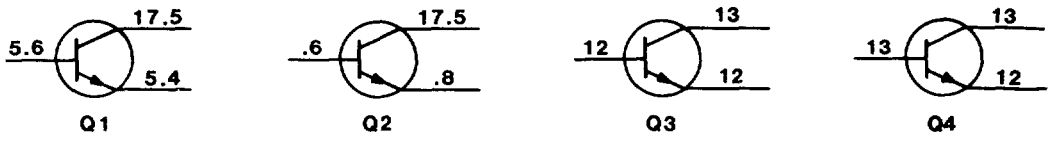
Always disconnect the AC source, and ground the part with a shorting stick before making resistance measurements.

CAUTION

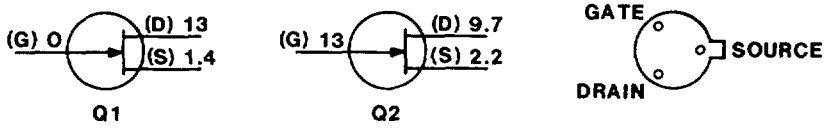
This equipment is transistorized: observe all cautions to prevent transistor damage. Do not make continuity checks other than those specified in the tables. Damage to the transistors and microelectronic devices, which can impair the performance of the equipment, may result if improper battery voltages and polarities are applied.

a. General. This equipment is transistorized. Observe all cautions to prevent transistor damage. Make voltage measurements in this equipment only as specified. When measuring voltages, use tape or sleeving to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin a transistor. (For example, if the bias is shorted out, excessive current would ruin the transistor between the emitter and the base.) Use all referenced diagrams as an aid when making voltage and resistance measurements.

b. Test Set Main Assembly. To perform voltage measurements on the main assembly it must be disassembled (para 3-16). Use figure 3-1 for measurements. Refer to figure 3-10 parts location diagram, and figures FO-1, FO-2, and FO-3 which are the resistor and capacitor color codes, schematic and wiring diagrams.



a. ENCODE PCB TRANSISTOR VOLTAGES



NOTES:
1. ALL VOLTAGES TAKEN WITH RESPECT TO GROUND VOM.
2. VOLTAGES SHOWN ARE MINIMUM ACCEPTABLE VALUES

b. PROBE AMPLIFIER PCB TRANSISTOR VOLTAGES

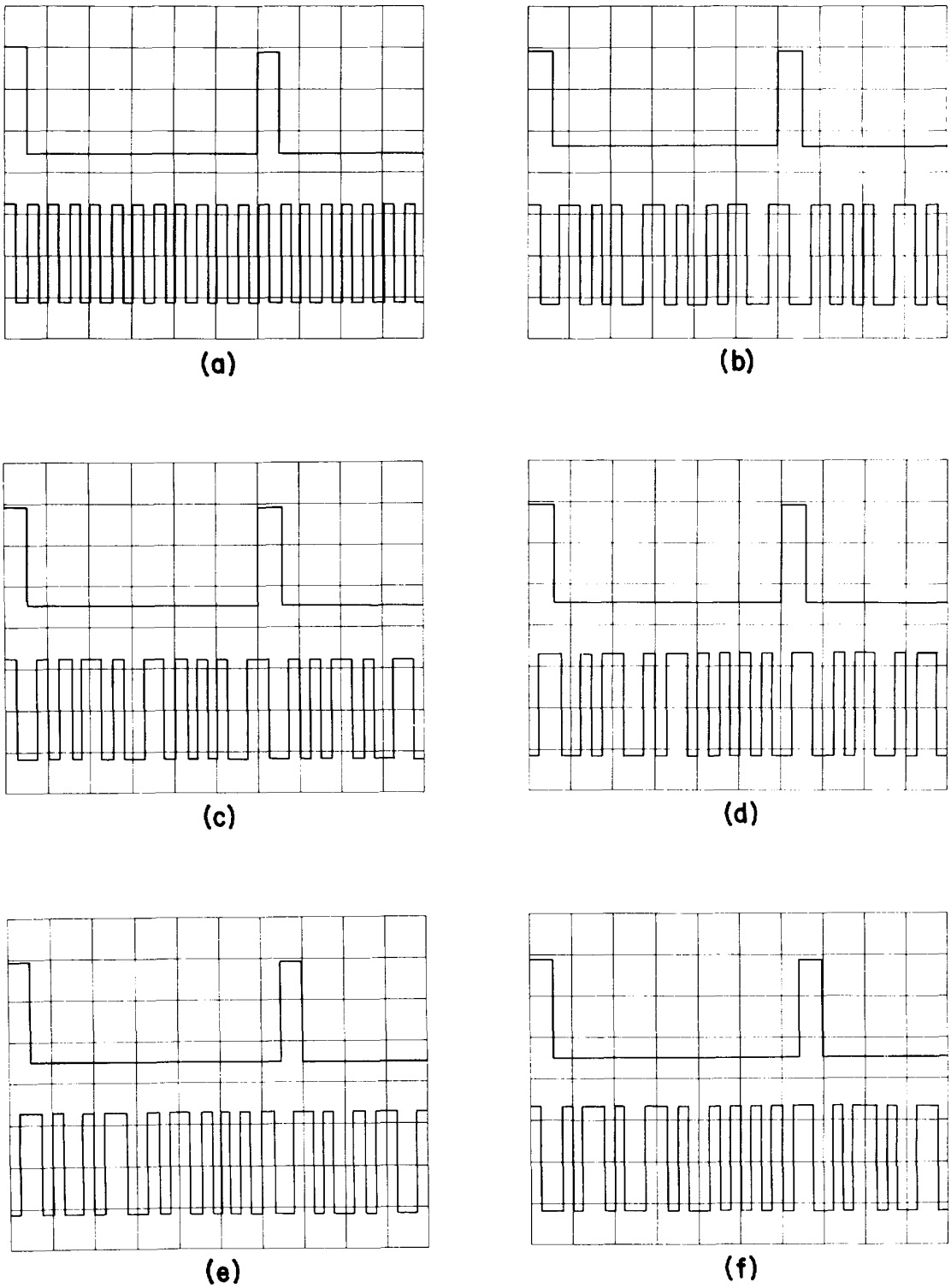
EL6QW004

Figure 3-1. TS-3566/GRA-114 Transistor Voltages.

c. Probe Amplifier Assembly. To perform voltage measurements on the probe amplifier assembly it must be disassembled (para 3-16). Use figure 3-1 for measurements. Refer to figure 3-11 parts location diagram, and figure FO-2 schematic diagram.

3-4. Waveform Measurements

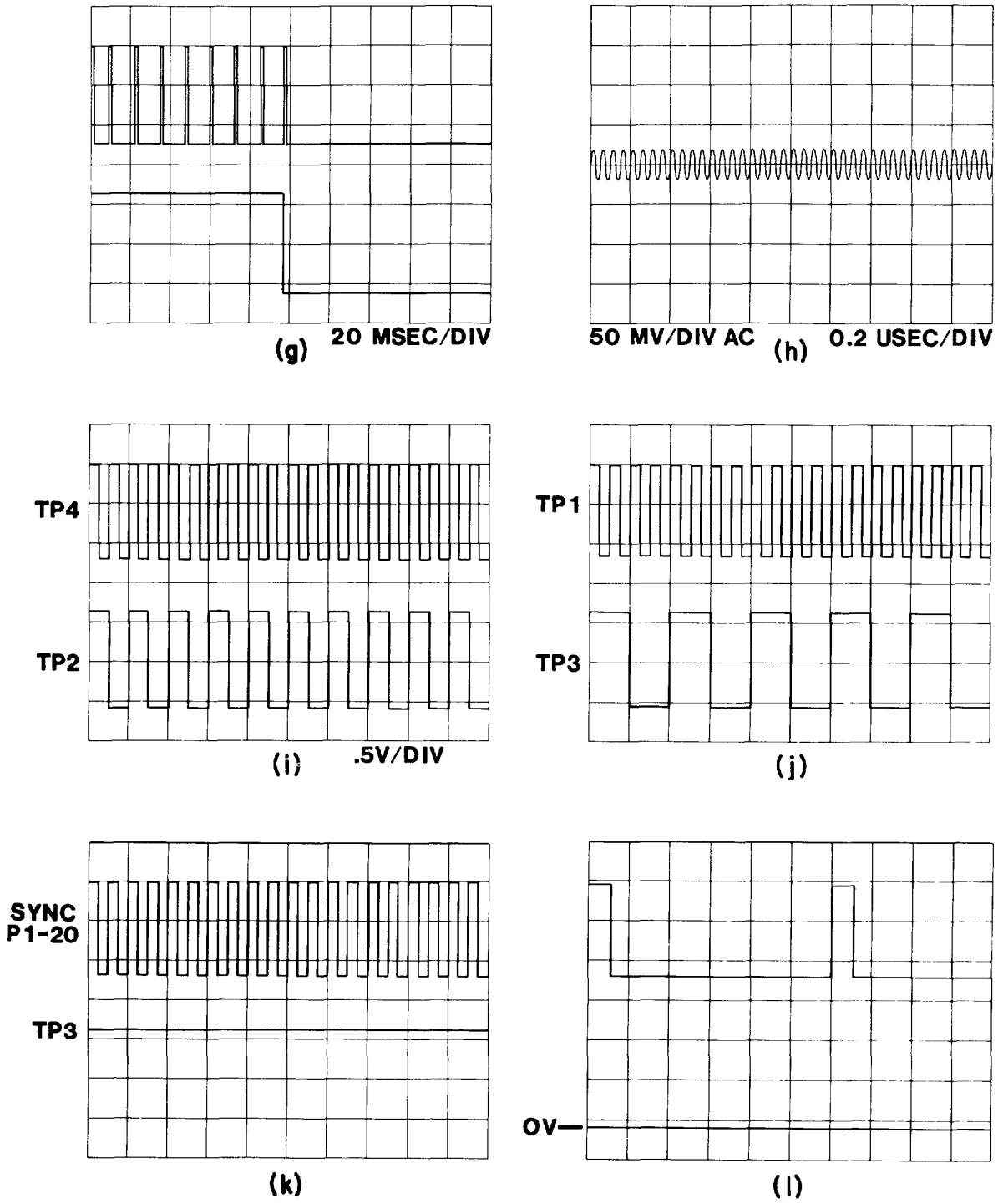
Make all waveform measurements using Oscilloscope OS-262(P)/U, or equivalent at the points specified in the bench test (para 3-6), and the troubleshooting tables (para 3-11).



NOTES: 1. ALL UPPER TRACES ARE CH 1, ALL LOWER TRACES ARE CH 2.
2. ALL SETTINGS ARE 5V/DIV, 2 MSEC/DIV UNLESS OTHERWISE NOTED.
3. ALL TRACES ARE ≃12V AMPLITUDE UNLESS OTHERWISE NOTED.

EL6QW005

Figure 3-2. Waveform Measurements (Sheet I of 3).



NOTES: 1. ALL UPPER TRACES ARE CH 1, ALL LOWER TRACES ARE CH 2.
2. ALL SETTINGS ARE 5V/DIV, 2 MSEC/DIV UNLESS OTHERWISE NOTED.
3. ALL TRACES ARE ≈12V AMPLITUDE UNLESS OTHERWISE NOTED.

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Figure 3-2. Waveform Measurements (Sheet 2 of 3).

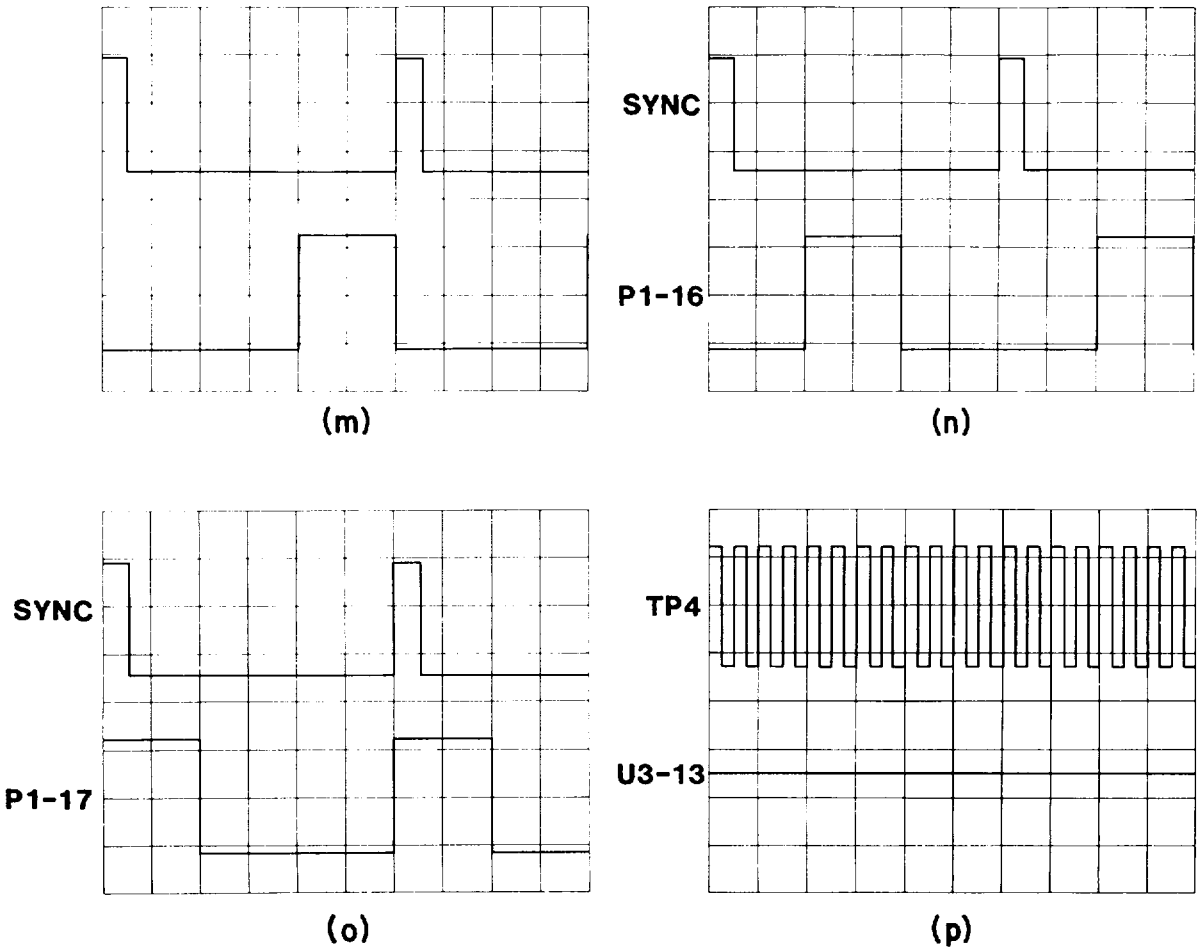

Figure 3-2. Waveform Measurements (Sheet 3 of 3).

3-5. Continuity Measurements.

Routine continuity checks between various points of circuitry can be made using Multimeter AN/USM-223, or equivalent, and the schematic and wiring diagrams (fig FO-2, FO-3).

3-6. Bench Tests.

a. General. To perform the bench tests, hookup the equipment as shown in the applicable hookup diagram and perform the procedures in the applicable test table in the order given.

b. Main Assembly Bench Test. Hookup the equipment as shown in figure 3-3. Set the controls as shown in table 3-1. Follow the procedures in table 3-2 to determine the proper operation of the test set main assembly.

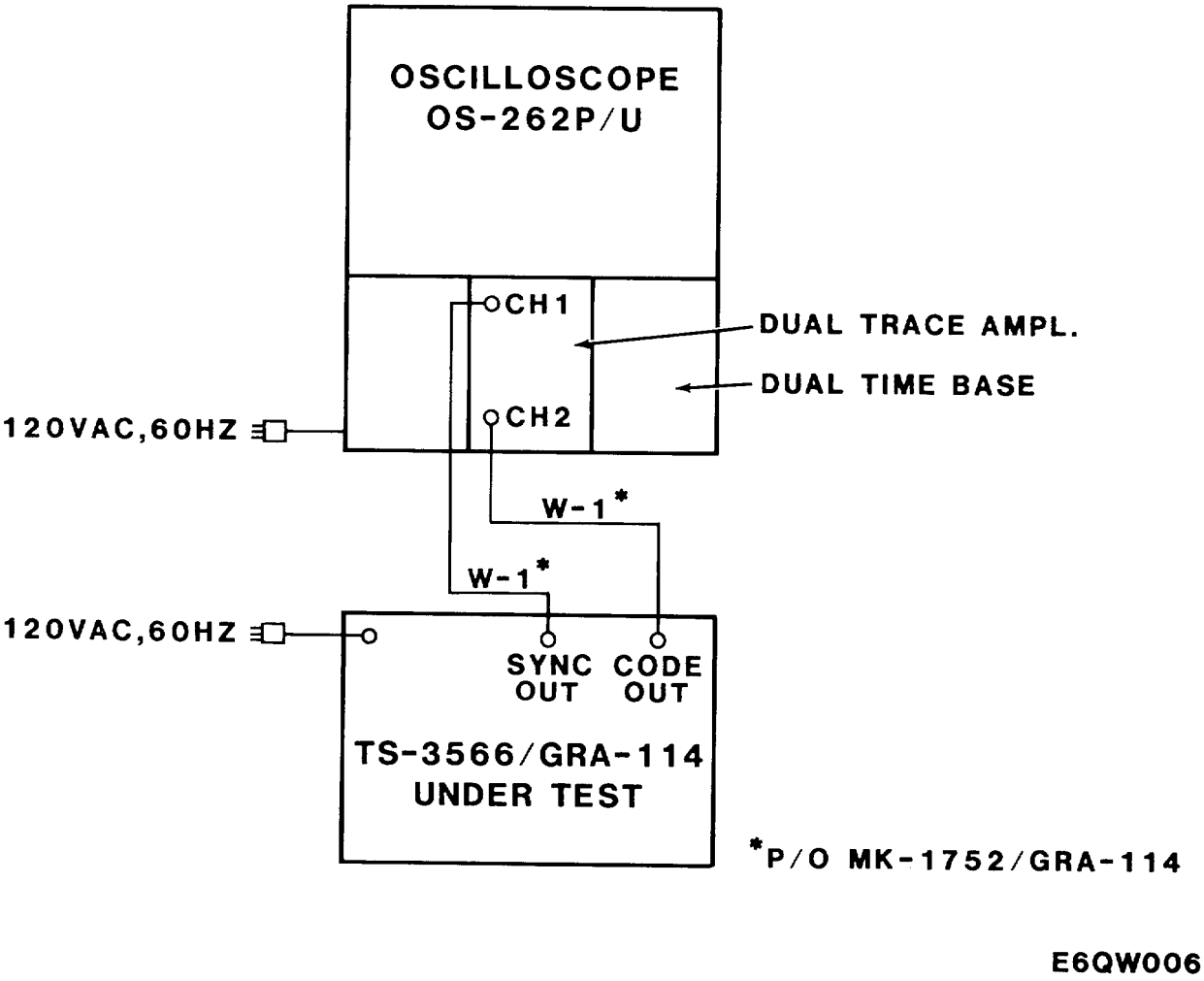

Figure 3-3. Main assembly Bench Test Hookup.

c. Probe Amplifier Bench Test. Remove the probe from he probe amplifier and hookup the equipment as shown in figure 3-4. Set the controls as shown in table 3-3. Follow the procedures in table 3-4 to determine the proper operation of the probe amplifier assembly.

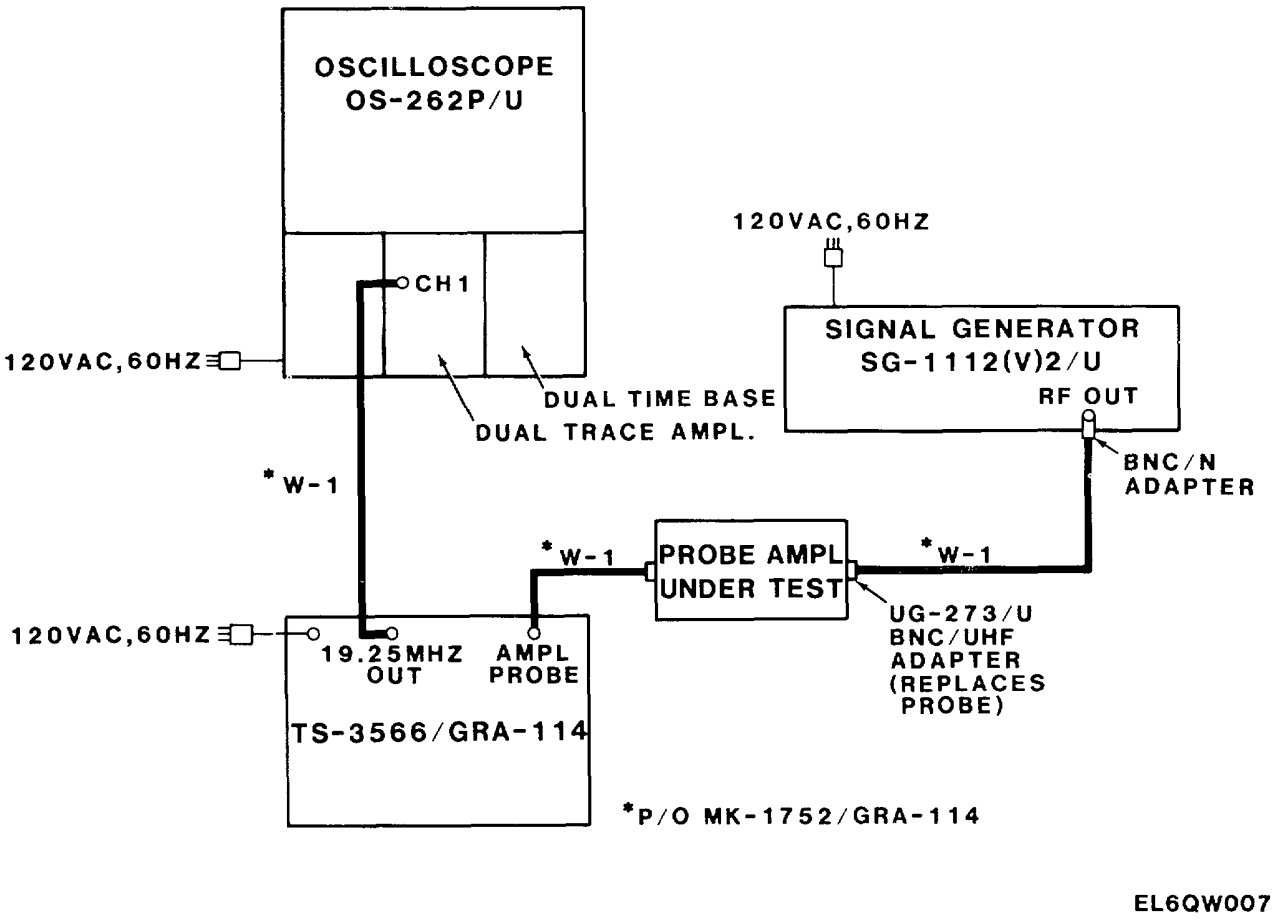

Figure 3-4. Probe Amplifier Bench Test Hookup.

Table 3-1. Main Assembly Bench Test Control Settings

Oscilloscope		Test Set	
Control	Setting	Control	Setting
Channel 1 deflection	5V/Div, DC	POWER	ON
Channel 2 deflection	5V/Div AC	PHASE	NORMAL
Display Mode	Chop	MESSAGE	SOI-START
Trigger Source	Int, CH1	MODULATION	CONTINUOUS
Trigger Mode	Auto	CODE SELECTOR	000
Trigger Slope	Positive		
Time/Division	2 msec		

Table 3-2. Main Assembly Bench Test Procedures

Step	Procedure	Result/Indication
1	Observe test set POWER indicator	POWER indicator is ON
2	Adjust horizontal, vertical position and trigger level as required to observe display.	Display as shown in figure 3-2 (a) appears.
3	Set MODULATION switch to OFF and observe oscilloscope.	Display disappears.
4	Reset MODULATION switch to CONTINUOUS and observe oscilloscope.	Display as shown In figure 3-2 (a) reappears.
5	Change CODE SELECTOR to 195 and observe oscilloscope	Display as shown in figure 3-2 (b) appears.
6	Change CODE SELECTOR to 724 and observe oscilloscope	Display as shown in figure 3-2 /c) appears.
7	Change CODE SELECTOR to 638 and observe oscilloscope	Display as shown in figure 3-2 (d) appears.
8	Set MESSAGE switch to SO-2 STOP and observe oscilloscope	Display as shown in figure 3-2 (e) appears.
9	Set PHASE switch to REVERSE and observe oscilloscope	Display as shown in figure 3-2 (f) appears.
10	Set test set POWER switch to OFF Change equipment controls as follows: a Oscilloscope. (1) Channel 1 deflection-5V/Div, DC (2) Trigger Mode - DC (3) Time/Division-20 msec	None.

Table 3-2. Main Assembly Bench Test Procedures - Continued

Step	Procedure	Result/Indication
10	(continued) b Test Set. (1) PHASE switch-NORMAL (2) MESSAGE switch-SO1-START (3) MODULATION switch)OFF (4) CODE SELECTOR-000	
11	Set test set POWER switch to ON Repeatedly set the MODULATION switch to MANUAL and release at a rate of twice per second. Adjust trigger level of oscilloscope as required and observe display.	Display as shown in figure 3-2 (g) appears.
12	Turn test set POWER switch to OFF and perform probe amplifier bench tests (para 3-6(c)).	None.

Table 3-3. Probe Amplifier Bench Test Control Settings

Oscilloscope		Test Set	
Control	Setting	Control	Setting
Channel I deflection	50mv/AC	POWER	ON
Display Mode	CH 1	All other controls	Any
Trigger Source	Internal		
Trigger Mode	Auto		
Time/Div	0.2 ,sec/Div		
Trigger Slope	Positive		

Table 3-4. Probe Amplifier Bench Test Procedures

Step	*Procedure*	*Result/Indication*
1	Adjust the signal generator for an unmodulated output of 19.250 MHz at 2.0 mv RMS.	None.
2	Adjust vertical position and trigger level of oscilloscope as required and observe display	A sinewave of 19.250 MHz (approximately 4 cycles per div) of about 28 mv peak-to-peak minimum (fig 3-2 (h))
	NOTE **There will be a 120 Hz ripple on the displayed signal. (Not visible at specified sweep speeds.)**	
3	Turn signal generator and oscillosocpe OFF. Set test set POWER switch to OFF. Disconnect test setup.	None.

Section II. TOOLS AND EQUIPMENT

3-7. Tools and Equipment Required

The following tools and equipment are required to perform general support maintenance on the TS-3566/GRA-114:

a. Tools.

(1) Tool Kit, Electronic Equipment TK-100/G.
(2) Tool Kit, Electronic Equipment TK-105/G.

b. Equipment.

(1) Dual Time Base TD-1159/U.
(2) Dual Trace Amplifier AM-6880/U.
(3) Maintenance Kit MK-1752/GRA-114
(4) Multimeter AN/USM-223.
(5) Oscilloscope OS-262(P)/U.
(6) Probe P6105, 2 meters long.
(7) Repair Kit MK-772/U.
(8) Signal Generator SG-1112(V)/U.

3-8. Repair Parts

Repair parts are listed and illustrated in the repair parts and special tools list (RPSTL) TM 11-5895-1096-40P, covering general support maintenance for this equipment. TM 11-5895-1096-20P will also be used where applicable.

SECTION III. Troubleshooting

3-9. General Troubleshooting Information

a. Troubleshooting at the general support maintenance level includes the techniques outlined for organizational maintenance and additional techniques required to isolate to a defective assembly and part. Paragraph 3-10 describes the systematic procedure to be followed which will enable the maintenance personnel to isolate the cause of the trouble and correct the fault.

b. The FIRST STEP is to trace the fault to a particular module or assembly. This is called LOCALIZATION. Bench tests can be made by following the procedures in paragraph 3-6.

c. The FINAL STEP is to trace the fault to the defective part of an assembly. This is called ISOLATION.

d. LOCALIZATION and ISOLATION of a fault are determined by visual inspection, voltage and resistance measurements, and use of the troubleshooting charts. Visual inspection will locate many faults without testing the circuits. All visual signs should be observed and an attempt made to localize the fault.

NOTE

In all tests the possibility of intermittent troubles should be investigated. Jarring or tapping the equipment may expose this type of problem.

3-10. Troubleshooting Procedures

a. General. The malfunctions listed in the troubleshooting procedures and corrective measures have been performed. The tables provide general support maintenance personnel with the information required to check and correlate all information from organizational maintenance with the test equipment and tools available. Perform the procedures contained in the troubleshooting tables in the order given. Do not proceed to the next action when the corrective measures have already been taken to eliminate the trouble.

(1) Defective material, such as piece parts, modules, or minor components, shall be recorded and identified by National stock number (NSN), inspected and verified as defective. All replaced equipment will be repaired, or disposed of in accordance with AR 775-1 and current established procedures for general support.

(2) When replacing a part, make sure that the part is the same as the one being replaced. Refer to section IV, Maintenance of Test Set for instructions on assembly.

(3) When trouble has been localized to a stage, either through performance of the tests given in your troubleshooting charts, or other means, isolate the defective part by measuring voltage at the test points and other points related to the stage suspected of being faulty.

WARNING

When troubleshooting this equipment, be extremely careful. 120 volts AC is present in the power supply circuit. DEATH ON CONTACT or serious injury may result if safety precautions are not followed. Do not make internal connections alone. Always have another person to help in the case of an accident.

CAUTION

This equipment is transistorized: observe all cautions to prevent transistor damage. Do not make continuity or resistance checks other than those specified in the tables. Damage to the transistors and microelectronic devices, which can impair the performances of the equipment, may result if improper battery voltages and polarities are applied.

b. Voltage Measurements. This equipment is transistorized. Observe all cautions to prevent transistor damage. Make voltage measurements in this equipment only as specified. When measuring voltages, use tape or sleeving to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin the transistor. (For example, if the bias is shorted out, excessive current would ruin the transistor between emitter and base.) Use resistor and capacitor color codes shown in figure FOI1 to find values of components, or refer to the component location drawing.

c. Intermittent Troubles. In all tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble may develop by tapping or jarring the assembly. Check the wiring and connections to the assemblies and subassemblies.

d. Test Points. The printed circuit card is equipped with test points to facilitate connections of test instruments. The test points should be used whenever possible to avoid needless disassembly of the equipment. These test points are shown on figure 3-10.

3-11. Troubleshooting Tables

a. General. There are two troubleshooting tables for the TS-3566/GRA-114: table 3-5 enables you to troubleshoot the main assembly and probe amplifier while table 3-6 enables you to troubleshoot the encode generator circuit card.

NOTES

All troubleshooting procedures on the test set are performed with the test set disassembled (para 3-16).

It may be necessary to partially remove the fungicide coating to insure good electrical connections.

b. Main Assembly and Probe Amplifier. Follow the procedures in table 3-5 to determine the corrective action for repair of the main assembly and probe amplifier.

c. Encode Generator Circuit Card. Follow the procedures in table 3-6 to determine the corrective action for repair of the encode generator circuit card.

Table 3-5. Main Assembly and Probe Amplifier Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. POWER indicator does not light when POWER switch is set to ON	a Defective fuse assembly	a Disconnect test set from 120 VAC source. Using Multimeter AN/USM-223, check for continuity of AC input circuit. (1) If CORRECT, go to step e. (2) If INCORRECT, repair wiring/replace defective component.
	b Defective indicator assembly,	b Perform a above.
	c Defective POWER switch S7	c Perform a above.
	d Defective input power cord	d Perform a above.
	e Defective transformer TI	e Replace.
2 No CODE OUT or SYNC OUT signals generated	Defective encode generator circuit card	Go to table 3-6, Malfunction 1.
3 Erratic or no CODE OUT signal generated; SYNC OUT normal	a Defective code output wiring	a Disconnect test set from 120 VAC source. Using Multimeter AN/USM-223, check for continuity (1) If CORRECT, go to table 3-6, Malfunction 2. (2) If INCORRECT, repair wiring/replace defective component.
	b Defective CODE SELECTOR switches.	b Perform a above.
	c Defective PHASE, MODULATION, or MESSAGE switch.	c Perform a above.
4 Erratic or no SYNC OUT signal generated CODE OUT normal	Defective SYNC OUT wiring or BNC connector J3	Disconnect test set from 120 VAC source Using Multimeter AN/USM-223, check for continuity from center conductor of SYNC OUT connector J3 to PI-20 on encode generator circuit card. (1) If CORRECT, go to table 3-6, Malfunction 3. (2) If INCORRECT, repair wiring/replace defective connector.
5 Signal not present at 19.25 MHz OUT connector J4 on test set when using external probe amplifier assembly.	a Defective cable WI to oscilloscope or WI to probe amplifier.	a Replace both Wl cables.
	b Defective DC supply output to probe amplifier	b Using Multimeter AN/USM-223, check for + 12 VDC nominal at center conductor of AMPL PROBE connector J5. (1) If CORRECT, go to step c. (2) If INCORRECT, disconnect test set from 120 VAC source Using Multimeter AN/USM-223, check for continuity from center conductor of AMPL PROBE connector J5 to P2 on encode generator circuit card.
Using	c Defective 19.25 MHz output connector on test set	c. Disconnect test set from 120 VAC source Multimeter AN/USM-223, check for continuity from center conductor of 19.25 MHz OUT connector J4 to P3 on encode generator circuit card. (1) If CORRECT, check C9 on encode generator circuit card.

		(a) If GOOD, go to step d. (b) If DEFECTIVE, replace. (2) If INCORRECT, repair wiring/replace defective connector.
d.	Defective BNC connector on probe amplifier.	d. Remove probe and top cover from amplifier (para 3-16). Using Multimeter AN/USM-223 check for continuity from center conductors of BNC connectors to their circuit card tiepoints. (1) If CORRECT, go to e below. (2)If INCORRECT, repair wiring/replace defective connector.
e.	Defective probe amplifier circuit card.	e. Set up test equipment as shown in figure 3-5 and perform the following tests:
(1)	Defective input circuit.	(1) Using Oscilloscope OS-262P/U, connect CHI probe to input tie point and observe waveform as shown in figure 3-2 (h) of 19.25 MHz @ 0.5 mV p-p.
(2)	Defective output circuit.	(2) Using Oscilloscope OS-262P/U, connect CHI probe to output tiepoint and observe waveform as shown in figure 3-2(h) of 19.25 MHz @ 30 to 40 mV p-p. (a) If CORRECT, reassemble probe. (a) If INCORRECT, repair wiring, go to test (3).
(3)	Defective circuit card component.	(3) Using Osciloscope OS-262P/U, trace 19.25 MHz signal through L3, Q2, Ql, RI, and LI-CI stages. (a) If CORRECT, adjust Ll and L2 for maximum gain. (b) If INCORRECT, replace defective component.

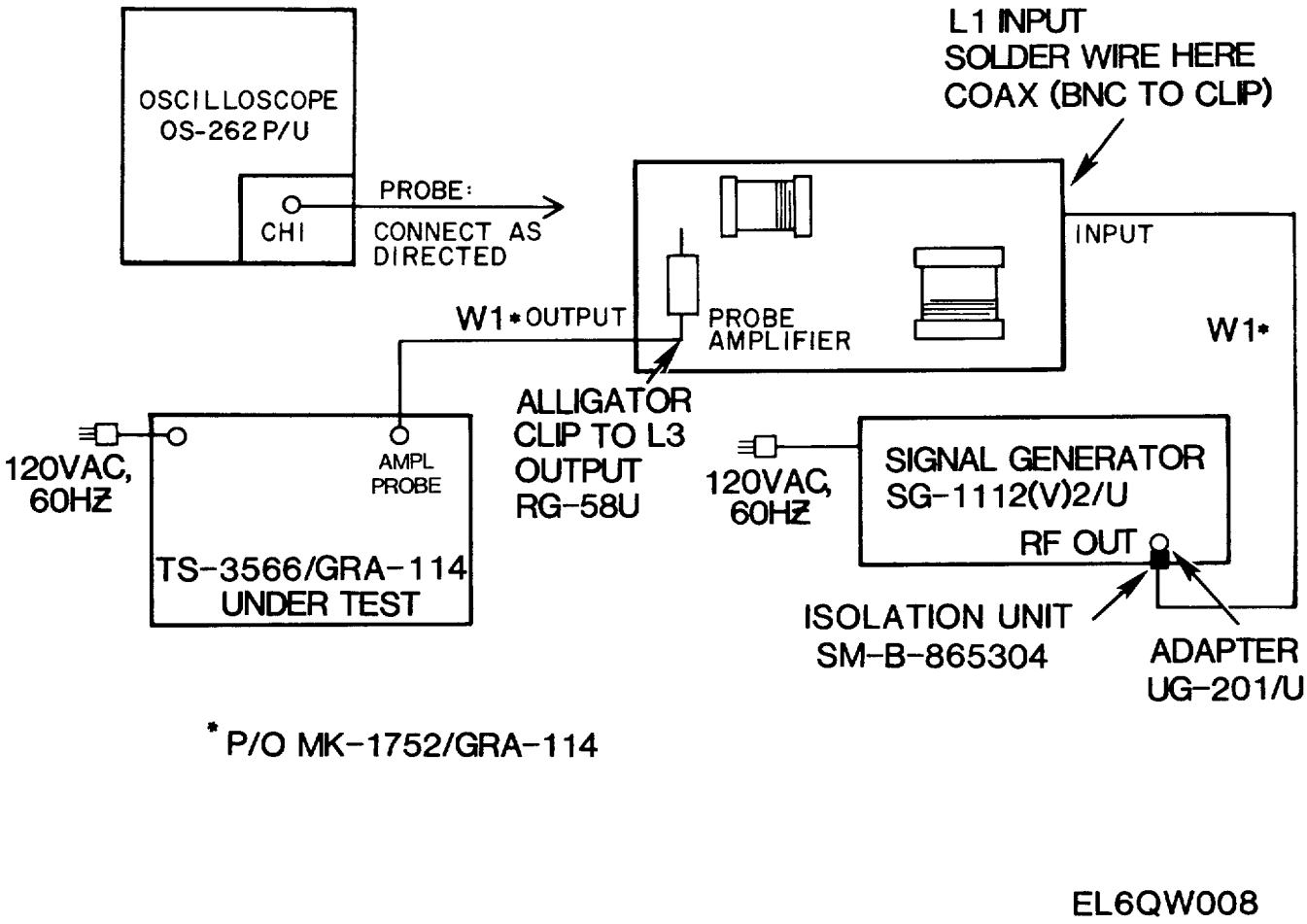

Figure 3-5. Probe Amplifier Troubleshooting Test Setup.

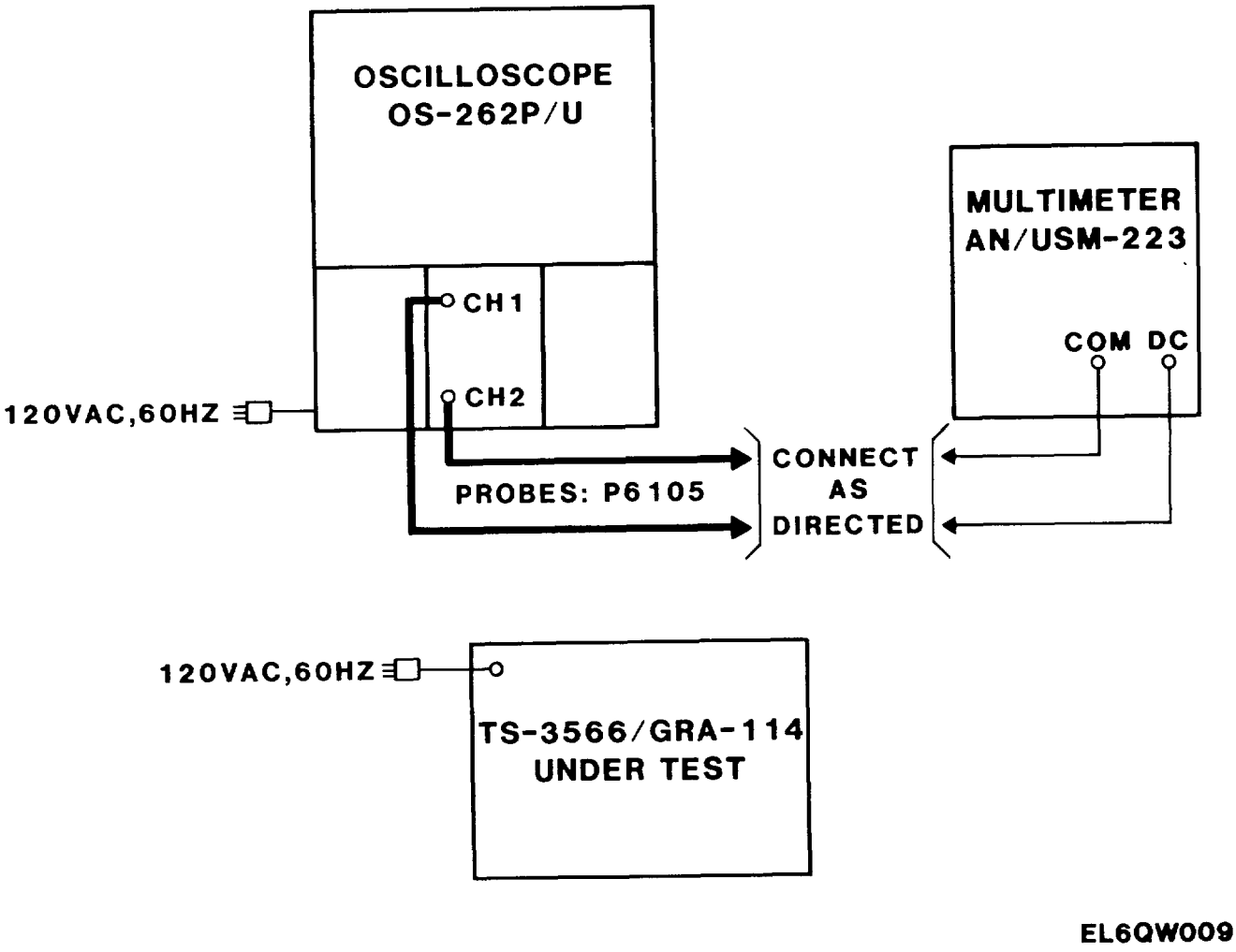

Figure 3-6. Encode Generator Circuit Card Troubleshooting Test Setup.

Table 3-6. Encode Generator Circuit Card Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. No CODE OUT or SYNC OUT signals generated.	a. Defective DC supply components CR3, CR4, C14.	a. Set up test equipment as shown in figure 3-6 Using Multimeter N/USM-223, check for + 18 VDC nominal at + side of C14. (1) If CORRECT, go to b below. (2) If INCORRECT, disconnect test set from 120 VAC source. Using Multimeter AN/USM-223, check CR3, CR4, C14 and replace defective component.
	b. Defective DC supply components CR2, C12, C13, R20.	b. Disconnect test set from 120 VAC source. Using Multimeter AN/USM-223 check CR2, C12, C13, R20. Replace defective component.
2. Erratic of no CODE OUT signal generated. SYNC OUR normal.	a. Defective clock component.	a. Set up test equipment as shown in figure 3-6. Using Oscilloscope OS-262P/U, connect CHI probe to TP4. Adjust horizontal, vertical position, and trigger level as required to observe display as shown in figure 3-2 (i). **NOTE** Only upper trace will be displayed on oscilloscope. (1) If CORRECT, go to b below. (2) If INCORRECT, check Ul, U2, Yl and associated components. Replace defective component.
	b. Defective divider U5B.	b. Using Oscilloscope OS-262P/U, connect CH2 probe to TP2 and observe display as shown in figure 3-2 (i). (1) If CORRECT, go to c below. (2) In INCORRECT, replace U5.
	c. Defective divider U5A:	c. Using Oscillscope OS-262P/U, connect CH2 probe to TPI and observe display as shown in figure 3-2 (j). (1) If CORRECT, go to d below. (2) If INCORRECT replace U5.
	d. Defective reset line component.	d. Using Oscilloscope OS-262P/U, connect CH2 probe to TP3 and connect CHI probe to PI-20 (SYNC). Set test set MODULATION to MANUAL and adjust oscilloscope controls as required to observe display as shown in figure 3-2 (k). Set test set MODULATION to CONTINOUS and observe display in figure 3-2 (1). (1) If CORRECT, go to e below. (2) If INCORRECT, check CRI, C8, RI5, R16, U6. Replace defective component.
	e. Defective code output component U7A, U7B.	e. Using Oscilloscope OS-262P/U, connect CH2 probe to PI-15 and observe display as shown in figure 3-2 (m). (1) If CORRECT, go to f below. (2) If INCORRECT, replace U7.
	f. Defective code output component U 1.	f. Using Oscilloscope OS-262P/U, connect CH2 probe to Pl-17 and observe display as shown in figure 3-2 (o). Replace UI.
3. Erratic or no SYNC OUT signal generated. CODE OUT normal.	Defective sync component.	Using Oscilloscope OS-262P/U, connect CHI probe to TP4, CH2 probe to U3-13. Adjust horizontal, vertical position, and trigger level as required to observe display as shown in figure 3-2 (p) (1) if INCORRECT, replace U3. (2) if CORRECT, check R13, Q2. Replace defective component.
4. Signal not present at 19.25 MHz OUT connector J4 when using external probe amplifier assembly.	a. Defective probe power supply.	a. Using Multimeter AN/USM-223, check LI, L2, R18, R19, Q3, Q4. Replace defective component.
	b. Defective DC blocking capacitor C9.	b. Replace C9.

Section IV. MAINTENANCE OF TEST SET

3-12. General

a. This section describes the following procedures for the test set: preliminary inspection, cleaning, disassembly and repairs, and repainting and refinishing.

b. After repairs or replacement have been made to components of the test set, it should be ready for return to service. To verify its condition, conduct the operational checks described in TM 11-5895-1096-12 and the Test Procedures in section V.

3-13. Inspection

Preliminary maintenance on the test set consists of inspection upon receipt; and cleaning (para 3-14) if required.

a. Inspection. Inspection is the evaluation of a repairable item to determine the extent of repair, modification, or replacement necessary to make the item completely serviceable. Inspection includes, but is not limited to the following:

(1) A check of maintenance forms and records attached to the equipment.

(2) A check of DA Pam 310-1 for any modification work order (MWO) pertaining to the test set.

(3) A visual inspection of the test set for compliance with all MWO's.

(4) A listing of outstanding MWO's on DA Form 2404.

b. Visual Inspection.

(1) Exterior surface. Inspect exterior surfaces for obvious signs of damage. Check metal surfaces for signs of rust and corrosion.

(2) Controls and indicators. Inspect controls for smooth operation and alinement of position Check to see that indicator assembly is intact and complete.

(3) Wiring. Inspect wiring for breaks, cuts, or worn insulation.

(4) Connectors. Inspect connectors for damage such as bent pins and dented or deformed casings.

(5) Results. Include all results of the visual inspection on maintenance forms or work tag.

3-14. Cleaning

NOTE

Do not perform needless disassembly of equipment for the purpose of cleaning. Clean the equipment only to the extent required for serviceability.

a. Exterior Surfaces.

(1) Remove loose dirt or dust from outside surfaces of case and front panel using lint-free cloth and/or soft bristled brush.

(2) Remove ground-in dirt or grease using lint-free cloth dampened (not wet) with soap and water

(3) Rinse cleaned areas with clean water and allow to dry.

b. Interior Surfaces.

WARNING

Compressed air is dangerous and can cause bodily harm. Compressed air shall not be used for cleaning purposes except when reduced to less than 29 pounds per square inch (psi); and then only with protective equipment to prevent chips or particles from entering the eyes or breaking the skin of the operator or other personnel.

CAUTION

Air jet can damage delicate components. Be careful NOT to place air jet too close to small coils or delicate components.

NOTE

When necessary to disturb the position of wiring and harness assemblies for cleaning purposes, always replace them to their original position after cleaning.

(1) Remove dust, dirt, and foreign matter from all surfaces, components, and wiring using air jet and soft bristled brush.

(2) Remove dust from connector holes and recesses using air jet and soft bristled brush.

CAUTION

Be careful when using lint-free cloth to wipe cleaning compound from resistors, as marking colors may be removed.

(3) Wipe interior surfaces using lint-free cloth dampened (not wet) with soap and water.

(4) Dry surfaces immediately with lint-free cloth.

(5) Wipe dust and dirt from casings, pins and cable clamps using lint-free cloth dampened (not wet) with soap and water.

(6) Dry surfaces immediately with lint-free cloth

3-15. General Repair Procedures

The subassemblies and parts in the test set can be easily reached and replaced without the use of special tools. When replacing parts, observe the precautions listed below.

WARNING

120 volts AC is present at power supply connections inside equipment. Ensure test set is disconnected from power supply source before attempting repairs. DEATH ON CONTACT or serious injury may result if safety precautions are not observed.

CAUTION

Use a pencil-type soldering iron with a 25-watt maximum rating. Too much heat from the iron will damage the printed wiring of circuit cards. Use only enough heat to quickly remove or replace components. This equipment is also transistorized. If the iron must be used with ac, use an isolating transformer between the iron and the line. Do NOT use a soldering gun near the transistorized assemblies; damaging voltage may be induced in the circuit components.

NOTE

For additional soldering techniques refer to TB SIG 222.

3-16. Disassembly

WARNING

Ensure test set is disconnected from power source before attempting disassembly. DEATH ON CONTACT or serious injury may result if safety precautions are not observed.

a. Main Assembly (fig. 3-7 and 3-8). To disassemble the test set main assembly proceed as follows:

(1) Ensure POWER switch is in OFF position and ac power cord is disconnected from power source.

(2) Remove six screws (1) from panel assembly (2).

(3) Carefully remove panel assembly (2) from case assembly (3).

b. Probe Amplifier Assembly. To disassemble the probe amplifier assembly, refer to figure 3-9, and proceed as follows:

(1) Disconnect probe from amplifier assembly.
(2) Remove four screws (1) securing cover (2).
(3) Remove cover (2) from case (3).

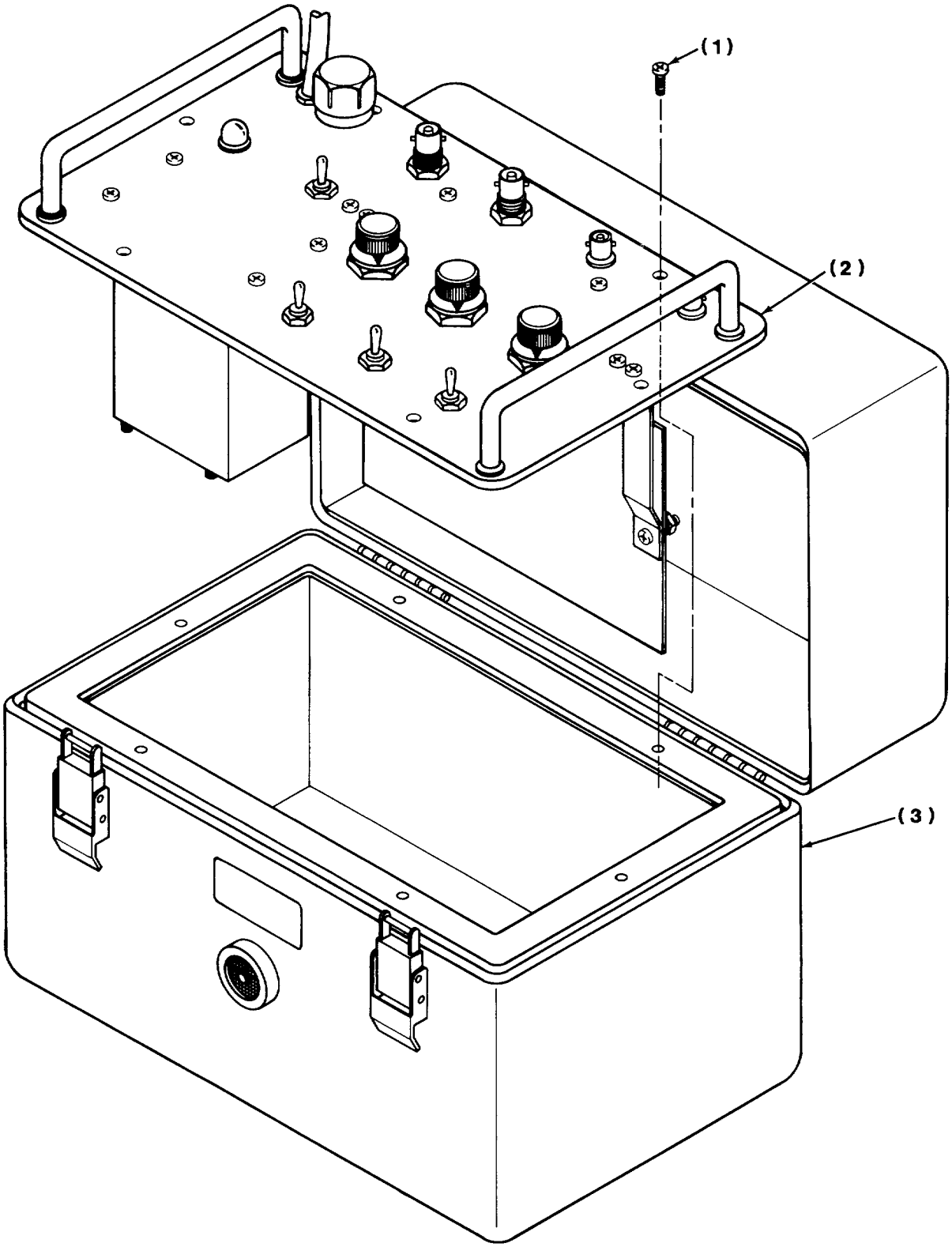

Figure 3-7. Test Set Disassembly.

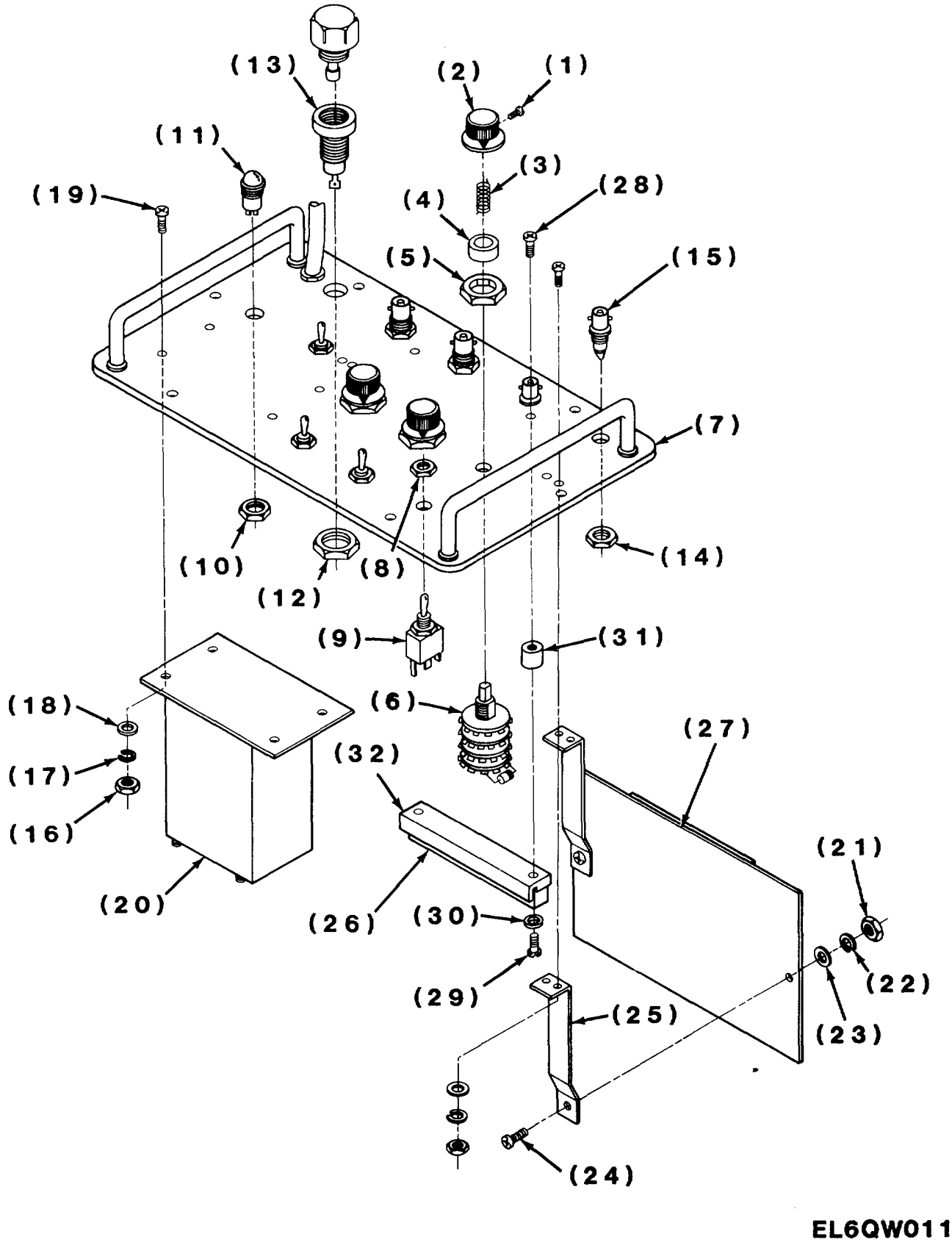

Figure 3-8. Exploded View of Test Set TS-3566/GRA-114.

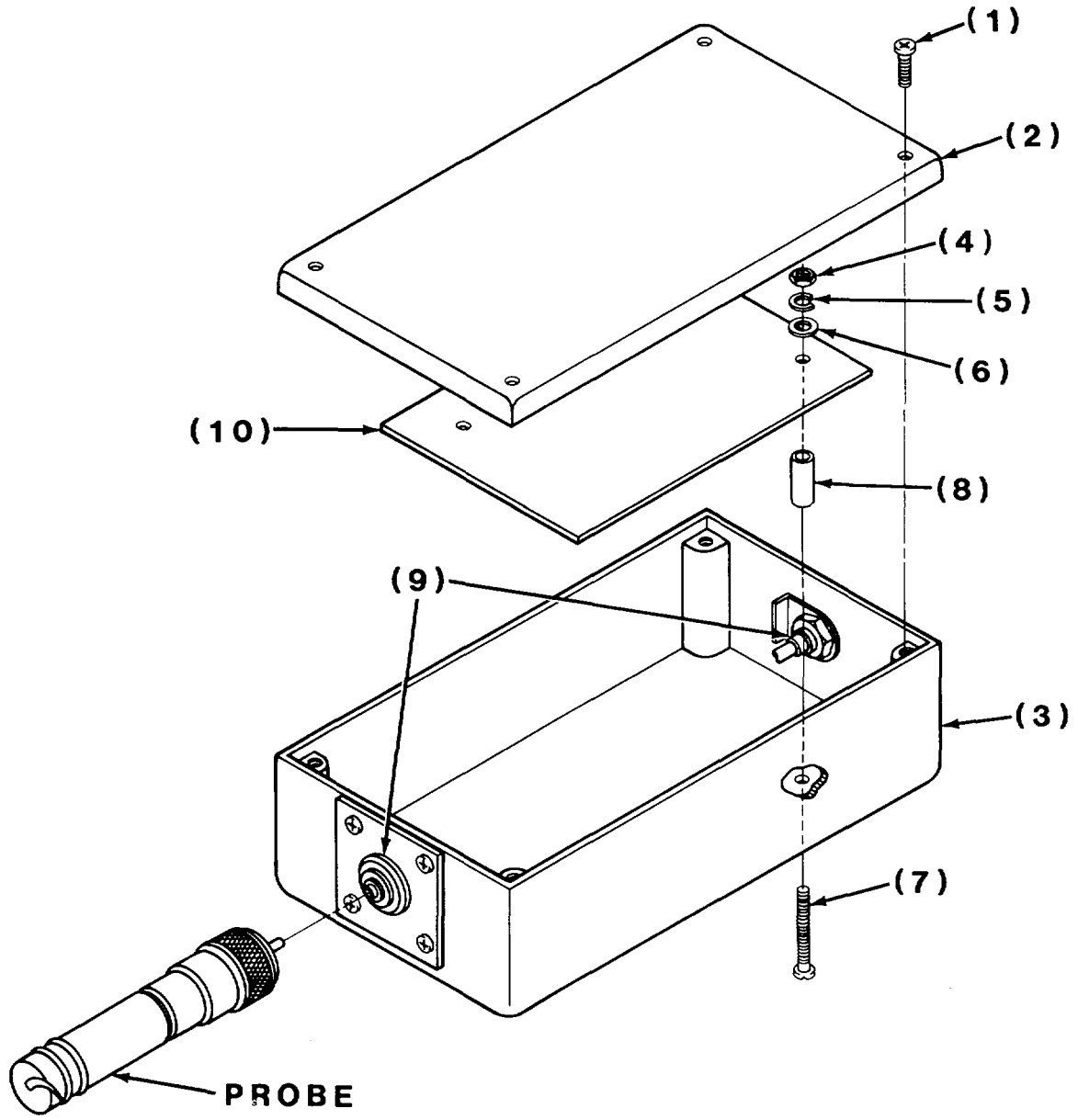

Figure 3-9. Exploded View of Probe Amplifier.

3-17. Parts Replacement

a. Code Selector Switch S1, S2, S3 Replacement. Refer to figure 3-8 and replace the defective switch as follows:
(1) Disassemble test set (para 3-16).
(2) Tag and unsolder all wires connected to defective switch.
(3) Remove knob setscrew (1).
(4) Remove knob (2), coil spring (3), and bushing (4).
(5) Remove nut with washer (5).
(6) Remove defective switch (6) from panel (7).
(7) Install new switch (6) into panel.
(8) Install nut with washer (5), and tighten.
(9) Install bushing (4), coil spring (3), and knob on new switch.
(10) Install knob setscrew (1), and tighten.
(11) Solder all wires in their correct position on switch.
(12) Reassemble test set (para 3-20).

b. Toggle Switch S4, S5, S6, S7 Replacement. Refer to figure 3-8, and replace the defective switch as follows:

(1) Disassemble test set (para 3-16).
(2) Tag and unsolder all leads.
(3) Remove nut (8), then remove defective switch (9) from panel (7).
(4) Install new switch (9) into panel.
(5) Install nut (8) and tighten.
(6) Solder all leads to new switch.
(7) Reassemble test set (para 3-20).

c. Indicator Assembly Replacement. Refer to figure 3-8 and replace the defective indicator assembly as follows:

(1) Disassemble test set (para 3-16).
(2) Tag and solder all leads.
(3) Remove nut (10) and defective indicator assembly (11).
(4) Install new indicator assembly (11) into panel (7).
(5) Install nut (10) and tighten.
(6) Solder all leads to new indicator assembly.
(7) Reassemble test set (para 3-20).

d. Fuse Assembly Replacement. Refer to figure 3-8 and replace the defective fuse assembly as follows:

(1) Disassemble test set (para 3-16).
(2) Tag and unsolder all leads.
(3) Remove nut (12), and lift fuse assembly (13) from panel (7).
(4) Install new fuse assembly (13) into panel (7).
(5) Install nut (12) and tighten.
(6) Solder all leads to new fuse assembly.
(7) Reassemble test set (para 3-20).

e. Connector J2, J3, J4, J5 Replacement. Refer to figure 3-8 and replace the defective connector as follows:

(1) Disassemble test set (para 3-16).
(2) Unsolder leads.
(3) Remove nut (14) and lift defective connector (15) from panel (7).
(4) Install new connector (15) into panel (7).
(5) Install nut (14) and tighten.
(6) Solder all leads to connector.
(7) Reassemble test set (para 3-20).

f. Transformer TI Replacement. Refer to figure 3-8 and replace the defective transformer as follows:

(1) Disassemble test set (para 3-16).
(2) Tag and unsolder all leads.
(3) Remove four nuts (16), lockwashers (17), flat washers (18), screws (19), and defective transformer (20).
(4) Aline new transformer (20) on panel (7).
(5) Install four screws (19), flat washers (18), lockwashers (17), nuts (16), and tighten.
(6) Solder all leads to transformer.
(7) Reassemble test set (para 3-20).

g. Encode Generator Circuit Card Replacement. Refer to figure 3-8 and replace the encode generator circuit card as follows:

(1) Disassemble test set (para 3-16).
(2) Remove two nuts (21), lockwashers (22), flat washers (23), and screws (24 securing circuit card to holding bracket (25).
(3) Disengage connector J 1 (26) and remove printed circuit card (27).
(4) Install circuit card (27) by engaging connector J 1 (26) and aligning with holding brackets (25).
(5) Install two screws (24), flat washers (23), lockwashers (22), nuts (21), and tighten.
(6) Reassemble test set (para 3-20).

h. Connector P1 Replacement. Refer to figure 3-8 and replace the defective connector as follows:

(1) Remove encode generator circuit card (para 3-17g).
(2) Remove two screws (28).
(3) Remove two screws (29), flat washers (30), and spacers (31) from defective connector (32).
(4) Tag and unsolder all leads to defective connector.
(5) Solder all wires to new connector (32).
(6) Install two spacers (31), flat washers (30), screws (29), and tighten.
(7) Aline connector, install two screws (28), and tighten.
(8) Replace encode generator circuit card (para 3-17g).

i. Probe Amplifier Circuit Card Replacement. Refer to figure 3-9 and replace the probe amplifier circuit card as follows:

(1) Remove four screws (1), and top cover (2) from case (3).
(2) Remove four nuts (4), lockwashers (5), flat washers (6), screws (7), and allow spacers (8) to fall loose.
(3) Tag and unsolder leads to connector (9).
(4) Lift circuit card (10) out of case (3).
(5) Install two screws (7) into case (3).
(6) Install two spacers (8) over screws (7).
(7) Install circuit card (10) over screws (7).
(8) Install two flat washers (6), lockwashers (5), nuts (4), and tighten.
(9) Solder leads from connector (9).
(10) Onto case (3), install top cover (2), four screws (1), and tighten.

3-18. Circuit Card Repairs.

a. Remove defective part by cutting leads as close as possible between part and circuit card mounting holes.

b. Remove conformal coating around lead connections on the cards printed wiring side.

c. Heat printed side wiring at mounting holes with iron until solder melts.

d. Remove excess solder and remaining pieces of leads.

e. Insure lead mounting holes are free of solder.

f. Bend the leads of replacement part to fit mounting holes.

g. Insert leads through mounting holes from parts side of circuit card.

h. Press part firmly against card.

i. On circuit cards wiring side, cut leads leaving 1/8 inch protruding.

j. Bend and press the leads against the printed wiring.

k. Quickly solder leads to printed wiring conductor.

l. Apply protective coating to all repaired exposed areas.

3-19. Repainting and Refinishing

Refinishing processes should restore equipment to original appearance and as-in-new-standards. Minor damage to finishes, such as small scratches, require touchup painting of the affected area only. Major surface damage requires complete repainting.

b. Test Set TS-3566/GRA-1 14 is painted in accordance with military specification MIL-F-14072, Finish No. 513.1W. Use this material if the entire case is stripped and refinished. For nicks, scratches, or small areas which have peeling, use any matching paint or finish listed in SB 11-573.

NOTE

Touchup or new finish should be applied as prescribed in TB 43-0118. Field Instructions for Painting and Preserving Electronics Command Equipment.

3-20. REASSEMBLY

WARNING

Ensure test set is disconnected from power source before attempting reassembly. DEATH ON CONTACT or serious injury may result if safety precautions are not observed.

CAUTION

Always read over and be sure you understand the instructions before attempting reassembly. Use the illustrations to locate parts and subassemblies of the unit to be reassembled.

a. Main Assembly. To reassemble the test set main assembly, refer to figure 3-8 and proceed as follows:

(1) Insure POWER switch is in OFF position and ac power cord is disconnected from power source.

(2) Carefully install panel assembly (2) into case assembly. (3).

(3) Install six screws (1) into panel assembly.

b. Probe Amplifier. To reassemble the probe amplifier assembly, refer to figure 3-9 and proceed as follows:

(1) Install cover (2) on case (3).

(2) Install four screws (1) securing cover (2).

(3) Connect probe to the amplifier assembly.

Section V. TESTING PROCEDURES

3-21. General

a. The following testing procedures are necessary to verify the performance standards for Test Set, Radio Data Link, Sound Ranging TS-3566/GRA-114 for general support level maintenance as authorized by the Maintenance Allocation Chart. If a part, subassembly, component, etc., does not meet the performance standard, the fault should be isolated and corrected using the troubleshooting, disassembly and repair sections of chapter 3 of this manual. The SMR recoverability code of the affected part should be determined by consulting TM 11-5895-1096-20P and TM 11-5895-1096-40P.

b. Insure all applicable MWO's have been done. Refer to DA Pam 310-1 for a listing of current MWO's. Use the test equipment and materials listed for each test. Perform the test connections and conditions listed before proceeding to the actual test.

c. Perform each test step in sequence. Starting at step 1 , perform all the actions listed in the "Control Settings" columns for test equipment and equipment to be tested, ensuring the controls are set accurately. Then perform all the actions listed in the "Test Procedure" column and verify the correct indication listed in the "Performance Standard" column.

3-22. Physical Tests and Inspection

a. Test Equipment and Inspection. No test equipment or materials are required.

b. Test Connections and Conditions.

(1) Remove any connections to test set.

(2) Disassemble test set and probe amplifier (para 3-16 and 3-17).

c. Procedure. Refer to table 3-7 for correct procedures.

Table 3-7. TS-3566/GRA-114 Physical Tests and Inspection

Step No	Control Settings: Test Equipment	Control Settings: Unit under test	Test Procedures	Performance Standard
1	N/A	Controls may be set In any position.	*a.* Inspect all exterior surfaces for stains, fungus and corrosion	*a.* Surfaces shall be free of stains, fungus and corrosion.
			b. Inspect case for dents, cracks and general structural damage.	*b* Case shall be free of structural damage.

Table 3-7 TS-3566/GRA-l14 Physical Tests and Inspection - Cont.

Step No	Control Settings Test Equipment	Unit under test	Test Procedures	Performance Standard
			c. Inspect painted surfaces for scratches and cracked or peeling paint.	*c.* All painted surfaces shall be free of scratches Which penetrate the paint, and cracked or peeling paint.
			d. Inspect screws. nuts and bolts for looseness.	*d.* All screws, bolts and nuts shall be tight; none shall be missing
			e. Inspect front panel switches for looseness, missing knobs and normal switch action.	*e.* Switch knobs shall be tight and mechanical action normal.
			f. Inspect front panel indicator for burned-out or missing bulb.	*f.* Indicator bulb shall be installed and in working order.
			g. Inspect fuse and fuseholder for proper size, burned out, or missing fuse.	*g.* Fuse shall be correct size (A), installed and in working order.
			h. Inspect electrical components and printed circuit cards for signs of heat damage.	*h.* Electrical components and printed circuit cards shall be free of heat damage.
			I. Inspect electrical components and printed circuit cards for signs of physical damage	*i* Electrical components and printed circuit cards shall be free of physical damage.
			j. Inspect wiring for breaks and damaged or frayed insulation.	*j.* All siring shall be free of damage to Insulation and conductors.

3-23. TS-35661GRA-114 Performance Test

a. Test Equipment and Materials
(1) Dual Time Base TD-1159/U
(2) Dual Trace Amplifier AM-6880/L
(3) Maintenance Kit MK-1752/GRA-1 14
(4) Oscilloscope OS-262(P)/U

b. Test Connectors and Conditions. Connect equipment as shown in figure 3-3

c. Procedure. Refer to table 3-1 for control settings and table 3-2 for correct procedures

3-24. 19.25 MHz Amplifier Performance Test

a. Test Equipment and Materials.
(1) BNC/UHF Adapter UG-273/U.
(2) Dual Time Base TD-1159/U.
(3) Dual Trace Amplifier AM6880/U.
(4) Maintenance Kit MK-1752/GRA-114.
(5) Oscilloscope OS-262(P)/U.
(6) Probe P6105, 2 meters long.
(7) Signal Generator SG-112(V)2/U.

b. Test Connections and Conditions. Connect equipment as shown in figure 3-4.

c. Procedure. Refer to table 3-3 for control settings and table 3-4 for correct procedures.

APPENDIX A

REFERENCES

A-1. Scope

This Appendix lists all forms, technical manuals and miscellaneous publications referenced in this manual.

A-2. Forms

DA Form 2028-2	Recommended Changes to Equipment Technical Publications.
DA Form 2404	Equipment Inspection and Maintenance Worksheet.
DA Form 2407	Maintenance Request.
SF 368	Quality Deficiency Report.

A-3. Field Manuals

FM 21-11	First Aid for Soldiers.

A-4. Technical Manuals

TM 11-5895-1096-12	Operator and Organizational Maintenance Manual for Radio Data Link, Sound Ranging TS-3566/GRA-114.
TM 11-5895-1096-20P	Organizational Maintenance Repair Parts and Special Tools List, Test Set, Radio Data Link, Sound Ranging, TS-3566/GRA-1 14.
TM 11-5895-1096-40P	General Support Maintenance Repair Parts and Special Tool List, Test Set, Radio Data Link, Sound Ranging, TS-3566/GRA-114.
TM 740-90-1	Preparation of Equipment for Storage or Shipment.
TM 750-244-2	Destruction of Army Materiel to Prevent Enemy Use.

A-5. Miscellaneous Publications

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMNIS).
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TB SIG 222	Solder and Soldering.
TB 43-0118	Field Instructions for Painting and Preserving Electroni9 Command Equipment Including Camouflage Pattern o. Electrical Equipment Shelters.

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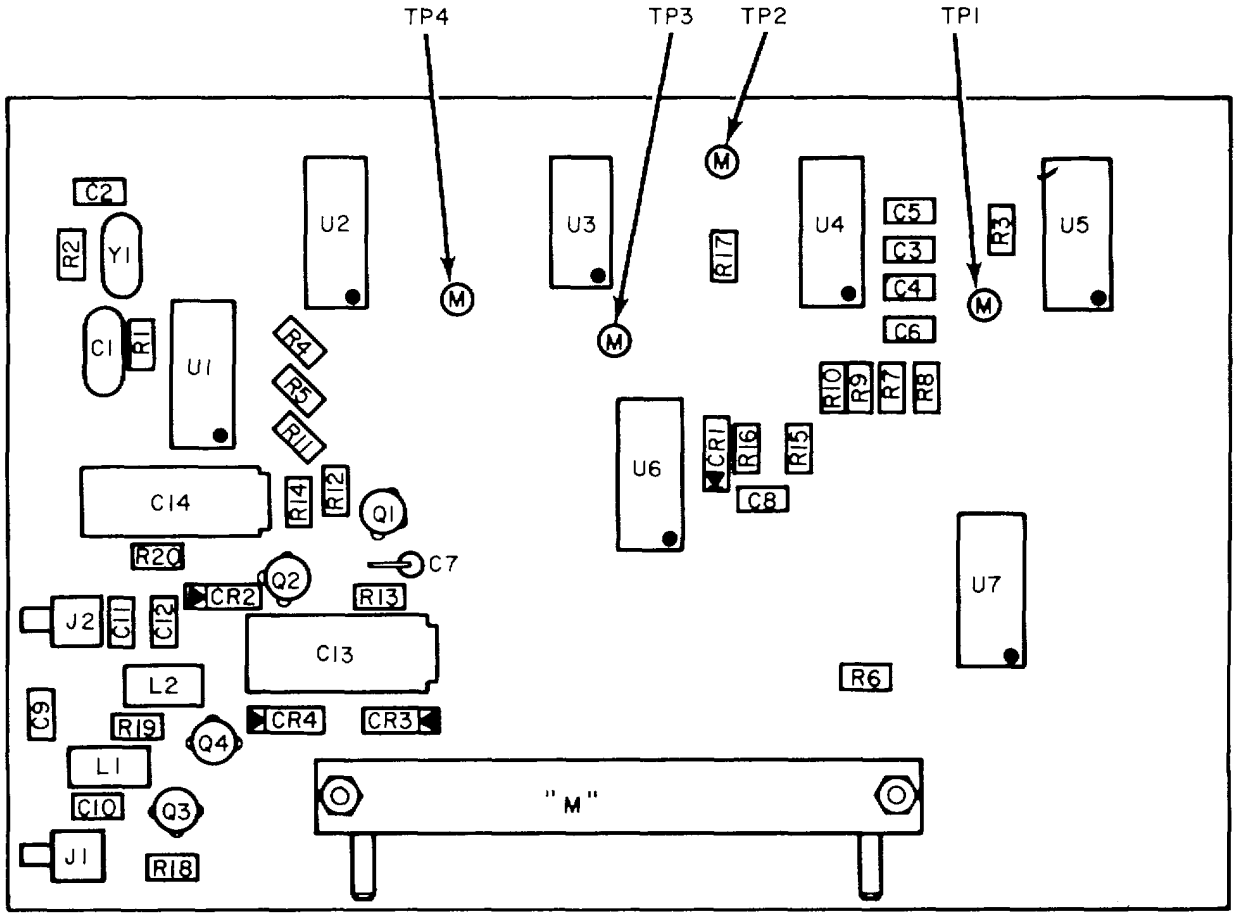


EL6QW013

Figure 3-10. Encode Generator Circuit Card

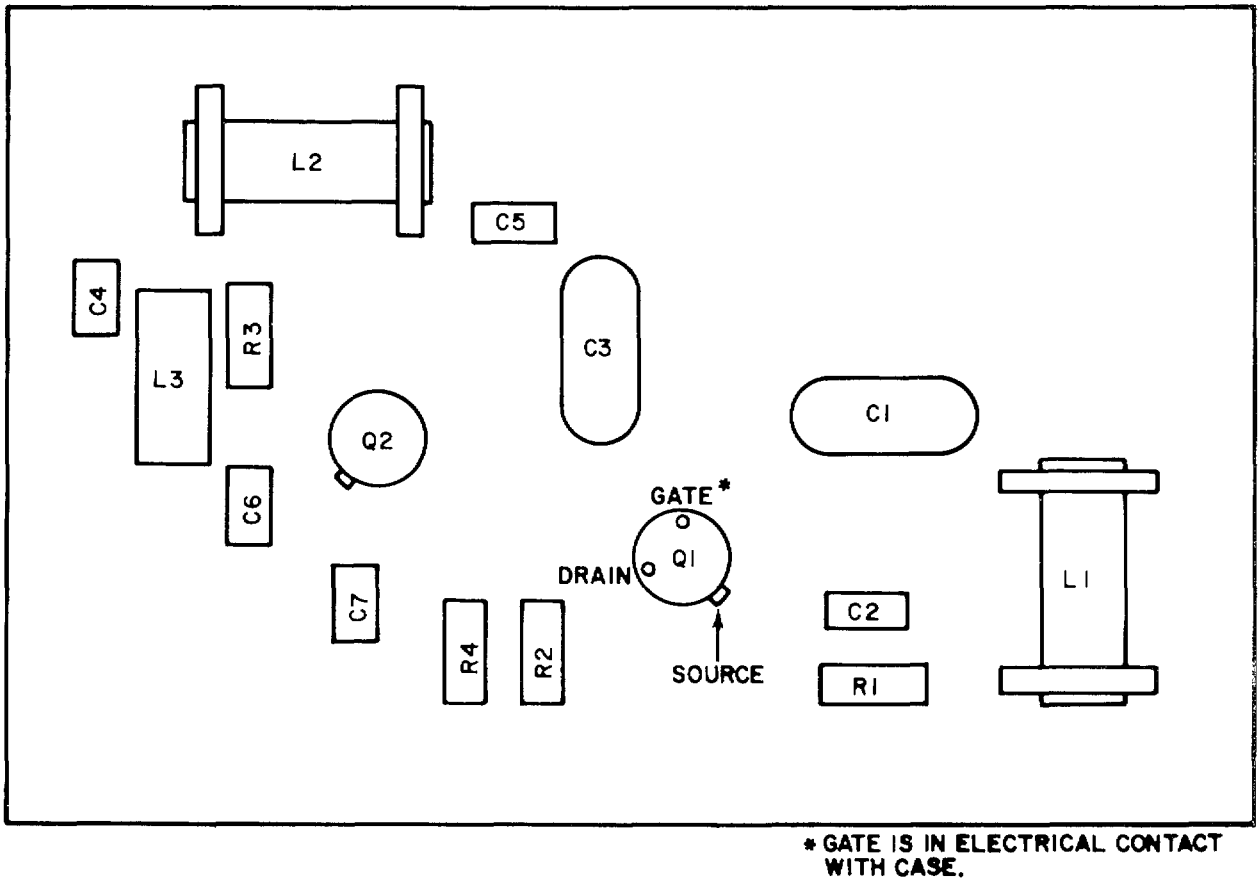


Figure 3-11. Probe Amplifier Circuit Card

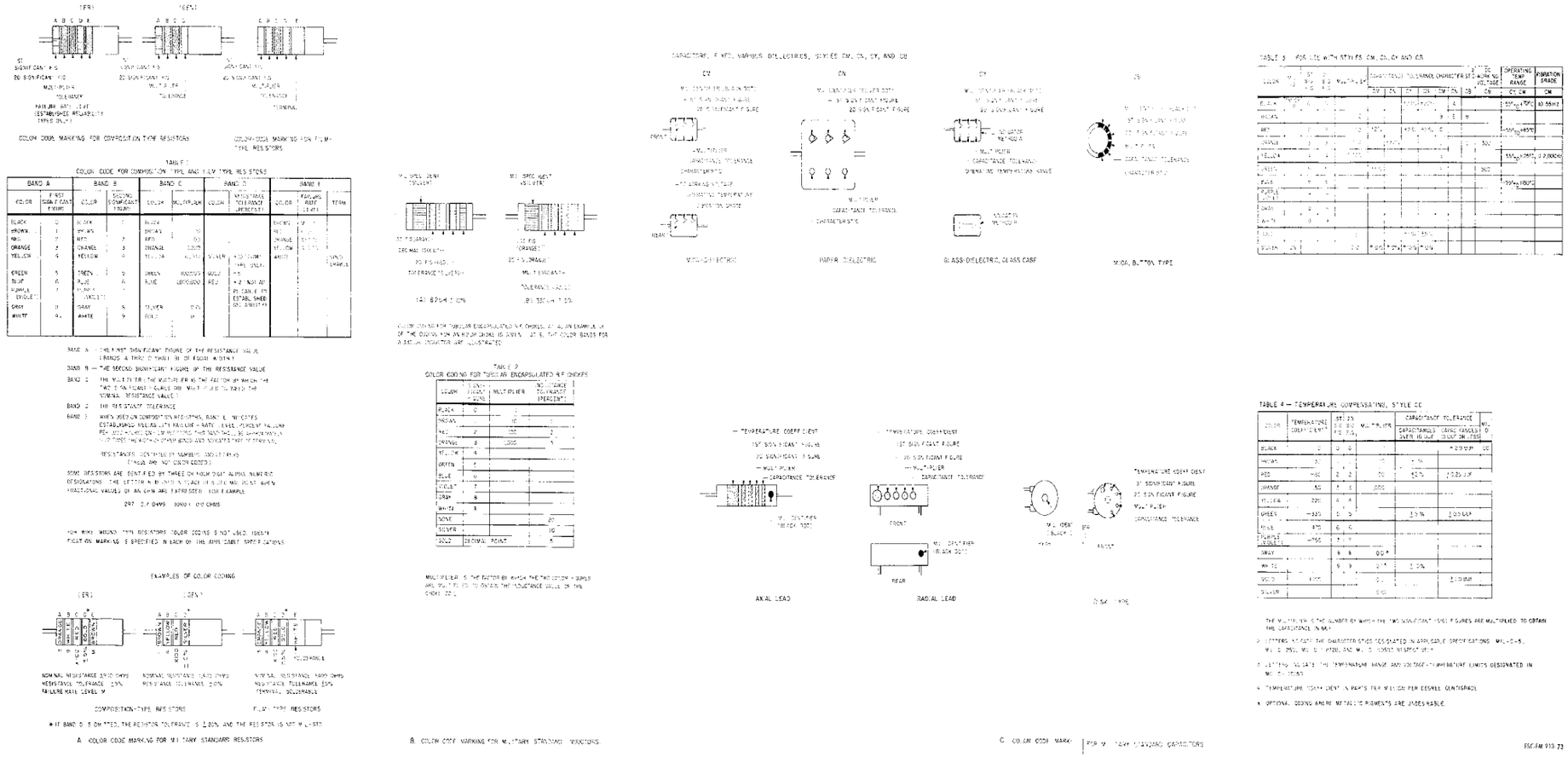
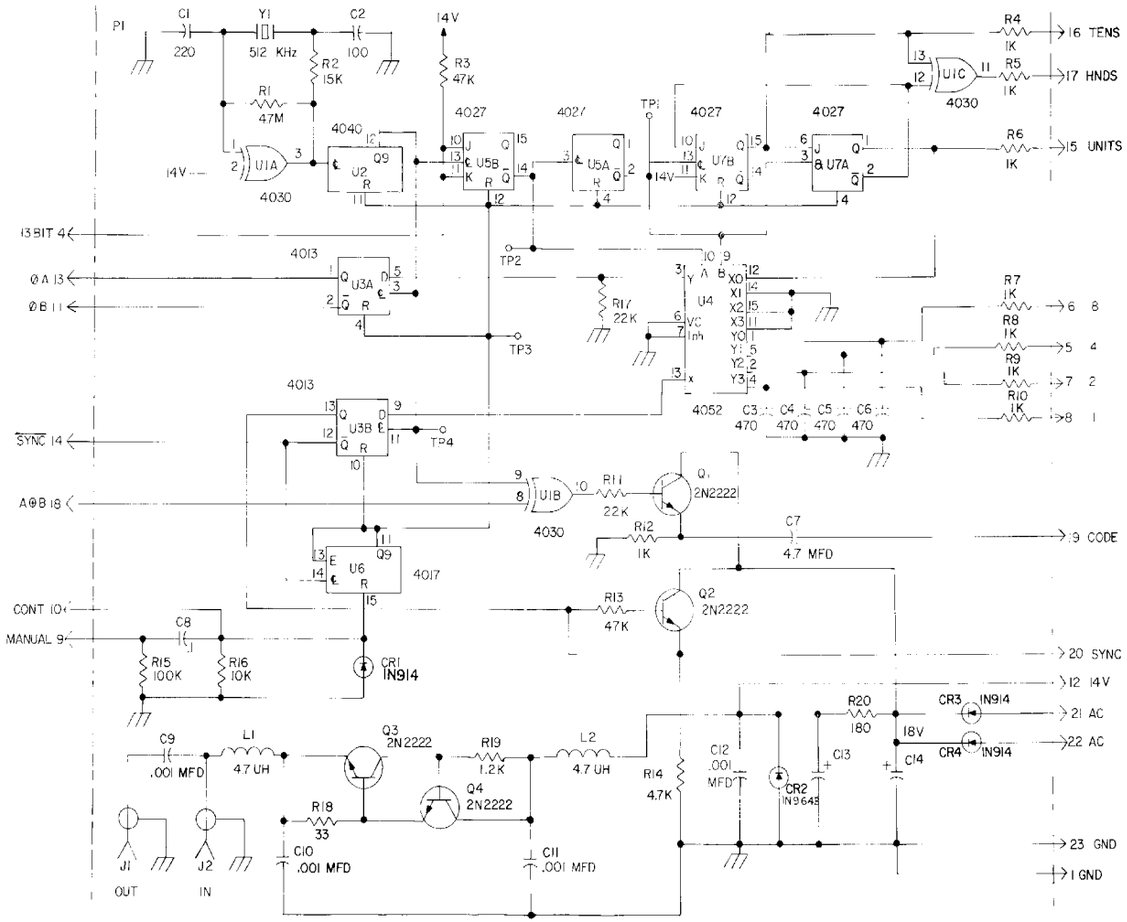
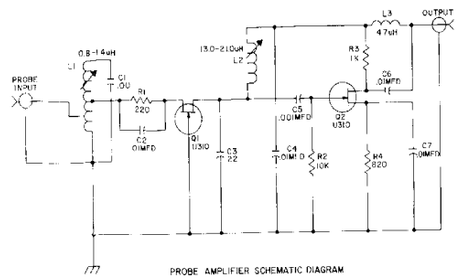


Figure FO-1. Color Code Marking for MIL-STD Resistors, Inductors, and Capacitors.





PROBE AMPLIFIER SCHEMATIC DIAGRAM

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   1.1 RESISTANCE VALUES ARE IN OHMS.
   1.2 CAPACITANCE VALUES ARE IN PICOFARADS.
2. THE FOLLOWING IC GND CONNECTIONS ARE NOT ILLUSTRATED ON THE SCHEMATIC: U1-2, U3-16; U3-14, U4-16; U5-5,6,15; U6-16; U7-5,11, 16.
3. THE FOLLOWING GROUND CONNECTIONS ARE NOT ILLUSTRATED ON THE SCHEMATIC: U1-7, U2-8, U3-8, U4-8, U4-6,7,8,11,14, 15; U5-7,8,9; U6-8; U7-7,8,9.

Figure FO-2. Schematic Diagram of TS-3566 GRA-114.

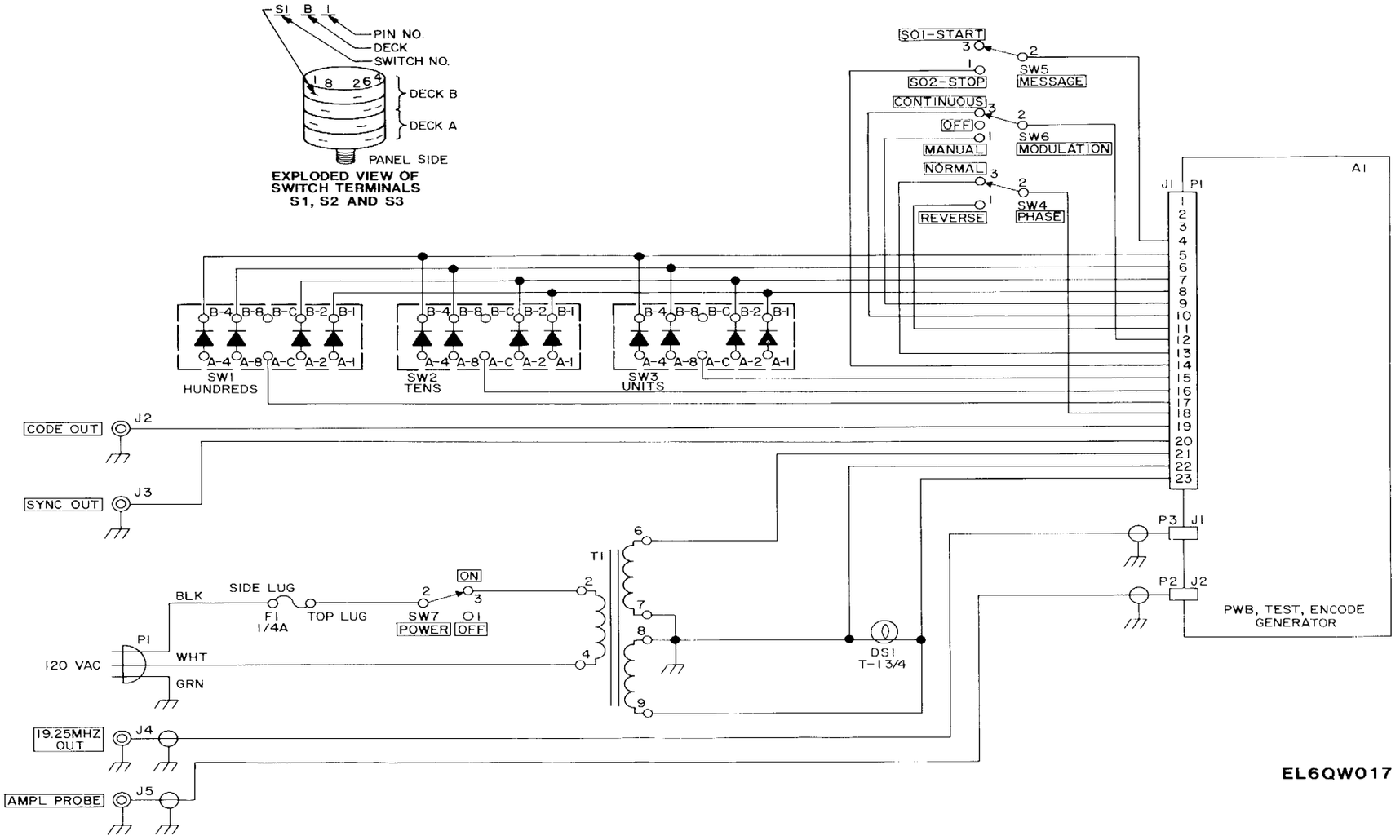


Figure FO-3. Wiring Diagram of TS-3566/GRA-114.

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