KAM-144B/TSEC

[redacted]

Register No. 1998

CRYPTO ~~CONFIDENTIAL~~ CRYPTO

REPAIR AND MAINTENANCE INSTRUCTIONS FOR TSEC/KW-7 (FOUO)

Volume II—Preventive Maintenance, Troubleshooting and Diagrams

Upon receipt, consult List of Effective Pages and verify presence of each page.

DEPARTMENT OF DEFENSE
NATIONAL SECURITY AGENCY
WASHINGTON 25, D. C.

APRIL 1963

[redacted]

CRYPTO ~~CONFIDENTIAL~~ CRYPTO

ORIGINAL
(Reverse Blank)

KAM-144B/TSEC

~~CONFIDENTIAL~~

DEPARTMENT OF DEFENSE
NATIONAL SECURITY AGENCY
WASHINGTON 25, D. C.

15 March 1963

REPAIR AND MAINTENANCE INSTRUCTIONS FOR TSEC/KW-7 ~~(TOUCH)~~
Volume II—Preventive Maintenance, Troubleshooting and Diagrams

LETTER OF PROMULGATION

1. This is a CONFIDENTIAL registered publication and will be handled, stored, accounted for and destroyed in accordance with current regulations of the appropriate Department, Agency, or other controlling authority pertaining to registered cryptomaterial. Formal authorization for access to CONFIDENTIAL cryptomaterial is required for personnel to have access to this publication.

2. This publication will become effective upon receipt. Specific disposition instructions for this publication will be issued by the appropriate Department, Agency, or other controlling authority. Authorization for the eventual destruction of this publication will be issued at an appropriate time by the Director, National Security Agency.

3. Amendments to this publication will be promulgated by means of printed or electrically transmitted amendments. Individuals entering such amendments shall so indicate on the "Record of Amendments" page included herein as page 5.

4. This publication is distributed to authorized holders of TSEC/KW-7.

5. THIS PUBLICATION CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793, 794, AND 798. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

6. Classified extracts from this publication may be made as necessary. Such extracts will be classified CONFIDENTIAL, marked CRYPTO, and accounted for locally until destroyed by burning. Formal authorization for access to CONFIDENTIAL cryptomaterial is required for personnel to have access to such extracts.

7. This publication may not be carried in aircraft for use therein.

Gordon A. Blake
GORDON A. BLAKE
Lieutenant General, USAF
Director

LIST OF EFFECTIVE PAGES

Note: BLANK pages are not indicated in the Page Numbers column when they fall within a group listing of page numbers. However, *all* BLANK pages in the publication are accounted for by means of the notation "Reverse (Page_____) Blank" printed in the lower right-hand corner of each page immediately preceding the BLANK page.

Subject Matter	Effective Pages	Page Numbers (Inclusive)
Front Cover	ORIGINAL	Unnumbered (Reverse Blank)
Letter of Promulgation	ORIGINAL	1 Reverse (Page 2) Blank
List of Effective Pages	ORIGINAL	3 Reverse (Page 4) Blank
Record of Amendments	ORIGINAL	5 Reverse (Page 6) Blank
Record of Page Checks	ORIGINAL	7 Reverse (Page 8) Blank
Table of Contents	ORIGINAL	9 and 10
List of Illustrations	ORIGINAL	11
List of Tables	ORIGINAL	12
CHAPTER 1	ORIGINAL	13 Reverse (Page 14) Blank
CHAPTER 2	ORIGINAL	15 through 47 Reverse (Page 48) Blank
CHAPTER 3	ORIGINAL	49 through 175 (Reverse Blank)
Back Cover	ORIGINAL	Unnumbered (Reverse Blank)

RECORD OF AMENDMENTS

Identification of Amendment and Reg. No. (if any)	Date Entered	By Whom Entered (Signature; Rank or Rate; Name of Command)

RECORD OF PAGE CHECKS

Date Checked	By Whom Checked (Signature; Rank or Rate; Name of Command)	Date Checked	By Whom Checked (Signature; Rank or Rate; Name of Command)
23 Aug. '65			
13 May 175			
1 Sep 8n			

RECORD OF PAGE CHECKS

Date Checked	By Whom Checked (Signature; Rank or Rate; Name of Command)	Date Checked	By Whom Checked (Signature; Rank or Rate; Name of Command)

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION AND CLASSIFICATION

CHAPTER 2

PREVENTIVE MAINTENANCE

CHAPTER 3

TROUBLESHOOTING

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

CHAPTER 1
INTRODUCTION AND CLASSIFICATION

1000—INTRODUCTION

1001. Contents.—This publication is Volume II of three volumes containing repair and maintenance information for the TSEC/KW-7 Electronic Tactical Teletypewriter Security Equipment. It also contains information about the following special-purpose ancillary units designed to operate with the KW-7: Remote Control Unit, Functional Remote Control Unit and the Two-Wire Loop Adapter. The short and long titles of Volumes I and III are as follows:

Short Title	*Long Title*
KAM-143B/TSEC	Repair and Maintenance Instructions for TSEC/KW-7 (FOUO) - (Volume I —Description, Installation and Theory of Operation).
KAM-145A/TSEC	Repair and Maintenance Instructions for KW-7 (FOUO) - (Volume III— Illustrated Parts Lists).

Personnel maintaining the TSEC/KW-7 will need all three volumes. A fourth publication, KAM-146A/TSEC, "Limited Repair and Maintenance Instructions for TSEC/KW-7", is a special-purpose document designed for personnel who will be authorized to perform limited maintenance.

1002. Operating Instructions.—Operating instructions for the TSEC/KW-7 are contained in the effective edition of KAO-83/TSEC. Maintenance personnel should familiarize themselves with this publication.

1003. Qualifications for Maintenance Personnel.—No persons will attempt to perform repair and maintenance work on the TSEC/KW-7 unless they have completed an approved course of instruction in the maintenance of this equipment.

1004. Modification of Equipment.—No modifications will be made to the TSEC/KW-7 without prior authorization by the Director, National Security Agency. Correspondence pertaining to such modifications should be forwarded through proper Service or Agency channels to Assistant Director, NSA, for Communications Security, 3801 Nebraska Avenue, N.W., Washington 25, D.C., ATTN: S2. The modification instructions (KABs) which have been issued by the National Security Agency for the TSEC/KW-7 are listed on the last page of chapter 2, KAM-143B/TSEC.

1005. Comments and Recommendations.—Comments and recommendations regarding the TSEC/KW-7 or the contents of this manual are invited. Such comments and recommendations should be forwarded (except as noted below) through proper Service or Agency channels to the Assistant Director, NSA, for Communications Security, National Security Agency, 3801 Nebraska Avenue, N.W., Washington 25, D.C. ATTN: S2.

For Army Accounts:

Comments regarding this manual or the equipment will be forwarded through channels to the Commanding Officer, U.S. Army Signal Communications Security Agency, Arlington Hall Station, Arlington 12, Virginia, ATTN: SIGCR-4.

1100—CLASSIFICATION

1101. Classification of KAM-144B/TSEC.—This book is a registered publication and is classified ~~CONFIDENTIAL, CRYPTO.~~ Formal authorization for access to CONFIDENTIAL cryptomaterial is required for personnel to have access to this publication.

1102. Classification of Equipment.—The KW-7 is classified CONFIDENTIAL, CRYPTO. For instructions regarding access to the equipment, and for classifications of individual components, see chapter 1 of KAM-143B/TSEC.

1103. Safeguarding the TSEC/KW-7.—The KW-7 will be handled and accounted for in accordance with the regulations of each Service or Federal agency governing the handling of registered cryptomaterial. Specific requirements for the proper safeguarding of registered cryptomaterial are contained in the effective edition of KAG-1/TSEC, KAG-8/TSEC and KAG-9/TSEC.

CHAPTER 2
PREVENTIVE MAINTENANCE

2000—GENERAL

2001. Introduction.—This chapter is divided into three Sections: Section 2ØØØ—General; Section 21ØØ—Inspection and Cleaning; and Section 22ØØ—Performance Testing. Section 2ØØØ defines the areas to be covered during preventive maintenance and general maintenance techniques; section 21ØØ contains instructions for inspecting and cleaning various system areas, components, chassis, etc.; section 22ØØ contains instructions for performing a complete performance test on the KW-7 to determine that the equipment is operating properly.

2002. Preventive Maintenance Usage.— Preventive maintenance is that work performed on a system or systems to determine that the equipment is in working order. Both mechanical and operational preventive maintenance routines should be performed, and all parts should be checked for dirt, rust, corrosion, fungus and ordinary signs of wear. In this manner the troubleshooting techniques employed in chapter 3 may be held to a minimum. The following paragraphs describe the general nature of preventive maintenance and general practices normally associated with preventive maintenance.

a. *Period of Preventive Maintenance.*—The time required for preventive maintenance performed on operational equipment must, for obvious reasons, be held to a minimum. Some systems are allowed extensive "down-times" while others are allowed very little. The KW-7 equipment should have preventive maintenance performed on it at intervals determined by actual usage. If the KW-7 is operating 24 hours a day, it is necessary that periodic preventive maintenance be performed on the equipment. In the event that the KW-7 equipment is not employed over a long period of time the periodic preventive maintenance will be contingent upon practical judgment, official scheduling, ambient operating conditions, etc.

b. *General Preventive Maintenance Instructions.*—To reduce the time required to perform preventive maintenance, certain operating practices should be observed at all times. It should be mentioned that all operating techniques and practices discussed in section 2ØØØ are contingent upon the availability of necessary material. In many cases the exact techniques employed will depend upon cognizant personnel.

(1) If possible, disconnect the KW-7 from the signal line.

(2) Remove the power cord from the power source.

(3) Use a clean, dry, lint-free cloth or a dry brush for cleaning purposes.

(4) Use No. ØØØØ sandpaper to remove corrosion.

(5) When possible, use a cloth moistened with solvent to clean all metallic parts (except electrical contacts).

(6) Dipping an orange stick in a cleaning compound and allowing the compound to drip onto electrical contacts is an excellent cleaning technique. Remove the cleaning compound carefully with a clean dry cloth.

Note: Use a cleaning compound approved by the cognizant Service or Agency.

WARNING: PROLONGED BREATHING OF CLEANING COMPOUND IS DANGEROUS. MAKE SURE THAT ADEQUATE VENTILATION IS PROVIDED. CLEANING COMPOUND IS FLAMMABLE; DO NOT USE NEAR A FLAME.

2003. Maintenance Controls.—For general reference purposes, the KW-7 maintenance controls are illustrated in figures 2-1 and 2-2 and described in table 2-1.

TABLE 2-1.—MAINTENANCE CONTROLS

Panel Marking	Type	Location	Fig.	Function
-53V ADJ	Potentiometer R49	Power Supply	2-1	-53 volt adjustment
-18V ADJ	Potentiometer R34	Power Supply	2-1	-18 volt adjustment
-24V ADJ	Potentiometer R29	Power Supply	2-1	-24 volt adjustment
-6V ADJ	Potentiometer R19	Power Supply	2-1	-6 volt adjustment
+6V ADJ	Potentiometer R7	Power Supply	2-1	+6 volt adjustment
FREQ ADJ	Variable Control	Time Standard	2-2	Time standard output frequency adjustment
ALARM ON/OFF	Toggle Switch S9	Top Left Rear of KW-7	2-2	Enables operator to disable audible alarm
LOOP-OUTPUT ADJUST	Potentiometer R1Ø	Top Center Rear of KW-7	2-2	Enables operator to adjust loop current output

2004. Fuses and Test Jacks.—The fuses in the KW-7 are illustrated in figure 2-4 and described in table 2-2. Card signals are described in table 2-3.

TABLE 2-2.—FUSES

Panel Marking	Type	Location	Fig.	Function
-24 VDC	5 amp fuse F1	Filter A17	2-3	Protects dc-to-dc converter
+24 VDC	5 amp fuse F2	Filter A17	2-3	Protects dc-to-dc converter
115/23Ø VAC	2 amp fuse F3	Filter A17	2-3	Protects ac-to-dc converter
115/23Ø VAC	2 amp fuse F4	Filter A17	2-3	Protects ac-to-dc converter

TABLE 2-3.—CARD SIGNALS

Card	Signal	Connector Pin	Signal Description
E-AJK (A1)	Set	8	System initial set pulse
	F Drive Pulse	C	Fibonacci shift register drive pulse
	A	2	Fibonacci feedback signal
	$\overline{A}$	1	Fibonacci feedback signal
	$\overline{r1}$	x	$\overline{r}$ code combiner input
	$\overline{r2}$	19	$\overline{r}$ code combiner input
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GND	18	Ground
	16	F	Fibonacci shift register, output stage no. 16
	$\overline{16}$	E	Fibonacci shift register, output stage no. $\overline{16}$
	$\overline{r4}$	y	$\overline{r}$ code combiner input
	$\overline{r3}$	21	$\overline{r}$ code combiner input
	$\overline{r}$	22	$\overline{r}$ code combiner output
	$\overline{s}$	Z	$\overline{s}$ code combiner output
	$\overline{t}$	P	$\overline{t}$ code combiner output
E-AJJ (A2)	SET	8	System initial set pulse
	F Drive Pulse	9	Fibonacci shift register drive pulse
	$\overline{16}$	4	Fibonacci shift register, output stage no. $\overline{16}$
	16	1	Fibonacci shift register, output stage no. 16
	$\overline{r4}$	2	$\overline{r}$ code combiner input

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJJ (A2) (Cont.)	$\overline{r3}$	D	$\overline{r}$ code combiner input
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	18	Ground
	$\overline{32}$	x	Fibonacci shift register, output stage no. $\overline{32}$
	32	21	Fibonacci shift register, output stage no. 32
	$\overline{r2}$	3	$\overline{r}$ code combiner input
	$\overline{r1}$	5	$\overline{r}$ code combiner input
	$\overline{p}$	R	$\overline{p}$ code combiner output
	$\overline{q}$	E	$\overline{q}$ code combiner output
	$\overline{r}$	B	$\overline{r}$ code combiner output
E-AJM (A3)	YN-1	5	An intermediate code form
	$\overline{p}$	M	$\overline{p}$ code combiner output
	SET	N	System initial set pulse
	KG	1	Timing signal for key generator activity
	$\overline{KG}$	2	Timing signal for key generator activity
	START	3	Time interval decoded from output counter
	STOP	4	Time interval decoded from output counter

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJM (A3) (Cont.)	$\overline{M}$	B	Gating level that indicates data activity
	$\overline{PC\emptyset}$	W	Phasing counter, stage $\emptyset$ output
	BG · $\overline{NO}$	V	BG and Normal
	$\overline{PC1}$	X	Phasing counter, stage 1 output
	S · $\overline{N}$	Y	Send and Normal
	WPM1ØØ	C	1ØØ words per minute
	WPM67	K	67 words per minute
	$\overline{NORMAL\ 3}$	J	
	SEND 2	U	
	$\overline{s}$	P	$\overline{s}$ code combiner inverted output
	$\overline{YN\text{-}1}$	A	An intermediate code form
	E	T	Extensor (SRX) output
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	$\overline{E}$	E	Extensor (SRX) output
	Z1	D	Output data form prior to start and stop bauds addition
	W	R	An intermediate code form
	V	S	Output of auto key generator
	$\overline{W}$	22	An intermediate code form

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJL (A4)	Z1	12	Output data form prior to start and stop bauds addition
	32	1	Fibonacci shift register, stage no. 32 output
	F Drive Pulse	3	Fibonacci shift register drive pulse
	32	2	Fibonacci shift register, stage no. 32 output
	SET	L	System initial set pulse
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	NORMAL 2	18	
	Z3	15	Output data form after start and stop bauds addition
	AT3A	4	Alarm test switch output
	$\overline{s}$	D	$\overline{s}$ code combiner output
	$\overline{t}$	K	$\overline{t}$ code combiner output
	$\overline{I\&N}$	S	Indicator or Normal
	OBR	T	Output bit rate
	PLAIN	A	
	$\overline{q}$	13	$\overline{q}$ code combiner output
	$\overline{r}$	V	$\overline{r}$ code combiner output
	A	Y	Fibonacci feedback signal

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJL (A4) (Cont.)	AT3A	N	Alarm test switch output
	Z1A	11	Output data form prior to addition of start and stop bauds
	35	J	Fibonacci shift register, stage no. 32 output
	$\overline{39}$	Z	$\overline{\text{Fibonacci shift register, stage no. 39 output}}$
	39	22	Fibonacci shift register, stage no. 39 output
	YN-1	5	An intermediate code form
	$\overline{\text{YN-1}}$	C	$\overline{\text{An intermediate code form}}$
	$\overline{\text{NORMAL 3}}$	19	
	A	21	Fibonacci feedback signal
	KG	R	Timing signal for key generator activity
	$\overline{\text{SP}}$	F	$\overline{\text{Special point, F drive pulse deletion level}}$
	$\overline{\text{s}}$	8	$\overline{\text{s}}$ code combiner inverted output
	$\overline{\text{A}}$	W	$\overline{\text{Fibonacci feedback signal}}$
	AT4B	M	Alarm test switch output
E-AJO (A5)	$\overline{\text{OBR1}}$	M	$\overline{\text{Output bit rate}}$
	$\overline{\text{W}}$	C	$\overline{\text{An intermediate code form}}$
	$\overline{\text{AT2A}}$	B	$\overline{\text{Alarm test switch output}}$
	ASP	1	Alarm sampling pulse

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJO (A5) (Cont.)	I&N	4	Indicator and Normal
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	SET	L	System initial set pulse
	AT3A	K	Alarm test switch output
	GEO	T	Gated extensor output, crypto sync line
	NORMAL 1	U	
	KG	11	Timing signal for key generator activity
	Z2	9	An intermediate code form
	NORMAL 2	8	
	$\overline{\text{NORMAL 2}}$	H	
	35	J	Fibonacci shift register, stage no. 35 output
	39	D	Fibonacci shift register, stage no. 39 output
	$\overline{\text{A}}$	E	$\overline{\text{Fibonacci feedback signal}}$
	$\overline{39}$	13	$\overline{\text{Fibonacci shift register, stage no. 39 output}}$
	AT5	P	Alarm test switch output
	A	14	Fibonacci feedback signal
	AT6	R	Alarm test switch output

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJO (A5) (Cont.)	GZO	F	Gated Z stream output, data line
	V	V	Output of auto key generator
	W	15	An intermediate code form
	$\overline{\text{SEND 1}}$	S	
	PLAIN	12	
	$\overline{\text{E}}$	21	$\overline{\text{Extensor (SRX) output}}$
	Z1A	19	Output data form prior to addition of start and stop bauds
	E	2Ø	Extensor (SRX) output
	Z1A	22	Output data form prior to addition of start and stop bauds
	AT8	18	Alarm test switch output
	AT7	X	Alarm test switch output
	$\overline{\text{AT1A}}$	2	$\overline{\text{Alarm test switch output}}$
	ALARM 1	Z	Condition indicative of a compromising failure which will disable transmitter
	ALARM 1	A	Condition indicative of a compromising failure which will disable transmitter
	ALLR	6	Alarm lamp remote
	ALL	5	Alarm lamp
	TEX	16	Text
	$\overline{\text{TEX 1}}$	Y	$\overline{\text{Text}}$

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJO (A5) (Cont.)	BUZ 1	W	Audible alarm actuator
E-AJN (A6)	$\overline{\text{INDC}}$	D	$\overline{\text{Indicator counter}}$
	SE1	15	Send switch output
	SE2	X	Send switch output
	OC6	21	Output counter, stage 6
	$\overline{\text{CTRP}}$	W	$\overline{\text{P counter}}$
	-24V	14	Power supply voltage
	+6V	7	Power supply voltage
	P	13	Output counter character rate timing pulse
	INDC	1	Indicator counter
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	SNB	J	Timing pulse (receive mode) for M flip-flop
	SNA	9	Something not available (data presence level)
	PLAIN	2Ø	
	AT4A	11	Alarm test switch output
	OCØ	M	Output counter, stage Ø
	$\overline{\text{CLX}}$	B	$\overline{\text{Clear X register}}$
	$\overline{\text{SP}}$	3	$\overline{\text{Special point, F drive pulse deletion level}}$

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJN (A6) (Cont.)	KG	4	Timing signal for key generator activity
	LJG	L	Lock in gate
	ALARM SET	Y	Level from alarm test switch which generates set pulses
	NORMAL 1	F	
	$\overline{\text{BREAK}}$	E	
	BRLR	S	Break lamp remote
	BRL	N	Break lamp
	SEND	16	
	BREAK	19	
	$\overline{\text{I\&N}}$	8	Indicator or Normal
	I&N	H	Indicator or Normal
	NORMAL 2	A	
	NORMAL 3	6	
	$\overline{\text{NORMAL 2}}$	5	
	SEND 2	U	
	$\overline{\text{SEND 1}}$	P	
	BG	18	Gating level for CLX
	$\overline{\text{SEND}}$	R	
	SET	K	System initial set pulse
	SET 1	12	Input to SET driver

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJN (A6) (Cont.)	POWER SET	C	A special purpose set pulse
	SEND 1	V	
E-AJQ (A7)	$\overline{\text{LINE IN}}$	E	Gated line output
	$\overline{\text{OBR - BIT 1}}$	A	Output bit rate and bit 1
	OBR 1	D	Output bit rate
	SEND 1	5	
	$\overline{\text{I\&N}}$	C	Indicator or Normal
	$\overline{\text{START}}$	6	
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	TMSTD	Y	Time standard
	1ØØKC B	8	1ØØKC (internal or external) timing pulse to timing counter
	SET	Z	System initial set pulse
	WPM67	W	67 words per minute
	WPM1ØØ	X	1ØØ words per minute
	SG	F	Slow gate
	1ØØKC A	K	Internally generated 1ØØKC signal
	CLOCK	V	Corrected system timing pulses

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJP (A8)	CLOCK	2	Corrected system timing pulse
	-24V	14	Power supply voltage
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	TRB	3	Transfer pulse, B register
	TRA	4	Transfer pulse, A register
	POWER SET	2Ø	A special purpose set pulse
	$\overline{FL}$	21	$\overline{\text{Input character (fixed length) gating level}}$
	$\overline{BG}$	D	$\overline{\text{Gating level for CLX}}$
	$\overline{SEND\ 3}$	6	
	NORMAL 3	C	
	LIIST	F	Line in schmitt trigger
	MOD 6	Y	Input counter counting mode (6 bauds per cycle)
	LOIG	K	Loop in gate
	$\overline{NSC}$	22	$\overline{\text{Non-synchronous continuous}}$
	SEND 1	16	
	PA	Z	Plain asynchronous
	CLX	19	Clear X register
	IBR	V	Input bit rate

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJP (A8) (Cont.)	LIG	18	Lock in gate
	$\overline{PC1}$	9	$\overline{\text{Phasing counter, stage 1}}$
	$\overline{PCØ}$	5	$\overline{\text{Phasing counter, stage Ø}}$
	$\overline{T8}$	1	$\overline{\text{A pulse used to measure MOD 8 phasing characters}}$
	IC7	A	Input counter, stage 7
	$\overline{IBR1}$	W	$\overline{\text{Input bit rate}}$
E-AJJ (A9)	S · $\overline{N}$	A	Send and $\overline{\text{Normal}}$
	Pd	3	P pulse delayed
	$\overline{SEND\ 2}$	H	
	SET	1	System initial set pulse
	SHIFT-A	R	SRA register shift pulse
	ABIN	4	Input of A and B registers
	$\overline{ABIN}$	5	$\overline{\text{Input of A and B registers}}$
	$\overline{CTRP}$	21	$\overline{\text{P counter}}$
	M2B	B	Randomizer output to SRA2
	$\overline{CLX}$	19	$\overline{\text{Clear X register}}$
	TRA	P	Transfer pulse, A register
	INDC	22	Indicator counter
	NORMAL 2	X	
	$\overline{INDC}$	Y	$\overline{\text{Indicator counter}}$

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJJ (A9) (Cont.)	OBR1	12	Output bit rate
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	TRB	2Ø	Transfer pulse, B register
	SHIFT B	6	SRB register shift pulse
	SRA2	11	Shift register A, stage 2
	SRA5	V	Shift register A, stage 5
	$\overline{\text{SRA5}}$	18	$\overline{\text{Shift register A, stage 5}}$
	$\overline{\text{E}}$	2	$\overline{\text{Extensor (SRX) output}}$
	E	S	Extensor (SRX) output
	ZOD	W	ZERO/ONE indicator message detector
E-AJR (A1Ø)	SET	1	System initial set pulse
	CLOCK	2	Corrected system timing pulse
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	I&N	E	Indicator or Normal
	PILD	A	Phasing or Indicator lamp driver
	NORMAL 1	H	

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJR (A1Ø) (Cont.)	SRA2	B	Shift register A, stage 2
	BG	C	Gating level for CLK
	BREAK	F	Recognized break condition
	SET 1	8	Input to SET driver
	BRK	11	BREAK
	LIOD	M	Line out digital
	LIST	14	Line in schmitt trigger
	NORMAL 2	N	
	BRK	K	Signal initiating transmission break
	BRLO	R	Break receive lockout
	OC6	Z	Output counter, stage 6 output
	OCØ	3	Output counter, stage Ø output
	OBR	22	Output bit rate
	CTRP	2Ø	P counter
	$\overline{\text{CTRP}}$	Y	$\overline{\text{P counter}}$
	$\overline{\text{OC6}}$	21	$\overline{\text{Output counter, stage 6 output}}$
	$\overline{\text{OBRI}}$	12	$\overline{\text{Output bit rate}}$
	$\overline{\text{CTRPI}}$	19	$\overline{\text{P counter, stage 1 output}}$
	STOP	X	
	$\overline{\text{OBR . BIT1}}$	J	$\overline{\text{Output bit rate and bit 1}}$
	START	T	

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJR (A1Ø) (Cont.)	START	V	
	P	9	Output counter character rate timing pulse
	P	W	Output counter character rate timing pulse
	ICR	D	Indicator counter reset
	Pd	S	P pulse delayed
	OBR1	4	Output bit rate
	CLX	P	Clear X register
	CLX	18	Clear X register
	OBR2	V	Output bit rate
	BTC	13	Break receive level to break (indicator) character counter
E-AJU (A11)	NORMAL 3	15	
	ABIN	M	Input of A and B registers
	IBR	14	Input bit rate
	SET	F	System initial set pulse
	T8	B	A pulse used to measure MOD 8 phasing characters
	IC7	H	Input counter, stage 7 output
	P	E	Output counter character rate timing pulse
	+6V	7	Power supply voltage

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJU (A11) (Cont.)	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	SEND 1	3	
	LIS	N	Loop inhibit switch
	PA	L	Plain asynchronous
	LIIR	4	Line in relay
	M	K	Gating level that indicates data activity
	OBR1	18	Output bit rate
	NORMAL 3	2	
	Z2	1	Data output in final form (start-stop bauds superimposed)
	LOCO	A	Loop output control
	PCØ	U	Phasing counter, stage Ø output
	LO12	6	Loop in
	PTS	S	Plain text safety
	PC1	T	Phasing counter, stage 1 output
	ALARM 1	P	
	SEND 1	Y	
	SAG	2Ø	Shift A gate
	IBR1	X	Input bit rate
	SBG	21	Shift B gate

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJU (A11) (Cont.)	$\overline{\text{OBRI}}$	19	Output bit rate
	$\overline{\text{SEND}}$	22	
	FL	C	Input character (fixed length) gating level
	DS	16	Down shift
	$\overline{\text{NSC}}$	9	Non-synchronous continuous
	MOD 6	J	Input counter counting mode (6 bauds per cycle)
	LOIG	D	Loop in gate
	LOOD	V	Loop out digital
	LIIST	5	Line in schmitt trigger
	$\overline{\text{SEND 2}}$	R	
	$\overline{\text{FL}}$	8	Input character (fixed length) gating level
	SEL	11	Send lamp
	SELR	13	Send lamp remote
	SHIFT-A	Z	Register A shift pulse
	SHIFT-B	W	Register B shift pulse
E-AJT (A12)	ICR	N	Indicator counter reset
	Pd	F	P pulse delayed
	BTC	22	Break receive level to break (indicator) character counter

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJT (A12) (Cont.)	ZOD	1	ZERO/ONE indicator message detector
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	BRK	4	Break
	GRD	18	Ground
	DS	5	Down shift
	$\overline{\text{SEND 3}}$	A	
	SET	M	System initial set pulse
	IC7	C	Input counter, stage 7 output
	SEND	Y	
	$\overline{\text{SRA5}}$	W	Shift register A, stage 5 output
	TEX	J	Text
	OBR2	3	Output bit rate
	$\overline{\text{TEX-1}}$	8	$\overline{\text{Text}}$
	SRA5	12	Shift register A, stage 5 output
	FL	2	Input character (fixed length) gating level
	SEND 2	T	
	$\overline{\text{NORMAL 2}}$	S	
	SET 1	B	Input to SET driver
	$\overline{\text{P}}$	19	$\overline{\text{Output counter character rate timing pulse}}$

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJT (A12) (Cont.)	INDC	2Ø	Indicator counter
	$\overline{\text{INDC}}$	21	$\overline{\text{Indicator counter}}$
	$\overline{\text{M}}$	Z	$\overline{\text{Gating level that indicates data activity}}$
	$\overline{\text{Pd}}$	H	$\overline{\text{P pulse delayed}}$
	LIOD	K	Line out digital
	LOCO	6	Loop out control
	SNA	18	Something not available (data presence level)
	TRA	P	Transfer pulse, A register
	SAG	E	Shift A gate
	SNB	V	Timing pulse (receive mode) for M flip-flop
	SBG	D	Shift B gate
	M	X	Gating level that indicates data activity
	TRB	U	Transfer pulse, B register
E-AJW (A13)	SOS	2	Special one shot (randomizer) output
	$\overline{\text{AT1B}}$	P	$\overline{\text{Alarm test switch output}}$
	RNA1	R	Randomizer (stage 1)
	CTRP	1	P counter
	I&N	5	Indicator or Normal
	PLAIN	4	

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJW (A13) (Cont.)	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	$\overline{\text{ABIN}}$	19	$\overline{\text{Input of A and B registers}}$
	RNA2	S	Randomizer (stage 2)
	$\overline{\text{AT2B}}$	T	$\overline{\text{Alarm test switch output}}$
	SET	22	System initial set pulse
	OBR2	Z	Output bit rate
	M2A	V	Randomizer output to alarm
	M2B	21	Randomizer output to SRA2
	PLAIN-1	X	
	BREAK	3	
	BUZ1	6	Audible alarm actuator
	CLOCK	B	Corrected system timing pulses
	$\overline{\text{OC6}}$	H	$\overline{\text{Output counter, stage 6}}$
	ALARM 1	9	Condition indicative of a compromising failure which will disable transmitter
	$\overline{\text{CTRP2}}$	11	$\overline{\text{P counter}}$
	$\overline{\text{M}}$	D	$\overline{\text{Gating level that indicates data activity}}$
	$\overline{\text{NORMAL 3}}$	12	
	Z1A	16	Output data form prior to addition of start-stop bauds

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJW (A13) (Cont.)	START	18	
	STOP	14	
	NORMAL	13	
	$\overline{E}$	N	Extensor (SRX) output
	$\overline{SEND2}$	Y	
	MIL	L	MI lamp
	ASP	2Ø	Alarm sampling pulse
	ACT	W	Activity (PTS function)
	AUDO1	K	Audible alarm
	REDR	A	Relay driver
	GZO	15	Gated Z stream output, data line
	Z3	M	An intermediate code form
	$\overline{Z2}$	J	An intermediate code form
	$S \cdot \overline{N}$	E	Send and Normal
	GEO	F	Gated extensor output, crypto sync line
	AT4B	C	Alarm test switch output
	$\overline{Z1A}$	U	Output data form prior to addition of start-stop bauds
	$\overline{SEND3}$	8	

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJV (A14)	LIIR	3	Line in relay
	ALARM SET	U	Level from alarm test switch which generates set pulses
	AUDO1	A	Audible alarm
	REDR	D	Relay driver
	LOA1	19	Loop output analog 1
	-4ØVR	16	Zener controlled 4Ø volt reference for loop out circuits
	-18V	22	Power supply voltage
	-53V	12	Power supply voltage
	$\overline{OBRI}$	P	Output bit rate
	+6V	7	Power supply voltage
	-6V	17	Power supply voltage
	GRD	1Ø	Ground
	$\overline{S \cdot N}$	21	Send and Normal
	AT4A	M	Alarm test switch output
	LIOD	5	Line out digital
	LOOD	C	Loop out digital
	LOA2	2	Loop out analog 2
	LOOA	B	Loop out analog
	LIOR	4	Line out relay
	LIOA	6	Line out analog

TABLE 2-3 (Continued)

Card	Signal	Connector Pin	Signal Description
E-AJV (A14) (Cont.)	AUDO2	1	Audible alarm
	NCL	E	Negative coil (TD step relay)
	TDS1	K	Transmitter-Distributor step pulse 1
	PCL	F	Positive coil (TD step relay)
	LOOP	V	Loop out positive
	LOA3	2Ø	Loop out analog 3
	ZR	15	Zener reference
	LOON2	T	Loop out negative 2
	SOS	11	Special one-shot (randomizer) output
	RNA1	R	Randomizer (stage 1)
	M2B	H	Randomizer output to SRA2
	M2A	N	Randomizer output to alarm logic
	RNA2	S	Randomizer (stage 2)

2100—INSPECTION, CLEANING, AND LUBRICATION

2101. Schedule for Inspection, Cleaning, and Lubrication.—The KW-7 requires no lubrication but should be inspected for physical damage and cleaned at least weekly. Environmental conditions may cause the frequency of these checks to vary.

2102. Instructions for Inspection and Cleaning.

a. *Inspection.*—A careful inspection of all parts of the equipment is most important since it determines the necessity for other maintenance procedures. Table 2-4 presents the methods for inspecting the equipment.

TABLE 2-4.—EQUIPMENT INSPECTION

Part	Damaging Condition
Overall	Overheating, which is indicated by discoloration, blistering, bulging of parts or containers, or peculiar odors. Leakage of insulating compounds. Dirt, corrosion, rust, mildew, or fungus growth.
Leads	Looseness or separation, corrosion, or damaged.
Terminal Connections	Corrosion, dirt, or damage.
Mechanical assemblies	Looseness, insecure mounting, damage.
Switches	Loose mounting and connections. Pitting, dirt, corrosion, or wear of accessible contacts. Freedom in action.
Pushbutton Lamp	Dirt or damage.

b. *Cleaning.*—All parts, except electrical contact surfaces, should be cleaned with a clean, lint-free cloth, or a brush moistened with an approved solvent. When cleaning has been completed, the white film deposit remaining after the fluid dries must be wiped off. Electrical contact surfaces should be cleaned with a clean, lint-free cloth moistened with trichloroethylene. Table 2-5 presents, in tabular form, the procedures for cleaning various areas of the equipment.

WARNING: CARE SHOULD BE EXERCISED WHEN USING TRICHLOROETHYLENE AS A CLEANING AGENT. ALTHOUGH THIS SOLVENT IS A NON-INFLAMMABLE AND NON-EXPLOSIVE LIQUID, IT CAN PRODUCE TOXIC EFFECTS. REPEATED CONTACT WITH THE SKIN CAN CAUSE IRRITATION. RUBBER GLOVES SHOULD BE WORN WHEN USING THIS SOLVENT. DO NOT APPLY TRICHLOROETHYLENE TO POLYSTYRENE, LUCITE, PLEXIGLASS, OR SIMILAR PLASTICS. INSTEAD USE DRY CLEANING SOLVENT.

TABLE 2-5.—CLEANING PROCEDURES

Part or Area	Cleaning Procedure
Inaccessible areas or areas where loose dirt has accumulated.	Dry, compressed air may be used if the line pressure does not exceed 6Ø psi. Clear air line of moisture prior to cleaning equipments.
Element and logic packages, electronic chassis, contacts and terminals. 1) Corrosion	1) Clean with No. ØØØØ sandpaper and then polish with a clean, dry lint-free cloth.

TABLE 2-5 (Continued)

Part or Area	Cleaning Procedure
2) Dirt, mildew, or fungus	2) Clean with a dry, lint-free cloth or brush moistened with trichloroethylene.
Corroded switch contacts	Burnish with burnishing blade, keeping the blade clean by wiping it frequently with a clean, dry, lint-free cloth moistened with trichloroethylene.

2200—PERFORMANCE TESTING

2201. Explanation of Performance Testing Procedures.—The performance testing procedures as presented in this section serve the dual purpose of determining the operational capability of the equipment as part of a scheduled testing program and aiding the technician in troubleshooting the functional units of the system. Two KW-7 units—one, the unit under test, and the other, a unit known to be operational—are utilized to facilitate testing. In this manner, the unit can be thoroughly tested in all phases of operation by simulating on-line conditions.

Note: If abnormal indications are observed during any test, reference should be made to the troubleshooting procedures contained in chapter 3.

2202. Test Equipment Required.—Table 2-6 defines the test equipment used to perform the individual testing procedures.

TABLE 2-6.—TEST EQUIPMENT REQUIRED FOR PREVENTIVE MAINTENANCE TESTING

Test Equipment	Quantity	Notes
Teletypewriter, 60 wpm	2	KBD Filters Removed
Teletypewriter, 100 wpm	2	KBD Filters Removed
100 wpm Step TD	1	Line Filters Removed
60 wpm TD	2	Line Filters Removed
60 wpm TD	1	Line Filters Installed
100 wpm TD	2	Line Filters Removed
TTY Test Tape	2	
DC Power Supply, 120-140 volts, 200 ma.	1	

TABLE 2-6 (Continued)

Test Equipment	Quantity	Notes
Oscilloscope, Tektronix 535 (or equivalent)	1	
Voltmeter, AC 115/230 volts	1	
Voltmeter, Digital	1	
Ammeter, DC, 20 to 60 ma.	1	
Multimeter	1	
Potentiometer, 7000 ohm, 25 watt	2	
Resistor, 1000 ohm, 5 watt	1	
Resistor, 500 ohm, 5 watt	1	

2203. Test Procedures.—For a complete check of the KW-7, the following test procedures should be performed in the sequence given to ensure that the equipment is tested in the proper manner.

Note: Reference is made in the procedures to adjustment of the line and the loop currents. These adjustments should be made to the value (either 20 ma or 60 ma.) for the teletypewriter equipment and the line conditions.

a. *Initial Test Setup.*—The following test procedures are preliminary tests. Two KW-7's will be employed for these tests. For this reason the following steps will define the unit under test as STATION A KW-7 and the reference unit as STATION B KW-7.

(1) Set the switches on both KW-7A and KW-7B to the positions indicated in table 2-7.

TABLE 2-7.—INITIAL SWITCH SETTINGS

Switch	Location	Setting
Power ON-OFF	Front Panel	OFF
Alarm Test	Front Panel	OFF
PCR Switch	Front Panel	CIPHER
Line Input	Time Standard Area	20
Loop Output	Card A14	60

TABLE 2-7 (Continued)

Switch	Location	Setting
Speed Selector	Rear of Unit	*
Break Function	Rear of Unit	ON
Alarm ON-OFF	Time Standard Area	ON
TD Step	Time Standard Area	CONT.
115-230 VAC	Main Filter	Applicable Position

*Set SPEED SELECTOR switch to setting determined by teletypewriters being used.

(2) Perform the wiring connections indicated in figure 2-8.

(3) Unlock the patch cord front cover and perform the wiring connections indicated in table 2-8.

WARNING: THE PATCH CORDS MUST NEVER BE SET AS SHOWN IN TABLE 2-8 WHEN THE KW-7 IS CONNECTED TO THE LINE.

TABLE 2-8.—PATCH CORD TEST ARRANGEMENT

From Combiner Board Jack	To Register Card Terminal
1	A1
2	A2
3	A3
4	A4
5	A5
6	A6
7	B7
8	B8
9	B9

TABLE 2-8 (Continued)

From Combiner Board Jack	To Register Card Terminal
10	B10
11	C11
12	C12
13	C13
14	C14
15	C15
16	C16
17	D17
18	D18
19	D19
20	D20
21	D21
22	D22
23	E23
24	E24
25	E25
26	F26
27	F27
28	F28
29	F29
30	F30

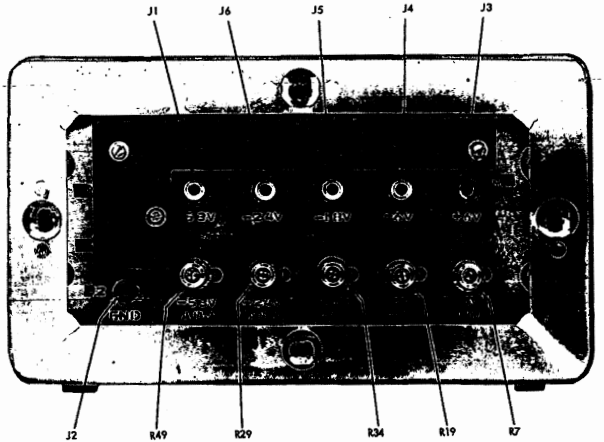


Figure 2-1.—Power Supply, Top View (Cover Removed).

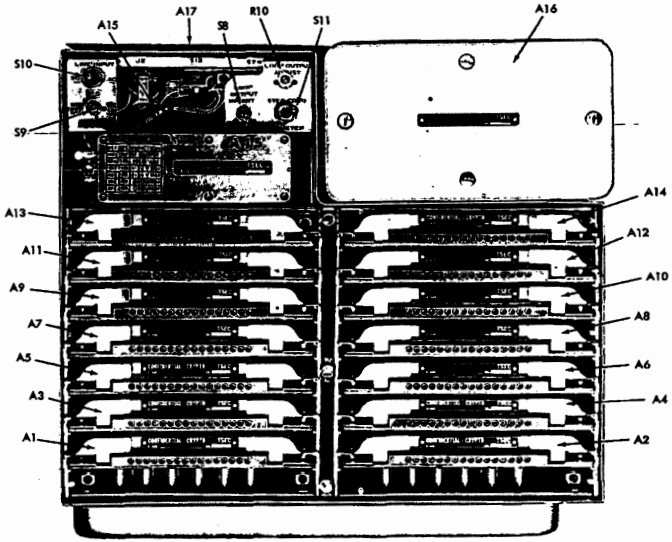


Figure 2-2.—KW-7, Top View (Cover Removed).

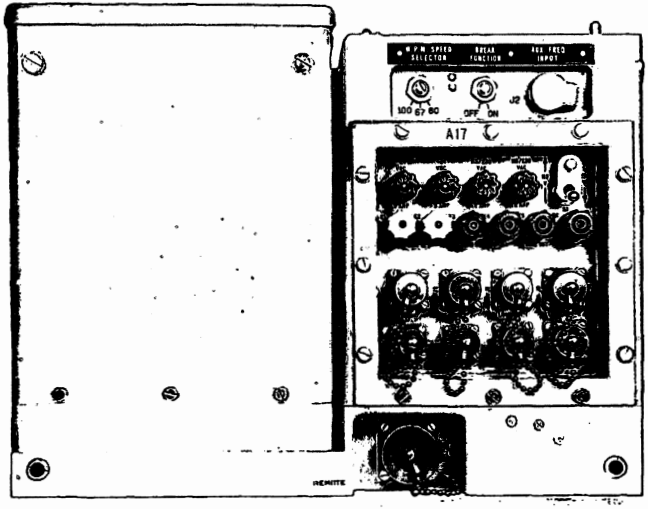


Figure 2-3.—KW-7, Rear View.

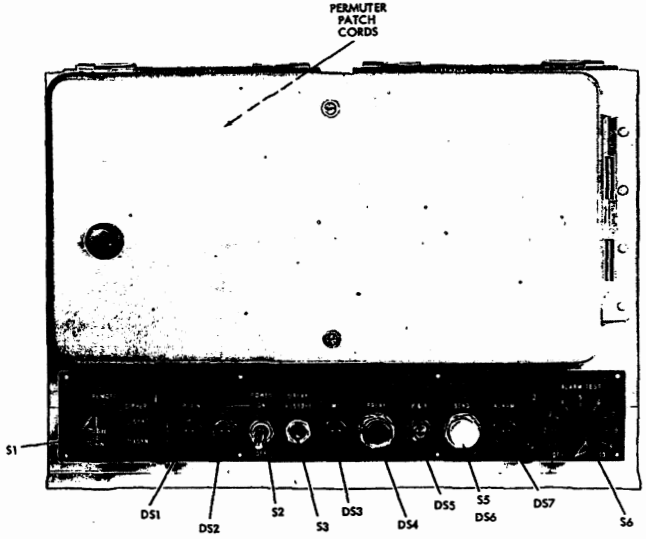


Figure 2-4.—KW-7, Front View.

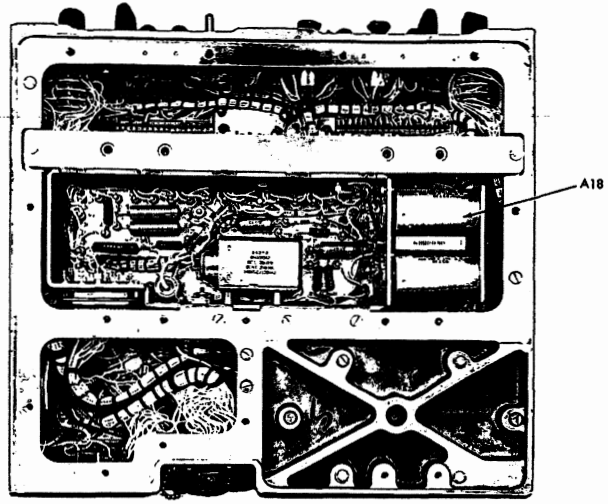


Figure 2-5.—KW-7, Bottom View (Cover Removed).

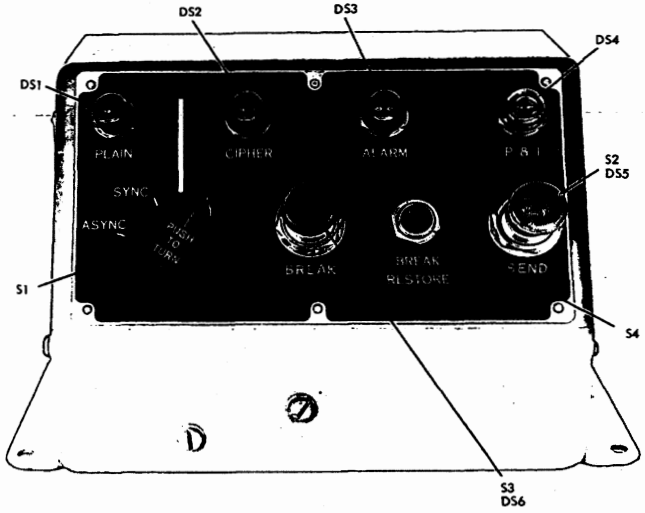


Figure 2-6.—Front View of Remote Control Unit.

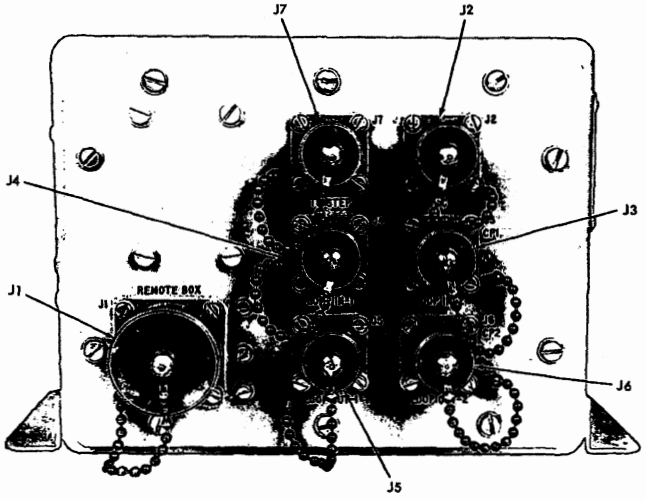


Figure 2-7.—Rear View of Remote Control Unit.

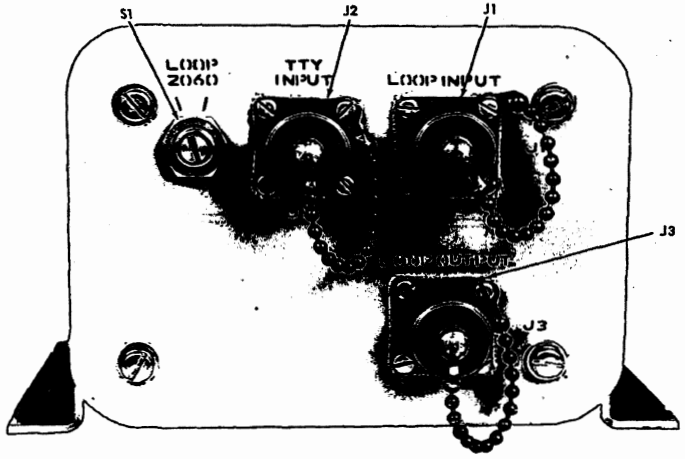


Figure 2-8.—Front View of Loop Adapter Unit.

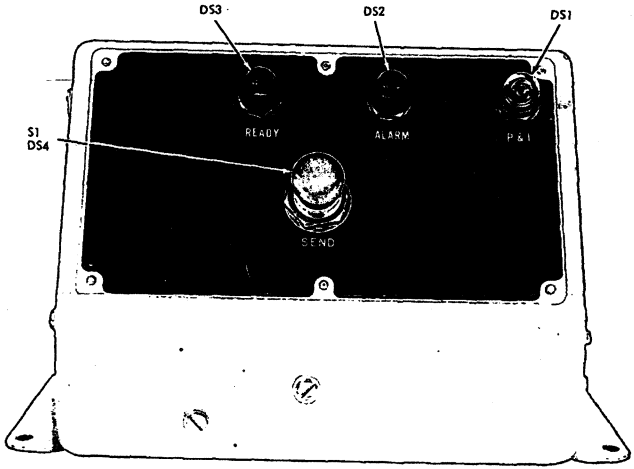


Figure 2-9.—Front View of Functional Remote Control Unit.

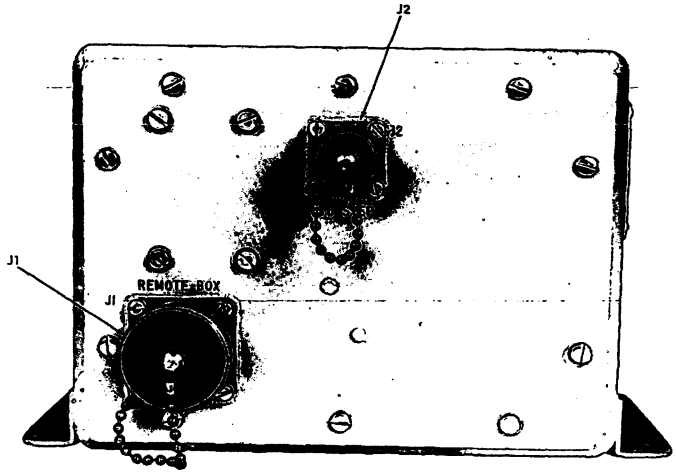


Figure 2-10.—Rear View of Functional Remote Control Unit.

(4) Place the POWER ON-OFF switch in the ON position and observe that the POWER ON indicator lamp becomes illuminated. Allow a five-minute warm-up period before performing any further steps.

b. Power Supply Adjustments.

(1) Remove the power supply top cover from the unit under test. Using a multimeter, measure the voltages indicated in table 2-9. Make any adjustments necessary to bring the voltages within tolerance.

TABLE 2-9.—POWER SUPPLY OUTPUT VOLTAGE MEASUREMENTS

Voltage	From Test Point	To Test Point	Adjustment	Tolerance	
				Minimum	Maximum
+6	J3	J2(GND)	+6V ADJ	+5.82V	+6.18V
-6	J4	J2(GND)	-6V ADJ	-5.82V	-6.18V
-18	J5	J2(GND)	-18V ADJ	-17.64V	-18.36V
-24	J6	J2(GND)	-24V ADJ	-23.28V	-24.72V
-53	J1	J2(GND)	-53V ADJ	-52.35V	-55.65V

(2) With an oscilloscope, check the ripple at the test points indicated in table 2-9. The ripple shall not exceed 0.3 volts peak-to-peak at any point.

c. Loop Current Adjustments.

(1) Connect a multimeter as an ammeter in series between the spade lug on the end of the W7 cable signal output leads from J7 (STATION A) and its corresponding terminal on the teletypewriter. Leave the other signal output lead connected to the teletypewriter. (See fig. 2-8.)

(2) Remove card E-AJV (STATION A) and place the LOOP OUTPUT switch, located on the card, in the 60 position. (This switch may already be in the 60 position.) Replace the card.

Note: If the teletypewriters in use are equipped with current adjusting controls, turn these controls to the maximum current position.

(3) Adjust the LOOP OUTPUT ADJUST potentiometer (STATION A) until a reading of 60 milliamperes is observed on the multimeter.

(4) Remove card E-AJV (STATION A) and place the LOOP OUTPUT switch in the 20 position. Replace the card.

(5) Repeat step (3) observing for an indication of 20 milliampere on the multimeter.

d. Break Character Counter Test.

(1) Connect the oscilloscope sync lead to test point TP-8 (Card E-AJR) and the scope test lead to test point TP-5 (Card E-AJR).

(2) Adjust the oscilloscope for negative external synchronization with a sweep time of 200 milliseconds per centimeter.

(3) Press the BREAK pushbotton/indicator (S4) and observe the oscilloscope for a waveform. Measure from the start of sweep to fall of the pulse from 0 to -6 volts.

Note: Oscilloscope measurement will vary with the teletypewriter being used as follows:

Teletypewriter	Measurement
60 wpm	1665 Milliseconds ± Scope Error
67 wpm	1680 Milliseconds ± Scope Error
100 wpm	1117 Milliseconds ± Scope Error

(4) Press the BREAK RESTORE pushbutton.

e. Output Bit Rate Test.

(1) Adjust the oscilliscope for positive internal synchronization with a sweep time of 5 milliseconds per centimeter.

(2) Place the oscilloscope probe at test point TP-12 (Card E-AJR).

(3) Measure the signal period for the WPM SPEED SELECTOR switch positions indicated in table 2-10.

TABLE 2-10.—WPM SPEED SELECTOR SWITCH POSITIONS

Switch Position	Signal Period
100	13.3 Milliseconds
67	20.0 Milliseconds
60	22.2 Milliseconds

(4) Return the WPM SPEED SELECTOR switch to the position for the teletypewriter in use.

f. Power Set Test.—Place the POWER switch in the OFF position, wait at least two seconds and then return it to the ON position. Observe that the POWER ON indicator lamp becomes illuminated. If any other lamp becomes illuminated, observe that they become deactivated.

g. PCR Switch Set Test.

(1) Set all switches to the switch positions listed in table 2-7.

(2) Place both KW-7 POWER switches in the ON position.

(3) Depress the STATION A SEND switch and observe that the SEND indicator lamp on STATION A and the P&I indicator lamps located on both KW-7's become illuminated for a few seconds

and then become deactivated. (Relay clicks can be detected in both STATION A KW-7 and STATION B KW-7 during the P&I lamp illumination period.)

(4) Place the STATION A PCR switch in the SYNC (plain) position and observe that the SEND indicator lamp becomes deactivated. The PLAIN indicator lamp becomes illuminated, and the audible alarm sounds.

(5) Depress the STATION A SEND switch and observe that the SEND indicator lamp becomes illuminated.

(6) Place the STATION A PCR switch in the CIPHER position and observe the following:

(a) The SEND indicator lamp becomes deactivated.

(b) The PLAIN indicator lamp becomes deactivated.

(c) The audible alarm becomes deactivated.

h. ALARM TEST Switch Set Test.

(1) Place the STATION A KW-7 ALARM TEST switch in position 1Ø and observe that the audible alarm becomes activated.

(2) Depress the STATION A KW-7 SEND switch and observe that the SEND indicator becomes illuminated.

(3) Return the ALARM TEST switch to the OFF position, through position 11, and observe the following:

(a) The SEND indicator lamp becomes deactivated.

(b) The audible alarm becomes deactivated.

i. BREAK Switch Set Test.

(1) Depress the STATION A KW-7 SEND switch. Observe that the STATION A KW-7 SEND lamp and both KW-7 P&I indicator lamps become illuminated.

(2) After both P&I indicator lamps become deactivated, depress the BREAK switch on STATION B KW-7 and keep it depressed until the BREAK indicator lamp becomes illuminated and the audible alarm sounds on both KW-7's. Observe that the SEND indicator lamp on STATION A KW-7 becomes deactivated.

(3) Depress the STATION A KW-7 BREAK RESTORE switch and observe that the BREAK indicator lamp and the audible alarm both become deactivated.

j. SEND Switch Set Test.

(1) Depress the STATION A KW-7 SEND switch.

(2) After the P&I indicator lamp becomes deactivated, ground permuter patch-cord terminal F31 with a clip lead. Observe that the ALARM indicator lamp becomes illuminated and the audible alarm becomes activated. Remove the clip lead from terminal F31.

(3) Depress the STATION A KW-7 SEND switch and observe the following:

(a) The ALARM indicator lamp becomes deactivated.

(b) The audible alarm becomes deactivated.

(c) The SEND indicator becomes illuminated.

Note: The remaining portions of this section relate to various operational tests on the STATION A KW-7.

k. 2Ø Milliampere Neutral Mode Test.

(1) Place the STATION A KW-7 LINE INPUT switch in the 2Ø milliampere position.

(2) Adjust the 7K, 25W potentiometer for 2Ø milliamperes of line current as observed on an ammeter connected between terminal E5 STATION A and terminal E1 (STATION B).

(3) Place a test tape in the transmitter-distributor at STATION A.

(4) Depress the STATION A KW-7 SEND switch and observe that the STATION A KW-7 SEND indicator becomes illuminated.

(5) Start STATION A TD and send test message for five minutes. Observe the printouts on both STATION A page printer and STATION B page printer for "clean" copy without any garble.

(6) Place STATION A TD in a deactivated condition and wait ten minutes before performing any further steps.

(7) Activate STATION A TD but do not depress the SEND switch. Transmit six error-free lines.

l. 6Ø Milliampere Neutral Mode Test.

(1) Place the STATION A KW-7 LINE INPUT switch in the 6Ø position.

(2) Adjust the 7K, 25W potentiometer for 6Ø milliamperes of line current as observed on an ammeter inserted in the E5 (STATION A)-E1 (STATION B) line.

(3) Depress the STATION A KW-7 SEND switch and send six error-free lines from STATION A TD.

(4) Observe the printouts on both STATION A page printer and STATION B page printer.

Note: Copy at STATION B page printer may be garbled until shortly after the STATION B KW-7 P&I indicator lamp goes on.

m. Alarm Test Circuitry Test.

(1) Place the STATION A KW-7 and the STATION B KW-7 in the receive mode by turning power off for five seconds and then turning it on again.

(2) Rotate the STATION A KW-7 ALARM TEST switch through each of its 1Ø test positions, pausing for approximately five seconds at each position.

(3) Note an audible alarm indication at positions 1 through 1Ø and ALARM indicator lamp indication at positions 1 through 9. Both the SEND and P&I lamps should come on at position 6 only. The MI indicator should be ON for positions 1 through 5. The alarm indications should cease at position 11. Rotate the ALARM TEST switch to OFF.

(4) Rotate the STATION A KW-7 PCR switch to the SYNC (plain) position and observe that the audible alarm becomes activated.

(5) Place the ALARM ON-OFF switch in the OFF position and observe that the audible alarm goes off.

(6) Return the ALARM ON-OFF switch to the ON position. Rotate the STATION A KW-7 PCR switch to the ASYNC (plain) position and observe that the audible alarm remains activated.

(7) Repeat step 5.

(8) Return the ALARM ON-OFF switch to the ON position and the PCR switch to the CIPHER position.

n. BREAK and BREAK RESTORE Switch Test.

(1) Depress the STATION A KW-7 SEND switch. Observe that the SEND indicator lamp goes on.

(2) After both P&I lamps are extinguished, depress the STATION A KW-7 BREAK switch. Observe that the BREAK indicators and audible alarms for both KW-7's become active and that the STATION A KW-7 SEND lamp goes out.

(3) Depress the STATION A KW-7 SEND switch and observe that the STATION A KW-7 unit is unaffected.

(4) Press the STATION A KW-7 BREAK RESTORE switch. Observe that the BREAK indicator lamp and the audible alarm are deactivated for the STATION A KW-7.

(5) Press the STATION B KW-7 BREAK RESTORE switch and then the STATION B KW-7 BREAK switch. Observe that STATION A KW-7 is unaffected.

o. BREAK FUNCTION Switch Test.

(1) Place the BREAK FUNCTION switch, on both equipments, in the OFF position.

(2) Depress the STATION A KW-7 SEND switch.

(3) After both P&I lamps become extinguished, depress the STATION B KW-7 BREAK switch and observe that both equipments remain unaffected.

(4) Depress the STATION A KW-7 BREAK switch and observe that both equipments remain unaffected.

(5) Place the POWER ON-OFF switches for both KW-7's in the OFF position.

p. Plain Asynchronous Mode Test (fig. 2-9).

(1) Connect the unit under test (STATION A) as shown in figure 2-9. Observe that the line TD must have its line filters installed.

(2) Place the STATION A KW-7 POWER ON-OFF switch in the ON position. With the 7K potentiometer, adjust the line current to 60 milliamperes.

(3) Place the STATION A KW-7 PCR switch in the ASYNC (plain) position.

(4) Depress the STATION A KW-7 SEND switch and observe that the P&I indicator becomes activated and then is deactivated immediately upon release of the SEND switch.

(5) Send a test message from the line TD and print six error-free lines on the line page printer and STATION A page printer.

(6) Deactivate the line TD.

(7) Send a test message from STATION A TD and print six error-free lines on the line page printer and STATION A page printer.

(8) Place the POWER ON-OFF switch in the OFF position.

q. Local TD Stepping Test (Continuous).

(1) Perform the wiring connections indicated in figure 2-10.

(2) Place the STEP-CONT/TD STEP switch on both equipments to the CONT position.

(3) Place the POWER ON-OFF switch on both equipments in the ON position.

(4) Place a test tape in STATION A TD and put the TAPE ADVANCE switch in the ON position.

(5) Depress the STATION A KW-7 SEND switch and observe the following:

(a) The STATION A KW-7 SEND indicator becomes illuminated.

(b) The P&I indicator lamp on both equipments becomes illuminated.

(c) As both P&I lamps become deactivated, STATION A step TD starts.

(d) The TD clutch magnet should remain energized.

(e) The STATION A KW-7 should transmit six error-free lines to the STATION B KW-7 page printer.

(6) Place the STATION A TD TAPE ADVANCE switch in the OFF position.

r. Local TD Stepping Test (Stepping).

(1) Place the STATION A KW-7 STEP-CONT/TD STEP switch in the TD STEP position.

(2) Place test tape in STATION A TD and put the TAPE ADVANCE switch in the ON position.

(3) Depress the STATION A KW-7 SEND switch and observe the following:

(a) The STATION A KW-7 SEND indicator becomes illuminated.

(b) The P&I indicator, on both KW-7's becomes illuminated.

(c) After the STATION A KW-7 P&I indicator lamp becomes deactivated, STATION A TD begins to step.

(d) The STATION A TD clutch magnet is pulsed once each revolution.

(e) Both the STATION A KW-7 and STATION B KW-7 page printers record error-free printouts.

(4) Place the STATION A TD TAPE ADVANCE switch in the OFF position.

(5) Place the POWER ON-OFF switch for both equipments in the OFF position.

s. Remote Control TD Stepping (Stepping and Continuous) Test.

(1) Perform the wiring connections indicated in figure 2-11.

(2) Place the POWER ON-OFF switch on both equipments in the ON position.

(3) Place the STATION A KW-7 STEP-CONT/TD STEP switch in the TD STEP position.

(4) Place the STATION A KW-7 PCR switch in the REMOTE position.

(5) Place the STATION A TD TAPE ADVANCE switch in the ON position.

(6) Place both the Remote Control Unit PLAIN-CIPHER-SYNC-ASYNC switch (hereinafter called PC switch) and the STATION B KW-7 PCR switch in the CIPHER position. Observe that the remote control CIPHER indicator lamp becomes illuminated.

(7) Depress the Remote Control Unit SEND switch and observe the following:

(a) Both the STATION A KW-7 and Remote Control Unit SEND indicators become activated.

(b) The STATION A KW-7, STATION B KW-7 and Remote Control Unit P&I indicator lamps become illuminated for several seconds and then become deactivated.

(c) When the P&I indicator lamps become deactivated, STATION A TD begins to step.

(d) The STATION A TD clutch magnet is pulsed once each revolution.

(e) The STATION A KW-7 and STATION B KW-7 page printers record error-free printouts.

(8) Place the STATION A KW-7 STEP-CONT/TD STEP switch in the CONT position and observe the following:

(a) The STATION A TD clutch magnet remains energized.

(b) The STATION A KW-7 and the STATION B KW-7 page printers record error-free printouts.

t. Remote Control Break Function Test.

(1) Depress Remote Control Unit SEND switch, observing the following results:

(a) Both the STATION A KW-7 and the Remote Control Unit SEND indicators become activated.

(b) The STATION A KW-7, STATION B KW-7 and Remote Control Unit P&I indicators become illuminated for several seconds, and then become deactivated.

(2) After P&I has been completed, depress the Remote Control Unit BREAK switch and observe the following:

(a) The STATION A KW-7 and Remote Control Unit SEND indicator lamps become deactivated.

(b) The STATION A KW-7, STATION B KW-7B and Remote Control Unit BREAK indicator lamps become illuminated and the audible indicators on the Remote Control Unit and STATION B KW-7 become activated.

(3) Depress the Remote Control Unit BREAK RESTORE switch and observe that both the STATION A KW-7 and the Remote Control Unit BREAK indicator lamps become deactivated.

u. Remote Control Alarm Test.

(1) Place the STATION A KW-7 ALARM TEST switch in the 1 position and observe that the ALARM indicator lamps on STATION A KW-7 and the Remote Control Unit both become illuminated and that the audible alarm on the Remote Control Unit becomes activated. Return the STATION A KW-7 ALARM TEST switch to the OFF position by rotating it clockwise.

(2) Place the Remote Control Unit PC switch in the SYNC (plain) position and observe the following:

(a) The STATION A KW-7 and Remote Control Unit PLAIN indicator lamps become illuminated.

(b) The audible alarm on the Remote Control Unit becomes activated.

(c) The Remote Control Unit CIPHER indicator lamp becomes deactivated.

(3) Place the STATION B KW-7 PCR switch in the SYNC (plain) position.

(4) Depress Remote Control Unit SEND switch, then release it and observe the following:

(a) STATION A TD transmission begins when the SEND switch is released.

(b) The P&I indicator lamps on STATION A KW-7, STATION B KW-7 and the Remote Control Unit become deactivated once the SEND switch is released.

(c) The STATION A KW-7 and STATION B KW-7 page printers record error-free printouts.

(5) Place the STATION A TD TAPE ADVANCE switch in the OFF position.

(6) Place the POWER ON-OFF switches for STATION A KW-7 and STATION B KW-7 in the OFF position.

v. Two-Wire Loop Adapter Test.

(1) Perform the wiring connections indicated on figure 2-12.

(2) Place the STATION A KW-7 LOOP-OUT INHIBIT/ALLOW switch in the INHIBIT position.

(3) Place the POWER ON-OFF switch in both STATION A KW-7 and STATION B KW-7 in the ON position.

(4) Place the LOOP ADAPTER 2Ø-6Ø switch in the 6Ø position.

(5) Place the PCR switches for both STATION A KW-7 and STATION B KW-7 in the CIPHER position.

(6) Activate the loop circuit 12Ø-volt DC Power Supply and measure the current. The loop current should read 6Ø milliamperes (the 7K potentiometer should be adjusted if this current is not read).

CAUTION: DO NOT ALLOW LOOP CURRENT TO EXCEED 7Ø MILLIAMPERES. THE ELECTRONIC RELAY CONTAINED IN THE TWO-WIRE LOOP ADAPTER MAY BE SEVERELY DAMAGED.

(7) Depress the STATION A KW-7 SEND switch and observe the usual results.

(8) Send a test message from STATION A TD.

(9) Observe both STATION A page printer and STATION B page printer for at least six lines of error-free copy.

(1Ø) Deactivate STATION A TD.

(11) Place the STATION A KW-7 PCR switch in the REMOTE position.

(12) Depress the Remote Control Unit SEND switch and observe the usual results.

(13) Repeat steps (8) through (1Ø).

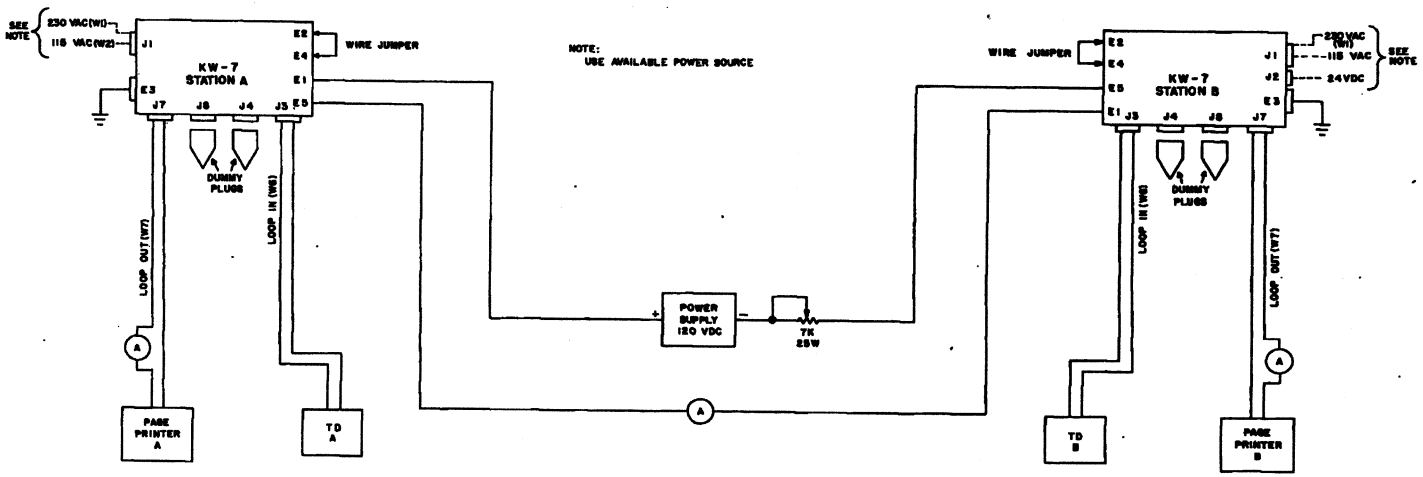


Figure 2-11.—Test Connections.

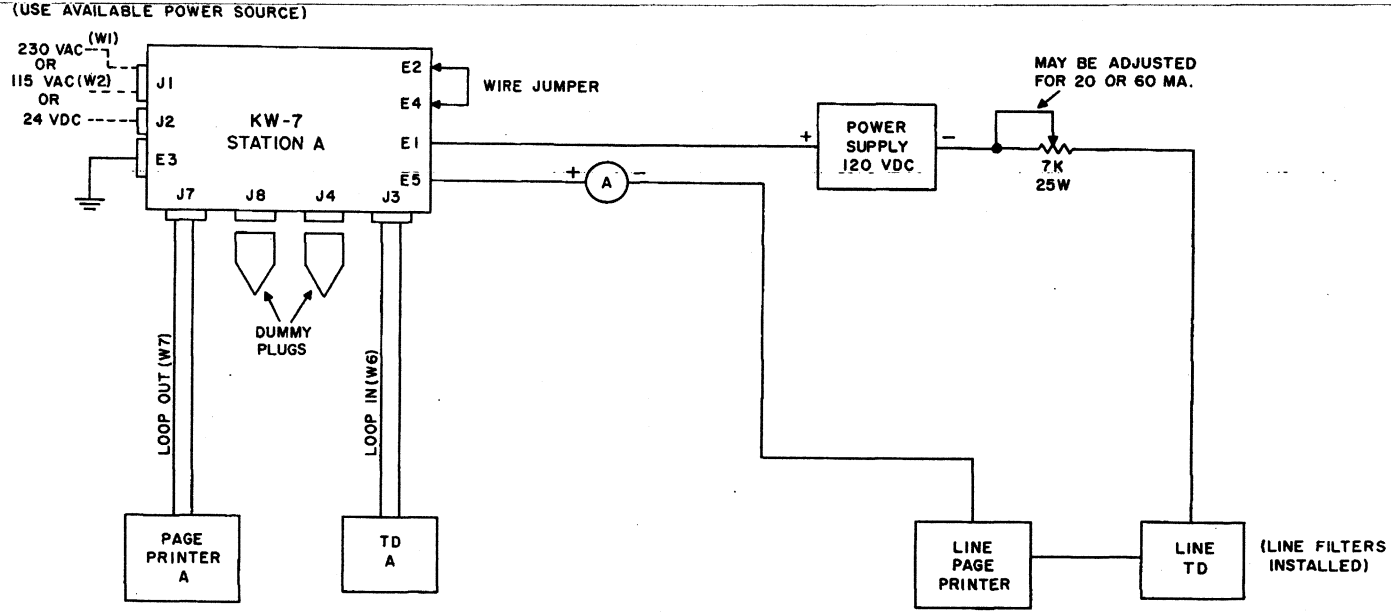


Figure 2-12.—Plain Async Mode Test Connections.

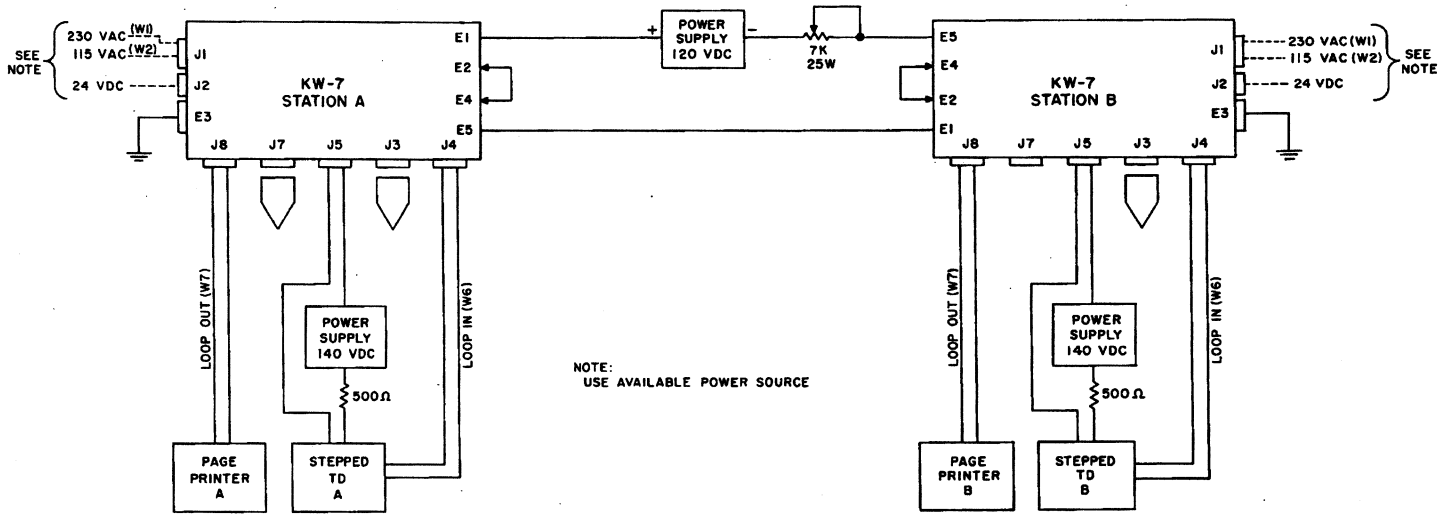


Figure 2-13.—Stepped Transmitter-Distributor Test Connections, Local Control.

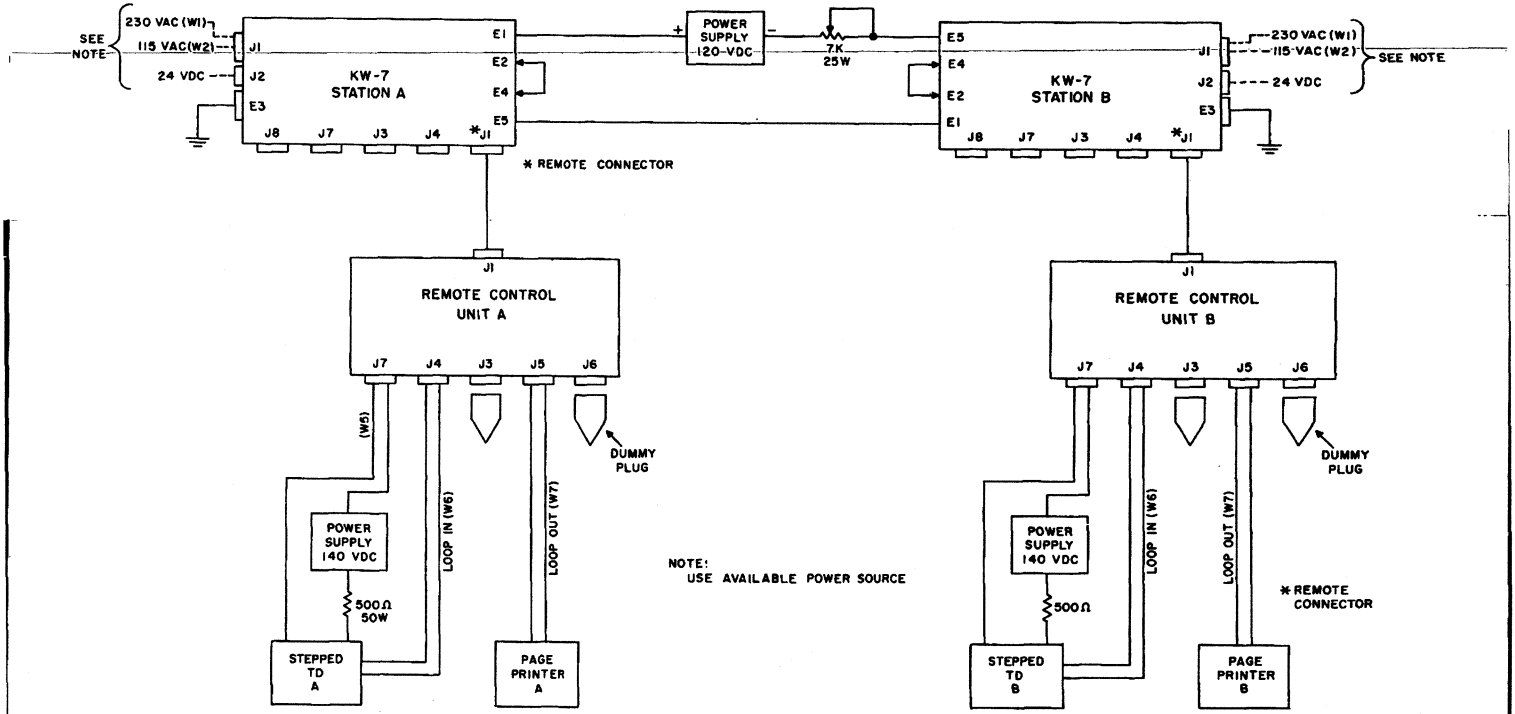


Figure 2-14.–Stepped Transmitter-Distributor Test Connections, Remote Control.

KAM-144B/TSEC

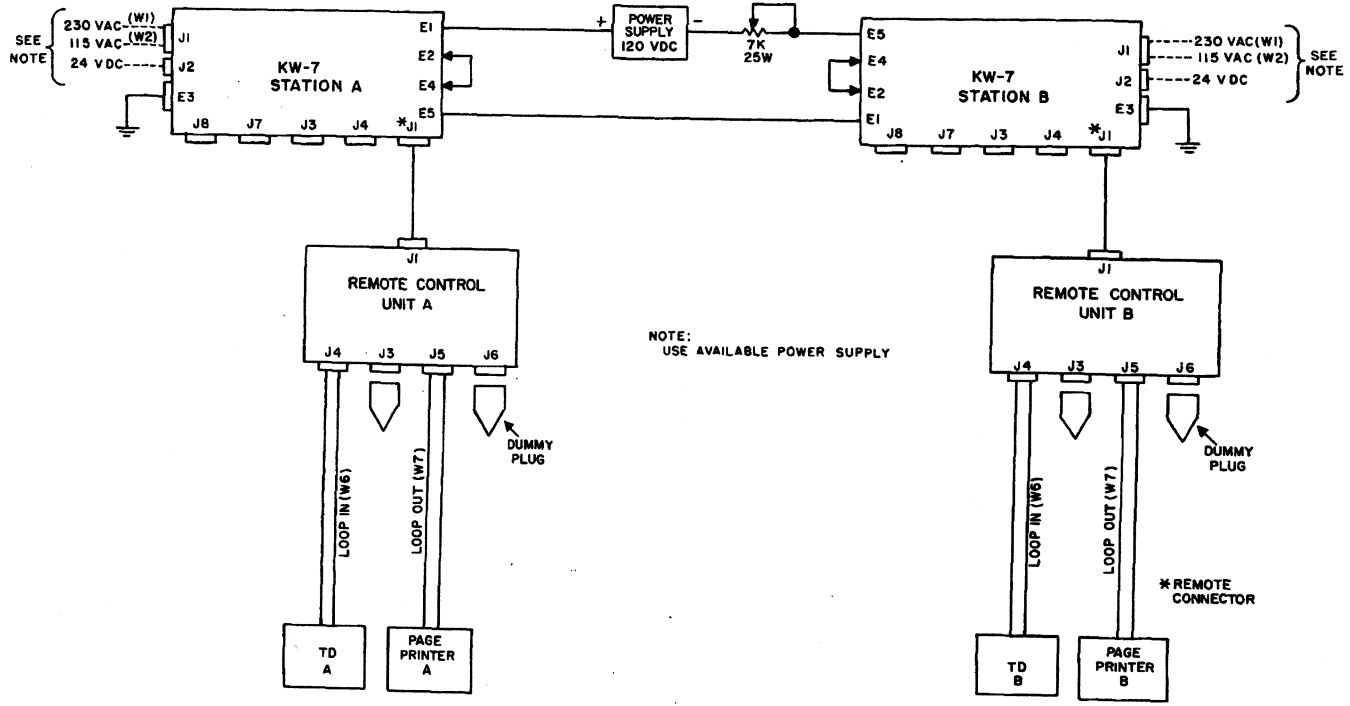


Figure 2-15.—Continuous Transmitter-Distributor Test Connections, Remote Control.

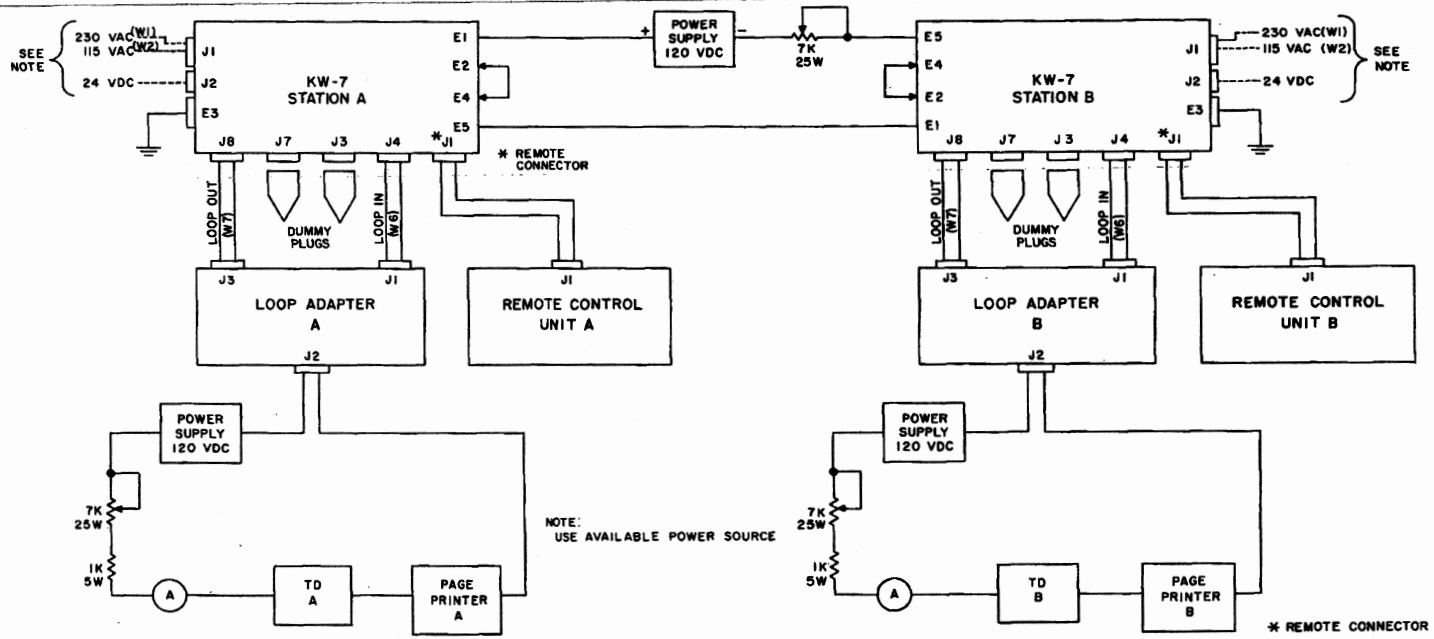


Figure 2-16.—Loop Adapter Unit Test Connections.

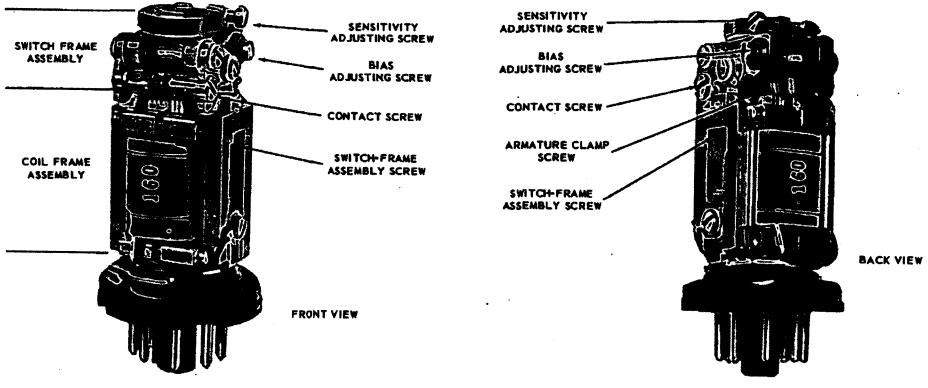


Figure 2-17.—Sigma Series 72AOZ relay.

2300—RELAY ADJUSTMENTS

2301. Introduction.—The line input and line output relays used in the KW-7 are SIGMA type 72 AOZ relays. Under normal conditions, they should give several months of trouble-free operation. If a trouble develops and the relay is suspected, it is recommended that it be replaced with a new one. However, if additional relays are not available, cleaning and/or replacement of relay contact screws and armatures can be accomplished under field conditions. Further parts replacements or adjustments should be made only at depot maintenance levels.

CAUTION: ON RELAYS HAVING METAL COVERS, REMOVAL OF THE COVER WHILE THE RELAY IS CONNECTED IN AN OPERATING CIRCUIT SHOULD BE AVOIDED BECAUSE OF SHOCK HAZARD OR THE RISK OF SHORT CIRCUITING THE CONTACTS.

2302. Field Maintenance.—If the Sigma 72 relay is found to be the cause of trouble, remove it from its socket. Remove the relay cover and inspect the contact screws (fig. 2-17) using a good light and, if possible, a magnifying glass. If the contacts appear to be tarnished or burned, draw a piece of clean, hard paper between the mating surfaces to clean them. Do not file or burnish the contacts, since this can cause excessive stress on the contact damper springs in the subsequent clearance adjustments. If the contact surfaces are damaged by pitting or buildup, or if the contact damper springs (fig. 2-18) are damaged (unsymmetrical appearance, or clearance under damper feet), it will be necessary to replace the contact screws and the armature. Using the Sigma Relay Repair Kit No. AT36-1 (FSN 5945-587-5036) proceed as follows:

a. Remove the contact screws from the relay.

b. Loosen the armature clamp screw (fig. 2-17) approximately one turn with a 1/16-inch tip screwdriver.

c. Remove the armature by gently pulling it out through the space left vacant after performing step *a*. If a gentle pull with small tweezers does not dislodge the armature, work it up and down while maintaining a steady pull. Make sure armature clamp screw is loose.

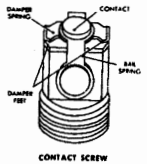


Figure 2-18.—Contact Screw.

CAUTION: DO NOT ATTEMPT TO DRIVE THE ARMATURE OUT FROM THE BACK. THIS MAY CAUSE DISTORTION OF THE HINGE SPRING.

d. Install the new armature at the back by inserting it between the pole pieces, through the clamp, and pushing gently until the back edge of the armature is approximately flush with the pole pieces. If the armature is loose, tighten the clamp screw just enough to prevent it from falling out. The armature may need to be moved in the clamp for better alignment after the contact screws are inserted.

e. Install the new contact screws. Be careful not to cross-thread the screws or to create metal filings.

f. Using a screwdriver with a 3/16-inch tip, tighten the screws until they are just clear of the armature contacts.

g. Align the armature so that its contact surfaces are even with the contact screws.

h. Make certain that when the armature is held against each of the pole pieces no foreign matter adheres to either gap.

i. Position the relay on its side with the contact screws on top and the octal plug facing away; move the armature against the right-hand pole piece.

j. Apply leads of an ohmmeter to relay base pins 6 and 7 (fig. 2-19) and turn the right-hand contact screw clockwise until the ohmmeter indicates that contact is just made with the armature contact.

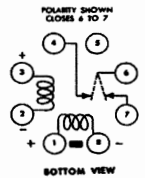


Figure 2-19.—Relay Pin Polarities.

k. Transfer the armature to the left-hand pole piece and transfer the ohmmeter leads to pins 4 and 6 of the base. Turn the left-hand contact screw clockwise until the ohmmeter indicates that contact is just made with the armature contact.

l. Contact symmetry (or equal air gap) now exists between the contact screws and the armature contacts when the armature contacts are in a centered position. However, the air gap will be excessive. To obtain the correct 0.004-inch gap, move the armature so that it touches one contact screw.

m. Insert a Ø.ØØ4-inch non-metallic shim between the armature and the opposite contact screw.

n. Move the contact screw until the Ø.ØØ4-inch shim is a sliding-fit between the contact screw and the armature.

o. Repeat the procedure for the other contact screw.

p. Adjust the bias adjusting screw (fig. 2-17) until the armature remains on either contact (when transferred manually) and the forces required to move the armature in either direction are as nearly equal as possible. To achieve near equality, a gram gage should be used to measure the force or pull required to move the armature. (Newer type relays have two bias adjusting screws with no sensitivity adjusting screw. To adjust bias on these, loosen one screw and tighten the other.)

CAUTION: DO NOT MOVE THE SENSITIVITY ADJUSTING SCREW.

2303. **Service Depot Maintenance.**—Service depots should have the following test set and publications to repair and adjust Sigma 72 relays:

Sigma Series 45ØØ Relay Test Set (or equivalent).
Instruction Book H289.
Maintenance and Adjustment Manual for use with the Sigma Type 72AOZ Relay.

If the two publications are not available, the following instructions will be of aid when repairing and adjusting the relays.

a. Repeat steps *a* through *p* of paragraph 23Ø2 except, substitute the Sigma Series 45ØØ Relay Test Set for the ohmmeter in steps *j* and *k*.

b. Contact spacing and bias are now set. Check for trip current value. It should be from Ø.6 to 1.4 ma DC, in either direction with only one coil energized each time.

c. If the trip value is not as specified, make certain that the armature suspension is in good condition. To check this, tighten the Sensitivity Adjusting Screw 1/4 turn each time and note the changes in operating-trip points (changes in DC current). If the suspension is in good condition, sensitivity will increase as the Adjusting Screw is tightened until the relay becomes stable.

Note: Test sets with fixed operating and non-operating currents will not accommodate this procedure. If variable operating currents are not available, DO NOT UNDER ANY CIRCUMSTANCES RESET THE SENSITIVITY.

d. If the relay responds as described in step *c*, set the sensitivity to the desired settings. Then back out the Sensitivity Adjusting Screw somewhat further than required and gently tap the top of the relay with a small plastic hammer or wooden screwdriver handle to remove possible backlash.

e. Turn the Sensitivity Adjusting Screw clockwise until the required trip sensitivity is reached. If the relay fails to respond, a damaged suspension and/or switch frame is indicated. In this event, the entire frame must be replaced.

f. To remove the switch frame, unsolder the two contact leads and remove the two Allen-head switch frame assembly screws. Be careful not to create metal filings.

g. Position the new assembly correctly, referring to the contact leads.

h. Run in the two new assembly screws with their lockwashers but do not tighten them securely.

CAUTION: DO NOT DISTURB THE ADJUSTING AND ARMATURE CLAMP SCREWS.

i. Move the assembly sideways along the keyways provided until the armature is attached to two diagonally opposite pole pieces (e.g., right front and left rear or left front and right rear). This assures that the hinge is correctly centered.

j. Tighten the assembly screws alternately, without changing the switch frame position.

k. The armature should hold firmly on either pair of diagonally opposite pole pieces. If the armature does not hold to the pole pieces, carefully inspect them for foreign matter. If foreign matter is present, air jet cleaning is effective in most cases.

CAUTION: BE CAREFUL NOT TO DAMAGE CONTACT SPRINGS WITH AIR STREAM.

l. Using a gram gage, determine the force required to move the armature in either direction. These forces should be equal and somewhere between 1Ø and 2Ø grams. The forces should not vary more than 15 percent.

m. As a final check, a Ø.ØØ9-inch non-magnetic shim should enter any one of the four gaps (fig. 2-2Ø) to a depth of approximately 1/32 inch.

n. Install contact screws as explained in 23Ø2 and resolder contact leads.

o. Adjust the relay as explained in 23Ø2 but use the Sigma Series 45ØØ Relay Test Set, or equivalent.

Note: Whenever damage to the coils, base, or magnets make the relay inoperable, discard it and replace with a new one.

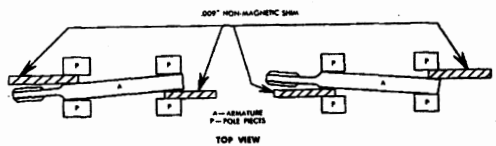
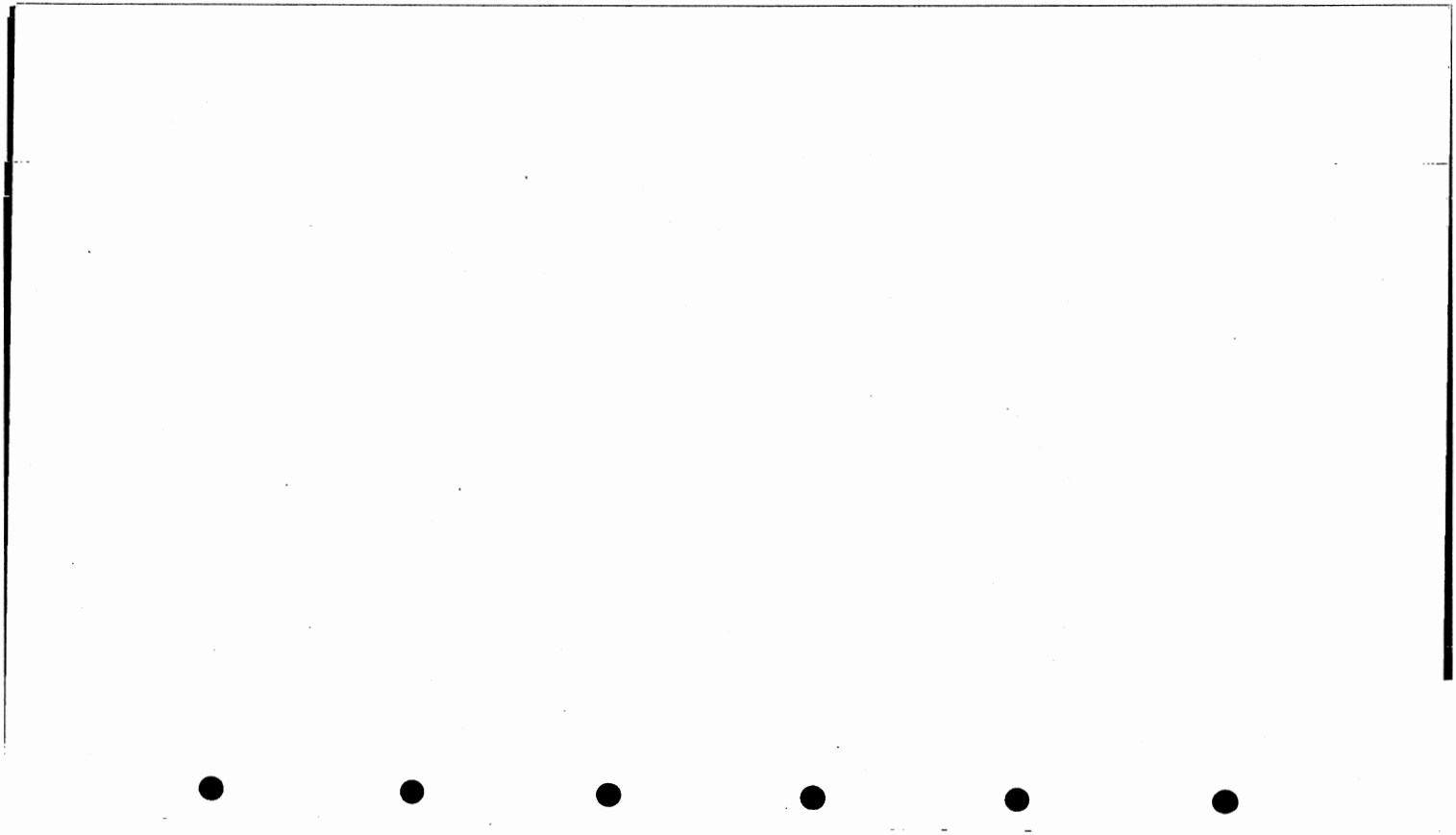


Figure 2-2Ø.—Relay Armature Gap Adjustment.

DOCID: 3559657



CHAPTER 3
TROUBLESHOOTING

3000—GENERAL INFORMATION

3001. Contents.—This chapter presents information to aid the technician in locating and correcting defects within the KW-7 equipment. The information presupposes a thorough knowledge of the theory of operation of the KW-7. Maintenance personnel should refer to chapter 4, Theory of Operation, KAM-143B/TSEC, whenever any portion of the circuitry is not clearly understood.

3002. Tools and Test Equipment Required.—Special tools are not required to troubleshoot the KW-7. Table 3-1 lists the test equipments that are required for this purpose.

TABLE 3-1.—TEST EQUIPMENT

	Test Equipment	*Required For*	*Supplied By*
1.	KG Test Adapter Card	Maintenance	Spare Parts Kit
2.	Test Extender Card	Maintenance	Spare Parts Kit
3.	Power Supply Extender Cable	Maintenance	Spare Parts Kit
4.	Multimeter, Triplett 630 or equivalent	Installation and Maintenance	Supplied by User
5.	Oscilloscope, Tektronix 535 or equivalent	Installation and Maintenance	Supplied by User
6.	Electronic Counter Hewlett Packard 525D or equivalent	Installation and Maintenance	Supplied by User

3003. Basic Approach to Troubleshooting.—Most malfunctions that occur in the KW-7 will result in a visual indication (an indicator lamp becomes illuminated when it should be deactivated), an audible indication (the audible alarm indicates a malfunction in one of those circuits being monitored by the alarm), or notification by another KW-7 operator via the break method. The troubleshooting information supplied in this chapter consists of a series of paragraphs that explain the functions of the troubleshooting aids, describe how to conduct the troubleshooting cycle and specify what action to take when a malfunction has been located.

3004. General Method of Troubleshooting.—The subparagraphs which follow define a feasible troubleshooting method.

a. Locating Troubles.—The KW-7 is divided into functional or logical units. Malfunctions can be localized to a specific unit by checking the inputs and outputs of the various logic units in a systematic order. If a logic unit's outputs are normal, it can be assumed to be functioning within tolerance and therefore eliminated as a possible cause of the malfunction. If the outputs of a logic unit are abnormal, with normal inputs available, the trouble lies within the logic circuitry. If the inputs are abnormal, then the malfunction exists in one of the logic units that supply these inputs. After the trouble has been localized to a specific logic unit, the next step is to check the inputs and outputs of that logic unit's subassemblies and related groups of elements or circuits. The previously discussed procedure should be followed for the subassemblies and groups of associated circuitry to localize malfunctions. This elimination process should continue until the malfunction has been isolated to a particular section within a logic unit. Use of the individual test points on the logic units is a valuable aid in locating malfunctions.

b. Correcting Malfunctions.—The final step in the localization of trouble requires that the individual printed circuit cards and individually mounted components be checked. These various components may be checked for proper voltage outputs, waveforms, and collective operation within a logic unit to determine their operational status. In this manner the individual defective component or components may be found and replaced. Remove the suspect card and replace it with an identical one from a working logic unit. In this manner it is possible to readily determine, without the use of time consuming tests, the status of the suspect card. The technician should apply a logical approach to as many of the existing problems as is possible in order that time consumption be kept at a minimum. The test procedures should never be attempted in a random fashion. The remaining portion of this chapter will assist the technician in an evaluation and subsequent repair of malfunctions in the equipment.

3005. Test Practices.—The following test practices apply to the test equipment employed in troubleshooting the KW-7.

a. Oscilloscope.—The oscilloscope should be allowed a minimum warm-up period of five minutes to allow the vertical and horizontal preamplifiers to warm up to ambient temperatures. The probe to be used with this piece of test equipment should be checked for tightness of cable connectors and for proper connection of the probe tip. The ground lead from the oscilloscope should be connected to a ground located on the KW-7 chassis.

b. Meters.—If the meter used is of the VTVM type, the warm-up period for this equipment should be approximately five minutes to allow for tube equalization. If the meter to be used is of the Simpson type, the resistance scales should be zeroized before any resistance checks are taken. The ground lead should be connected to a ground located on the KW-7 chassis.

3006. Troubleshooting Data.—The following paragraphs define the various troubleshooting aids included in this chapter. These aids are primarily aimed at assisting the technician in locating and repairing malfunctions within the KW-7.

a. Block Diagrams.—Although the system block diagrams, located in chapter 4, KAM-143B/TSEC, are not included in this chapter they are mentioned as a source of reference material in the event the technician requires them. By proper observation of the symptoms, it is often possible to trace the cause of faulty operation to a particular functional unit illustrated on these block diagrams.

b. Interconnecting Wiring Diagrams.—The interconnecting wiring diagrams show the wiring interconnections between individual cards, receptacles and components contained within the KW-7. These diagrams are especially useful for tracing troubles between cards or components.

c. Overall Logic Diagrams.—Overall logic diagrams are provided for both the Extensor and Control and the Key Generator. This type of diagram shows all logic elements in the system and will usually be used to determine the faulty area in which the malfunction has occurred. When a signal has an origin or destination which must be shown on another drawing, the origin or destination is referenced by means of a grid coordinate system. Referring to figure 3-56 it is seen that the right edge of the drawing is marked off in increments labeled A, B, C, etc., while the top edge is marked off in increments numbered 1, 2, 3, etc. If a signal is located, for example, at D7, it may be found by moving horizontally left from D until directly below the number 7. If the signal destination is in the Key Generator, it will be preceded by KG (i.e. KGD7).

d. Card Logic Diagrams.—Individual card logic diagrams make it possible to define those individual logic elements mounted on a particular card. In this manner it is possible for the technician to observe a particular logic element.

e. Card Printed-Circuit Layouts.—Individual printed-circuit layouts are provided to aid the technician in following printed-circuit etch. Each layout illustrates both sides of a printed-circuit board. One side (the module side) is in dark lines while the other side (module pin side) is lighter to illustrate the reverse of the board. In this manner it is possible for the technician to trace etch and locate the feed-throughs points without having to remove modules from the actual board. These layouts also illustrate the proper module alignment and are used in conjunction with the individual module schematics.

f. Individual Module Schematics.—Individual module schematics show the schematic, logic symbol, module base layout, and (if applicable) the truth table for each different module. This will aid the technician in replacing modules found to be defective.

g. KW-7 Unit Level Schematics.—These schematic-wiring diagrams illustrate all components not mounted on individual cards. This illustration provides the technician with information which will allow him to trace troubles external to cards.

h. Power Supply, Remote Control Unit, Two-Wire Loop Adapter and Functional Remote Control Unit Schematics.—These four schematics aid the technician in troubleshooting these particular units.

i. Test Point Signal Table.—Table 3-2 lists all of the signals to be found at the test point block of each card. Reference to this table will enable the technician to observe those signals that are available without use of the extender card.

3007. Troubleshooting Techniques.—The following paragraphs are aimed at assisting the technician in employing proper troubleshooting techniques.

a. Wave Form Analysis.—Waveforms may be observed at test points and at other significant points throughout the KW-7. A departure from the required waveform (a ZERO level instead of a ONE level) indicates trouble between one point at which the waveform is to be normal and another point at which the waveform is observed to be abnormal. When a waveform at a specific point is observed to be absent, the cause may be the absence of a signal from another component. The point at which to start checking waveforms is at the component or module input state. To determine whether a signal is reaching a certain stage when a test point is not provided use the extender card and check either the connector pins of the suspect card or the module.

TABLE 3-2.—TEST POINT SIGNALS

Card	Test Point	Signal
E-AJK (A1)	1	GRD
	2	A
	3	$\overline{A}$
	5	SET
	11	F DRIVE
	12	16
	13	$\overline{16}$
	14	$\overline{F}$
	15	$\overline{t}$
	16	$\overline{s}$
E-AJJ (A2)	1	$\overline{F}$
	2	$\overline{16}$
	3	16
	6	F DRIVE
	7	GRD
	1Ø	$\overline{p}$
	13	32
	14	$\overline{q}$

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJJ (A2) (Cont.)	15	SET
	16	$\overline{32}$
E-AJM (A3)	1	K
	2	START
	3	$\overline{M}$
	4	Z1
	5	$\overline{E}$
	6	$\overline{\text{NORMAL 3}}$
	8	GRD
	9	$\overline{\text{YN-1}}$
	10	S
	12	$\overline{V}$
	13	KG
	14	SEND 2
	15	$\overline{p}$
	16	$\overline{W}$
E-AJL (A4)	1	32
	2	PLAIN
	3	$\overline{s}$
	4	$\overline{35}$
	5	F DRIVE
	6	$\overline{32}$

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJL (A4) (Cont.)	7	$\overline{t}$
	8	35
	9	$\overline{q}$
	10	$\overline{\text{I\&N1}}$
	11	Z3
	12	OBR
	13	$\overline{\text{NORMAL 3}}$
	15	$\overline{F}$
	16	A
E-AJO (A5)	1	Z2
	2	(MD8 INT)
	3	$\overline{W}$
	4	ASP
	6	$\overline{39}$
	11	GEO
	12	(MD4 INT)
	13	V
	14	(MD17 INT)
	15	$\overline{\text{TEX}}$
	16	(MD10 INT) ALARM

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJN (A6)	1	$\overline{\text{CLX}}$
	2	$\overline{\text{SP}}$
	3	KG
	4	PLAIN
	5	$\overline{\text{INDC}}$
	7	SET
	8	INDC
	9	LIG
	10	OCO
	11	(MD20 INT)
	13	SE 1
	14	ALARM SET
	15	P
E-AJQ (A7)	1	$\overline{\text{LINE IN}}$
	2	$\overline{\text{OBR} \cdot \text{BIT 1}}$
	3	SEND 1
	4	(MD17 INT)
	5	(MD15 INT)
	6	(MD16 INT)
	9	(MD8 INT)
	10	$\overline{\text{I\&N}}$

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJQ (A7) (Cont.)	11	(MD11 INT)
	12	CLOCK
	13	100KCB
	14	TMSTD
	15	OBR1
	16	$\overline{\text{START}}$
E-AJP (A8)	1	IC7
	2	$\overline{\text{T8}}$
	3	CLOCK
	4	NORMAL 3
	5	$\overline{\text{Q7}}$
	6	$\overline{\text{SEND 3}}$
	7	MISS
	9	SEND 1
	10	LIG
	11	CLX
	12	$\overline{\text{IBR1}}$
	13	$\overline{\text{FL}}$
	14	PA
	15	$\overline{\text{NSC}}$
	16	MOD6

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJS (A9)	1	TRA
	2	$\overline{\text{ABIN}}$
	3	SHIFT A
	5	AT4B(M2B)
	6	S . $\overline{\text{N}}$
	7	Pd
	8	SHIFT B
	10	(MD5 INT)SRA 10
	11	TRB
	12	$\overline{\text{CLX}}$
	13	OBR1
	14	INDC
	15	NORMAL 2
	16	E
E-AJR(A10)	2	SRA2
	3	$\overline{\text{BG}}$
	4	I&N
	5	$\overline{\text{BREAK}}$
	6	NORMAL 1
	7	BRK
	8	LIOD

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJR(A10) (Cont.)	9	$\overline{\text{NORMAL 2}}$
	10	LIIST
	12	START
	13	P
	16	$\overline{\text{P}}$
E-AJU(A11)	1	$\overline{\text{LIIR}}$
	2	$\overline{\text{LOI2}}$
	3	LOIG
	4	(MD17 INT)
	5	M
	6	LOCO
	7	(MD4 INT)C
	8	LOOD
	9	$\overline{\text{NORMAL 3}}$
	10	Z2
	11	SEND 1
	13	$\overline{\text{OBR1}}$
	14	(MD13 INT)
	15	SBG
	16	SAG
E-AJT(A12)	1	FL

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJT (A12) (Cont.)	5	OBR2
	7	Pd
	9	ZOD
	1Ø	M
	11	DS
	12	BTC
	13	$\overline{P}$
	14	LIOD
	15	$\overline{\text{NORMAL 2}}$
	16	SEND 2
E-AJW(A13)	2	REDR
	3	STOP
	4	AUDO1
	5	MI LAMP
	6	(MD5 INT)
	7	GZO
	8	$\overline{\text{Z1A}}$
	9	(MD14 INT PIN 2)
	1Ø	START
	11	ASP
	16	OBR2

TABLE 3-2 (Continued)

Card	Test Point	Signal
E-AJV(A14)	1	LIOA
	2	LOOA
	3	(M2B)
	4	TDS1
	5	RNA2
	6	M2A
	7	RNA1
	8	-53V
	9	(MD11 INT) ONE SHOT
	1Ø	-4ØVR
	11	LOOP
	12	-6V
	13	+6V
	15	GRD
	16	-18V

b. Replacing Defective Components or Modules.—Careless replacement of components or modules often creates new troubles. When replacing components or modules, observe the following precautions:

(1) Before a part is unsoldered, note the exact position of the module pins or component wires. If a part such as a transformer or a switch has a number of connections, tag each of the leads in order to make the proper connections when replacing the part. Be careful not to damage other leads by pulling or pushing them out of the way.

(2) Make well-soldered joints. A carelessly soldered joint may create a new trouble and is one of the most difficult troubles to locate. Be careful not to allow drops of solder to fall into the wire nest or into the base casting.

(3) Whenever a part has been replaced, make any necessary adjustments and check the performance of the KW-7 to be sure that the original trouble has been remedied and that no new trouble has developed in the equipment as a result of the repair.

(4) When soldering transistor leads, solder quickly; wherever wiring permits (this also applies to soldering those modules containing transistors or diodes) use a heat sink, such as long-nosed pliers, between the soldered joint and the transistor or module.

c. Intermittents.—If the operation of a component or module is intermittently faulty, the trouble may be difficult to locate when the component or module is functioning normally. Such troubles can often be found by placing an oscilloscope test probe on the suspect connector pin, test point or module pin, and lightly tapping each of the suspected parts with a non-metallic pencil or screwdriver while observing the oscilloscope. In the event that intermittent operation is caused by loose connections, broken wires, or defective components or modules, the best approach is to observe erratic behavior of one of the outputs from this stage or stages.

d. Fuses.—A blown fuse does not appear on the KW-7 filter unit as an obvious indication. Whenever a power failure is suspected the first thing to check will be the fuses associated with the power supply. If a fuse is blown, care should be taken to replace it with one that has the same rating. If a replacement fuse blows, do not install another until the trouble has been located and remedied.

e. Preliminary Checks and Control Settings.—Additional damage will be caused if power is applied to the KW-7 when a complete or partial short circuit exists. If any of the following conditions have occurred, check for short circuits before applying power to the equipment.

(1) A replaced fuse has blown.

(2) Smoke was observed coming from the equipment (particularly the power supply).

(3) Overheated parts detected by odors or visual indications.

3100—PRELIMINARY PROCEDURES

3101. General.—When a malfunction is first reported within a system employing the KW-7, the procedures contained within paragraphs 31Ø2 through 31Ø6 should be performed. The purpose of these procedures is to eliminate operational malfunctions and any system malfunctions that could effect the KW-7 operation.

3102. Question Operating Personnel.—Question the operating personnel who were on duty when the trouble developed. Determine such things as the following:

(1) Was the equipment being properly operated?

(2) Was the equipment being operated in the transmit or receive mode?

(3) What operator action, if any, preceded the trouble? Had the equipment been started properly?

(4) What informed the operator that a defect existed? If an alarm or indicator, which one?

3103. Inspect the Equipment.—Inspect the KW-7 for the following:

(1) Note the state of the alarm and indicators. Observe the position of all switches and note the readings of any external test meters in use.

(2) Check the permuter patch cords for concurrence with the key list. Look for improperly mated cards. Make certain that each patch card and printed circuit card is seated properly.

(3) Examine all external connections to the KW-7 equipment. Make certain that all connections are tight and properly made.

3104. Verify the Trouble.—Verify the trouble by operating the equipment under the same conditions in which the trouble was originally encountered. While doing so, carefully observe alarm light and indicators.

3105. Isolate Trouble to the KW-7.—Make certain that the origin of the trouble lies within the KW-7 and not in an ancilliary unit. If duplicate ancilliary units are available, substitute them for the equipment originally used and repeat the procedure in paragraph 31Ø4. Alternately, if an extra KW-7 is available, substitute it for the original one and repeat the procedure in paragraph 31Ø4.

3106. Refer to the Proper Troubleshooting Procedure.—Having verified the presence of a malfunction within the KW-7, the technician must determine which trouble shooting procedure is required to remedy the malfunction. Three types of troubleshooting procedures are available: a procedure for determining observable symptoms which indicate a malfunction, a procedure for replacing defective cards and locating troubles external to cards and a procedure for replacing defective modules.

a. Observable Conditions.—Table 3-3 defines those observable conditions which will aid the technician in determining which portion of the KW-7 is malfunctioning. This table contains columns which give the symptom, probable cause and recommended troubleshooting procedure. In this manner it is possible to rapidly determine where the malfunction has occurred and to repair it.

In the event that an observable condition is not apparent, the technician should go through a routine check of the equipment (par. 2203) until an observable condition is detected.

b. *Card Replacment and Troubles External to Cards.*— Table 3-4 describes the steps necessary to locate and replace cards and repair malfunctions external to cards. This table contains columns which give the possible symptom, probable cause and recommended procedure to correct the malfunction. These are grouped by major circuits. This table is used in conjunction with table 3-3 which references specific troubleshooting procedures.

c. *Defective Module Replacement.*—Once it has been determined that a card is defective, tables 3-5 through 3-19 describe the steps required to locate and replace defective modules on each card. Each table contains columns which give the step number, the preliminary procedure, an observation point at which the signal may be found, the normal indication to be found at that observation point and the corrective procedure to follow if the indication is abnormal.

3107. **Test Extender Card and KG Test Adapter (fig. 3-51).**— When testing or troubleshooting the KW-7 equipment, it is often necessary to monitor certain signals that are not available at the test-point connectors of the individual cards. The test extender card, in serving as an extension of a card, permits the required observations to be made. Prior to the test, the applicable card is removed from the KW-7 and replaced by the extender card. Insertion of the card under test into the mating receptacle of the extender card positions the card above the wire nest and thus provides access to its connector and printed wiring. In testing the Key Generator, card E-AJL(A4) is removed from its slot and replaced by the extender card; the KG (key generator) test adapter is installed in the extender card and card E-AJL is inserted into the adapter. All of the components involved in this procedure are mechanically keyed for proper assembly. The subparagraphs following describe the operational theory of the test adapter and the procedures to be followed for obtaining key generator test patterns shown in figure 3-52.

a. *KG-Test Requirements.*—The development of the test patterns requires that the Key Generator be forced into a short cycle. This requirement is satisfied by substituting the output of Fibonacci stage 35 for the normal input (A) to the first stage of the Fibonacci shift register, thus forming a closed loop for the first 35 stages of the register. Introduction of a pattern by the initial set pulse causes the shift register to produce test pattern of a short predictable nature.

(1) Loop-Output Message Control.—The Z1 signal, generated on card E-AJM, is routed to card E-AJL and then to the test adapter to permit control of the loop-output message during the test pattern generation.

(2) Loop-Output Gate Control.—Grounding the *DS* signal, normally active when the KW-7 enters the Normal mode, provides a down shift in signal level of the loop-output control signal (LOCO) to a logical ZERO that allows the test patterns to be gated through the Loop-Output gate.

(3) Auto Key Generator Test.—Grounding the output of the M flip-flop forces the $\overline{M}$ signal to a logical ZERO. This permits testing of the Auto Key Generator and its contribution to the final key formation.

(4) Test Pattern Circulation Control.—The Special Point Pulse Dilation circuit must be inhibited by grounding the $\overline{SP}$ signal during the test to ensure that the test patterns being circulated throughout the Fibonacci shift register are not disturbed.

(5) Fibonacci Drive Pulse Control.—To provide Fibonacci Drive Pulse Control when testing a single KW-7, the I&N flip-flop must be set to a ONE state. This is accomplished by collector setting the I&N flip-flop. In order to provide consistently repeatable test patterns, the I&N flip-flop cannot be set randomly. It must be set so that the circulating Fibonacci pattern is synchronized with the Output Counter. This is accomplished by setting the I&N flip-flop with a P pulse.

b. *KG TEST ADAPTER Switching Arrangements and Test Probe.*—The KG Test Adapter is provided with two pushbutton switches and a test probe, each performing a separate function. The following defines the function and operation of each:

(1) SP Switch.—The SP switch allows the Special Point Dilation circuit to resume its normal function by removing the ground from the $\overline{SP}$ signal.

(2) TEST CYCLE START Switch.—The TEST CYCLE START switch allows the technician to initiate the test pattern printout without depending upon another KW-7 to provide indicator characters.

(3) KG TEST ADAPTER Test Probe.—The test probe on the KG Test Adapter is used only when the key generator is being tested. The test probe allows the technician to insert various signals into the key generator Z stream. This allows the various patterns to be generated. Figure 3-52 illustrates the test patterns and the points at which they are to be found.

c. *Key Generator Test Procedures.*—The following procedures define the requirements for using the KG Test Adapter to check the key generator.

WARNING: FOR THE KEY GENERATOR TESTS, THE KW-7 MUST BE DISCONNECTED FROM THE LINE.

(1) Be sure power is turned off.

(2) Set the permuter patch cords as shown in table 2-8.

(3) Remove card E-AJL (A4) and replace it with the test extender card.

(4) Insert the KG test adapter into the test extender card.

(5) Insert card E-AJL in the mating receptacle of the KG test adapter.

(6) Turn the power on.

(7) Place the KG-extender test probe in TP-8 of card E-AJP.

(8) Press the TEST CYCLE START pushbutton.

(9) Observe the page printer for a continuous T pattern (see pattern 1 of fig. 3-52).

(10) If the teletypewriter has an automatic line feed and carriage return, proceed to step (11). If the teletypewriter does not have an automatic line feed and carriage return, a manual line feed and carriage return should be supplied when the pattern is printed out to the end of the line. This will prevent possible damage to the teletypewriter platen.

(11) Repeat the procedure for the other twelve key generator test points indicated in figure 3-52.

(12) The following points should be kept in mind when checking the key generator patterns.

(a) Test pattern number 5 consists of E, T, carriage return, E, T, etc. If this test is allowed to run for an excessive length of time there is a possibility that there will be damage to the teletypewriter platen.

(b) After observing a series of X's during test pattern No. 6, depress the SP pushbutton and observe the page printer for a QVKX pattern. Following this operation, the KW-7 must be recycled. This is accomplished by placing the POWER switch in the OFF position for approximately 5 seconds and then turning it to ON again. Press the TEST CYCLE START pushbutton to start the test pattern again.

(c) Allow a few random letters at the beginning of each test cycle before the indicated test pattern begins to be printed.

d. Card Test Procedure.— Remove the card to be tested and insert it in the Test Extender Card. Place the extender card in the applicable card slot.

3108. Power Supply.— In addition to the troubleshooting tables previously described, the power supply has a troubleshooting table to aid the technician. Table 3-2Ø describes those steps required to effectively troubleshoot and repair the power supply.

TABLE 3-3.—OBSERVABLE SYMPTOMS

Symptom	Probable Cause	Recommended Procedure
POWER SOURCE		
Step		
1. Voltages not present at test points located on card E-AJV: + 6V - TP-13 - 6V - TP-12 -18V - TP-16 -4ØV - TP-1Ø -53V - TP-8	Defective power supply	Proceed to Table 3-4, Procedure 1.
2. Voltages not present at Power Supply test points: + 6V - J3 - 6V - J4 -18V - J5 -24V - J6 -53V - J1	Defective power supply	Proceed to Table 3-4, Procedure 2.
3. POWER ON lamp does not light.	Defective POWER ON lamp	Proceed to Table 3-4, Procedure 3.
4. All lamps except power indicators do not go out within 1Ø seconds after POWER switch is turned on.	Defective set driver	Proceed to Table 3-4, Procedure 4.
5. PLAIN lamp does not light when the KW-7 is in the Plain Condition.	Defective PLAIN lamp	Proceed to Table 3-4, Procedure 5.
6. PLAIN lamp does not light when the Remote Control Unit is in the Plain mode.	Defective PLAIN lamp	Proceed to Table 3-4, Procedure 6.
7. READY lamp on Functional Remote Control Unit does not light when operational control is transferred from the KW-7.	Defective READY lamp	Proceed to Table 3-4, Procedure 7.
SEND CIRCUIT		
8. Send lamp does not light when the SEND pushbutton is pressed.	Defective send lamp	Proceed to Table 3-4, Procedures 8, 9 and 1Ø.
9. Phasing characters are not present on the line when the SEND pushbutton is pressed.	Defective output counter	Proceed to Table 3-4, Procedure 11.
1Ø. The KW-7 does not leave the phasing mode when the SEND pushbutton is released.	Defective randomizer	Proceed to Table 3-4, Procedure 12.
PHASING DETECTOR		
11. SEND lamp does not go out when phasing characters are on the line-in circuit.	Defective line-in relay	Proceed to Table 3-4, Procedures 13, 14 and 15.
P&I CIRCUIT		
12. P&I lamp does not light when phasing characters are on the line.	Defective line-in relay	Proceed to Table 3-4, Procedures 16 and 17.
13. P&I lamp does not light when the SEND pushbutton is pressed.	Defective P&I lamp	Proceed to Table 3-4, Procedures 17, 18 and 19.

TABLE 3-3 (Continued)

Symptom	Probable Cause	Recommended Procedure
LINE-OUT CIRCUIT		
14. Line-out malfunction: no line-out activity or garbled line-out signal.	Faulty line-out relay	Proceed to Table 3-4, Procedures 20, 21 and 22.
KEY GENERATOR		
15. Check the Key Generator using the KG Test Adapter and Test Extender Card.	Defective combiner circuit	Proceed to Table 3-4, Procedure 23.
LOOP-OUT CIRCUIT		
16. Rotation of the LOOP OUTPUT ADJUST potentiometer does not adjust loop current.	Defective digital-to-analog module	Proceed to Table 3-4, Procedures 24 and 25.
17. Loop-out malfunction: no local copy, garbled copy or local teletypewriter runs open.	Defective digital-to-analog module	Proceed to Table 3-4, Procedures 26 through 33.
18. Alarm circuit fails to activate the audible alarm in Plain, Break or Alarm conditions.	Defective lamp driver	Proceed to Table 3-4, Procedures 34 through 36.
19. Incorrect audible tone from the audible alarm.	Defective clock generator	Proceed to Table 3-4, Procedure 37.
20. Audible alarm becomes active in the Cipher mode when a Break or Alarm is not present.	Defective lamp driver	Proceed to Table 3-4, Procedure 38.
BREAK CIRCUIT		
21. BREAK lamp is on all the time.	Defective control circuit	Proceed to Table 3-4, Procedure 39.
22. BREAK lamp does not light when the BREAK pushbutton is pressed.	Defective BREAK lamp	Proceed to Table 3-4, Procedures 40 and 41.
23. Break is not transmitted when the BREAK pushbutton is pressed.	Defective line-out flip-flop	Proceed to Table 3-4, Procedure 42.

TABLE 3-3 (Continued)

Symptom	Probable Cause	Recommended Procedure
24. BREAK RESTORE pushbutton fails to reset BREAK lamp when pressed.	Defective break flip-flop	Proceed to Table 3-4, Procedures 43 and 44.
25. BREAK FUNCTION switch will not inhibit Break.	Defective BREAK FUNCTION switch	Proceed to Table 3-4, Procedure 45.
26. BREAK lamp does not go out when there are phasing characters on the line.	Defective line-in relay	Proceed to Table 3-4, Procedure 46.
EQUIPMENT ALARMS		
27. There is an Alarm indication in either the Plain or Cipher condition.	Defective inverter	Proceed to Table 3-4, Procedure 47.
28. MI indication.	Defective randomizer	Proceed to Table 3-4, Procedure 48.
29. The KW-7 will not pass the ALARM TEST switch check.	Defective alarm check circuit	Proceed to Table 3-4, Procedure 49.
SPEED SELECTOR CIRCUIT		
30. Rotation of WPM SPEED SELECTOR switch does not alter speed of clock circuit.	Defective clock circuit	Proceed to Table 3-4, Procedure 50.
TWO-WIRE LOOP ADAPTER UNIT		
31. Two-Wire Loop Adapter Unit malfunctions.	Defective relay	Proceed to Table 3-4, Procedures 51 through 53.
EXTERNAL 100 KC SOURCE		
32. The KW-7 will not operate on an external 100 KC input.	Insufficient signal amplitude	Proceed to Table 3-4, Procedure 54.
TD STEP		
33. The TD Step malfunctions.	Defective relay	Proceed to Table 3-4, Procedures 55 and 56.

TABLE 3-4—REPLACING DEFECTIVE CARDS AND REPAIRING TROUBLES EXTERNAL TO CARDS

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
1	Voltages not present at test points located on card E-AJV: + 6V - TP-13 - 6V - TP-12 -18V - TP-16 -53V - TP-8 -40V - TP-10	Defective Power Supply	1	Check voltages at Power Supply test points. If normal proceed to Procedure 2; if abnormal proceed to Step 2.
		Broken etch on card E-AJV or a broken wire in the KW-7	2	Replace card E-AJV and/or check the KW-7 wiring.
		Defective digital-to-analog module	3	Replace card E-AJV.
		Defective -40 volt regulator	4	Check transistor 1A18Q1.
		Broken wire in the Power Supply	5	Check the Power Supply wiring.
2	Voltages not present at Power Supply test points: + 6V - J3 - 6V - J4 -18V - J5 -24V - J6 -53V - J1	Blown fuse	1	Check Power Supply fuses.
		Defective Power Supply	2	Replace Power Supply.
		Open filter	3	Check the Filter Unit Wiring.
		Defective POWER switch	4	Check the Power Switch wiring.
		Broken wire in the Power Supply	5	Check the Power Supply wiring.
		Primary input power missing	6	Check input power cables (W1 or W2). If cable checks normal it will be necessary to check the Filter Unit and KW-7 wiring for a short circuit.
3	Power ON lamp does not light.	Defective Power ON lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the KW-7	3	Check the KW-7 wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
4	Indicator lamps do go out within 10 seconds after the POWER switch is turned on.	Defective set driver	1	Replace card E-AJN.
		Defective Miss Pulse Generator	2	Replace card E-AJP.
		Broken wire in the KW-7	3	Check the KW-7 wiring.
5	PLAIN lamp does not light when the KW-7 is operated in the Plain mode.	Defective PLAIN lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the KW-7	3	Check the KW-7 wiring.
6	PLAIN lamp does not light when the Remote Control Unit is operated in the Plain mode.	Defective PLAIN lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.
		Open or shorted wire in remote cable (W4)	4	Check cable continuity.
7	READY lamp on Functional Remote Control Unit does not light when operational control is transferred from the KW-7 to the Functional Remote Control Unit.	Defective READY lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the Functional Remote Control Unit	3	Check the Functional Remote Control Unit.
		Open or shorted wire in remote cable (W4)	4	Check cable continuity.
8	Send lamp does not light when the KW-7 SEND push-button is pressed.	Defective SEND lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
8 (Cont.)		Broken wire in the KW-7	3	Check the KW-7 wiring.
		Defective Control flip-flop	4	Replace card E-AJN.
		Defective Phasing or Input Counter	5	Replace card E-AJP.
		Defective lamp driver	6	Replace card E-AJU.
		Defective Output Counter	7	Replace card E-AJR.
		Defective Clock Circuit	8	Replace card E-AJQ.
		Defective Time Standard	9	Replace the Time Standard (E-AJY).
		Defective SEND switch	10	Check the SEND switch wiring.
9	Remote Control Unit SEND lamp does not light when the SEND pushbutton is pressed.	Defective SEND lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.
		Open wire in W4 (remote cable)	4	Check cable W4 for continuity.
		Broken wire in the KW-7	5	Check the KW-7 wiring.
		Defective lamp driver	6	Replace card E-AJU.
		Defective lamp driver in the Remote Control Unit	7	Replace the Remote Control Unit lamp driver.
10	Functional Remote Control Unit	Defective SEND lamp	1	Check lamp continuity.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
10	SEND lamp does not light when the SEND pushbutton is depressed.	Defective lamp socket	2	Check lamp socket wiring.
		Broken wire in the Functional Remote Control Unit	3	Check Functional Remote Control Unit wiring.
		Open wire in remote cable (W4)	4	Check cable W4 for continuity.
		Broken wire in KW-7	5	Check KW-7 wiring.
		Defective lamp driver	6	Replace card E-AJU.
		Defective lamp driver in Functional Remote Control Unit	7	Replace the Functional Remote Control Unit lamp driver.
11	Phasing characters are not present on the line when the SEND pushbutton is pressed.		1	If the SEND lamp is on proceed to Step 2. If the SEND lamp is off repeat Procedure 7.
		Defective Output Counter	2	Replace card E-AJR.
		Defective Control Circuit	3	Replace card E-AJN.
		Defective line-out Circuit	4	Refer to Procedure 28.
		Defective line-out relay	5	Replace line-out relay.
12	KW-7 does not leave phasing mode when the SEND pushbutton is released.	Defective Randomizer	1	Replace card E-AJV.
		Defective Combiner Circuit	2	Replace card E-AJW.
		Defective Indicator Counter	3	Replace card E-AJT.
		Defective Output Counter	4	Replace card E-AJR.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
12 (Cont.)		Defective Extensor	5	Replace card E-AJS.
		Broken wire in the KW-7.	6	Check the KW-7 wiring.
13	SEND lamp does not go out when phasing characters are on the line-in circuit.	Defective Loop-In circuit	1	Replace card E-AJU.
		Defective Phasing Counter	2	Replace card E-AJP.
		Defective Control Circuit	3	Replace card E-AJN.
		Defective Clock Circuit	4	Replace card E-AJQ.
		Defective Line-In relay	5	Replace relay 1A18K1.
		Defective Time Standard	6	Replace the Time Standard (E-AJY).
		Defective filter	7	Check the Filter Unit wiring.
		Broken wire in the KW-7	8	Check the KW-7 wiring.
14	SEND lamp does not go out in the Remote Control Unit.		1	If the SEND lamp in both the KW-7 and the Remote Control Unit do not go out repeat Procedure 13; if only the KW-7 SEND lamp goes out proceed to Step 2.
		Defective lamp driver	2	Replace the Remote Control Unit lamp driver.
		Open or shorted wire in cable W4 (remote)	3	Check cable W4 for continuity.
		Broken or shorted wire in the Remote Control Unit.	4	Check the Remote Control Unit wiring.
15	SEND lamp does not go out in the Functional Remote Control Unit.		1	If the SEND lamp in both the KW-7 and the Functional Remote Control Unit doesn't go out, repeat procedure 13; if only the KW-7 SEND lamp goes out, proceed to step 2.
		Defective lamp driver	2	Replace the Functional Remote Control Unit lamp driver.
		Open or shorted wire in remote cable (W4)	3	Check cable W4 for continuity.
		Broken or shorted wire in the Functional Remote Control Unit	4	Check the Functional Remote Control Unit wiring.
		KW-7 wiring	5	Check KW-7 wiring to Remote connector J1.
16	P&I lamp does not light when there are phasing characters on the line.	Defective P&I lamp	1	Check P&I lamp continuity.
		Defective Loop-In Circuit	2	Replace card E-AJU.
		Defective Phasing Counter	3	Replace card E-AJP.
		Defective Control Circuit	4	Replace card E-AJN.
		Defective gate	5	Replace card E-AJM.
		Defective lamp driver	6	Replace card E-AJR.
		Defective Clock Circuit	7	Replace card E-AJQ.
		Defective Line-In relay	8	Replace relay 1A18K1.
		Defective Time Standard	9	Replace the Time Standard (E-AJY).
		Defective filter	10	Check the Filter Unit wiring.
		Defective lamp socket	11	Check the lamp socket wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Causes(s)	Step	Recommended Procedure
16 (Cont.)		Broken wire in the KW-7	12	Check the KW-7 wiring.
17	P&I lamp will not light when the SEND pushbutton is pressed.		1	If the SEND lamp is on but the P&I lamp is not, proceed to Step 2. If the SEND lamp is not on repeat Procedure 8.
		Defective P&I lamp	2	Check lamp continuity.
		Defective lamp socket	3	Check lamp socket wiring.
		Defective lamp driver	4	Replace card E-AJR.
		Defective gate	5	Replace card E-AJM.
		Defective Phasing Counter	6	Replace card E-AJP.
		Defective BG flip-flop	7	Replace card E-AJN.
		Shorted module	8	Replace card E-AJU.
		Broken wire in the KW-7	9	Check the KW-7 wiring.
18	Remote Control Unit P&I lamp will not light when the SEND pushbutton is pressed.		1	If the KW-7 P&I lamp is on but the Remote Control Unit P&I lamp is not, proceed to Step 2; if both lamps are out repeat Procedure 9.
		Defective P&I lamp	2	Check lamp continuity.
		Defective lamp socket	3	Check lamp socket wiring.
		Open or shorted wire in cable W4 (Remote)	4	Check cable W4 for continuity.
		Broken wire in the Remote Control Unit	5	Check the Remote Control Unit wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Causes(s)	Step	Recommended Procedure
18		Broken wire in the KW-7	6	Check the KW-7 wiring.
		Defective lamp driver	7	Replace the Remote Control Unit lamp driver.
19	Functional Remote Control Unit P&I lamp will not light when the SEND pushbutton is pressed.		1	If the KW-7 P&I lamp is ON and the Functional Remote Control Unit P&I lamp is OUT, proceed to Step 2; if both lamps are out, repeat Procedure 9.
		Defective P&I lamp	2	Check lamp continuity.
		Defective lamp socket	3	Check lamp socket wiring.
		Open or shorted wire in cable W4 (remote)	4	Check cable W4 for continuity.
		Broken wire in the Functional Remote Control Unit	5	Check the Functional Remote Control Unit Wiring.
		Broken wire in the KW-7	6	Check the KW-7 wiring.
		Defective lamp driver	7	Replace the Functional Remote Control Unit lamp driver.
20	KW-7 Line-Out Malfunction: no line-out activity or garbled line-out signals.		1	If malfunction occurs in either Plain or Cipher mode proceed to Step 2; if malfunction occurs in the Cipher mode only, proceed to Procedure 23.
		No Loop-In signal	2	Replace card E-AJU.
		Defective Input Counter	3	Replace card E-AJP.
		Defective Extensor	4	Replace card E-AJS.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
20 (Cont.)		Signals AO and BO not complementing	5	Replace card E-AJT.
		Set pulse missing	6	Replace card E-AJN.
		Defective Output Counter	7	Replace card E-AJR.
		Defective Z Stream Combiners	8	Replace card E-AJM.
		Open gate in Output	9	Replace card E-AJW.
		Open relay	10	Replace card E-AJO.
		Defective digital-to-analog module.	11	Replace card E-AJV.
		Defective Clock Circuit	12	Replace card E-AJQ.
		Defective Line-Out relay	13	Replace relay 1A18K2.
		Defective Time Standard	14	Replace the Time Standard (E-AJY).
		Defective output transistor	15	Check transistors 1A18Q3 and 1A18Q4.
		Defective filter	16	Check the Filter Unit wiring.
		Broken wire in the KW-7	17	Check the KW-7 wiring.
			18	If malfunction occurs in Cipher mode only proceed to Key Generator check using Procedure 23.
21	Line-Out malfunction while using Remote Control Unit.		1	If malfunction occurs while using either the KW-7 or the Remote Control Unit proceed to Procedure 23, if the malfunction occurs while using the Remote Control Unit only, proceed to Step 2.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
21		Open or shorted wire in cable W4 (remote)	2	Check cable W4 for continuity.
		Broken wire in the Remote Control Box	3	Check the Remote Control Unit wiring.
22	Line-out malfunction while using Functional Remote Control Unit.		1	If malfunction occurs while using either the KW-7 or the Functional Remote Control Unit, proceed to Procedure 23; if the malfunction occurs while using the Functional Remote Control Unit only, proceed to Step 2.
		Open or shorted wire in remote cable (W4)	2	Check cable W4 for continuity.
		Broken wire in the Functional Remote Control Unit	3	Check Functional Remote Control Unit wiring.
23	Key Generator check using the KG Test Adapter and Test Extender Card: Pattern 1 is not present at card E-AJL, test point TP-8.		1	Refer to paragraph 3107 for the discussion of the KG Test Adapter and Extender Card.
		Short or open in patch cord	2	Check the patch cord wiring.
		Defective module in stages 33 through 35	3	Replace card E-AJL.
		Lack of F drive pulses	4	Replace card E-AJN.
		Defective module in stages 1 through 16	5	Replace card E-AJK.
		Defective module in stages 17 through 32	6	Replace card E-AJJ.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
23 (Cont.)		Broken wire in the KW-7	7	Check the KW-7 wiring.
	Pattern 2 is not present at card E-AJO, test point TP-6.	Defective module in stages 36 through 39	8	Replace card E-AJL.
		Broken wire in the KW-7	9	Check the KW-7 wiring.
	Pattern 3 is not present at card E-AJL, test point TP-16.	Defective A Stream Combiner	10	Replace card E-AJL.
		Broken wire in the KW-7	11	Check the KW-7 wiring.
	Pattern 4 is not present at card E-AJO, test point TP-4.	Defective ASP Generator	12	Replace Card E-AJW.
		Broken wire in the KW-7	13	Check the KW-7 wiring.
		Open or shorted patch cord	14	Check patch cords 25-30 for continuity.
	Pattern 5 is not present at card E-AJJ, test point TP-19.	Defective $\overline{p}$ Combiners	15	Replace card E-AJJ.
		Shorted module	16	Replace card E-AJL.
		Broken wire in KW-7	17	Check the KW-7 wiring.
		Open or shorted patch cord	18	Check patch cords 19-24 for continuity.
	Pattern 6 is not present at card E-AJJ, test point TP-14.	Defective $\overline{q}$ Combiners	19	Replace card E-AJJ.
		Shorted module	20	Replace card E-AJM.
		Broken wire in the KW-7	21	Check the KW-7 wiring.
	Pattern 6 is not present at card	Defective Pulse Deletion Circuit	22	Replace card E-AJL.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
23	E-AJJ, test point TP-14 when SP push-button is pressed.			
	Pattern 7 is not present at card E-AJK, test point TP-14.	Open or shorted patch cord	23	Check patch cords 13-18 for continuity.
		Defective $\overline{r}$ Combiners	24	Replace card E-AJK, E-AJJ.
		Shorted module	25	Replace card E-AJL.
		Broken wire in the KW-7	26	Check the KW-7 wiring.
	Pattern 8 is not present at card E-AJK, test point TP-16.	Open or shorted patch cords	27	Check patch cords 7-12 for continuity.
		Defective $\overline{s}$ Combiners	28	Replace card E-AJK.
		Shorted module	29	Replace card E-AJL.
		Broken wire in the KW-7	30	Check the KW-7 wiring.
	Pattern 9 is not present at card E-AJK, test point TP-15.	Open or shorted patch cord	31	Check the patch cords 1-6 for continuity.
		Defective $\overline{t}$ Combiner	32	Replace card E-AJK.
		Shorted module	33	Replace card E-AJL.
		Broken wire in the KW-7	34	Check the KW-7 wiring.
	Pattern 10 is not present at card E-AJM, test point TP-7.	Defective $\overline{x}$ Combiner	35	Replace card E-AJM.
		Defective YN Combiner	36	Replace card E-AJL.
		Broken wire in the KW-7	37	Check the KW-7 wiring.
	Pattern 11 is not present at card E-AJO, test point TP-13.	Defective Auto Key Generator	38	Replace card E-AJM, E-AJO.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
23 (Cont.)		Defective M Generator	39	Replace card E-AJT.
		Broken wire in the KW-7	40	Check the KW-7 wiring.
	Pattern 12 is not present at card E-AJO, test point TP-3.	Defective W Combiner	41	Replace card E-AJM, E-AJO.
		Defective YN Combiner	42	Replace card E-AJL.
		Shorted module	43	Replace card E-AJO.
	Pattern 13 is not present at card E-AJM, test point TP-1.	Defective K Combiner	44	Replace card E-AJM.
	No defect in Key Generator test procedure but cipher test is garbled.	Defective module not detected by Key generator Test Procedure	45	Replace cards in the following sequence: E-AJM, E-AJL, E-AJK and E-AJJ.
		Broken wire in the KW-7	46	Check the KW-7 wiring.
24	Rotation of LOOP OUTPUT ADJUST potentiometer fails to adjust loop-out current.		1	Check for -40 volts at card E-AJV, test point TP-10, if present proceed to Step 2 if not present repeat Procedure 1.
		Defective digital-to-analog module	2	Replace card E-AJV.
		Defective current regulator	3	Check transistors 1A18Q7 and 1A18Q8.
		Defective Current Control	4	Check transistors 1A18Q5 and 1A18Q6.
		Open potentiometer	5	Measure resistance of the LOOP OUTPUT ADJUST potentiometer 1R10.
		Open filter	6	Check the Filter Unit wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
24		Broken wire in the KW-7	7	Check the KW-7 wiring.
25	No Loop-Out current when the Remote Control Unit is used with the KW-7.	Open filter in the Remote Control Unit	1	Check the Remote Control Unit wiring.
		Open or shorted wire in remote cable (W4)	2	Check cable W4 for continuity.
		Broken wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.
26	KW-7 Loop-Out malfunction (send or receive mode): no local copy or garbled local copy.		1	Check for -40 volts at card E-AJV, test point TP-10; if present proceed to Step 2, if not present repeat Procedure 1.
		Defective Loop-Inhibit switch	2	Continuity check Loop-Inhibit switch.
		Defective digital-to-analog module	3	Replace card E-AJV.
		Defective Loop-Out flip-flop	4	Replace card E-AJU.
		Defective M generator	5	Replace card E-AJT.
			6	Replace card E-AJW.
		Defective Control Circuit	7	Replace card E-AJN.
		Defective Output Counter	8	Replace card E-AJR.
		Defective Input Counter	9	Replace card E-AJP.
		Defective Clock Circuit	10	Replace card E-AJQ.
		Defective Time Standard	11	Replace Time Standard (E-AJY).

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
26 (Cont.)		Defective -4Ø volt Voltage Regulator	12	Check transistor 1A18Q1.
		Defective Current Control	13	Check transistors 1A18Q5 and 1A18Q6.
		Defective Current Regulator	14	Check transistors 1A18Q7 and 1A18Q8.
		Broken wire in KW-7	15	Check KW-7 wiring.
		Open filter	16	Check the Filter Unit wiring.
		Open or shorted wire in loop cables	17	Check continuity of loop cables.
27	KW-7 Loop-Out malfunction (send mode only): no local copy or garbled local copy.	Defective LOOP OUTPUT (INHIBIT or ALLOW) switch	1	Check the LOOP OUTPUT switch wiring.
		Defective loop-out flip-flop	2	Replace card E-AJV.
			3	Repeat Procedure 26.
28	KW-7 Loop-Out malfunction (Receive Plain and Cipher mode): no local copy or garbled local copy.	Defective Extensor	1	Replace card E-AJS.
		Defective K Stream Combiner	2	Replace card E-AJM.
		Defective Line-In relay	3	Replace relay 1A18K1.
			4	Repeat Procedure 26.
29	KW-7 Loop-Out malfunction (Cipher mode only): no local copy or garbled local copy.	Defective Key Generator	1	Repeat Procedure 23.
3Ø	Loop-Out malfunction using Remote Control Unit.	Open or shorted wire in cable W4 (remote)	1	Check cable W4 for continuity.
		Open filter	2	Check the Filter Unit Wiring.
		Broken wire in the Functional Remote Control Unit	3	Check the Remote Control Unit wiring.
31	Loop-Out malfunction using Functional Remote Control Unit.	Open or shorted wire in remote cable (W4)	1	Check cable W4 for continuity.
		Open filter wiring	2	Check Filter Unit wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
31 (Cont.)		Broken wire in the Functional Remote Control Unit	3	Check the Functional Remote Control Unit wiring.
32	Local TTY runs open.	Defective digital-to-analog module	1	Replace card E-AJV.
		Defective Loop-In Circuit	2	Replace card E-AJU.
			3	Repeat Procedure 26.
33	Local TTY runs open when using the Remote Control Unit.	Open or shorted wire in cable W4 (remote)	1	Check cable W4 for continuity.
		Open wire in the Remote Box	2	Check the Remote Control Unit wiring.
		Open wire in the KW-7	3	Check the KW-7 wiring.
34	Audible alarm fails to sound in Plain, Break or Alarm conditions.	Defective lamp driver	1	Replace card E-AJW.
		Defective relay	2	Replace card E-AJO.
		Defective Clock Circuit	3	Replace card E-AJQ.
		Defective Time Standard	4	Replace Time Standard (E-AJY).
		Defective speaker	5	Check speaker wiring.
		Open wire in the KW-7	6	Check the KW-7 wiring.
35	Audible alarm fails to sound in Remote Control Unit.	Open or shorted wire in cable W4 (remote)	1	Check cable W4 for continuity.
		Defective speaker in Remote Control Unit	2	Check speaker wiring in Remote Control Unit.
		Open wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
35 (Cont.)		Open wire in the KW-7	4	Check the KW-7 wiring.
36	Audible alarm fails to sound in Functional Remote Control Unit.	Open or shorted wire in Remote cable (W4)	1	Check cable W4 for continuity.
		Defective speaker in the Functional Remote Control Unit	2	Check speaker wiring in the Functional Remote Control Unit.
		Open wire in the Functional Remote Control Unit	3	Check the Functional Remote Control Unit wiring.
		Open wire in the KW-7	4	Check the KW-7 wiring.
37	Incorrect tone from Audible Alarm.	Defective Clock Circuit	1	Replace card E-AJQ.
		Defective Time Standard	2	Replace the Time Standard (E-AJY).
		Broken wire in the KW-7	3	Check the KW-7 wiring.
		Open resistors	4	Replace card E-AJM.
38	Audible alarm activates in the Cipher mode.		1	If the Audible alarm sounds in the Cipher mode and if the BREAK or ALARM lamp is not on perform the following: (1) Perform the ALARM TEST switch test and, if the ALARM lamp lights proceed to Step 2, if the lamp does not light, proceed to Procedure 49. (2) Generate a break and, if the BREAK lamp lights proceed to Step 2, if the lamp does not light, proceed to Procedure 48.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
38		Defective lamp driver	2	Replace card E-AJW.
		Defective driver	3	Replace card E-AJV.
		Defective relay	4	Replace card E-AJO.
		Defective Control Circuit	5	Replace card E-AJN.
		Broken wire in the KW-7	6	Check the KW-7 wiring.
39	BREAK lamp on all the time.	Defective Control circuit	1	Replace card E-AJN.
		Broken wire in the KW-7	2	Check the KW-7 wiring.
40	BREAK lamp does not light when the BREAK pushbutton is pressed.	Defective BREAK lamp	1	Check lamp continuity.
		Defective lamp socket	2	Check lamp socket wiring.
		Defective lamp driver	3	Replace card E-AJN.
		Defective Line-Out flip-flop	4	Replace card E-AJT.
		Defective BREAK switch	5	Check BREAK switch wiring.
		Broken wire in the KW-7	6	Check the KW-7 wiring.
41	Remote Control Unit BREAK lamp does not light when the BREAK pushbutton is pressed.		1	If both the KW-7 and Remote Control Unit BREAK lamps do not light repeat Procedure 40, if only the lamp in the Remote Control Unit does not light, proceed to Step 2.
		Defective Remote Control Unit BREAK lamp	2	Check lamp continuity.
		Defective lamp socket	3	Check lamp socket wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
41 (Cont.)		Defective Remote Control Unit BREAK switch	4	Check the Remote Control Unit BREAK switch wiring.
		Open or shorted wire in cable W4 (remote)	5	Check cable W4 for continuity.
		Broken wire in the Remote Control Unit	6	Check the Remote Control Unit wiring.
		Broken wire in the KW-7	7	Check the KW-7 wiring.
42	Break is not transmitted on the line when the BREAK pushbutton is pressed.		1	If the BREAK lamp is lit when the BREAK pushbutton is pressed proceed to Step 2, if the lamp does light repeat Procedure 49.
		Defective Line-Out flip-flop	2	Replace card E-AJW.
		Defective digital-to-analog module	3	Replace card E-AJV.
		Defective relay	4	Replace relay 1A18K2.
		Defective transistor	5	Check transistors 1A18Q2 and 1A18Q3.
		Open filter	6	Check the Filter Unit wiring.
		Open wire in KW-7	7	Check wiring in KW-7.
43	BREAK RESTORE switch fails to reset the BREAK lamp when pressed.	Defective Break flip-flop.	1	Replace card E-AJN.
		Broken wire in the KW-7	2	Check the KW-7 wiring.
		Defective BREAK RESTORE switch	3	Check the BREAK RESTORE switch wiring.
44	BREAK RESTORE switch in the Remote Control Unit fails to function.	Open or shorted wire in cable W4 (remote)	1	Check cable W4 for continuity.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
44		Defective Remote Control Unit BREAK RESTORE switch	2	Check the Remote Control Unit BREAK RESTORE switch wiring.
		Broken wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.
		Broken wire in the KW-7	4	Check the KW-7 wiring.
45	BREAK FUNCTION switch will not inhibit generation or detection of a Break condition.	Defective BREAK FUNCTION switch	1	Check the BREAK FUNCTION switch wiring.
		Broken wire in the KW-7	2	Check the KW-7 wiring.
46	BREAK lamp does not go out when there are phasing characters on the line.	Defective Phasing Counter	1	Replace card E-AJP.
		Defective Input Circuit	2	Replace card E-AJU.
		Defective Control Circuit	3	Replace card E-AJN.
		Defective Clock Circuit	4	Replace card E-AJQ.
		Defective relay	5	Replace relay 1A18K1.
		Defective Time Standard	6	Replace the Time Standard (E-AJY).
		Broken wire in the KW-7	7	Check the KW-7 wiring.
47	Alarm condition exists in the Plain and Cipher condition.		1	If the ALARM lamp lights in the Plain condition or during the Phasing mode proceed to Step 2. If the ALARM lamp lights in the Cipher condition during Normal mode, repeat Procedure 23.
		Defective Plain circuit	2	Replace card E-AJN.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
47 (Cont.)		Defective Alarm flip-flop	3	Replace card E-AJO.
		Key Generator Motion	4	Replace card E-AJL.
		Broken wire in the KW-7	5	Check the KW-7 wiring.
48	MI lamp lights during Cipher condition.	Defective Randomizer	1	Replace card E-AJV.
		Defective Check Circuit	2	Replace card E-AJW.
		Broken wire in the KW-7	3	Check the KW-7 wiring.
49	KW-7 will not pass Alarm test.	MI Lamp:		
		Defective MI lamp	1	Check MI lamp wiring.
		Defective Randomizer circuit	2	Replace card E-AJV.
		Defective Randomizer alarm circuit	3	Replace card E-AJW.
		Defective Output Counter	4	Replace card E-AJR.
		Defective gate	5	Replace card E-AJP.
		Defective Clock Circuit	6	Replace card E-AJQ.
		Defective Control Circuit	7	Replace card E-AJN.
		Defective Time Standard	8	Replace the Time Standard (E-AJY).
		Defective lamp socket	9	Check lamp socket wiring.
		Broken wire in the KW-7	10	Check the KW-7 wiring.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
49		ALARM Lamp:		
		Defective ALARM lamp	11	Check the ALARM lamp wiring.
		Defective Alarm Check Circuit	12	Replace card E-AJO. If still incorrect, replace card E-AJW.
		Defective Key Generator	13	Repeat Procedure 23.
		Defective lamp socket	14	Check lamp socket wiring.
		Broken wire in the KW-7	15	Check the KW-7 wiring.
		Audible Alarm:		
		Defective buzzer	16	Repeat Procedure 34.
		Defective Clock Circuit	17	Replace card E-AJQ.
50	Rotation of WPM SPEED SELECTOR switch does not change speed of clock.	Open resistors	1	Replace card E-AJM.
		Defective WPM SPEED SELECTOR switch	2	Check the WPM SPEED SELECTOR switch wiring.
		Broken wire in the KW-7	3	Check the KW-7 wiring.
51	Two-Wire Loop Adaptor Unit malfunction.		1	If both Loop-In and Loop-Out are defective proceed to Step 2.if only Loop-In proceed to Procedure 52, if only Loop-Out proceed to Procedure 53.
		Broken wire in cable	2	Check Loop-In and Loop-Out Cables.
		Defective relay	3	Replace relay 3K2.
		Defective relay	4	Replace relay 3K1.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
51 (Cont.)		Broken wire in the Two-Wire Loop Adapter Unit	5	Check the Two-Wire Loop Adapter Unit wiring.
52	Two-Wire Loop Adapter Unit Loop-In malfunction.	Defective relay	1	Replace relay 3K1.
		Broken wire in cable	2	Check the Loop-In cable for continuity.
		Broken wire in the Two-Wire Loop Adapter Unit	3	Check the Two-Wire Loop Adapter Unit wiring.
			4	Repeat Procedure 26.
53	Two-Wire Loop Adaptor Unit Loop-Out malfunction.	Defective relay	1	Replace relay 3K2.
		Broken wire in cable	2	Check the Loop-Out cable for continuity.
		Broken wire in box	3	Check the Two-Wire Loop Adapter Unit wiring.
			4	Repeat Procedure 26.
54	Equipment will not operate on an external 1ØØ KC source.	Insufficient voltage	1	Check the input signal for proper amplitude (6 volt square wave).
		Defective Clock Circuit	2	Replace card E-AJQ.
		Defective AUX. FREQ. INPUT jack	3	Check the external 1ØØ KC jack wiring.
		Open wire in the KW-7	4	Check the KW-7 wiring.
55	T.D. Step malfunction.	Defective Relay	1	Replace card E-AJV.
		Defective gate	2	Replace card E-AJW.
		Defective Output Counter	3	Replace card E-AJR.
		Defective Alarm Circuit	4	Replace card E-AJO.
		Defective Control Circuit	5	Replace card E-AJN.

TABLE 3-4 (Continued)

Procedure	Symptom	Probable Cause(s)	Step	Recommended Procedure
55		Defective T.D. Step switch	6	Check the T.D. STEP wiring.
		Defective relay	7	Replace relay 1A18K3.
		Defective transistor	8	Check transistor 1A18Q2.
		Open filter	9	Check the Filter Unit wiring.
		Broken wire in the KW-7	1Ø	Check the KW-7 wiring.
56	Step T.D. does not operate with the Remote Control Unit.	Open or shorted wire in cable W4 (remote)	1	Check cable W4 for continuity.
		Defective relay	2	Replace relay 2K1.
		Broken wire in the Remote Control Unit	3	Check the Remote Control Unit wiring.
		Open or shorted diode	4	Check diodes 2CR1 and 2CR2.
57	Step T.D. does not operate with the Functional Remote Control Unit.	Open or shorted wire in remote cable (W4)	1	Check cable W4 for continuity.
		Defective relay	2	Replace relay 4K1.
		Broken wire in the Functional Remote Control Unit	3	Check the Functional Remote Control Unit wiring.
		Open or shorted diode	4	Check diode 4CR1.

TABLE 3-5.—E-AJK (A1) DEFECTIVE MODULE REPLACEMENT (figs. 3-3 and 3-4)

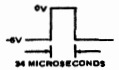
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJL and replace it by a Test Extender Card. Insert the KG Test Adapter in the Extender Card and then install card E-AJL in the adapter.				
2	Remove card E-AJK and place it in Extender Card. Place the Extender Card in the E-AJK slot.				
3	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
4	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse. Press the E-AJL KG Test Adapter Card TEST CYCLE START pushbutton.	Pins 1 and 8 of MD1-MD16.		Proceed to Step 5.	Continuity check card etch.
5	Ground pin 1Ø of MD1.	Pin 1Ø of MD2-MD16. Pin 3 of MD2-MD16.	Ø volts -6 volts	Proceed to Step 6.	Replace defective module.
6	Ground Test Point TP-2.	Pin 1Ø of MD1. Pin 3 of MD1.	Ø volts -6 volts	Proceed to Step 7.	Replace MD1.
7	Lift pin 8 of MD1.	Pin 1Ø of MD1.	-6 volts	Proceed to Step 8.	Replace MD1.
8	Ground test point TP-3.	Pin 3 of MD1.	Ø volts	Proceed to Step 9.	Replace MD1.
9	Rotate the PCR switch to generate a Set pulse.	Pin 1Ø of MD1-MD16.	Ø volts	Proceed to Step 1Ø.	Replace defective module.
1Ø	Resolder pin 8 of MD1.			Proceed to Step 11.	
11	Check jacks J2-J17 for defects.		Continuity	Proceed to Step 12.	Replace defective jack.
12	Check plugs P1, P2, P6, P7, P11 and P12.		Continuity	Proceed to Step 13.	Replace defective plug.
13	Open circuit plugs P1, P2, P6, P7, P11 and P12.	TP-15	Ø volts	Proceed to Step 14.	Replace MD18 and MD19.
14	Ground plugs P1, P2, P6, P7, P11 and P12 (shell to tip to ground).			Proceed to Step 15.	
15	Lift pins 11 and 12 of MD18.	TP-15	-6 volts	Proceed to Step 16.	Replace MD17.
16	Resolder pins 11 and 12 of MD18.			Proceed to Step 17.	
17	Open circuit plugs P3, P4, P8, P9, P13 and P14.	TP-16	Ø volts	Proceed to Step 18.	Replace MD19 and MD2Ø.

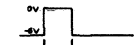
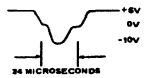
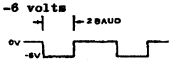
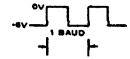
TABLE 3-5 (Continued)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
18	Ground plugs P3, P4, P8, P9, P13 and P14 (shell to tip to ground).			Proceed to Step 19.	
19	Lift pins 11 and 12 of MD2Ø.	TP-16	-6 volts	Proceed to Step 2Ø.	Replace MD19.
2Ø	Resolder pins 11 and 12 of MD2Ø.			Proceed to Step 21.	
21	Open circuit plugs P5, P1Ø and P15.	TP-14	Ø volts	Proceed to Step 22.	Replace MD21.
22	Ground plugs P5, P1Ø and P15 (shell to tip to ground).	TP-14	-6 volts	Proceed to Step 23.	Replace MD21.
23	Continuity check board etch.		Continuity		Repair etch.

TABLE 3-6.—E-AJJ (A2) DEFECTIVE MODULE REPLACEMENT (figs. 3-1 and 3-2)

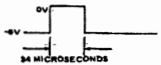
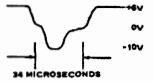
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJL and replace it by a Test Extender Card. Place the KG Test Adapter in the Extender Card and insert card E-AJL in the adapter.				
2	Remove card E-AJJ and place it in a Test Extender Card in the E-AJJ slot.				
3	Place the PCR switch in the CIPHER position and POWER switch in the ON position.				
4	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse. Press the E-AJL KG Test Adapter Card TEST CYCLE START pushbutton.	Pins 1 and 8 of MD1-MD14, MD2Ø and MD21.		Proceed to Step 5.	Continuity check card etch.
5	Ground test point TP-2.	Pin 1Ø of MD1-MD14, MD2Ø and MD21. Pin 3 of MD1-MD14, MD2Ø and MD21.	Ø volts -6 volts	Proceed to Step 6.	Replace defective module.
6	Ground test point TP-3.	Pin 1Ø of MD1-MD14, MD2Ø and MD21. Pin 3 of MD1-MD14, MD2Ø and MD21.	-6 volts Ø volts	Proceed to Step 7.	Replace defective module.
7	Rotate the PCR switch to generate a Set pulse.	Pin 1Ø of MD1-MD14, MD2Ø and MD21.	Ø volts	Proceed to Step 8.	Replace defective module.
8	Check jacks J2-J16 for defects.		Continuity	Proceed to Step 9.	Replace defective jack(s).
9	Open circuit plugs P1, P6 and P11.	TP-1	Ø volts	Proceed to Step 1Ø.	Replace MD15.
1Ø	Ground plugs P1, P6 and P11 (shell to tip to ground).	TP-1	-6 volts	Proceed to Step 11.	Replace MD15.
11	Open circuit plugs P2, P3, P7, P8, P12 and P13.	TP-14	Ø volts	Proceed to Step 12.	Replace MD16 and MD17.
12	Ground plugs P2, P3, P7, P8, P12 and P13 (shell to tip to ground).	TP-14	-6 volts	Proceed to Step 13.	
13	Lift pins 11 and 12 of MD17.	TP-14	-6 volts	Proceed to Step 14.	Replace MD16.
14	Resolder pins 11 and 12 of MD17.	TP-14	-6 volts	Proceed to Step 15.	Replace MD17.
15	Open circuit plugs P4, P5, P9, P1Ø, P14 and P15.	TP-1Ø	Ø volts	Proceed to Step 16.	Replace MD18 and MD19.
16	Ground plugs P4, P5, P9, P1Ø, P14 and P15 (shell to tip to ground).	TP-1Ø	-6 volts	Proceed to Step 17.	
17	Lift pins 11 and 12 of MD19.	TP-1Ø	-6 volts	Proceed to Step 18.	Replace MD18.
18	Resolder pins 11 and 12 of MD19.	TP-1Ø	-6 volts	Proceed to Step 19.	Replace MD19.
19	Continuity check board etch.		Continuity		Repair etch.

TABLE 3-7.—E-AJM (A3) DEFECTIVE MODULE REPLACEMENT (figs. 3-7 and 3-8)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJL and replace it by a Extender Card. Place the Test Adapter Card in the Extender Card and insert card E-AJL in the Adapter.				
2	Remove card E-AJM and place it in a Test Extender Card. Place the KG-Extender Card in the E-AJM slot.				
3	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
4	Press the KG-Extender Card TEST CYCLE START pushbutton.	Pins 1 and 8 of MD1 and MD7.		Proceed to Step 5.	Continuity check card etch.
5	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse. Press the E-AJL KG-Test Adapter Card TEST CYCLE START pushbutton.	Pin 12 of MD1-MD4 and MD5 and pin 6 of MD5 and MD6.		Proceed to Step 6.	Continuity check card etch.
6	Ground test point TP-5 located on card E-AJU.	TP-3 (E-AJM) Pin 11 of MD8 (E-AJM).	-6 volts 	Proceed to Step 7.	Continuity check card etch.
7	Ground test point TP-2.	Pin 11 of MD8.	-6 volts	Proceed to Step 8.	Replace MD8.
8	Ground pin 11 of MD8.	TP-11		Proceed to Step 9.	Replace MD1.
9	Ground pin 11 of MD8 and pin 9 of MD9.	Pin 10, in turn, of MD2, MD3, MD4, MD5 and MD6.	0 volts	Proceed to Step 10.	Replace defective module(s).
10	Ground pin 11 of MD8 and joins 6 and 8 of MD10.	Pin 10, in turn, of MD2, MD3, MD4, MD5 and MD6.	-6 volts	Proceed to Step 11.	Replace defective module(s).
11	Ground pin 11 of MD8 and pin 9 of MD9.	TP-12	-6 volts	Proceed to Step 12.	Lift, in turn, pins 11 of MD9, 2 of MD11, 2 of MD12 and 11 of MD13 until defective module is located; replace the defective module.

12	Observe at indicated test points.	Pin 1Ø of MD7, pin 11 of MD11, MD12, MD14, MD16, MD17, MD19, MD2Ø. Pin 2 of MD1Ø, MD13, MD14, and MD18, and pin 12 of MD21.	Motion at a baud rate.  (One to Zero alternations.)	Proceed to Step 13.	Replace defective module.
13	Measure the voltage at the indicated test point.	Pin 11 of MD21.	Ø volts	Proceed to Step 14.	Replace MD21.
14	Measure the voltage at the indicated test point.	Pin 2 of MD17.	Ø volts	Proceed to Step 15.	Replace MD17.
15	Continuity card etch.		Continuity		Repair etch.

TABLE 3-8.—E-AJL (A4) DEFECTIVE MODULE REPLACEMENT (figs. 3-5 and 3-6)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJL and replace it by a Test Extender Card. Place the KG Test Adapter Card in the Extender Card and insert card E-AJL in the Test Adapter.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Press the KG Test Adapter Card TEST CYCLE START pushbutton.	Pins 1 and 8 of MD1-MD1Ø.		Proceed to Step 4.	Continuity check card etch.
4	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse.	Pin 6 of MD1-MD3, MD8 and pin 12 of MD4-MD7, MD9 and MD1Ø.		Proceed to Step 5.	Continuity check card etch.
5	Press the KG Test Adapter Card TEST CYCLE START pushbutton.			Proceed to Step 6.	
6	Ground test point TP-6.	Pin 3 of MD1-MD7. Pin 1Ø of MD1-MD1Ø.	Ø volts -6 volts	Proceed to Step 7.	Replace defective module.
7	Ground pin 7 of MD1.	Pin 3 of MD1-MD7. Pin 1Ø of MD1-MD7.	-6 volts Ø volts	Proceed to Step 8.	Replace defective module.
8	Rotate the PCR switch to generate a Set pulse.	Pin 3 of MD1-MD3 and MD8. Pin 3 of MD1-MD7, MD9 and MD1Ø.	Ø volts -6 volts	Proceed to Step 9.	Replace defective module.
9	Rotate the PCR switch to the CIPHER position and press the KG Test Adapter Card TEST CYCLE START pushbutton.			Proceed to Step 1Ø.	
1Ø	Measure the waveform at the indicated test points.	TP-7	Motion at a baud rate. 	Proceed to Step 11.	Continuity check card etch.
11	Measure the waveform at the indicated test points.	Pins 2, 3, and 7 of MD8. Pins 2, 6, 7, 8, 9, and 11 of MD11.	Random motion at a baud rate. 	Proceed to Step 12.	If motion is not present at the output of each module but is present at its input, replace the defective module.

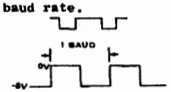
		Pins 6 and 11 of MD13. Pins 2, 6, 7, 9 and 11 of MD15. Pins 2, 6, 9, and 11 of MD16. Pins 2, 6, 7, 8 and 9 of MD17. Pins 2, 6, 9 and 11 of MD18. Pins 2 and 9 of MD19. Pins 2, 6, 7, 8 and 9 of MD2Ø. Pins 2, 6, 7, 8, 9 and 11 of MD11. Pins 2, 3, 7 and 1Ø of MD9 and Pins 2, 3, 7, and 1Ø of MD1Ø.			
12	Measure the voltage at the indicated test point.	Pin 2 of MD13.	Ø volts	Proceed to Step 13.	Replace MD13.
13	Ground pin 9 of MD13.	Pin 2 of MD13.	-6 volts	Proceed to Step 14.	Replace MD13.
14	Measure the voltage at the indicated test point.	TP-13	Ø volts	Proceed to Step 15.	Replace MD21.
15	Observe the waveform at the indicated test points.	Pins 2 and 8 of MD12.	Random motion at a baud rate.	Proceed to Step 16.	Replace MD12.
16	Observe the waveform at the indicated test point.	Pin 11 of MD19.		Proceed to Step 17.	Replace MD19.
17	Ground test point TP-2.	Pin 11 of MD 19.	-6 volts	Proceed to Step 18.	Replace MD19.
18	Continuity check module diodes.	Pins 4 and 8 of MD15. Pins 4, 5, 7 and 8 of MD16. Pins 5 and 7 of MD18.	Continuity	Proceed to Step 19.	Replace defective module.
19	Continuity check card etch.		Continuity		Repair etch.

TABLE 3-9.—E-AJO (A5) DEFECTIVE MODULE REPLACEMENT (figs. 3-11 and 3-12)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJO and place it in the Test Extender Card. Place the Test Extender Card in the E-AJO slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Ground TP-2.	TP-16	Ø volts	Proceed to Step 4.	Replace MD1Ø.
4	Measure the voltage at the indicated point.	Pin 6 of MD9.	Ø volts	Proceed to Step 5.	Replace MD9.
5	Measure the voltage at the indicated point.	Pin 2 of MD8.	Ø volts	Proceed to Step 6.	Replace MD8.
6	Measure the voltage at the indicated point.	Pin 2 of MD11.	-6 volts	Proceed to Step 7.	Replace MD11.
7	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse.			Proceed to Step 8.	
8	Ground pin 7 of MD11.	Pin 11 of MD11.	-6 volts	Proceed to Step 9.	Replace MD11.
9	Ground pin 1 of MD9.	Pin 4 of MD9.	-6 volts	Proceed to Step 1Ø.	Replace MD9.
1Ø	Ground pin 7 of MD5.	TP-15	Ø volts	Proceed to Step 11.	Replace MD5.
11	Ground test point TP-11.	Connector pin Y.	-6 volts	Proceed to Step 12.	Replace relay K1.
12	Ground pin 7 of MD11 and TP-16.	Connector pin W.	Audible Alarm on.	Proceed to Step 13.	Replace relay K1.
13	Rotate the PCR switch to generate a Set pulse.	Pin 1Ø of MD1-MD3.	-6 volts (After approximate two second delay.)	Proceed to Step 14.	Replace defective module.
14	Measure the voltage at the indicated test point.	TP-12	Ø volts	Proceed to Step 15.	Replace MD4.
15	Measure the voltage at the indicated test point.	Pin 1Ø of MD12.	-6 volts	Proceed to Step 16.	Replace MD4.
16	Rotate the ALARM TEST switch to the 1 position.	TP-12	-6 volts	Proceed to Step 17.	Replace MD1.
17	Measure the voltage at the indicated test point.	TP-16	Ø volts	Proceed to Step 18.	Replace MD12.
18	Rotate the ALARM TEST switch to the 2 position.	TP-12	-6 volts	Proceed to Step 19.	Replace MD2.

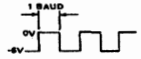
19	Rotate the ALARM TEST switch to the 3 position.	TP-12	-6 volts	Proceed to Step 2Ø.	Replace MD3.
2Ø	Measure the voltage at the indicated test point.	TP-14	-6 volts	Proceed to Step 21.	Proceed to Step 22.
21	Sequentially lift pin 11 of MD13, pins 11 and 12 of MD17 and pin 13 of MD21.	TP-14	-6 volts	Proceed to Step 22.	Replace defective module.
22	Place the ALARM TEST switch in the OFF position.	Pin 11 of MD15.	Ø volts	Proceed to Step 23.	Proceed to Step 25.
23	Lift pin 2 of MD16. Press and release the SEND pushbutton; after the P&I lamp goes out, observe indication.	Pin 11 of MD15.	Random motion at a baud rate.	Proceed to Step 24.	Replace MD15.
24	Type R-Y characters on the local TTY.	Pin 13 of MD13. Pin 2 of MD15. Pin 2 of MD16. Pin 2 of MD18. Pins 2 and 11 of MD19. Pin 11 of MD21.		Proceed to Step 25.	Replace the defective module.
25	Type R-Y characters on the local TTY.	Pin 2 of MD14. Pin 11 of MD16. Pin 2 of MD2Ø.		Proceed to Step 26.	Lift one of the two pins that are joined and look for motion. Replace the defective module if random motion is not observed.
26	Ground pin 7 of MD8.	TP-2	-6 volts	Proceed to Step 27.	Replace MD8.
27	Rotate the PCR switch to generate a Set pulse.				
28	Ground test point TP-11.	TP-15	Ø volts	Proceed to Step 29.	Replace MD5.
29	Press and release the SEND pushbutton. Ground test point TP-13.	TP-15	Ø volts	Proceed to Step 3Ø.	Replace MD12.
3Ø	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-1Ø.—E-AJN (A6) DEFECTIVE MODULE REPLACEMENT (figs. 3-9 and 3-1Ø)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJN and place it in the Test Extender Card. Place the Test Extender Card in the E-AJN slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the OFF position.				
3	After a five second delay place the POWER switch in the ON position.	Pin 9 of MD16.		Proceed to Step 4.	Replace MD15 if waveform is present at pin 5 of MD15; if waveform is not present, then replace MD17.
4	Press and hold the SEND pushbutton.	Pin 1Ø of MD7.	Ø volts	Proceed to Step 5.	Replace MD17.
5	Press and hold the SEND pushbutton.	TP-11		Proceed to Step 6.	Replace MD2Ø.
6	Press and hold the SEND pushbutton.	Pin 1Ø of MD5.	Ø volts	Proceed to Step 7.	Replace MD12.
7	Press and hold the SEND pushbutton.	Pin 4 of MD12.	-6 volts	Proceed to Step 8.	Replace MD12.
8	Press and hold the SEND pushbutton.	Pin 4 of MD13.	Ø volts	Proceed to Step 9.	Replace MD13.
9	Press and hold the SEND pushbutton.	Pin 8 of MD13.	Ø volts	Proceed to Step 1Ø.	Replace MD13.
1Ø	Release the SEND pushbutton.	Pin 1Ø of MD6.	Ø volts	Proceed to Step 11.	Replace MD6.
11	Measure the voltage at the indicated test point.	Pin 3 of MD1Ø.	Ø volts	Proceed to Step 12.	Replace MD1Ø.
12	Measure the waveform at the indicated test point.	Pin 3 of MD4.	 Period is a function of the Randomizer output.	Proceed to Step 13.	Replace MD4.
13	Measure the voltage at the indicated test point.	Pin 3 of MD3.	Ø volts (after indicator characters have been counted.)	Proceed to Step 14.	Replace MD3.
14	Measure the voltage at the indicated test point.	Pin 4 of MD8.	Ø volts	Proceed to Step 15.	Replace MD8.
15	Measure the voltage at the indicated test point.	Pin 11 of MD16.	Ø volts	Proceed to Step 16.	Replace MD16.

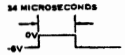
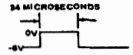
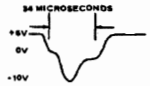
16	Press and release the BREAK pushbutton.	Pin 1Ø of MD9.	Ø volts	Proceed to Step 17.	Replace MD9.
17	Measure the voltage at the indicated test point.	Pin 6 of MD12.	-6 volts	Proceed to Step 18.	Replace MD12.
18	Rotate the ALARM TEST switch to generate a Set pulse.	Pin 3 of MD14.		Proceed to Step 19.	Replace MD14.
19	Measure the waveform at the indicated test point.	Pin 3 of MD19.		Proceed to Step 2Ø.	Replace MD19.
2Ø	Measure the waveform at the indicated test point.	TP-7		Proceed to Step 21.	Replace MD18.
21	Ground test point TP-4.	Pin 11 of MD2Ø.	-6 volts	Proceed to Step 22.	Replace MD2Ø.
22	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-11.—E-AJQ (A7) DEFECTIVE MODULE REPLACEMENT (figs. 3-15 and 3-16)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJQ and place it in the Test Extender Card. Place the Test Extender Card in the E-AJQ slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.	Pin 3 of MD21.	2 microsecond square-wave.	Proceed to Step 3.	Replace MD21.
3	Measure the waveform at the indicated test point.	TP-13	1Ø microsecond square-wave	Proceed to Step 8.	Proceed to Step 4.
4	Lift pin 7 of MD19 and pin 7 of MD2Ø; measure the waveforms at the indicated test points.	Pin 3 of MD2Ø.	4 microsecond square-wave		Replace MD2Ø.
		Pin 3 of MD19.	8 microsecond square-wave		Replace MD19.
		Pin 3 of MD18.	16 microsecond square-Wave	Proceed to Step 5.	Replace MD18.
5	Measure the waveform at the indicated test point.	TP-4	2Ø microsecond square-wave	Proceed to Step 6.	Replace MD17.
6	Ground TP-6 and pin 7 of MD8.	TP-11	4Ø microsecond square-wave	Proceed to Step 7.	Replace MD11.
7	Measure the waveform at the indicated test point.	Pin 1Ø of MD12.	8Ø microsecond square-wave	Proceed to Step 8.	Replace MD12.
8	Ground test point TP-11 and rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse.	Pin 1Ø of MD5, MD6, MD7 and MD14.	Ø volts	Proceed to Step 9.	Replace defective module.
9	Place the W.P.M. SPEED SELECTOR switch in the 6Ø position.	TP-12		Proceed to Step 12.	Proceed to Step 1Ø.
1Ø	Lift pins 5, 6, 7 and 9 of MD13; ground TP-6 and pin 7 of MD8; measure waveforms at the indicated test points.	Pin 1Ø of MD14.	16Ø microsecond square-wave		Replace MD14.
			32Ø microsecond square-wave		Replace MD7.
		Pin 1Ø of MD6.	64Ø microsecond square-wave		Replace MD6.
		TP-12	128Ø microsecond squarewave	Proceed to Step 11.	Replace MD5.

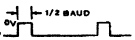
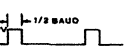
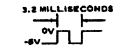
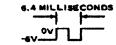
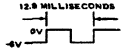
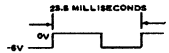
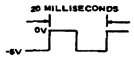
11	Resolder pins 5, 6, 7 and 9 of MD13.	TP-12		Proceed to Step 12.	Replace MD9.
12	Rotate the W.P.M. SPEED SELECTOR switch to the 67 position.	TP-12		Proceed to Step 13.	Replace MD9.
13	Rotate the W.P.M. SPEED SELECTOR switch to the 100 position.	TP-12	540 microsecond squarewave	Proceed to Step 14.	Replace MD9.
14	Measure waveform at the indicated test point.	Pin 3 of MD4.	320 microsecond squarewave	Proceed to Step 20.	Proceed to Step 15.
15	Lift pins 2 and 4 of MD13.	Pin 3 of MD1.	40 microsecond squarewave	Proceed to Step 16.	Replace MD1.
16	Measure waveform at the indicated test point.	Pin 3 of MD2.	80 microsecond squarewave	Proceed to Step 17.	Replace MD2.
17	Measure waveform at the indicated test point.	Pin 3 of MD3.	160 microsecond squarewave	Proceed to Step 18.	Replace MD3.
18	Measure waveform at the indicated test point.	Pin 3 of MD4.	320 microsecond squarewave	Proceed to Step 19.	Replace MD4.
19	Resolder pins 2 and 4 of MD13.	Pin 3 of MD4.	200 microsecond squarewave	Proceed to Step 20.	Replace MD4.
20	Rotate the ALARM TEST switch to the 1 position.	Pin 12 of MD15.		Proceed to Step 21.	Replace MD15.
21	Measure the waveform at the indicated test point.	TP-5		Proceed to Step 22.	Replace MD15.
22	Place a jumper wire between test point TP-1 and TP-2 and ground test point TP-5.	TP-9	Motion	Proceed to Step 23.	Replace MD8.
23	Leave the jumper wire in place (Step 22) and ground pin 12 of MD15.	TP-6	Motion	Proceed to Step 24.	Replace MD16.
24	Measure the waveform at the indicated test point.	Pin 12 of MD9.	Motion	Proceed to Step 25.	Replace MD9.
25	Measure the waveform at the indicated test point.	Pin 11 of MD9.	Motion	Proceed to Step 26.	Replace MD9.
26	Remove the jumper wire (Step 22) and continuity check the card etch.		Continuity		Repair etch.

TABLE 3-12.—E-AJP (A8) DEFECTIVE MODULE REPLACEMENT (figs. 3-13 and 3-14)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJP and place it in the Test Extender Card. Place the Test Extender Card in the E-AJP slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Place the W.P.M. SPEED SELECTOR switch in the 67 Position.				
4	Measure the waveform at the indicated test point.	TP-12		Proceed to Step 12.	Proceed to Step 5.
5	Ground test point TP-12.	Pin 1Ø of MD1.		Proceed to Step 6.	Replace MD1.
6	Ground test point TP-12.	Pin 1Ø of MD2.		Proceed to Step 7.	Replace MD2.
7	Ground test point TP-12.	Pin 1Ø of MD3.		Proceed to Step 8.	Replace MD3.
8	Ground test point TP-12.	Pin 1Ø of MD4.		Proceed to Step 9.	Replace MD4.
9	Ground test point TP-12.	Pin 1Ø of MD5.		Proceed to Step 1Ø.	Replace MD5.
1Ø	Measure the waveform at the indicated test point.	TP-12		Proceed to Step 11.	Replace MD16.
11	Measure the waveform at the indicated test point.	TP-1		Proceed to Step 15.	Proceed to Step 12.

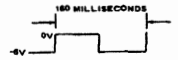
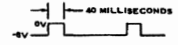
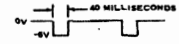
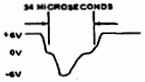
12	Measure the waveform at the indicated test point.	Pin 1Ø of MD6.		Proceed to Step 13.	Replace MD6.
13	Measure the waveform at the indicated test point.	Pin 1Ø of MD7.		Proceed to Step 14.	Replace MD7.
14	Measure the waveform at the indicated test point.	Pin 1Ø of MD14.		Proceed to Step 15.	Replace MD14.
15	Measure the waveform at the indicated test point.	Pin 11 of MD16.		Proceed to Step 16.	Replace MD16.
16	Measure the waveform at the indicated test point.	Pin 11 of MD15.		Proceed to Step 17.	Replace MD15.
17	Measure the waveform at the indicated test point.	Pin 3 of MD2Ø.		Proceed to Step 18.	Replace MD2Ø.
18	Measure the waveform at the indicated test point.	TP-7		Proceed to Step 19.	Replace MD19.
19	Measure the waveform at the indicated test point.	Pin 1Ø of MD8.		Proceed to Step 2Ø.	Replace MD8.
2Ø	Place a jumper wire between pin 8 of MD9 and test point TP-12, and ground pin 6 of MD2Ø.	TP-5		Proceed to Step 21.	Replace MD9.
21	Place a jumper wire between pin 8 of MD9 and test point TP-1 and ground pin 6 of MD2Ø.	Pin 1Ø of MD1Ø.		Proceed to Step 22.	Replace MD9.

TABLE 3-12 (Continued)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
22	Place a jumper wire between pin 8 of MD9 and test point TP-1 and ground pin 6 of MD20.	Pin 10 of MD11.		Proceed to Step 23.	Replace MD11.
23	Measure the voltage at the indicated test point.	TP-10	0 volts	Proceed to Step 24.	Replace MD12.
24	Ground TP-16.	TP-1		Proceed to Step 25.	Replace MD13.
25	Ground test point TP-4.	Pin 2 of MD15.	-6 volts	Proceed to Step 26.	Replace MD15.
26	Ground test point TP-4.	Pin 11 of MD17.	-6 volts	Proceed to Step 27.	Replace MD17.
27	Ground pin 9 of MD17.	Pin 12 of MD17.	-6 volts	Proceed to Step 28.	Replace MD17.
28	Ground pin 6 of MD18.	Pin 11 of MD18.	-6 volts	Proceed to Step 29.	Replace MD18.
29	Ground pin 9 of MD18.	Pin 2 of MD18.	-6 volts	Proceed to Step 30.	Replace MD18.
30	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-13.—E-AJS (A9) DEFECTIVE MODULE REPLACEMENT (figs. 3-19 and 3-20)

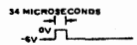
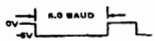
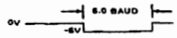
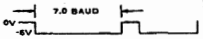
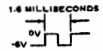
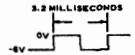
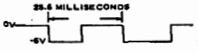
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJS and place it in the Test Extender Card. Place the Test Extender Card in the E-AJS slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Measure the voltage of the indicated test points.	Pin 10 of MD1-MD5 and pin 3 of MD6, MD7, MD8, MD11, MD14 and MD15.	0 volts	Proceed to Step 4.	Replace defective module.
4	Press and hold the SEND pushbutton.	TP-16	1 baud	Proceed to Step 5.	Replace MD15 and MD16.
5	Release the SEND pushbutton.	TP-12		Proceed to Step 6.	Continuity check the card etch.
6	Observe the indicated pattern at the indicated test point.	TP-16	Randomly spaced letter and blank characters.	Proceed to Step 7.	Check the SRX shift register, and if defective, replace MD10 and MD12.
7	Type a continuous blank character on the local TTY.	Pin 10 of MD16, MD17, MD18, MD19, and MD20.		Proceed to Step 8.	Replace defective module.
8	Type continuous blank character on the local TTY.	Pin 3 of MD1-MD5.		Proceed to Step 9.	Replace defective module.
9	Type a blank character on the local TTY.	TP-16		Proceed to Step 10.	Sequentially replace MD9, MD10, MD12 and MD13 until the defective module is found.
10	Ground test point TP-4.	Pin 10 of MD1-MD5.	0 volts	Proceed to Step 11.	Replace MD9 and MD10.
11	Observe the required condition.		The equipment does not leave the indicator mode (the P&I lamp does not go out).	Proceed to Step 12.	Replace MD21.
12	Continuity check the card etch.		Open etch.		Repair etch.

TABLE 3-14.—E-AJR (A1Ø) DEFECTIVE MODULE REPLACEMENT (figs. 3-17 and 3-18)

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJR and place it in the Test Extender Card. Place the Test Extender Card in the E-AJR slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Place the W.P.M. SPEED SELECTOR switch in the 67 position.				
4	Measure the waveform at the indicated test point.	Pin 1Ø of MD5.		Proceed to Step 1Ø.	Proceed to Step 5.
5	Ground pin 11 of MD1Ø.	Pin 1Ø of MD1.		Proceed to Step 6.	Replace MD1.
6	Ground pin 11 of MD1Ø.	Pin 1Ø of MD2.		Proceed to Step 7.	Replace MD2.
7	Ground pin 11 of MD1Ø.	Pin 1Ø of MD3.		Proceed to Step 8.	Replace MD3.
8	Ground pin 11 of MD1Ø.	Pin 1Ø of MD4.		Proceed to Step 9.	Replace MD4.
9	Ground pin 11 of MD1Ø.	Pin 1Ø of MD5.		Proceed to Step 1Ø.	Replace MD5.
1Ø	Measure the waveform at the indicated test point.	Pin 11 of MD1Ø.		Proceed to Step 11.	Replace MD1Ø.
11	Measure the waveform at the indicated test point.	Pin 4 of MD11.		Proceed to Step 12.	Replace MD11 and MD9.
12	Measure the waveform at the indicated test point.	Pin 6 of MD8.		Proceed to Step 13.	Replace MD8.

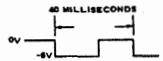
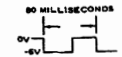
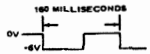
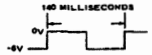
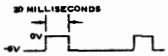
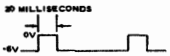
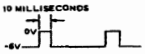
13	Measure the waveform at the indicated test point.	Pin 1Ø of MD6.		Proceed to Step 14.	Replace MD6.
14	Measure the waveform at the indicated test point.	Pin 1Ø of MD7.		Proceed to Step 15.	Replace MD7.
15	Measure the waveform at the indicated test point.	Pin 1Ø of MD14.		Proceed to Step 16.	Replace MD14.
16	Ground test point TP-4.	Pin 1Ø of MD14.		Proceed to Step 17.	Replace MD9.
17	Measure the waveform at the indicated test point.	Pin 11 of MD21.		Proceed to Step 18.	Replace MD21.
18	Measure the waveform at the indicated test point.	Pin 12 of MD13.		Proceed to Step 19.	Replace MD13.
19	Measure the waveform at the indicated test point.	TP-12		Proceed to Step 2Ø.	Replace MD12.
2Ø	Measure the waveform at the indicated test point.	Pin 11 of MD12.		Proceed to Step 21.	Replace MD12.
21	Measure the waveform at the indicated test point.	Pin 11 of MD13.		Proceed to Step 22.	Replace MD13.
22	Measure the waveform at the indicated test point.	Pin 2 of MD1Ø.		Proceed to Step 23.	Replace MD1Ø.

TABLE 3-14 (Continued)

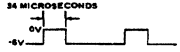
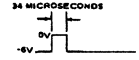
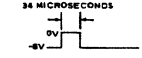
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
23	Measure the waveform at the indicated test point.	TP-13		Proceed to Step 24.	Replace MD2Ø.
24	Measure the waveform at the indicated test point.	TP-16		Proceed to Step 25.	Replace MD21.
25	Measure the waveform at the indicated test point.	Pin 3 of MD19.		Proceed to Step 26.	Replace MD19.
26	Rotate the PCR switch from CIPHER to SYNC and back to CIPHER to generate a Set pulse.	Pin 3 of MD16.		Proceed to Step 27.	Replace MD16.
27	Ground Test Point TP-9.	Pin 12 of MD18.	-6 volts	Proceed to Step 28.	Replace MD18.
28	Ground test point TP-3; measure the voltages at the indicated test points.	Pin 11 of MD17.	-6 volts		Replace MD17.
		Pin 6 of MD11.	Ø volts	Proceed to Step 29.	Replace MD11.
29	Place a jumper wire between test point TP-8 and test point TP-16; ground test point TP-9 and press the BREAK pushbutton.	Pin 12 of MD17.		Proceed to Step 3Ø.	Replace MD17 and MD18.
3Ø	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-15.—E-AJU (A11) DEFECTIVE MODULE REPLACEMENT (figs. 3-23 and 3-24)

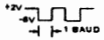
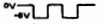
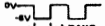
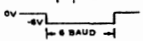
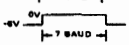
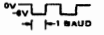
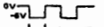
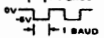
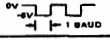
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJU and place it in the Test Extender Card. Place the Test Extender Card in the E-AJU slot.				
2	Place the PCR switch in the PLAIN position and the POWER switch in the ON position.				
3	Press and release the SEND pushbutton.				
4	Type R characters on the local TTY.	TP-2		Proceed to Step 5.	Replace MD15.
5	Type R characters on the local TTY.	Pin 3 of MD8.		Proceed to Step 6.	Replace MD8.
6	Type R characters on the local TTY.	TP-3		Proceed to Step 7.	Replace MD9.
7	Type R characters on the local TTY.	Pin 1Ø of MD16.		Proceed to Step 8.	Replace MD16.
8	Type R characters on the local TTY.	TP-4		Proceed to Step 9.	Replace MD17.
9	Type R characters on the local TTY.	Pin 11 of MD9.		Proceed to Step 1Ø.	Replace MD9.
1Ø	Type R characters on the local TTY.	Pin 1Ø of MD1Ø.	Ø volts	Proceed to Step 11.	Replace MD1Ø.
11	Ground pin 6 of MD2Ø.	Pin 11 of MD2Ø.	-6 volts	Proceed to Step 12.	Replace MD2Ø.
12	Ground pin 6 of MD2Ø.	Pin 2 of MD2Ø.	Ø volts	Proceed to Step 13.	Replace MD2Ø.
13	Ground pin 6 of MD2Ø.	Pin 4 of MD19.	-6 volts	Proceed to Step 14.	Replace MD19.
14	Type R characters on the local TTY.	Pin 12 of MD3.		Proceed to Step 15.	Replace MD3.
15	Type R characters on the local TTY.	TP-7		Proceed to Step 16.	Replace MD4.
16	Type R characters on the local TTY.	Pin 2 of MD11.		Proceed to Step 17.	Replace MD11.
17	Type R characters on the local TTY.	TP-8		Proceed to Step 18.	Replace MD12.

TABLE 3-15 (Continued)

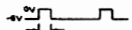
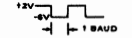
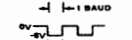
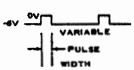
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
18	Type R characters on the local TTY.	E-AJS, TP-3		Proceed to Step 19.	Replace MD7.
19	Type R characters on the local TTY.	E-AJS, TP-8		Proceed to Step 20.	Replace MD14.
20	Type R characters on the local TTY.	Pins 2 and 11 of MD5.	-6 volts	Proceed to Step 21.	Replace MD5.
21	Ground test point TP-5.	Pin 11 of MD11.	-6 volts	Proceed to Step 22.	Replace MD11.
22	Generate data on the line by having the remote KW-7 transmit.	TP-1		Proceed to Step 23.	Replace MD1.
23	Generate data on the line by having the remote KW-7 transmit.	Pin 3 of MD2.		Proceed to Step 24.	Replace MD2.
24	Place the PCR switch in the PLAIN ASYNC position and generate data on the line by having a distant teletypewriter transmit.	Pin 11 of MD3.		Proceed to Step 25.	Replace MD3.
25	Type from the distant TTY.	Pin 3 of MD18.		Proceed to Step 26.	Replace MD18.
26	Ground test point TP-10.	TP-7	-6 volts	Proceed to Step 27.	Replace MD4.
27	Place a jumper wire between pins 1 and 8 of MD21.	Pin 3 of MD21.		Proceed to Step 28.	Replace MD21.
28	Continuity check the card etch.		Continuity		Repair the etch.

TABLE 3-16.—E-AJT (A12) DEFECTIVE MODULE REPLACEMENT (figs. 3-21 and 3-22)

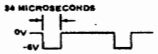
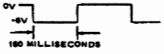
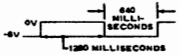
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJT and place it in the Test Extender Card. Place the Test Extender Card in the E-AJT slot.				
2	Place the PCR switch in the PLAIN position and POWER switch in the ON position. Place the W.P.M. SPEED SELECTOR switch in the 67 position.				
3	Measure the waveform at the indicated test point.	Pin 11 of MD16.		Proceed to Step 4.	Replace MD16.
4	Ground test point TP-12.	Pin 3 of MD1.		Proceed to Step 5.	Replace MD1.
5	Ground test point TP-12.	Pin 1Ø of MD2.		Proceed to Step 6.	Replace MD2.
6	Ground test point TP-12.	Pin 1Ø of MD3.		Proceed to Step 7.	Replace MD3.
7	Ground test point TP-12.	Pin 1Ø of MD5.		Proceed to Step 8.	Replace MD5.
8	Ground test point TP-12.	Pin 1Ø of MD6.		Proceed to Step 9.	Replace MD6.
9	Ground test point TP-12.	Pin 1Ø of MD7.		Proceed to Step 1Ø.	Replace MD7.
1Ø	Ground test point TP-1.	Pins 11 and 12 of MD8.	-6 volts	Proceed to Step 11.	Replace MD8.

TABLE 3-16 (Continued)

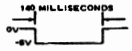
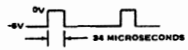
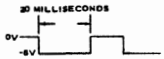
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
11	Press and release the SEND pushbutton and type characters on the local TTY.	Pin 3 of MD9.		Proceed to Step 12.	Replace MD9.
12	Type on the local TTY.	Pin 1Ø of MD1Ø.		Proceed to Step 13.	Replace MD1Ø.
13	Ground pins 6 and 9 of MD11.	Pin 11 of MD11.	-6 volts	Proceed to Step 14.	Replace MD11.
14	Ground pin 9 of MD12.	Pin 2 of MD12.	-6 volts	Proceed to Step 15.	Replace MD12.
15	Ground pin 1Ø of MD4.	Pin 3 of MD15.		Proceed to Step 16.	Replace MD15.
16	Ground pin 1Ø of MD4.	Pin 11 of MD12.		Proceed to Step 17.	Replace MD12.
17	Ground pin 1Ø of MD4.	Pin 11 of MD13.		Proceed to Step 18.	Replace MD13.
18	Ground pins 6 and 7 of MD14.	Pins 11 and 12 of MD14.	-6 volts	Proceed to Step 19.	Replace MD14.
19	Press and release the SEND pushbutton and type continuous RY characters on the local TTY.	TP-1Ø	Ø volts	Proceed to Step 2Ø.	Replace MD21.
2Ø	Press and release the SEND pushbutton and type RY characters on the local TTY.	TP-14		Proceed to Step 21.	Replace MD17.
21	Ground pins 1Ø of MD16.	Pin 12 of MD16.	-6 volts	Proceed to Step 22.	Replace MD16.
22	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-17.—E-AJW (A13) DEFECTIVE MODULE REPLACEMENT (figs. 3-27 and 3-28)

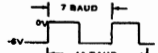
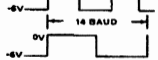
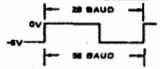
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJW and place it in the Test Extender Card. Place the Test Extender Card in the E-AJW slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Ground test point TP-9.	Pin 3 of MD7.	-6 volts	Proceed to Step 4.	Replace MD7.
4	Measure the voltage at the indicated test point.	Pin 11 of MD2Ø.	-6 volts	Proceed to Step 5.	Replace MD2Ø.
5	Measure the voltage at the indicated test point.	TP-5	Ø volts	Proceed to Step 6.	Replace MD11.
6	Ground pin 6 of MD14.	Pin 11 of MD14.	-6 volts	Proceed to Step 7.	Replace MD14.
7	Ground pin 6 of MD13.	Pin 11 of MD14.	-6 volts	Proceed to Step 8.	Replace MD13.
8	Press and hold the SEND pushbutton and ground pin 6 of MD14.	TP-9	Random zero levels	Proceed to Step 9.	Replace MD13.
9	Press and hold the SEND pushbutton and ground pin 6 of MD13.	TP-9	Random zero levels	Proceed to Step 1Ø.	Replace MD13.
1Ø	Rotate the ALARM TEST switch to the 1 position.	TP-5	Ø volts	Proceed to Step 11.	Replace MD5.
11	Rotate the ALARM TEST switch to the 2 position.	TP-5	Ø volts	Proceed to Step 12.	Replace MD6.
12	Rotate the ALARM TEST to the OFF position and press and release the SEND pushbutton.	Pin 2 of MD1.	-6 volts		Replace MD1.
		Pin 2 of MD21.	-6 volts	Proceed to Step 13.	Replace MD21.
13	Place the TD STEP/CONTINUOUS switch in the TD STEP position.	Pin 11 of MD1.		Proceed to Step 14.	Replace MD1.
14	Measure the waveform at the indicated test point.	Pin 1Ø of MD2.		Proceed to Step 15.	Replace MD2.
15	Measure the waveform at the indicated test point.	Pin 1Ø of MD3.		Proceed to Step 16.	Replace MD3.
16	Measure the waveform at the indicated test point.	Pin 1Ø of MD4.		Proceed to Step 17.	Replace MD4.

TABLE 3-17 (Continued)

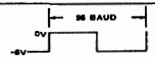
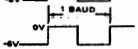
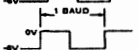
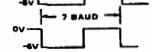
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
17	Measure the waveform at the indicated test point.	TP-11		Proceed to Step 18.	Replace MD1Ø.
18	Ground pin 6 of MD8.				
19	Measure the waveform at the indicated test point.	Pin 11 of MD9.		Proceed to Step 2Ø.	Replace MD9.
2Ø	Measure the waveform at the indicated test point.	Pin 2 of MD8.		Proceed to Step 21.	Replace MD8.
21	Measure the waveform at the indicated test point.	TP-4		Proceed to Step 22.	Replace MD1Ø.
22	Press and release the SEND pushbutton.	Pin 11 of MD15.		Proceed to Step 23.	Replace MD15.
23	Measure the waveform at the indicated test point.	TP-2		Proceed to Step 24.	Replace MD9.
24	Type RY characters on the local TTY.	Pin 2 of MD19.	Motion at a baud rate.	Proceed to Step 25.	Replace MD19.
25	Observe the condition at the indicated test point.	Pins 2 and 11 of MD18.	Motion at a baud rate.	Proceed to Step 26.	Replace MD18.
26	Observe the condition at the indicated test point.	Pins 2 and 11 of MD17.	Motion at a baud rate.	Proceed to Step 27.	Replace MD17.
27	Measure the voltage at the indicated test point.	Pins 12 of MD16.	-6 volts	Proceed to Step 28.	Replace MD16.
28	Observe the condition at the indicated test point.	TP-7	Motion at a baud rate.	Proceed to Step 29.	Replace MD16.
29	Measure the voltage at the indicated test point.	Pin 12 of MD15.	-6 volts	Proceed to Step 3Ø.	Replace MD15.
3Ø	Measure the voltage at the indicated test point.	Pin 4 of MD11.	Ø volts	Proceed to Step 31.	Replace MD11.
31	Ground pin 9 of MD21 and measure the voltage at the indicated test points.	Pin 8 of MD21. Pin 2 of MD2Ø.	-6 volts -6 volts	Proceed to Step 32.	Replace MD21. Replace MD2Ø.
32	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-18.—E-AJV (A14) DEFECTIVE MODULE REPLACEMENT (figs. 3-25 and 3-26)

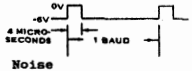
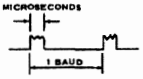
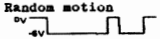
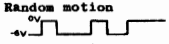
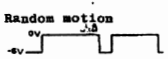
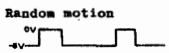
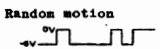
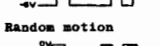
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Remove card E-AJV and place it in the Test Extender Card. Place the Test Extender Card in the E-AJV slot.				
2	Place the PCR switch in the CIPHER position and the POWER switch in the ON position.				
3	Measure the waveform at the indicated test point.	TP-9		Proceed to Step 4.	Replace MD11.
4	Observe the waveform at the indicated test point.	Pin 3 of MD6.	Noise	Proceed to Step 5.	Replace MD6 and MD7.
5	Observe the waveform at the indicated test point.	Pin 3 of MD13.	Noise	Proceed to Step 6.	Replace MD13 and MD14.
6	Measure the waveform at the indicated test point.	Pins 1, 4, 5, and 10 of MD4.		Proceed to Step 7.	Replace MD4.
7	Observe the waveform at the indicated test point.	TP-5	Random motion 	Proceed to Step 8.	Replace MD5.
8	Observe the waveform at the indicated test point.	TP-7	Random motion 	Proceed to Step 9.	Replace MD12.
9	Observe the waveform at the indicated test point.	Pins 2 and 11 of MD2, MD3, MD9 and MD10.	Random motion 	Proceed to Step 10.	Replace defective module.
10	Press and release the SEND switch and ground test point TP-7.	TP-3	Random motion 	Proceed to Step 11.	Replace MD8.
11	Press and release the SEND switch and ground test point TP-5.	TP-3	Random motion 	Proceed to Step 12.	Replace MD8.
12	Press and release the SEND switch and ground test point TP-7.	TP-6	Random motion 	Proceed to Step 13.	Replace MD1.
13	Press and release the SEND switch and ground test point TP-5.	TP-6	Random motion 	Proceed to Step 14.	Replace MD1.

TABLE 3-18 (Continued)

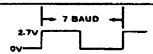
Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
14	Place the TD STEP/CONTINUOUS switch in the CONTINUOUS position.	TP-4		Proceed to Step 15.	Replace MD16.
15	The following Checks the Line-Out function by alternately applying and removing ground on pin 3 of MD15.	TP-1	Voltage level should alternate between +6 and -2 volts, approximately	Proceed to Step 16.	Check circuit etch; if correct, replace MD15.
16	Checking LIIR, any operating mode with line information.	Pin 5 of MD15.	Mark-space transitions from Ground (Ø) to +6 volts	Proceed to Step 17.	Check etch; if correct, replace MD15.
17	Checking LOOA, any operating mode with loop information at LOOD.	TP-2	Mark space transitions from +6 to -2 volts	Proceed to Step 18.	Check etch; if correct, replace MD15.
18	Checking audible alarm dropping resistor.	Pin 8 and Pin 9 of MD15.	Should read 56 ohms, approximately	Proceed to Step 19.	Replace MD15.
19	Checking despiking network LOON-2 DA-2 to loop remote card. Using ohmmeter reverse leads and check pin 6 to pin 5 as you would electrolytic capacitor.	Pin 6 and Pin 5 of MD2Ø.	Normal charge and discharge of capacitor and resistor in series if this is not sufficient check loop and LOON 2 for spikes or overshoot. None should be present	Proceed to Step 2Ø.	Replace MD2Ø.
2Ø	Checking Line-Output switch and loop-out current limiting resistors of DA-2 in any operating mode. Insert ammeter in Loop-Out circuit - Checking DA-3.	Insert meter in line to printer coil - either side.	Output current should be controlled roughly by switching to 2Ø and 6ØMA on output switch	Proceed to Step 21.	Check Line-Out-Put switch and etch; if switch is functioning, replace module. Check switch by reading continuity from pin 2Ø of card to DA-2 pins 1, 2, 3 and 4.
21	Check Loop-Out voltage - break condition from TTY.	Loop-Out cable to printer.	-4Ø V ±5%	Proceed to Step 22.	Replace MD19..
22	Continuity check diode.	Pins 3 and 4 of MD16.	Low forward resistance and high reverse resistance	Proceed to Step 23.	Replace MD16.
23	Continuity check the card etch.		Continuity		Repair etch.

TABLE 3-19.—E-AJY (A15) PLUG-IN ELEMENT CHECK PROCEDURE

Step	Procedure	Test Point	Normal Indication	If Indication is Normal	If Indication is Abnormal
1	Observe the Time Standard output on the oscilloscope.	RF OUTPUT	±0.5 volts peak-to-peak with rise time of 0.25 microseconds and a frequency of 1 megacycle.	Proceed to Step 2	
2	Using a dual trace oscilloscope perform the following: (1) Place a reliable 1 MC source on one of the scope inputs and the defective Time Standard 1 MC output on the other scope input. Synchronize the oscilloscope to the reliable 1 MC SOURCE. (2) Observe the oscilloscope and check both traces for drift. (3) If Time Standard drifts to the right, adjust the FREQ ADJUST to the left and allow time for the output to become stable. (4) If the drift is to the left, adjust the FREQ ADJUST to the right. (5) If drift cannot be corrected, replace the Time Standard.				

TABLE 3-20. – POWER SUPPLY TROUBLESHOOTING PROCEDURE (fig. 3-35)

Procedure	Symptom	Probable Cause(s)	Recommended Procedure
AC Operation			
1	Fuse opens.	Shorted capacitor.	Refer to Chart 1.
2	Output voltage not present at one of the Power Supply test jacks.	Open Transformer, open diode or open transistor.	Refer to Charts 2 through 5.
3	Poor Output regulation.	Defective Zener diode or defective transistor.	Refer to Charts 6 and 7.
4	Oscillations present on output voltages.	High loop gain.	Refer to Charts 11 and 12.
5	Ripple present on output voltages.	Open capacitor.	Refer to Chart 13.
DC Operation			
1	Fuse opens.	Shorted capacitor.	Refer to Chart 1.
2	Input voltage not present at one or more of the test jacks.	Failure in the DC-to-DC converter.	Refer to Charts 8, 9, and 10.
3	Poor output regulation.	Defective Zener diode or defective transistor.	Refer to Charts 6 and 7.
4	Oscillations present on output voltages.	High loop gain.	Refer to Charts 11 and 12.
5	Ripple present on output voltages.	Open capacitor.	Refer to Chart 13.

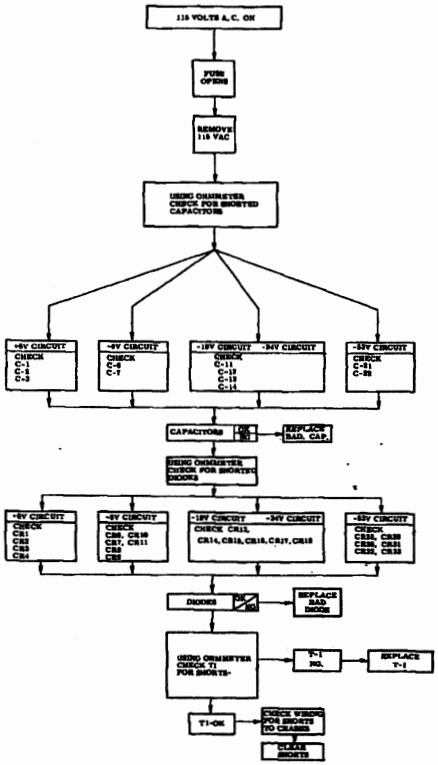


Chart 1

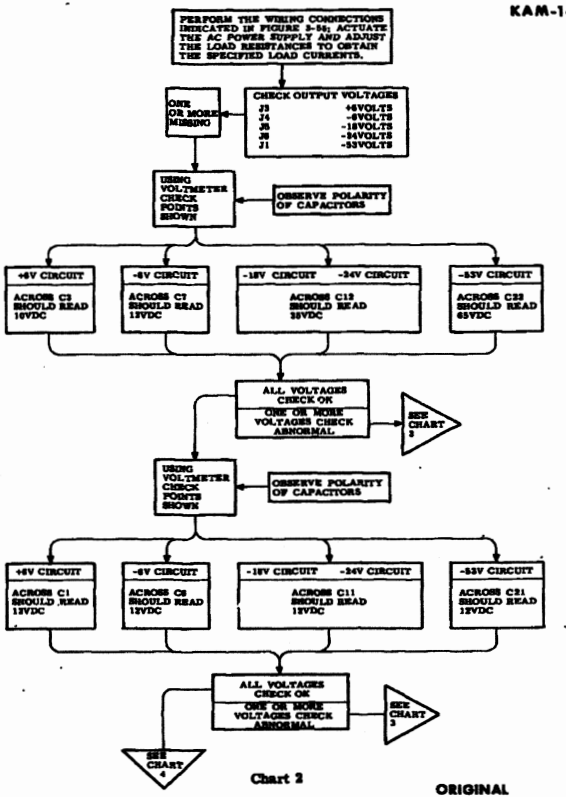


Chart 2

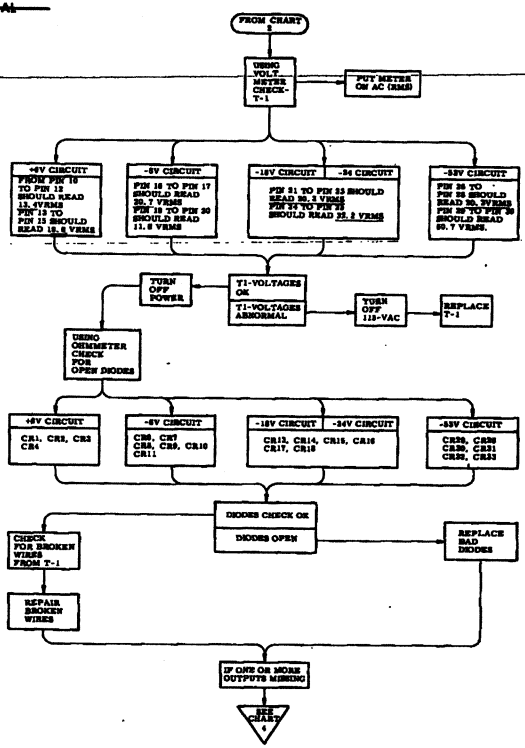


Chart 3

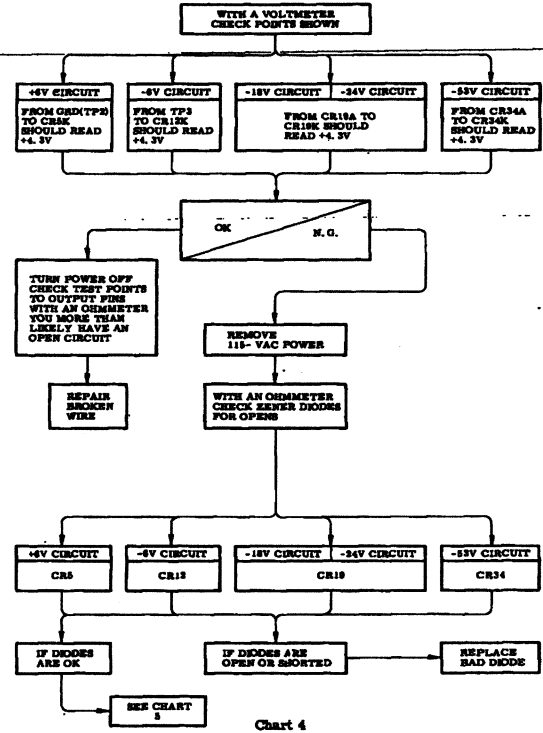


Chart 4

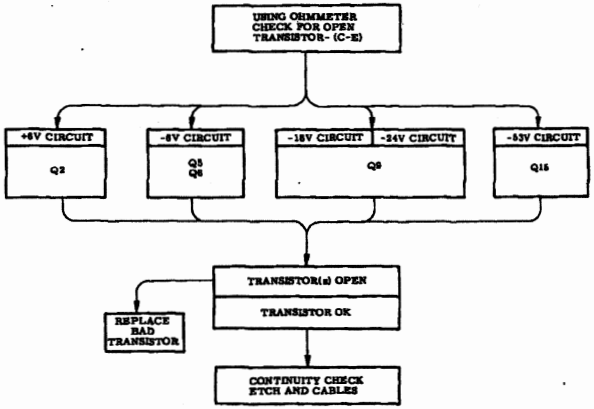


Chart 5

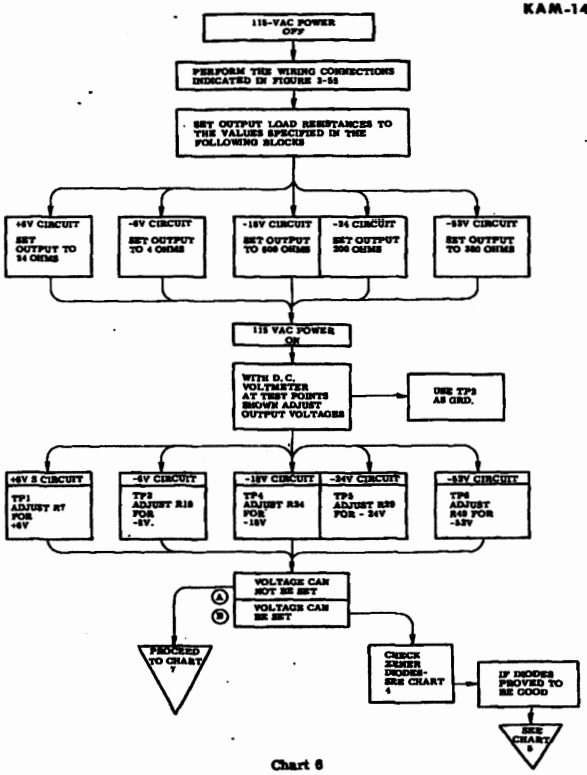


Chart 6

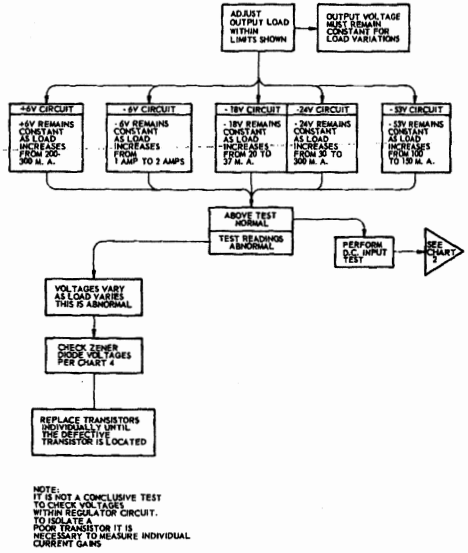


Chart 7

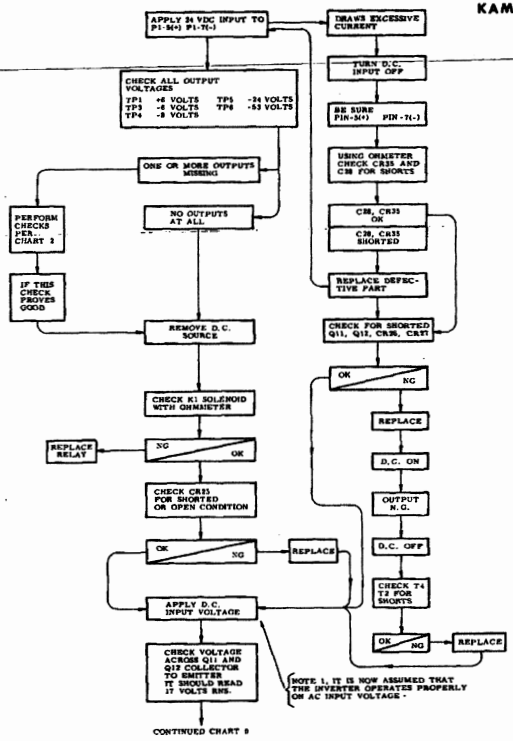


Chart 8

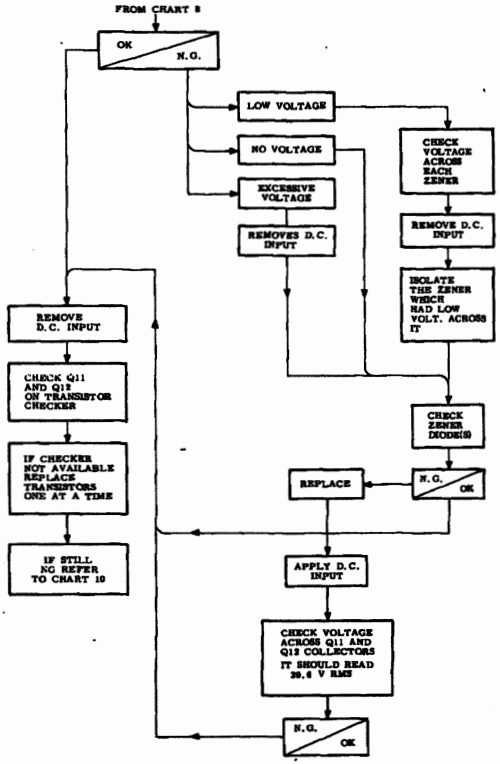


Chart 9

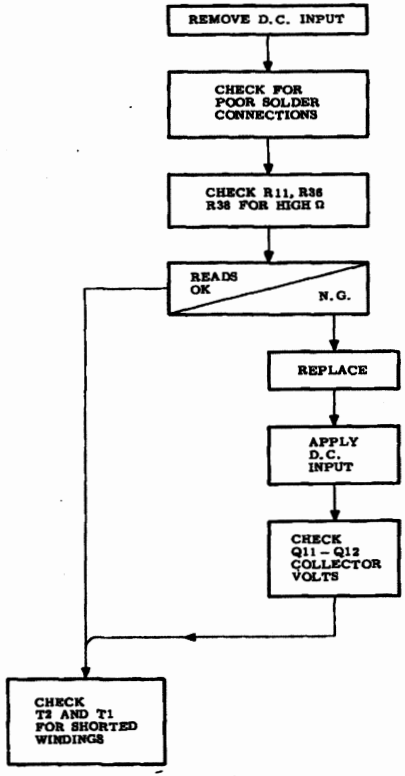


Chart 10

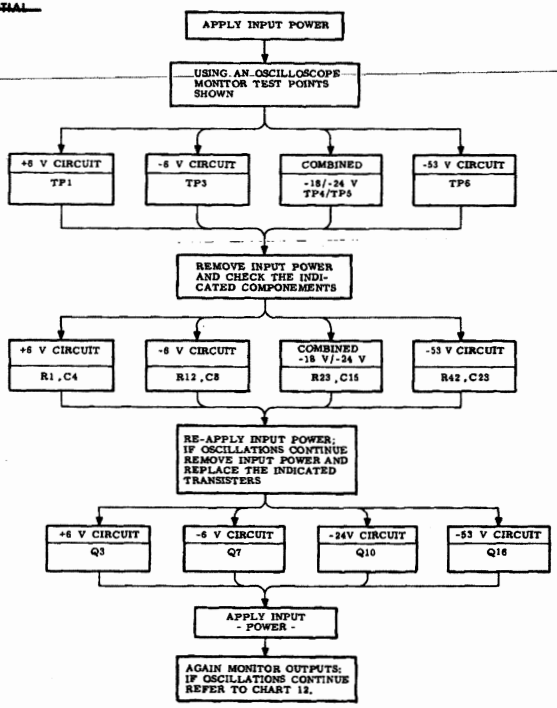


Chart 11

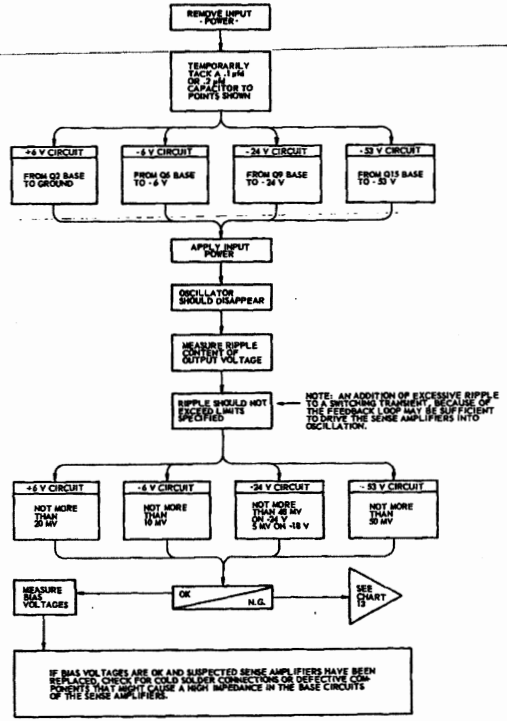


Chart 12

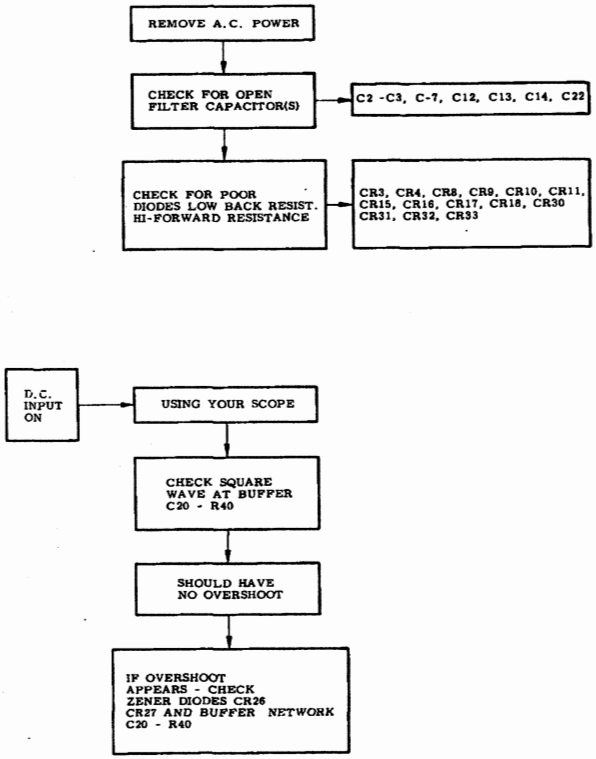


Chart 13

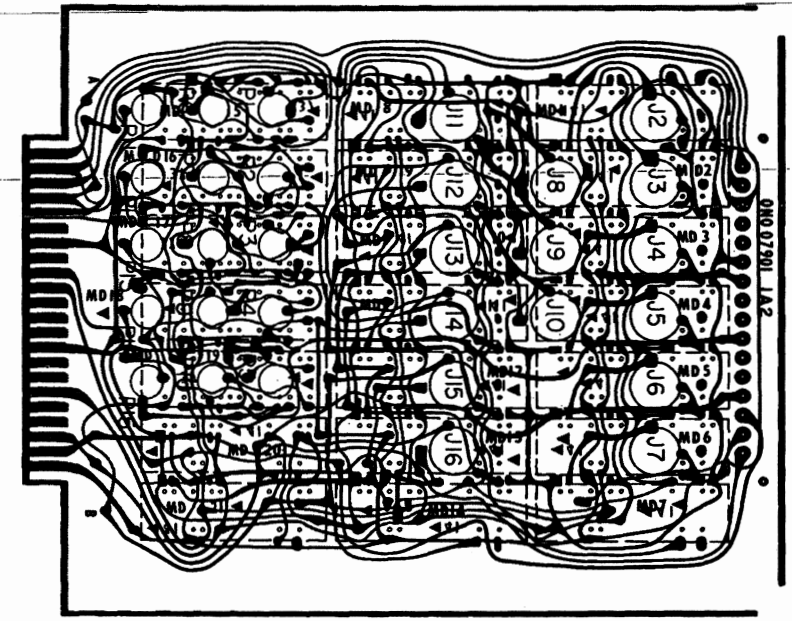
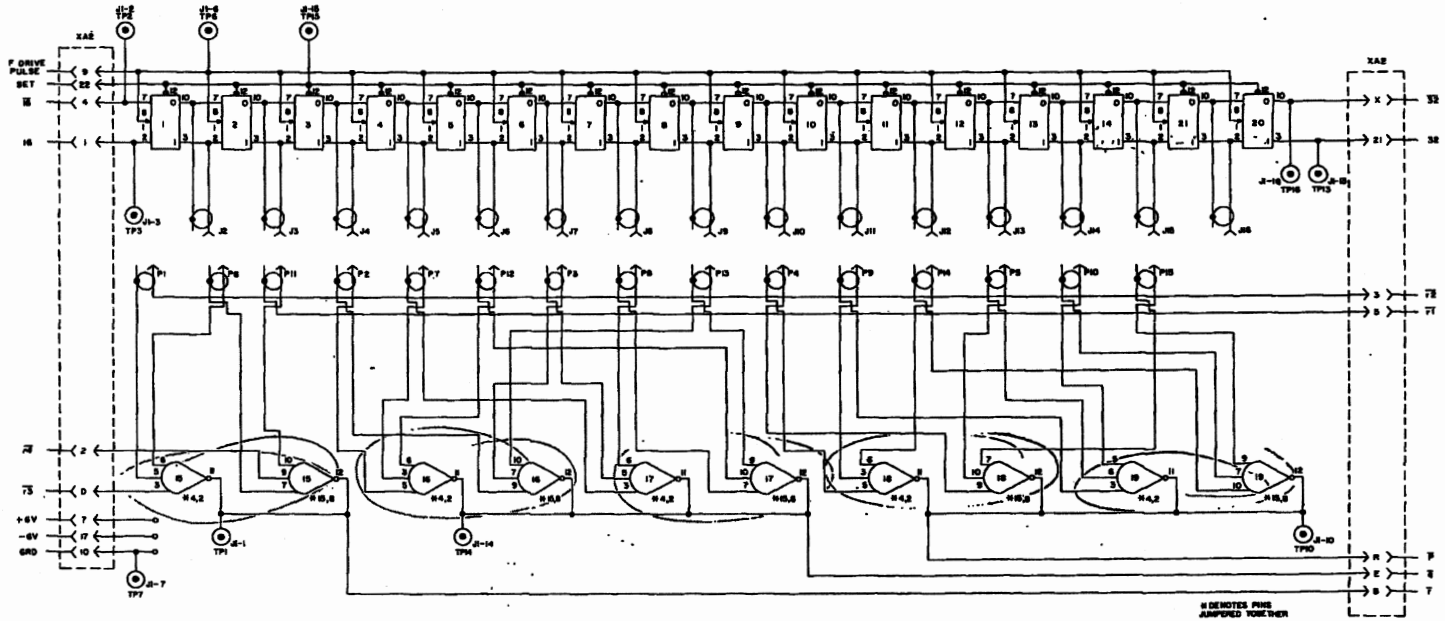


Figure 3-1. —Card E-AJJ Printed-Circuit Layout.



*2

Figure 3-2.—Card E-AJJ Logic Diagram. (A-2)

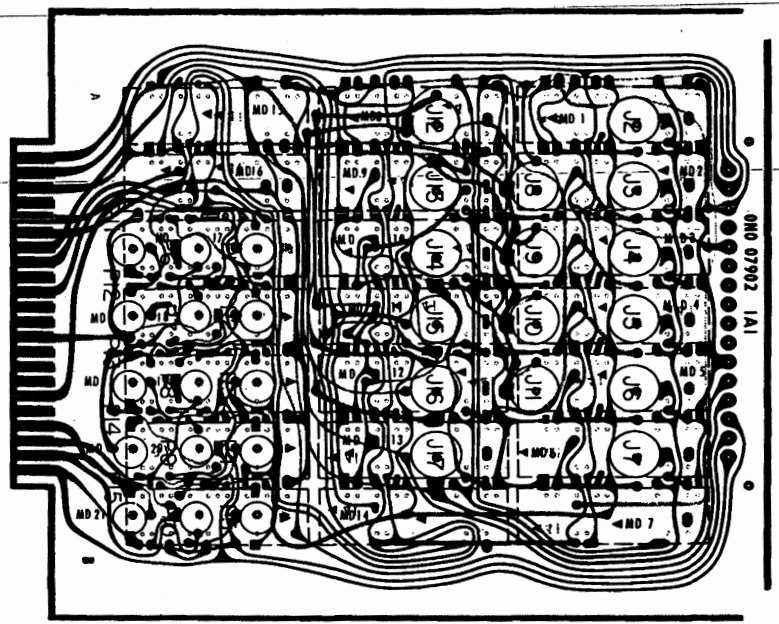


Figure 3-3.—Card E-AJK Printed-Circuit Layout.

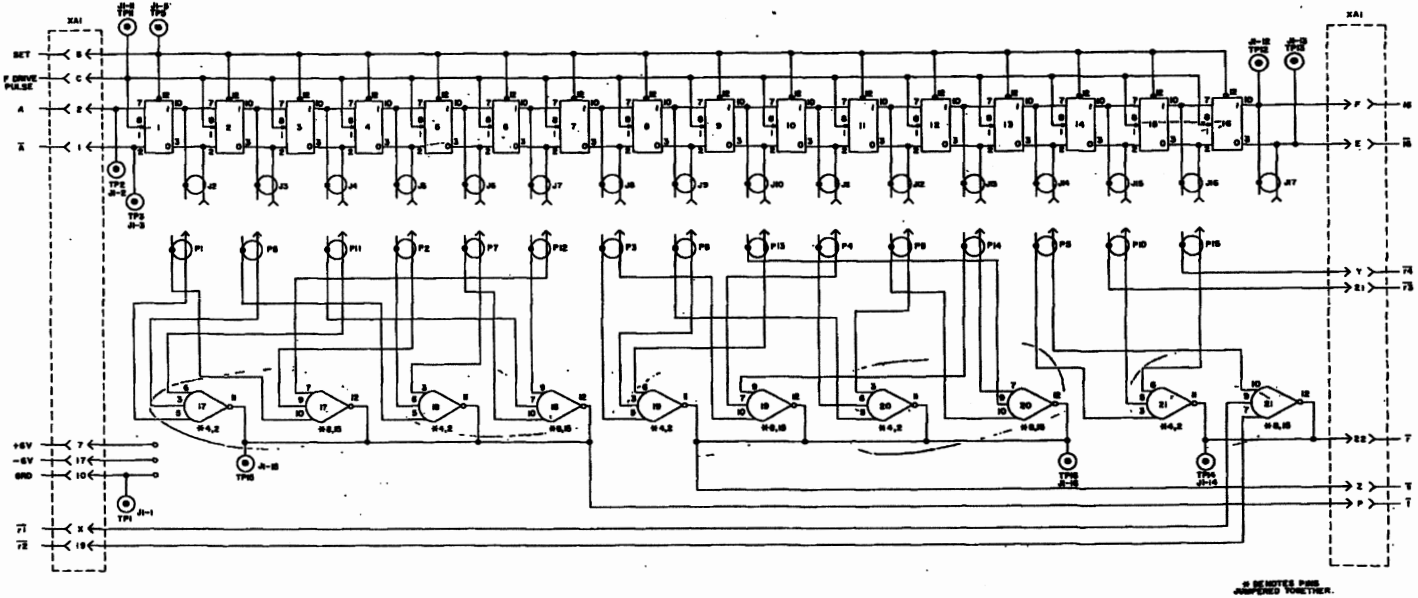


Figure 3-4.—Card E-AJK Logic Diagram. (A-1)

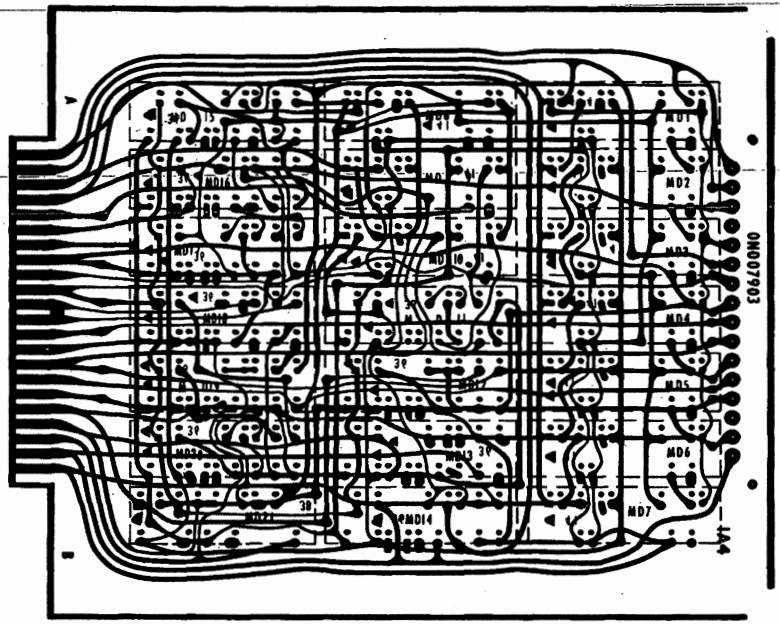


Figure 3-5.—Card E-AJL Printed-Circuit Layout.

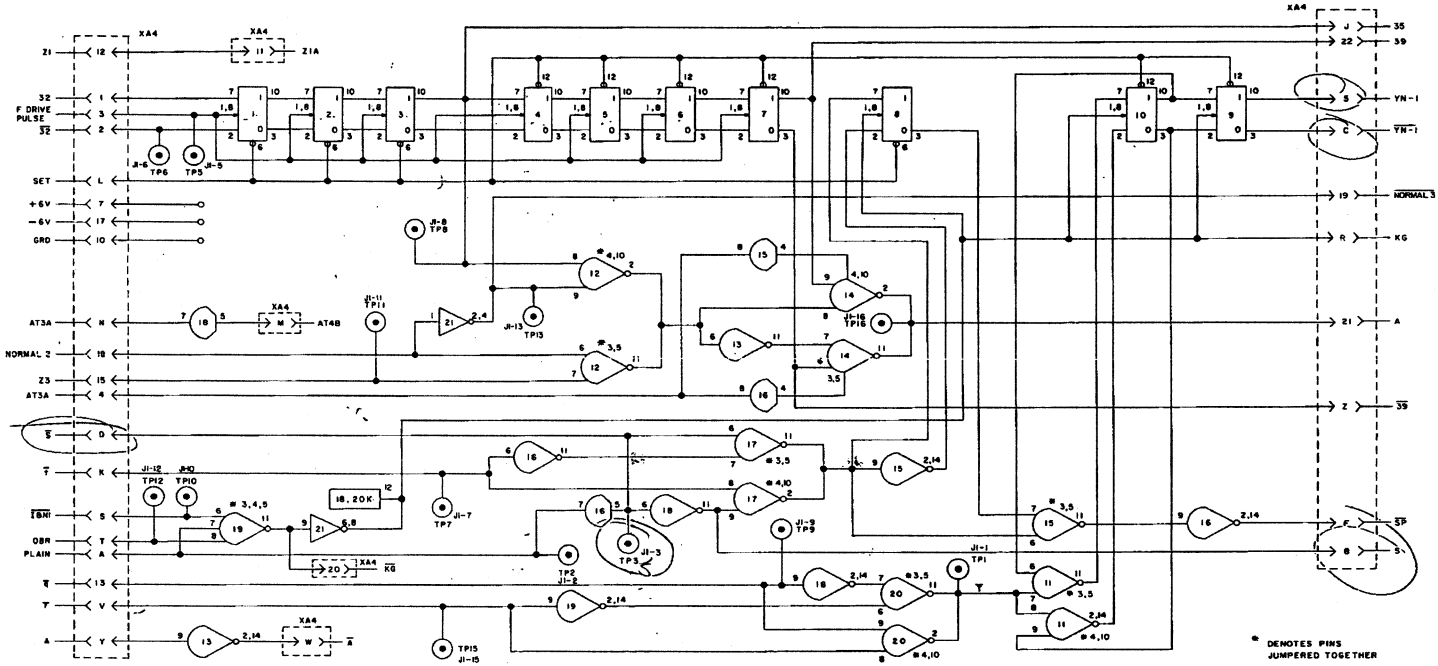


Figure 3-6.—Card E-AJL Logic Diagram. (A-4)

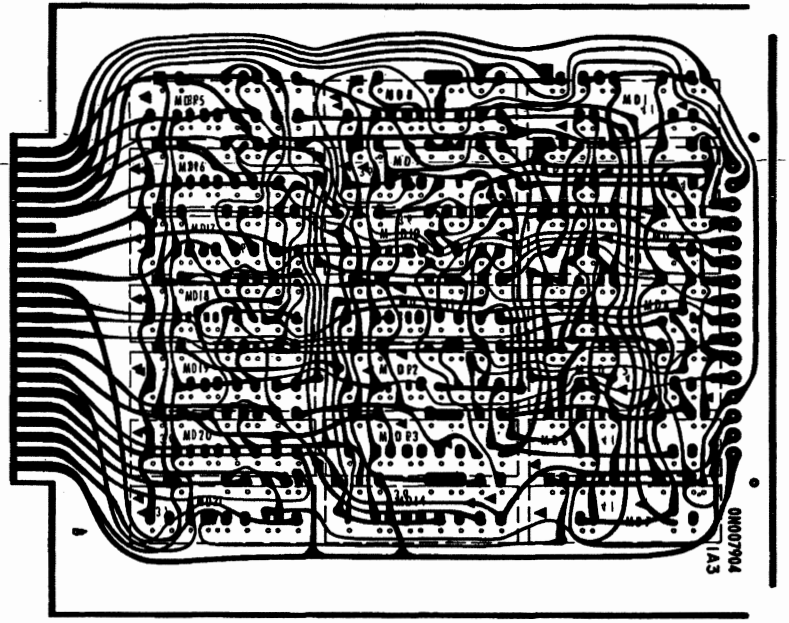


Figure 3-7.—Card E-AJM Printed-Circuit Layout.

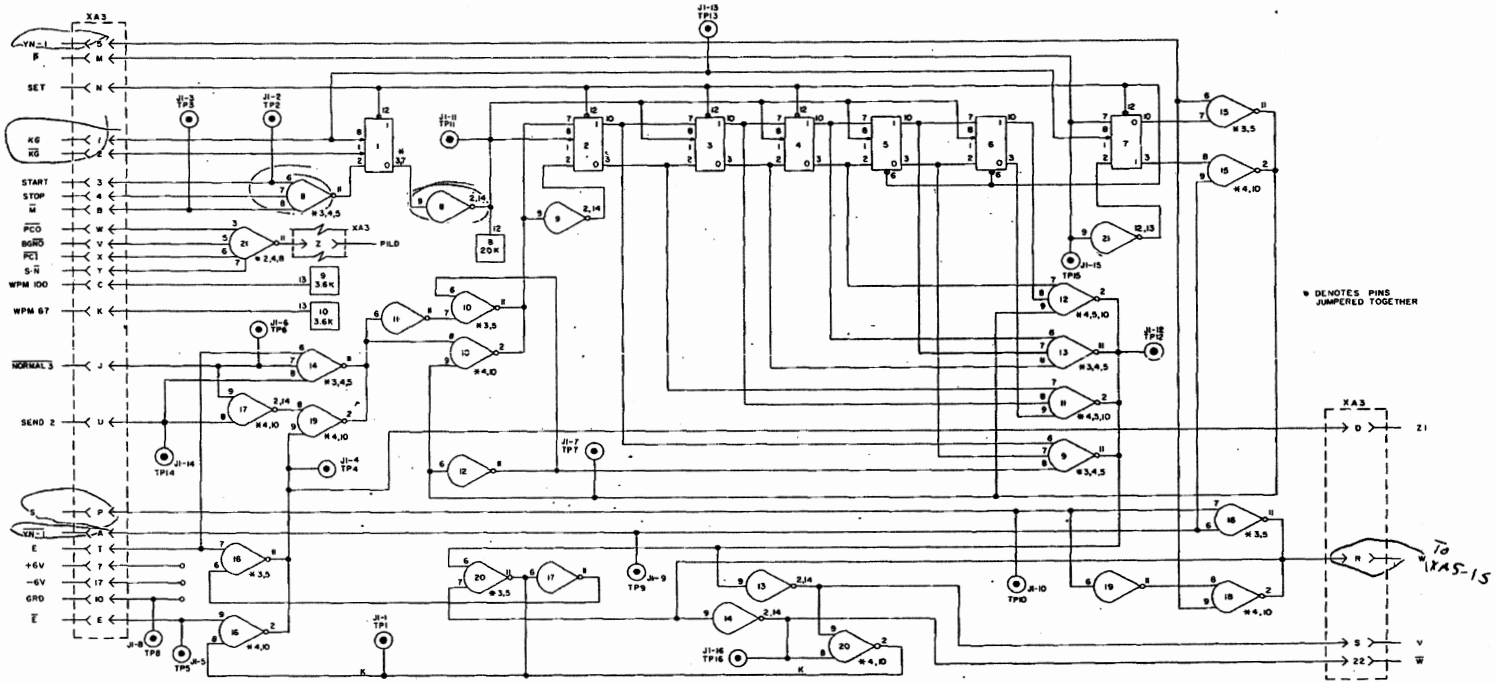


Figure 3-8.—Card E-AJM Logic Diagram.

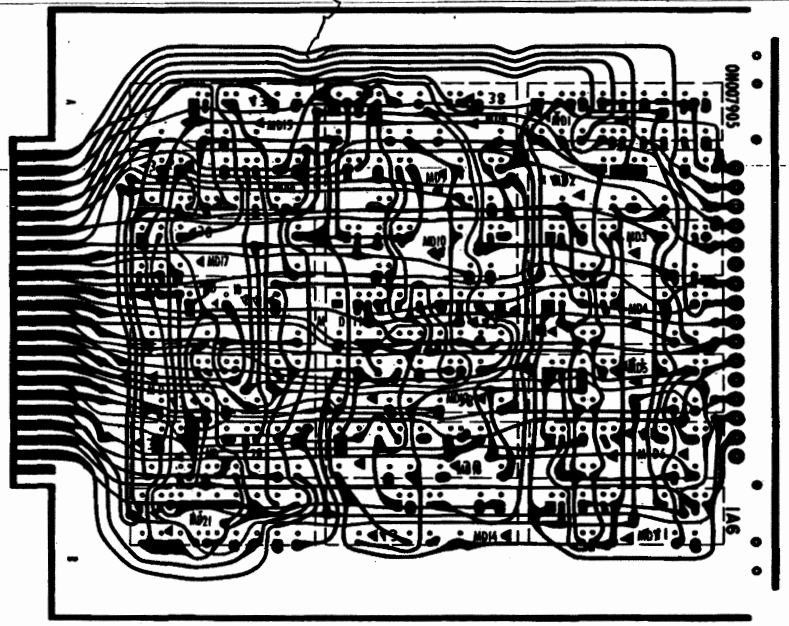


Figure 3-9.—Card E-AJN Printed-Circuit Layout.

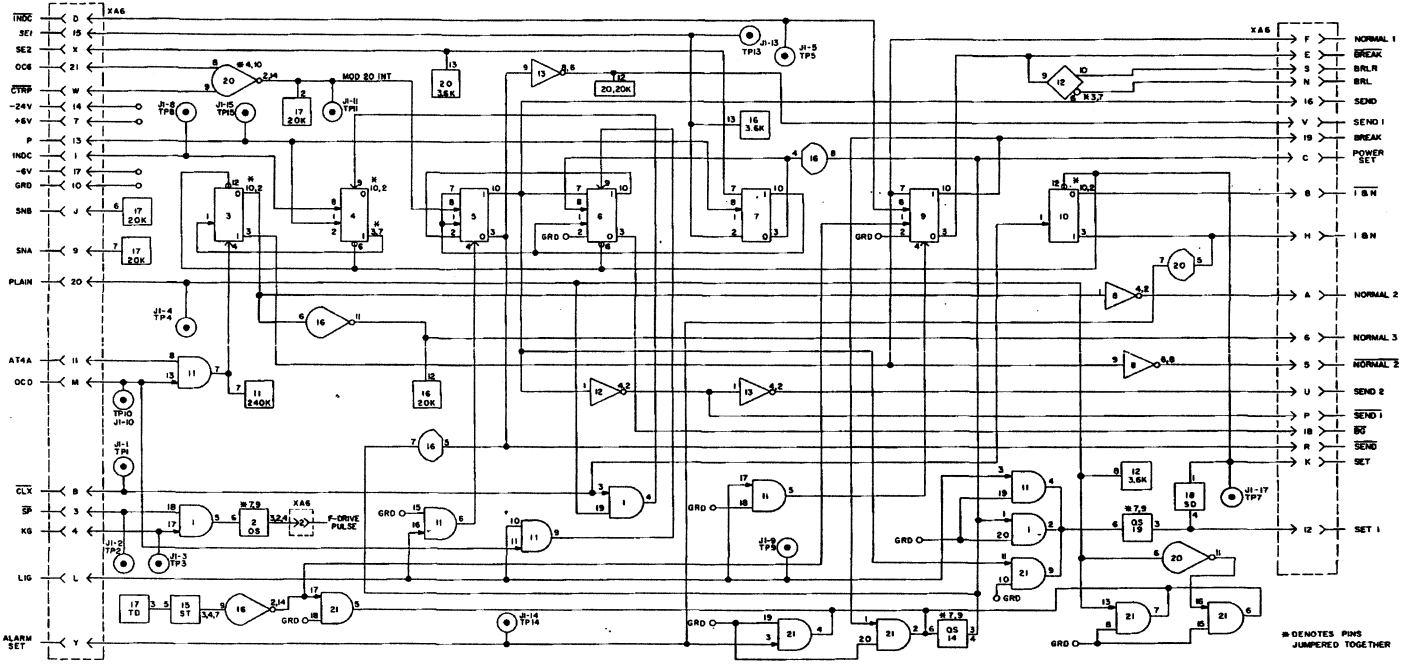


Figure 3-19.—Card E-AJN Logic Diagram.

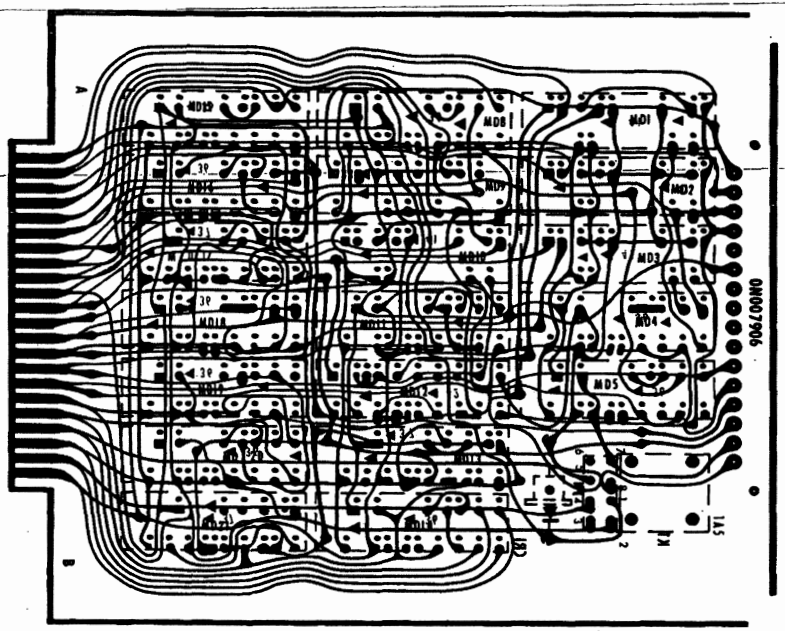


Figure 3-11.—Card E-AJO Printed-Circuit Layout.

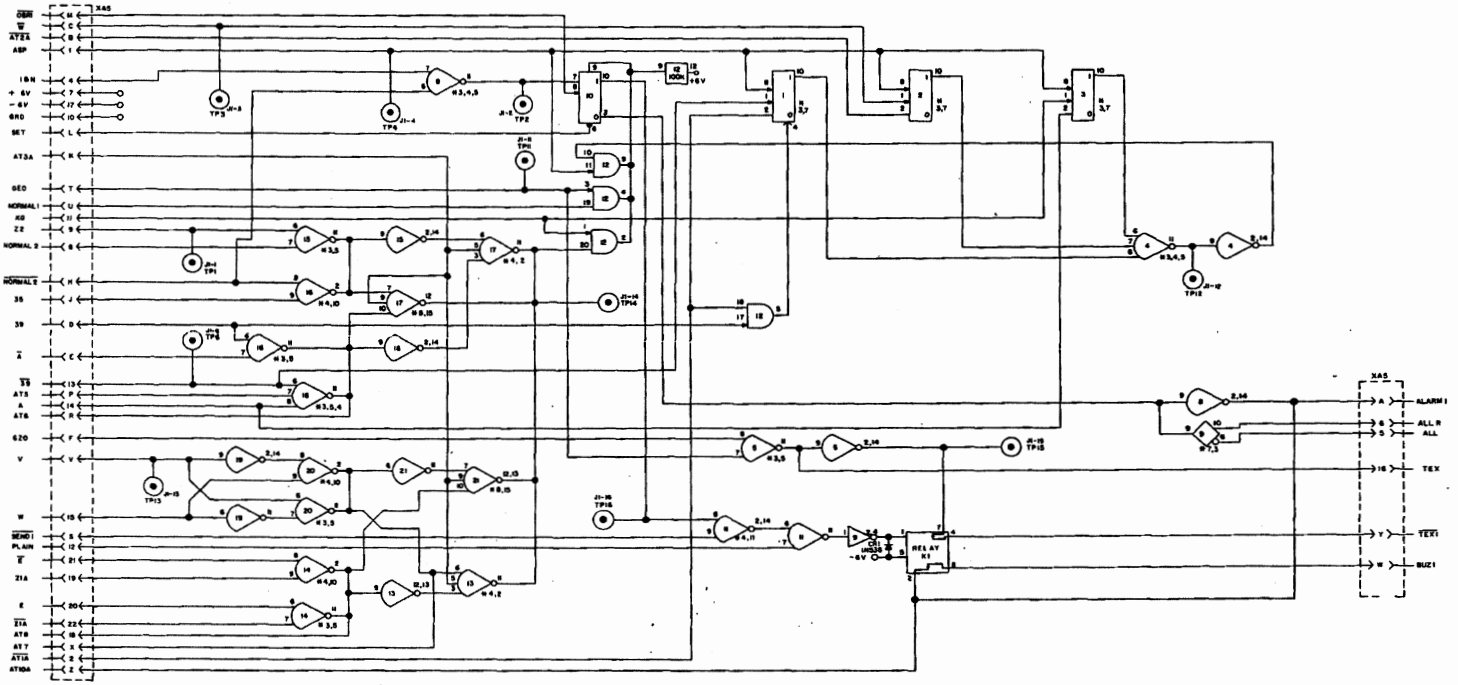


Figure 3-12.—Card E-AJO Logic Diagram. (A-5)

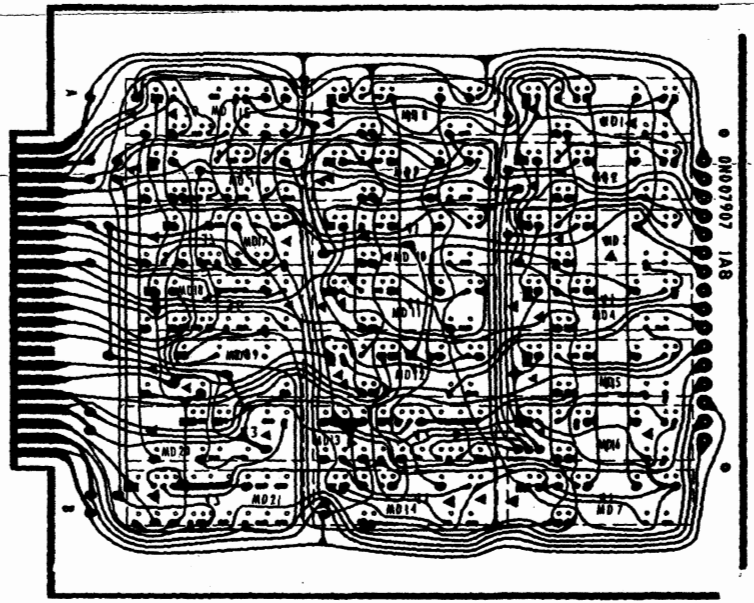


Figure 3-13.—Card E-AJP Printed-Circuit Layout.

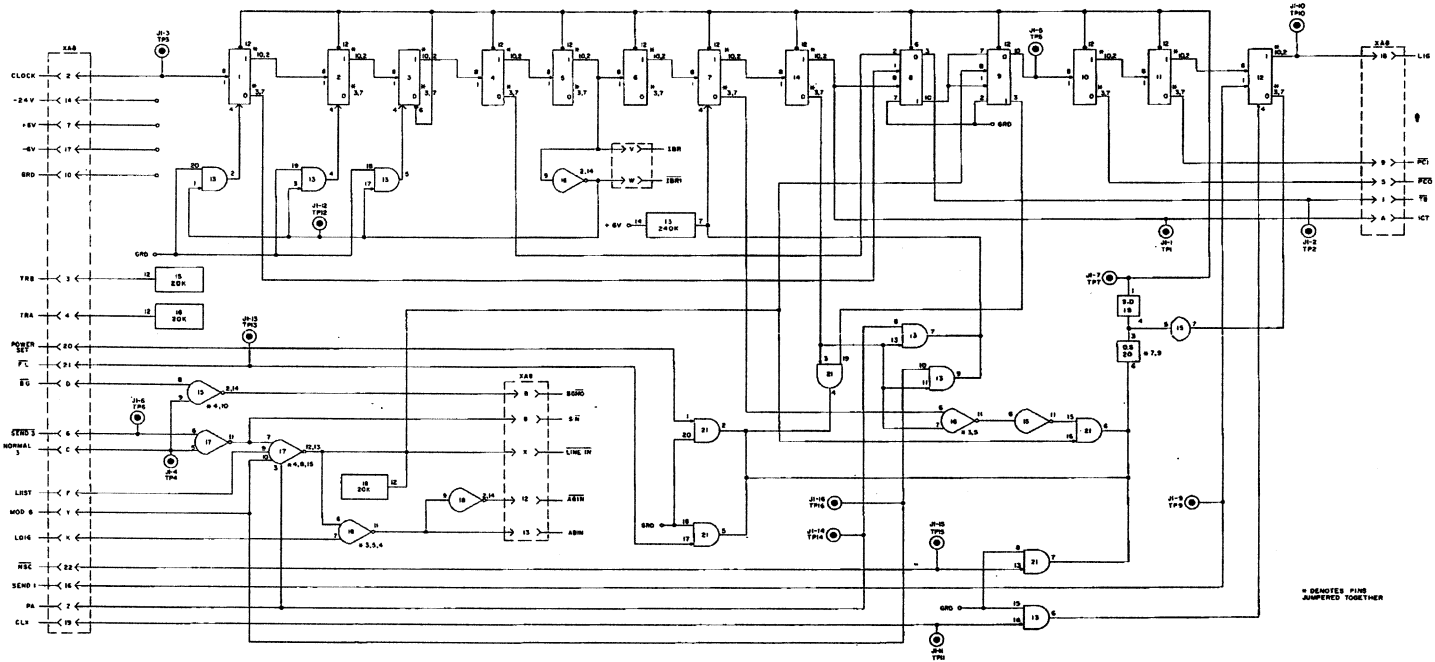


Figure 3-14.—Card E-AJP Logic Diagram. (A-8)

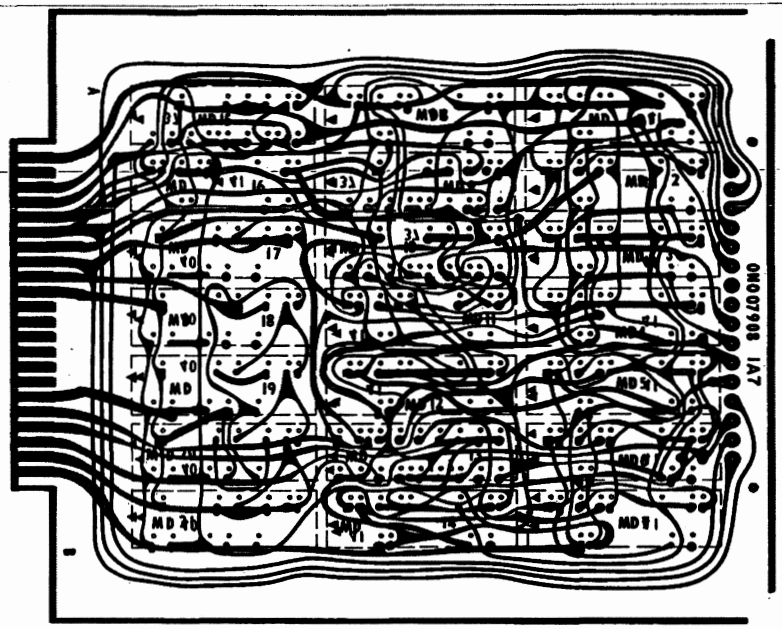


Figure 3-15.—Card E-AJQ Printed-Circuit Layout.

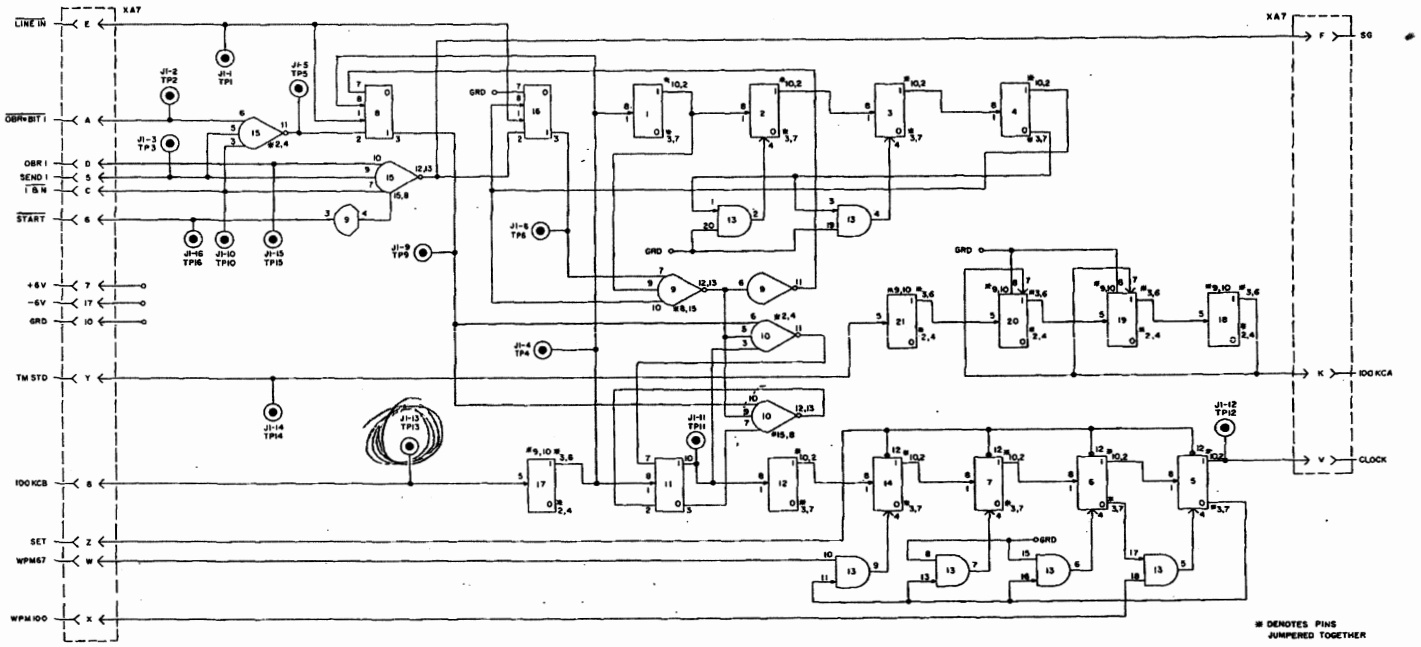


Figure 3-16.—Card E-AJQ Logic Diagram. (A-1)

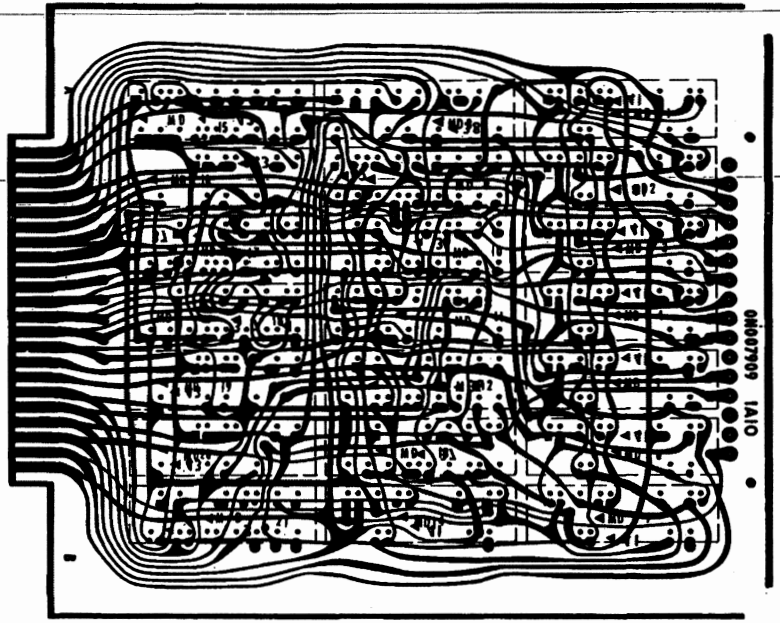


Figure 3-17.—Card E-AJR Printed-Circuit Layout.

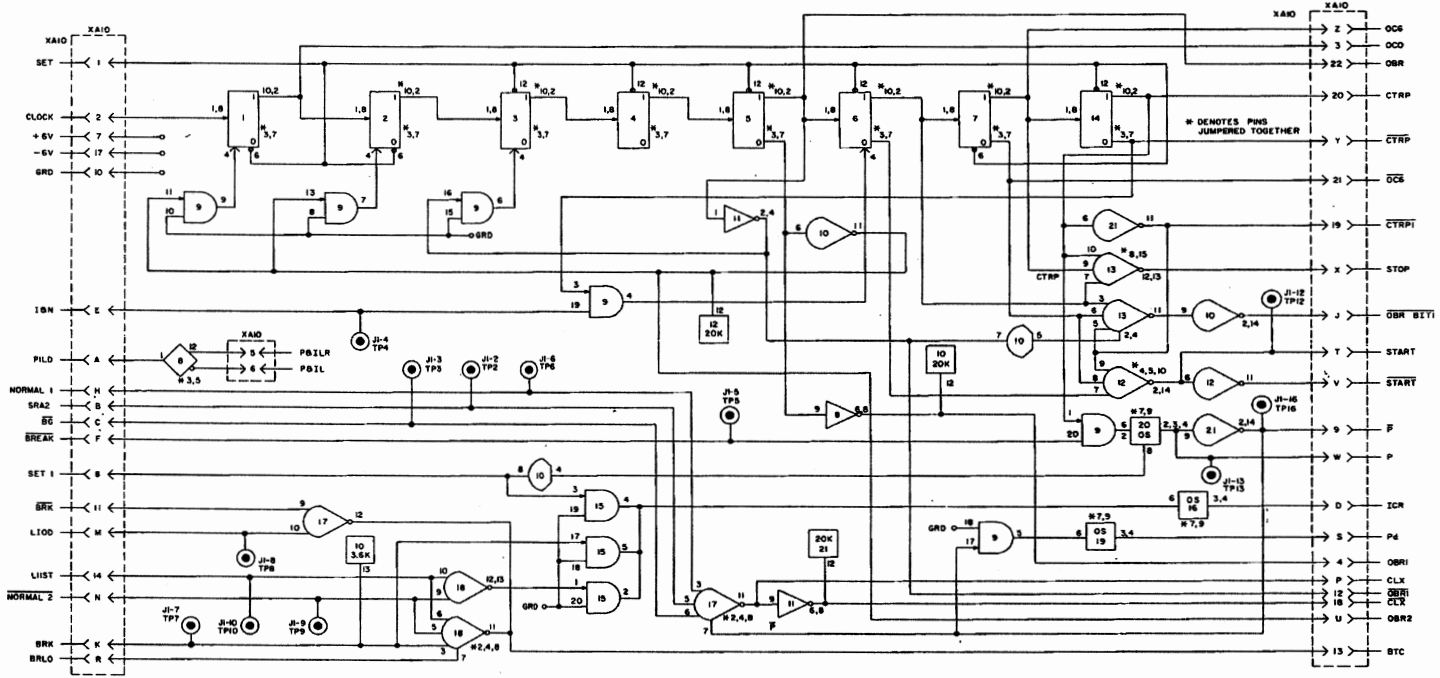


Figure 3-18.—Card E-AJR Logic Diagram. (1 of 10)

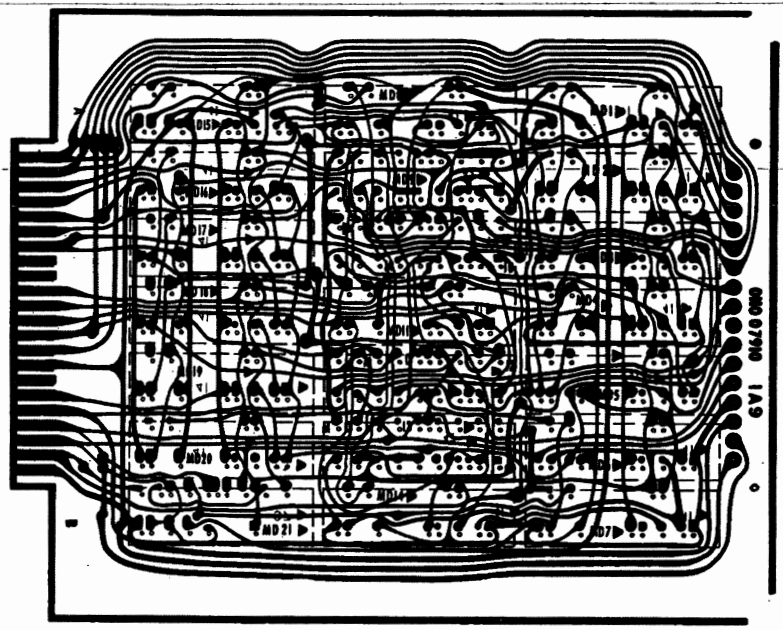


Figure 3-19.—Card E-AJS Printed-Circuit Layout.

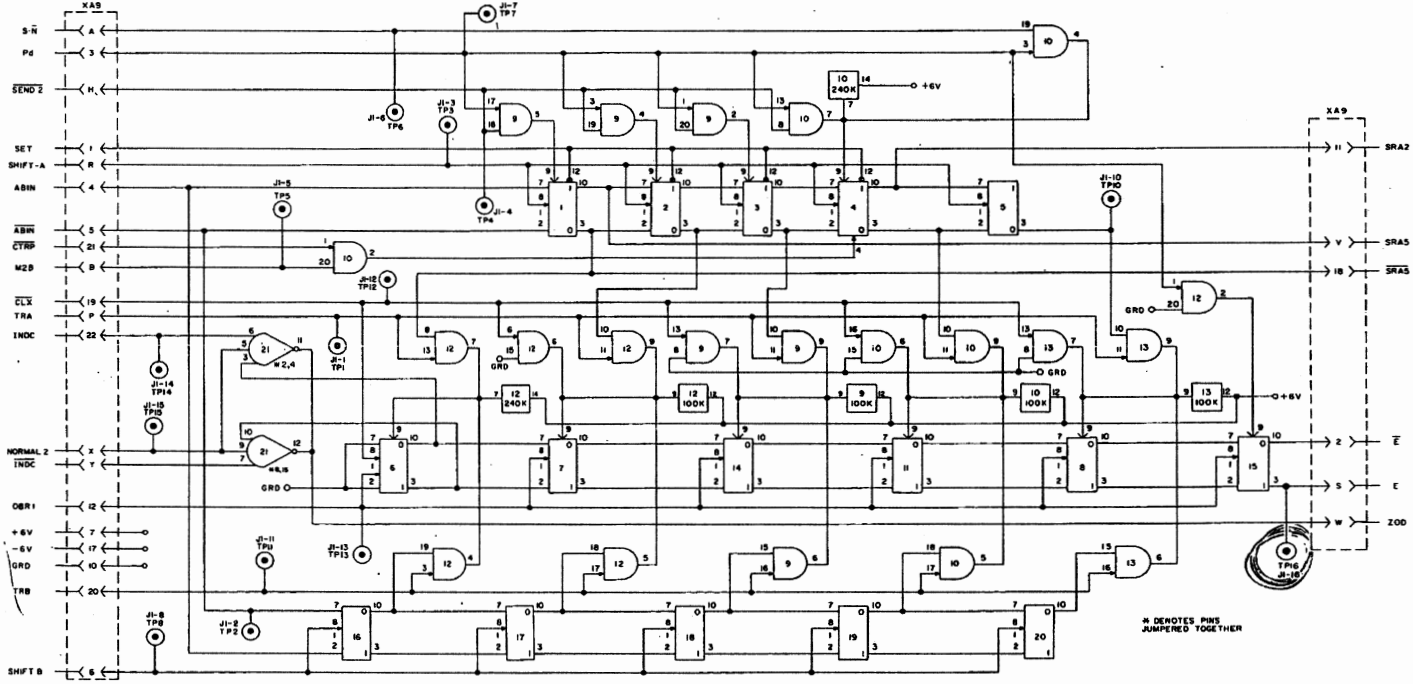


Figure 3-28.—Card E-AJS Logic Diagram. (U)

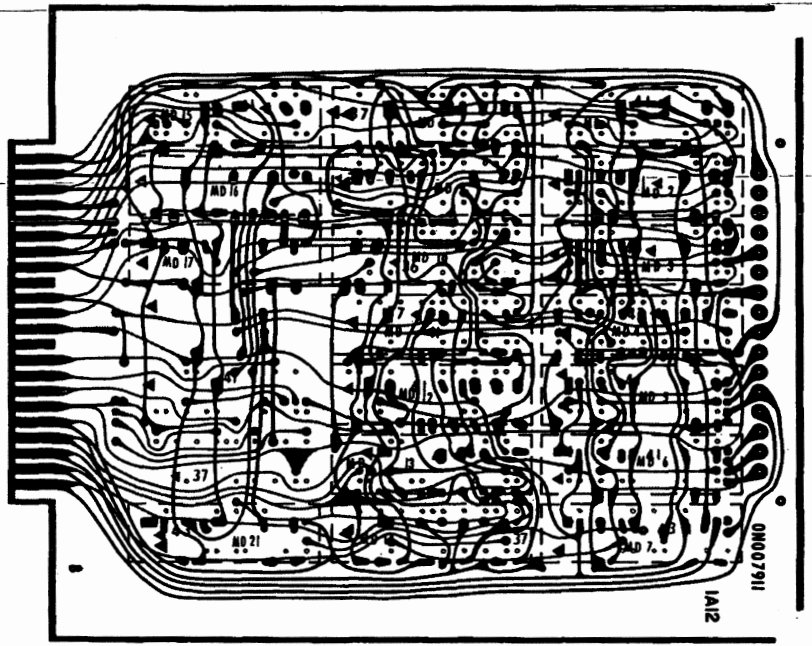


Figure 3-21.—Card E-AJT Printed-Circuit Layout.

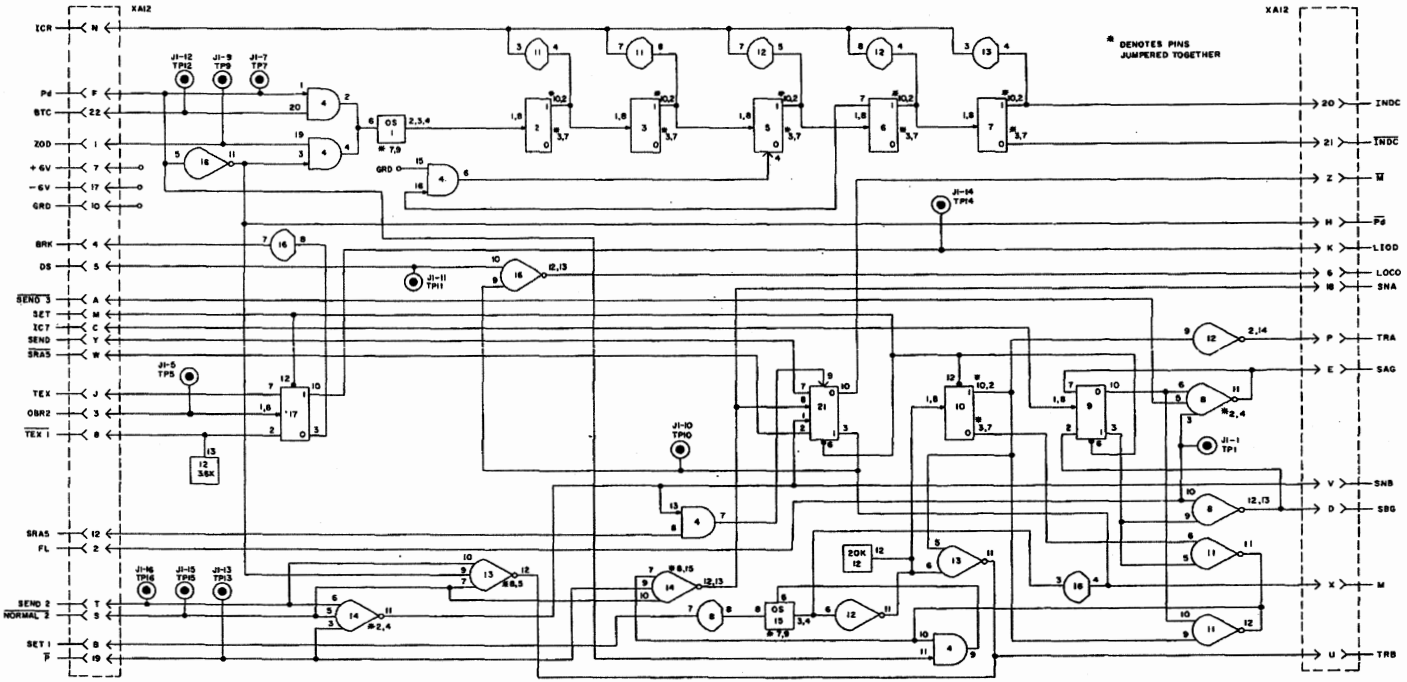


Figure 3-22.—Card E-AJT Logic Diagram.(Alt)

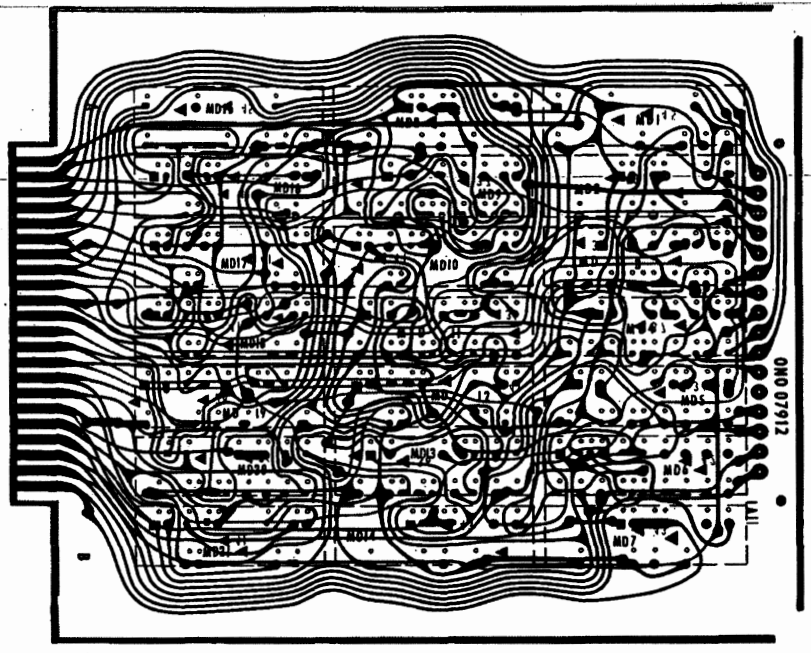


Figure 3-23.—Card E-AJU Printed-Circuit Layout.

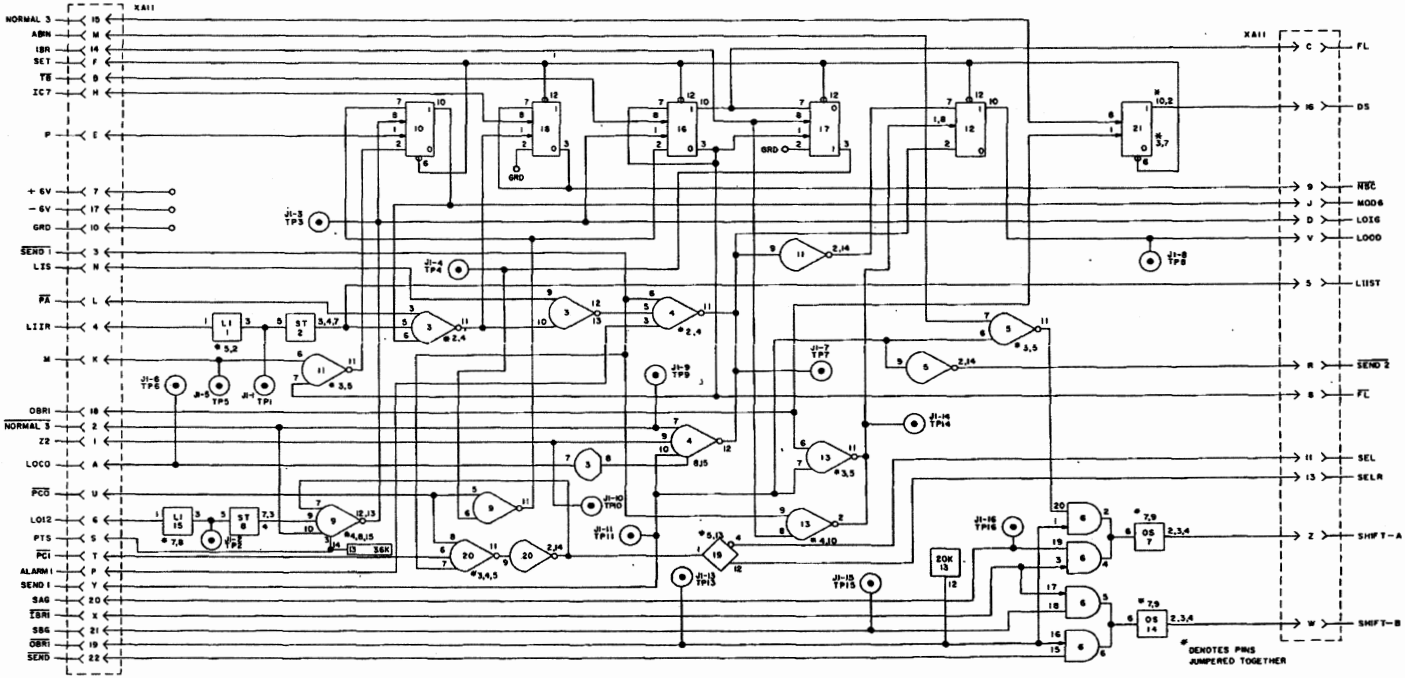


Figure 3-24.—Card E-AJU Logic Diagram.

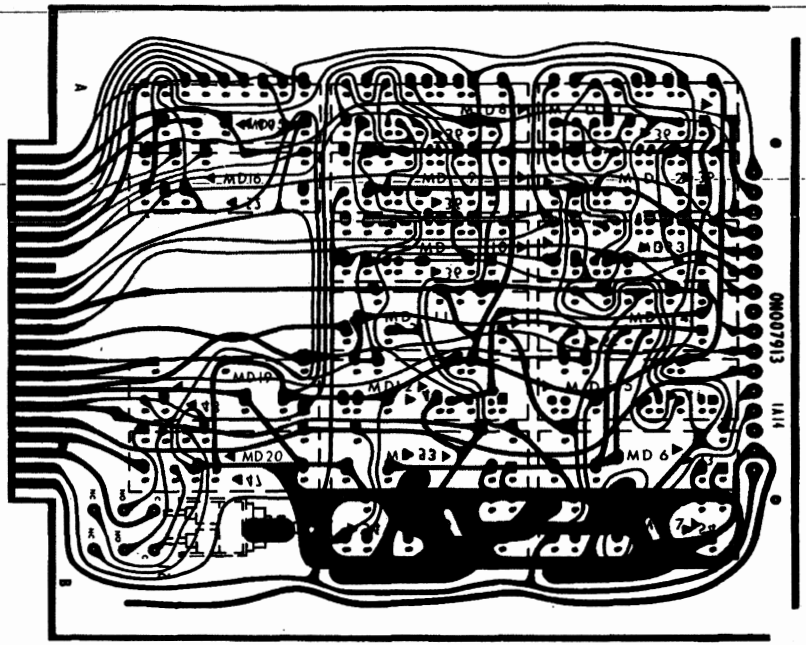


Figure 3-25.—Card E-AJV Printed-Circuit Layout.

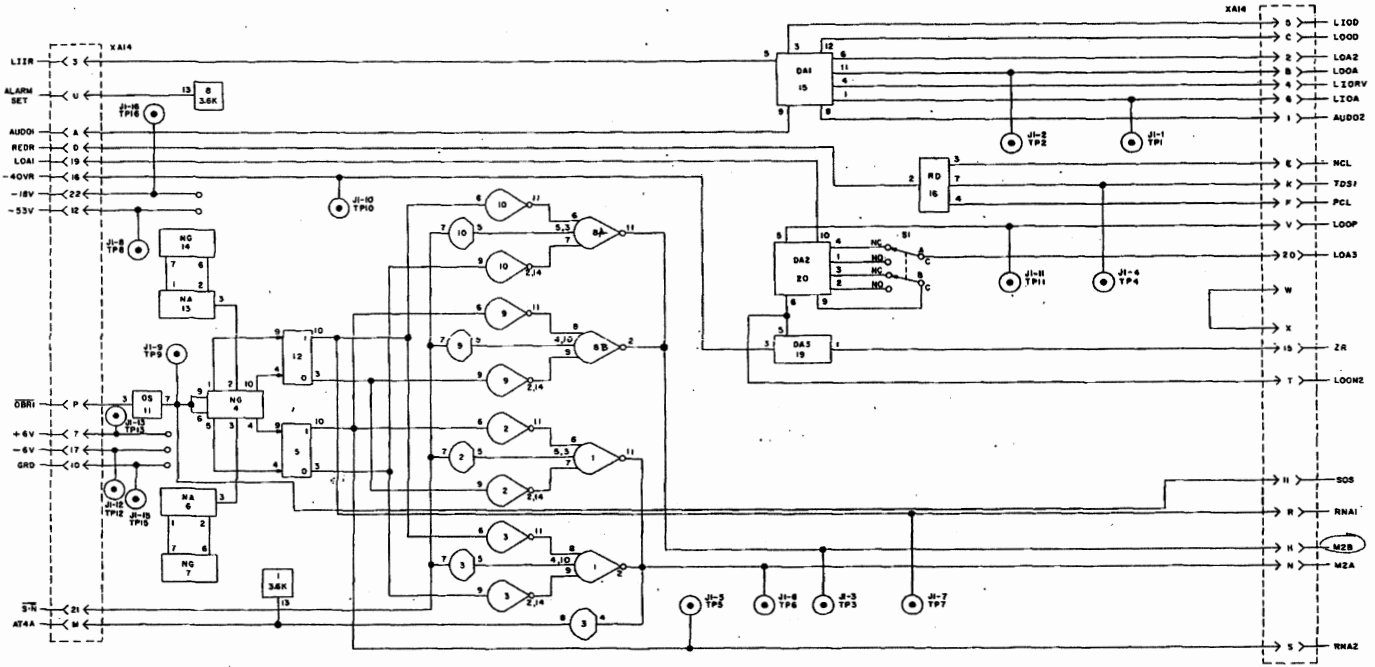


Figure 3-26.—Card E-AJV Logic Diagram. (A14)

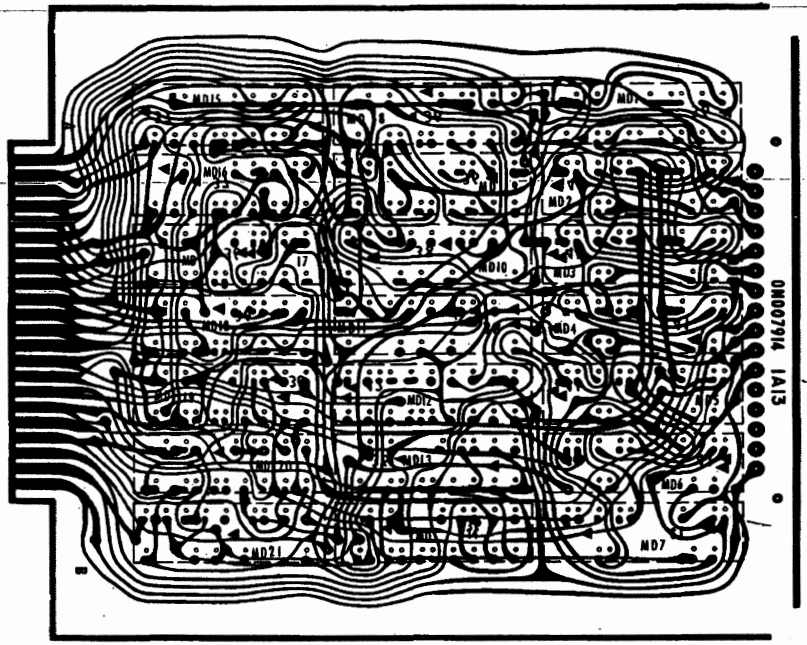
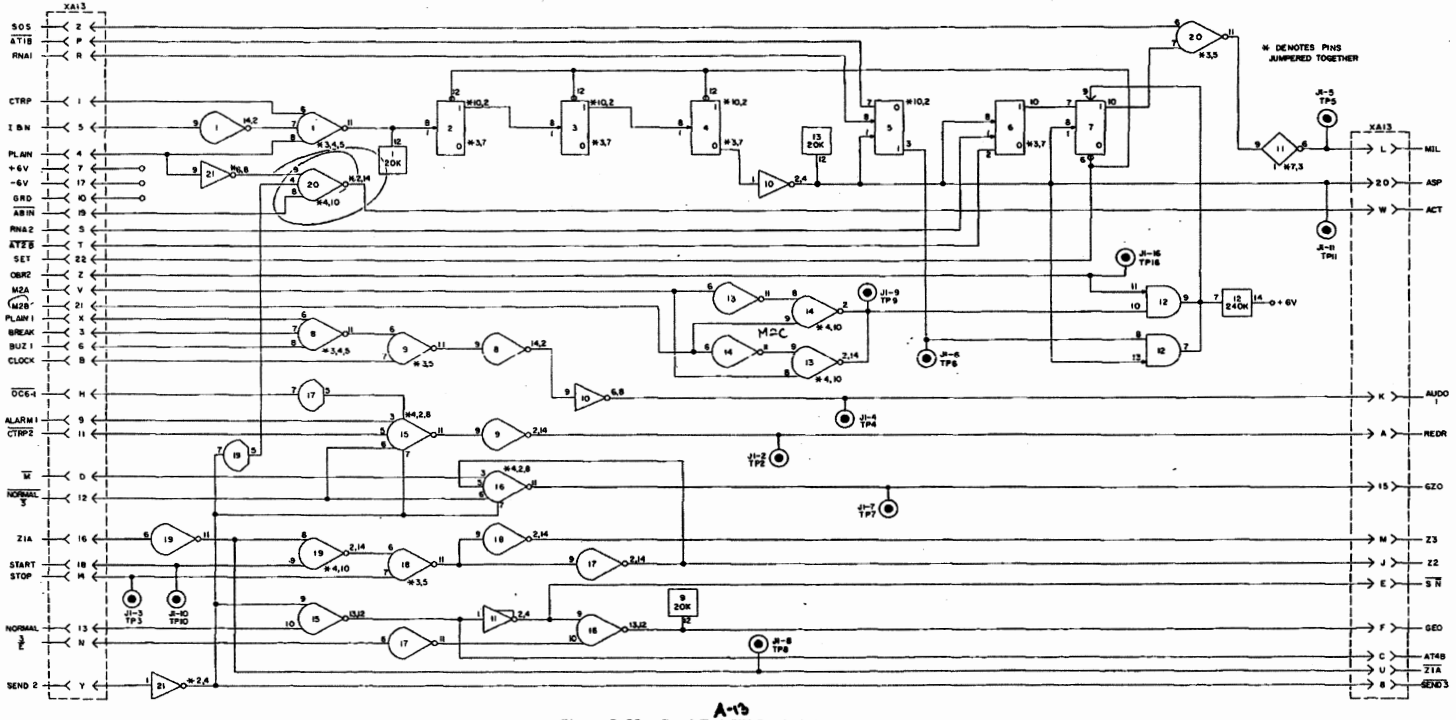
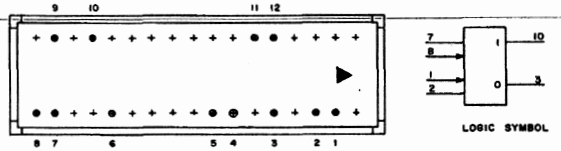


Figure 3-27.—Card E-AJW Printed-Circuit Layout.



A-13

Figure 3-28.—Card E-AJW Logic Diagram.



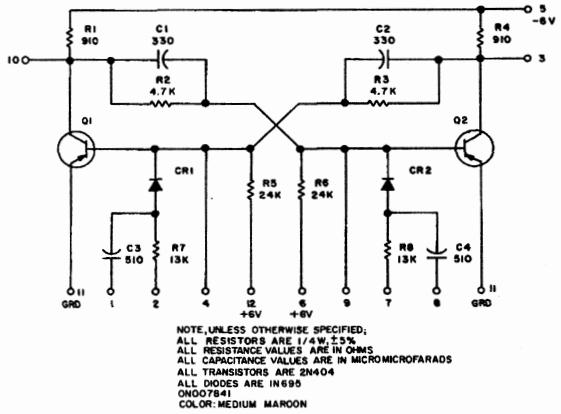
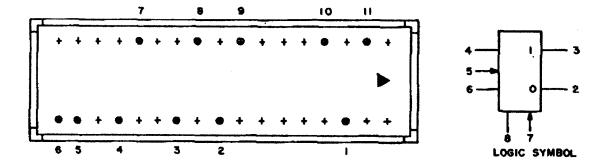


Figure 3-29.—Low-Speed Flip-Flop Module, Schematic Diagram.



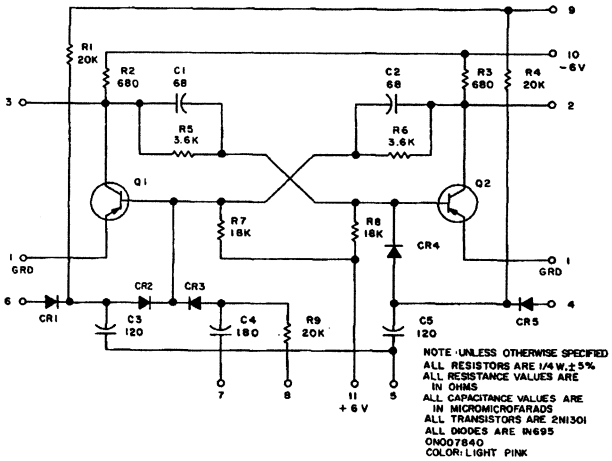


Figure 3-39.—Medium-Speed Flip-Flop Module, Schematic Diagram.

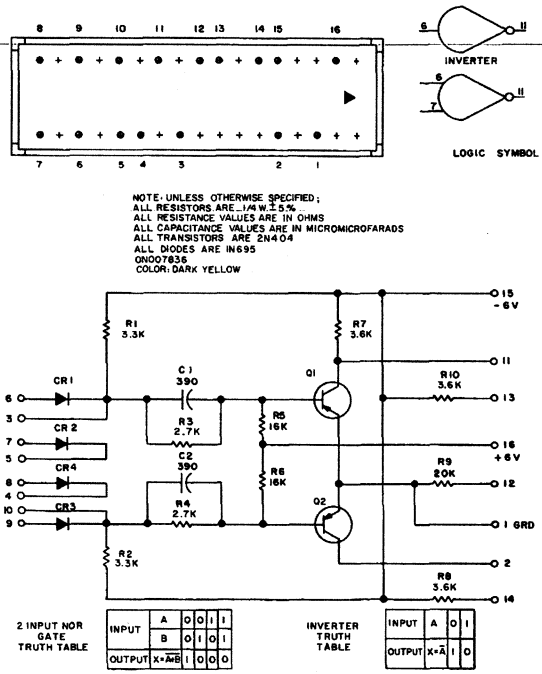


Figure 3-31.—Two-Input NOR Gate Inverter Module, Schematic Diagram.

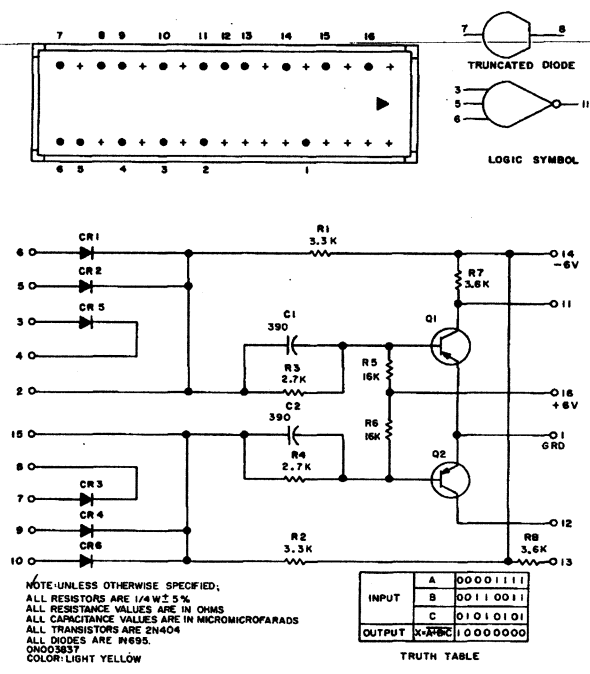


Figure 3-32.—Three-Input NOR Gate Truncated Diode Module, Schematic Diagram.

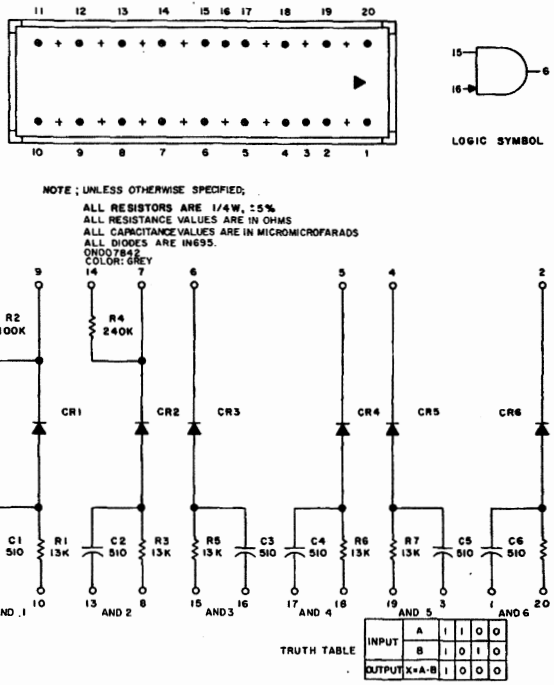


Figure 3-33. —AND Gate Module, Schematic Diagram.

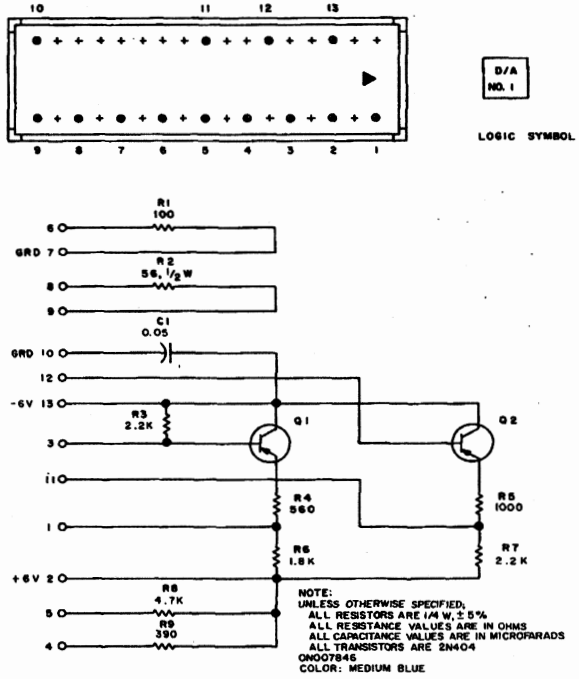


Figure 3-34. —Digital Analog No. 1 Module, Schematic Diagram.

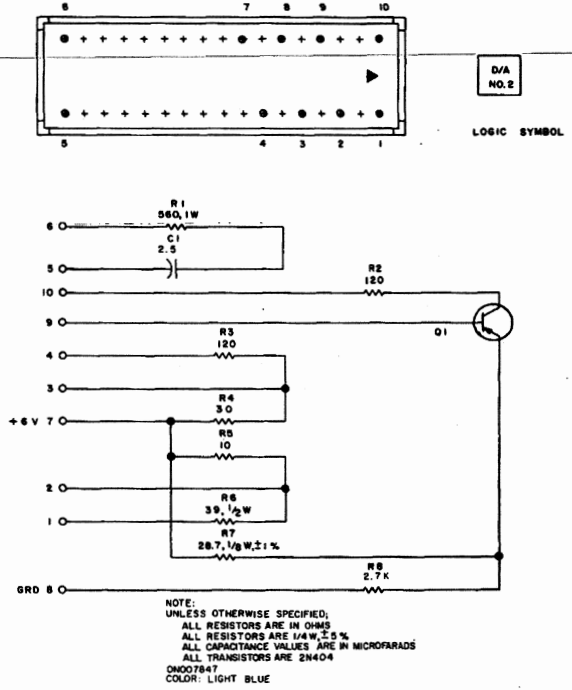


Figure 3-35. —Digital Analog No. 2 Module, Schematic Diagram.

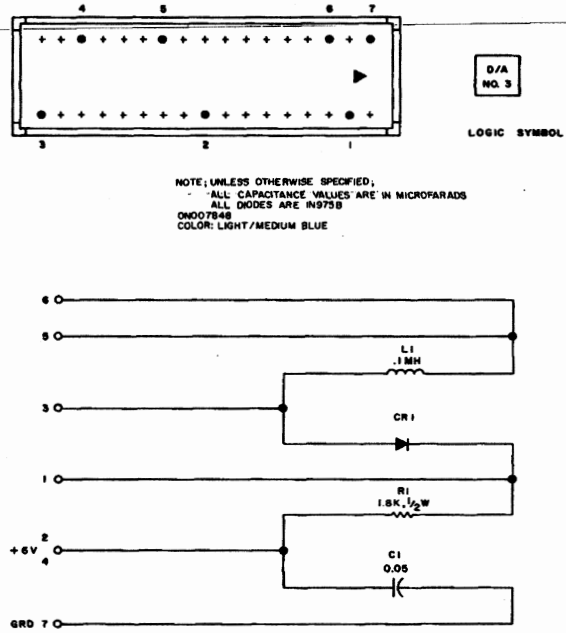
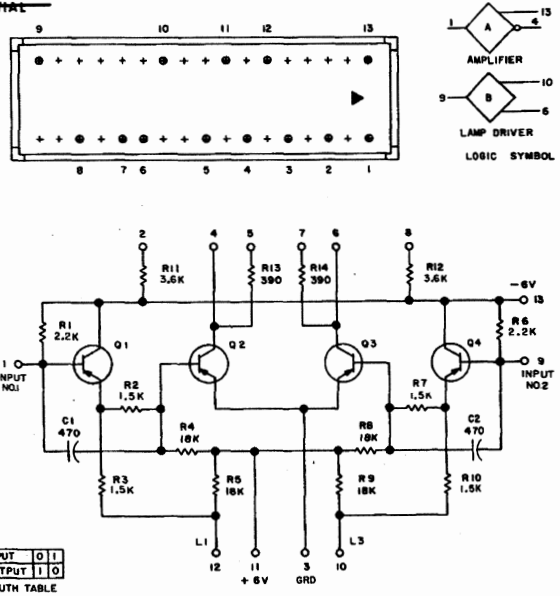
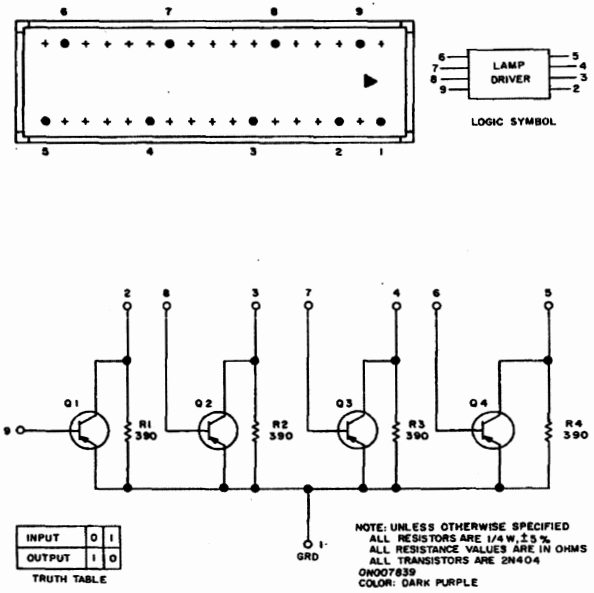


Figure 3-36. —Digital Analog No. 3 Module, Schematic Diagram.



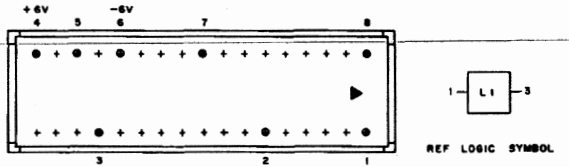
NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, ±5%
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
ALL TRANSISTORS ARE 2N404
PINS 10 AND 12 USED ONLY TO DRIVE REMOTE CONTROL UNIT LAMP DRIVER.
FOR AMPLIFIER APPLICATION: JUMPER PIN 2 TO PIN 4 (A) AND/OR PIN 6 TO PIN 8 (B).
FOR LAMP DRIVER APPLICATION: GROUND PINS 5 (A) AND/OR 7 (B).
ON007838
COLOR: MEDIUM ORANGE

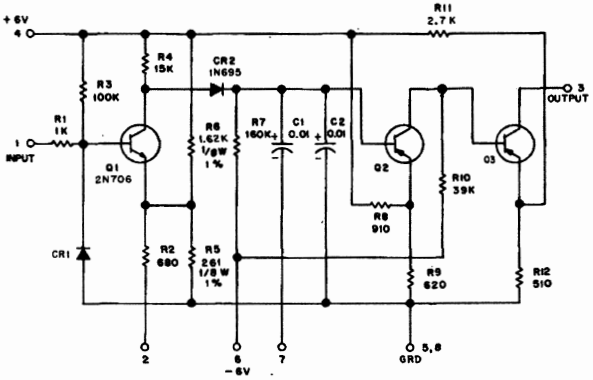
Figure 3-37. —Power Amplifier/Lamp Driver Module, Schematic Diagram.



NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, ±5%
ALL RESISTANCE VALUES ARE IN OHMS
ALL TRANSISTORS ARE 2N404
ON007839
COLOR: DARK PURPLE

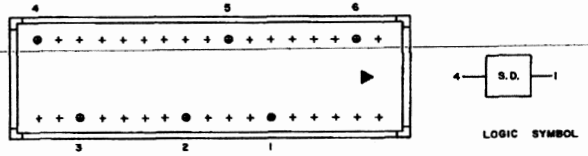
Figure 3-38. —Remote Control Unit Lamp Driver Module, Schematic Diagram.

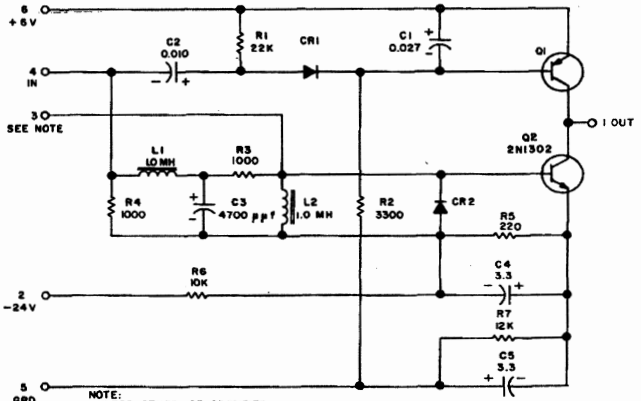




NOTE:
UNLESS OTHERWISE SPECIFIED;
ALL RESISTANCE VALUES ARE IN OHMS
ALL RESISTORS ARE 1/4W, ±5%
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ALL TRANSISTORS ARE 2N404
DIODE CR1 IS TYPE IN457
COLOR: ANTIQUE WHITE

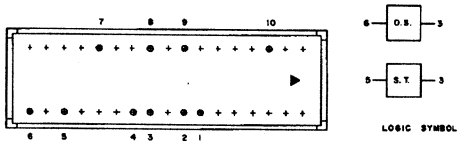
Figure 3-39. —Loop Input/Line Input Module, Schematic Diagram.

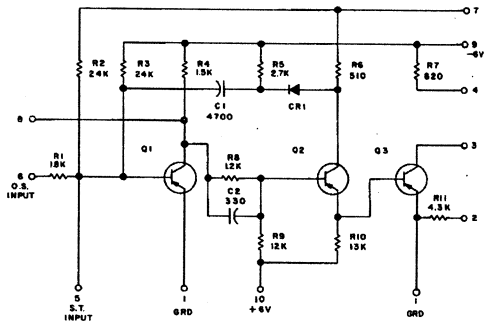




NOTE:
UNLESS OTHERWISE SPECIFIED;
ALL RESISTORS ARE 1/4W, ±5%
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ALL TRANSISTORS ARE 2N404
ALL DIODES ARE IN695
PIN 3 IS A DUMMY PIN, USED ONLY TO TIE MOD. TO MOTHER BOARD
ONDOT844
COLOR; MAROON

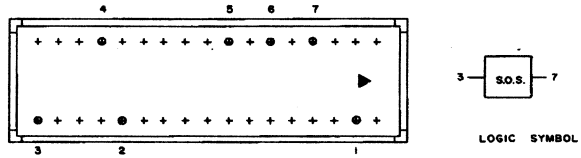
Figure 3-40. —Set Driver Module, Schematic Diagram.

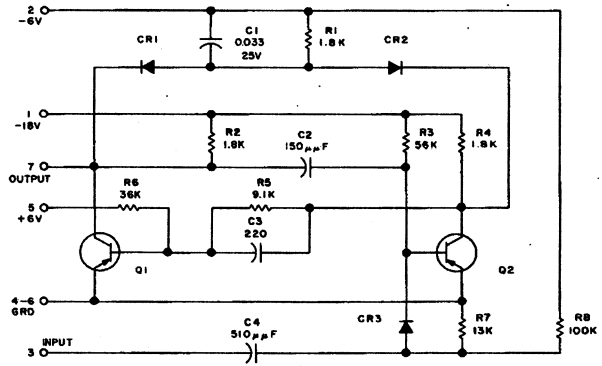




NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, ±5%.
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ALL TRANSISTORS ARE 2N404
ALL DIODES ARE IN695.
FOR ONE SHOT OPERATION, CONNECT PIN 7 TO PIN 9
FOR SCHMITT TRIGGER OPERATION, CONNECT PIN 7 TO PIN 3
IN ALL OPERATIONS, EXCEPT WHEN DRIVING A SET DRIVER
CONNECT PIN 3 TO PIN 4
ON007843
COLOR: BLACK

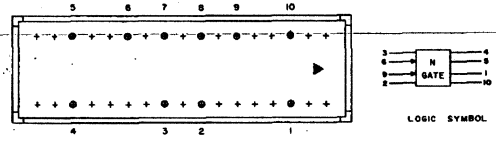
Figure 3-41. —One Shot/Schmitt Trigger Module, Schematic Diagram.



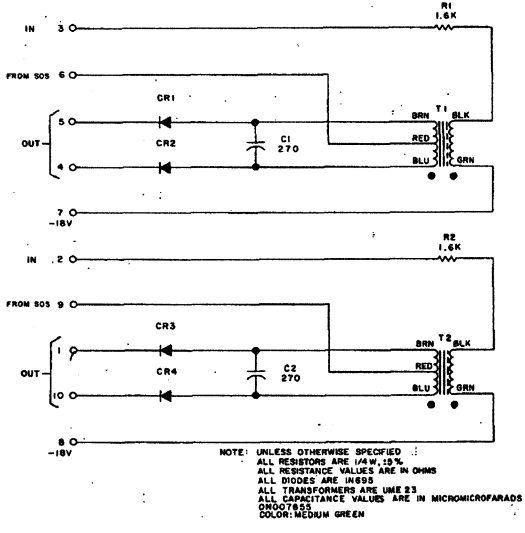


NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W ± 5 %
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ALL TRANSISTORS ARE 2N404
ALL DIODES ARE IN695
ON007851
COLOR; LIGHT GREEN

Figure 3-42. —Special One Shot Module, Schematic Diagram.

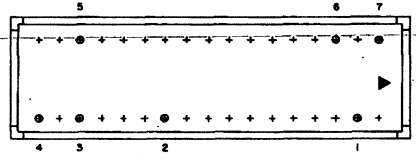


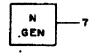
LOGIC SYMBOL



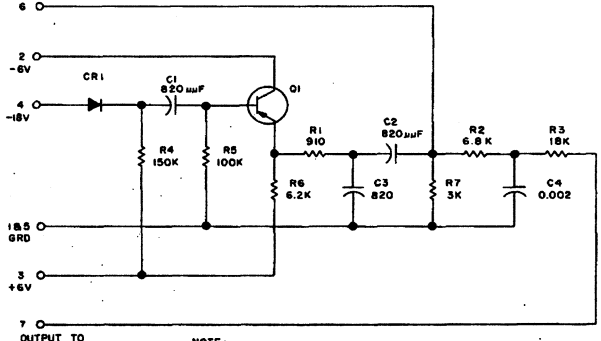
NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4 W, 5%
ALL RESISTANCE VALUES ARE IN OHMS
ALL DIODES ARE IN695
ALL TRANSFORMERS ARE UME 23
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
ON007695
COLOR: MEDIUM GREEN

Figure 3-43. —Noise Gate Module, Schematic Diagram.



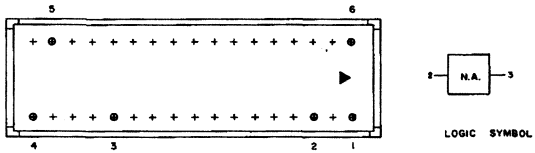


LOGIC SYMBOL

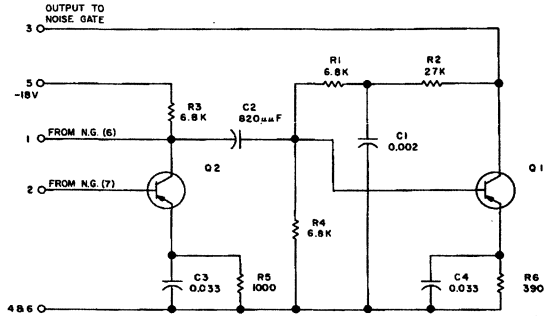


NOTE:
UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/4 W, ±5%
ALL CAPACITANCE ARE IN MICROFARADS
ALL RESISTANCE VALUES ARE IN OHMS
ALL TRANSISTORS ARE 2N404
ON007854
COLOR, GREEN

Figure 3-44. —Noise Generator Module, Schematic Diagram.



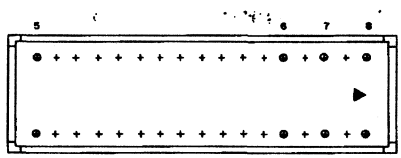
LOGIC SYMBOL

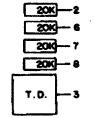


NOTE:
UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/4 W, ±5%
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ALL RESISTANCE VALUES ARE IN OHMS
ALL TRANSISTORS ARE T-2239
ON007853
COLOR: LIGHT/MEDIUM GREEN

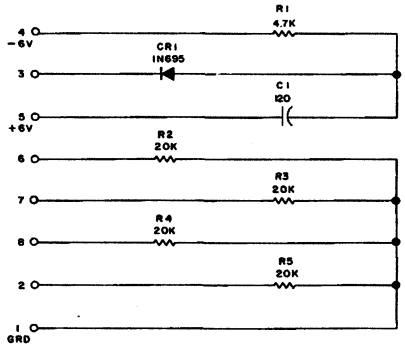
Figure 3-45.—Noise Amplifier Module, Schematic Diagram.

KAM-144B/TSEC



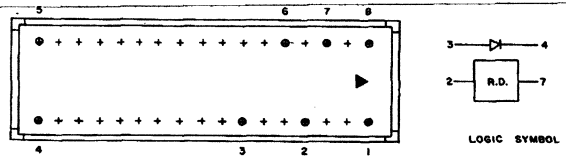


LOGIC SYMBOL



NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, ±5%
ALL CAPACITANCE VALUES ARE IN MICROFARADS
ON007850
COLOR, LIGHT PURPLE

Figure 3-46.—Time Delay Module, Schematic Diagram.



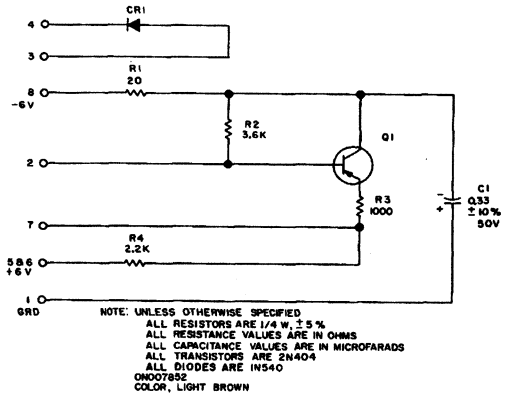


Figure 3-47. —Relay Driver Module, Schematic Diagram.

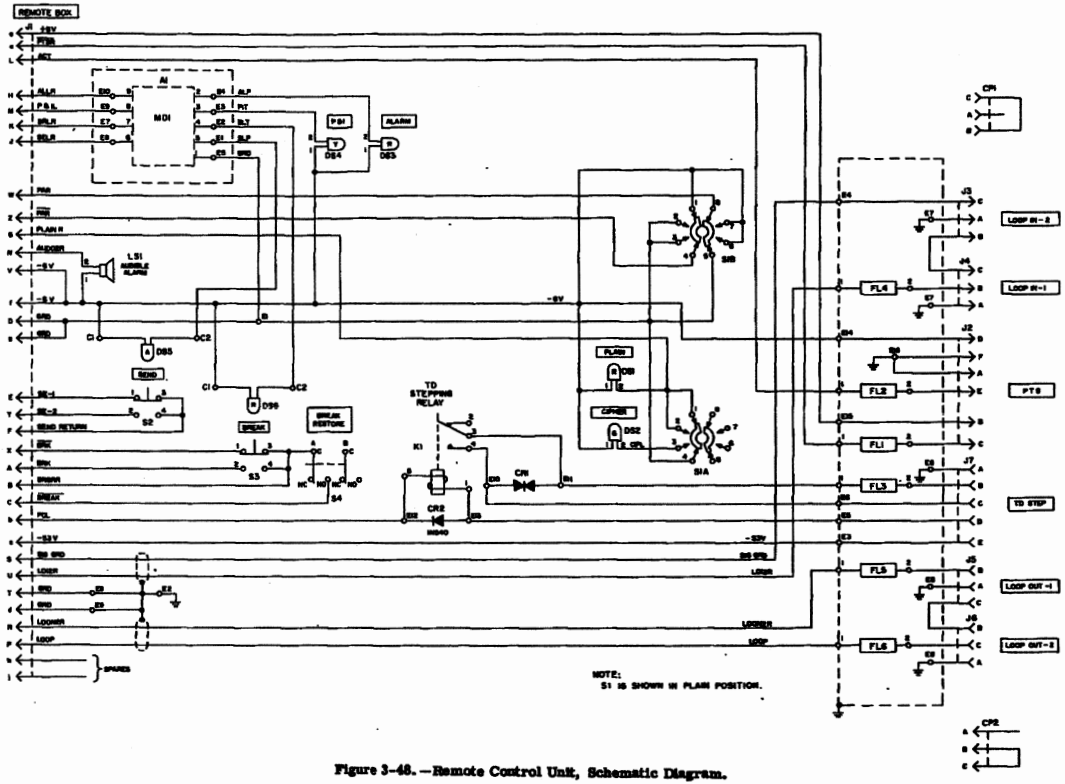
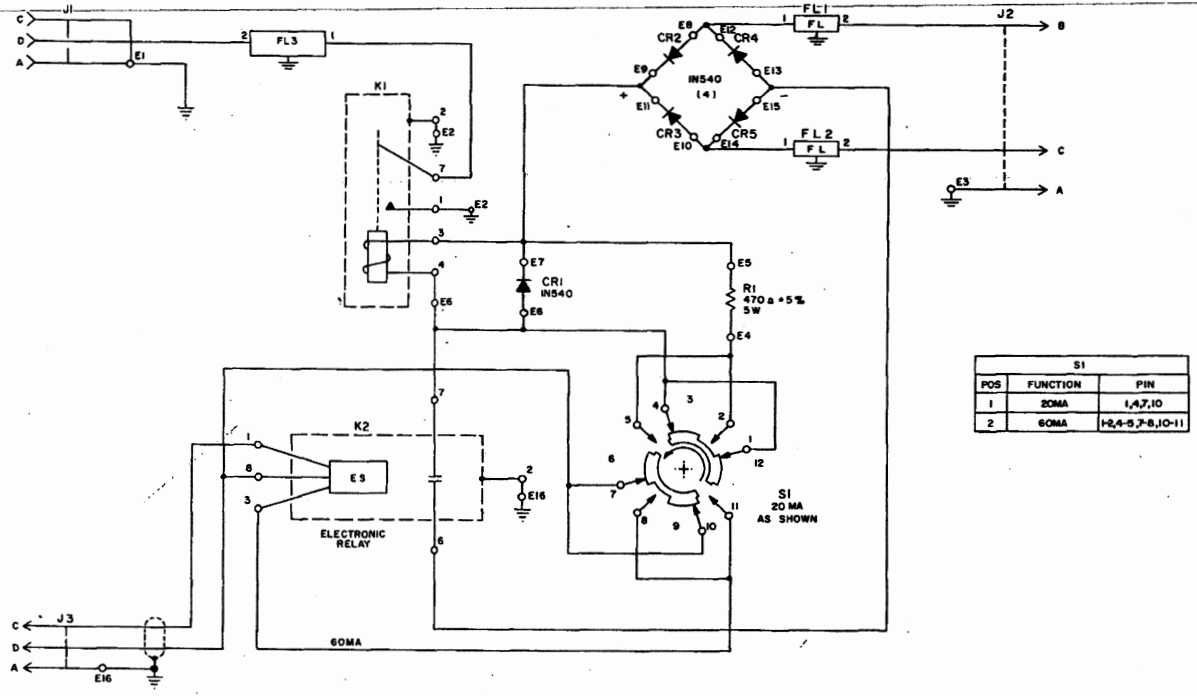


Figure 3-48.—Remote Control Unit, Schematic Diagram.



S1		
POS	FUNCTION	PIN
1	20MA	1,4,7,10
2	60MA	1-2,4-5,7-8,10-11

Figure 3-49. —Two-Wire Loop Adapter Unit, Schematic Diagram.

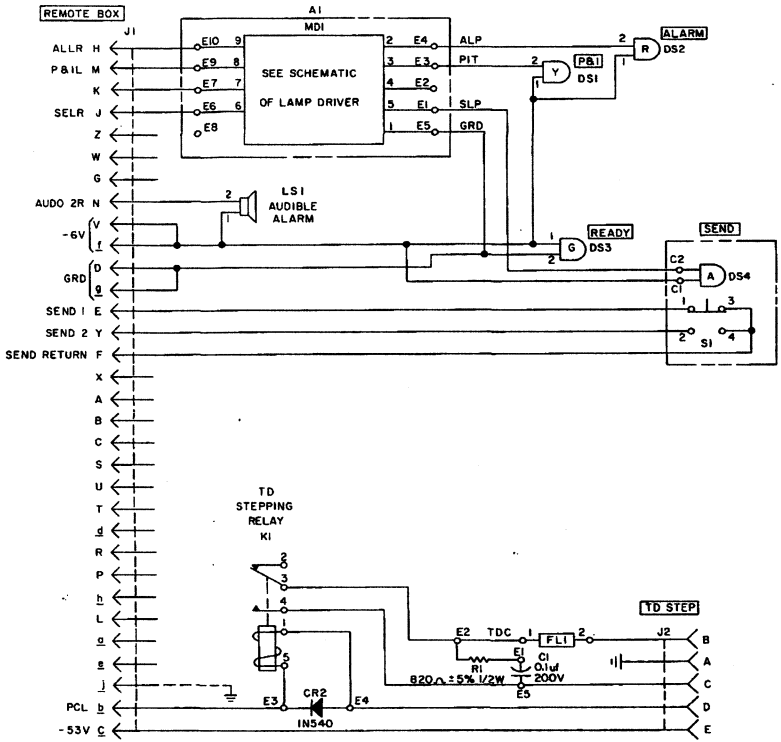


Figure 3-5ø. — Functional Remote Control Unit, Schematic Diagram.

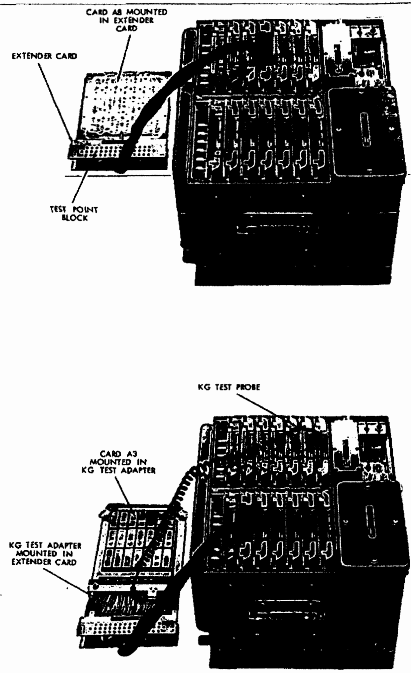


Figure 3-51. –KG Test Adapter and Extender Card.

TEST PATTERNS (TTY)

Test Pattern	Signal Name	Card Location
1. TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT	35	E-AJL (A4) TP-8
2. EOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOEOE	$\overline{39}$	E-AJO (A5) TP-6
3. UTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEUTEU	A	E-AJL (A4) TP-16
4. OUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUOUO	ASP	E-AJO (A5) TP-4
5. ET	$\overline{P}$	E-AJJ (A2) TP-10
6. XXXXXXXXXXXXXXXXXXXXXXXXXXXXQVKXQVKXQVKXQVKXQVKXQVKXQVKX	q and SP	E-AJJ (A2) TP-14
7. IEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEIEI	$\overline{r}$	E-AJK (A1) TP-14
8. ANANANANANANANANANANANANANANANANANANANANANANANANANANANA	$\overline{s}$	E-AJK (A1) TP-16
9. KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK	$\overline{t}$	E-AJK (A1) TP-15
10. YXX XP DQR YX XP DQR	X	E-AJM (A3) TP-7
11. PPZZNRPZBFPPZZNRPZBFPPZZNRPZBFPPZZNRPZBFPPZZNRPZBFPPZZN	V	E-AJO (A5) TP-13
12. BXLDQIFP BXLDQIFP BXLDQIFP	$\overline{W}$	E-AJO (A5) TP-3
13. WJATGTHMU WJATGTHMU WJATGTHMU WJATGTHMU WJATGTHMU	K	E-AJM (A3) TP-1

Figure 3-52. –KG Test Printouts.

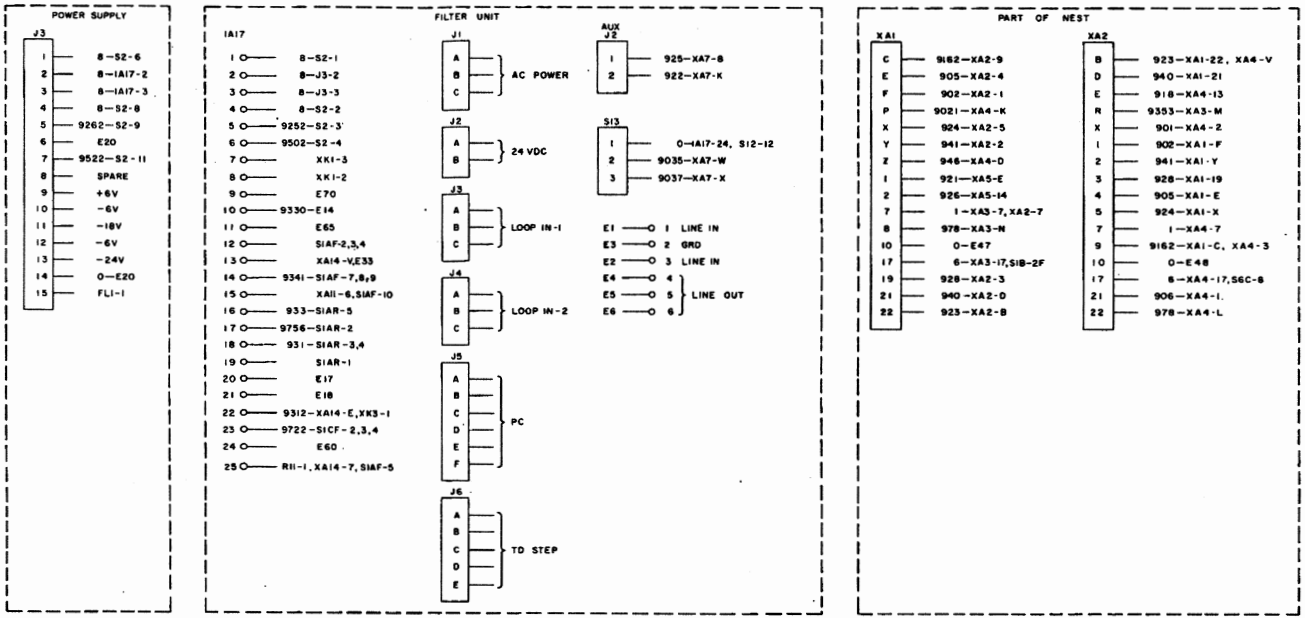


Figure 3-53.—Interconnection Wiring Diagram (sheet 1 of 6).

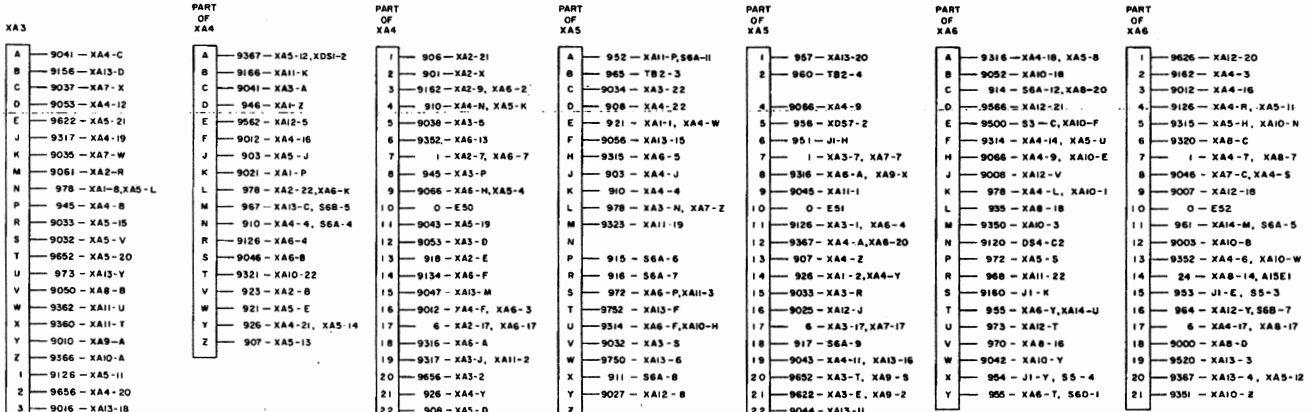


Figure 3-53. —Interconnection Wiring Diagram (sheet 2 of 6).

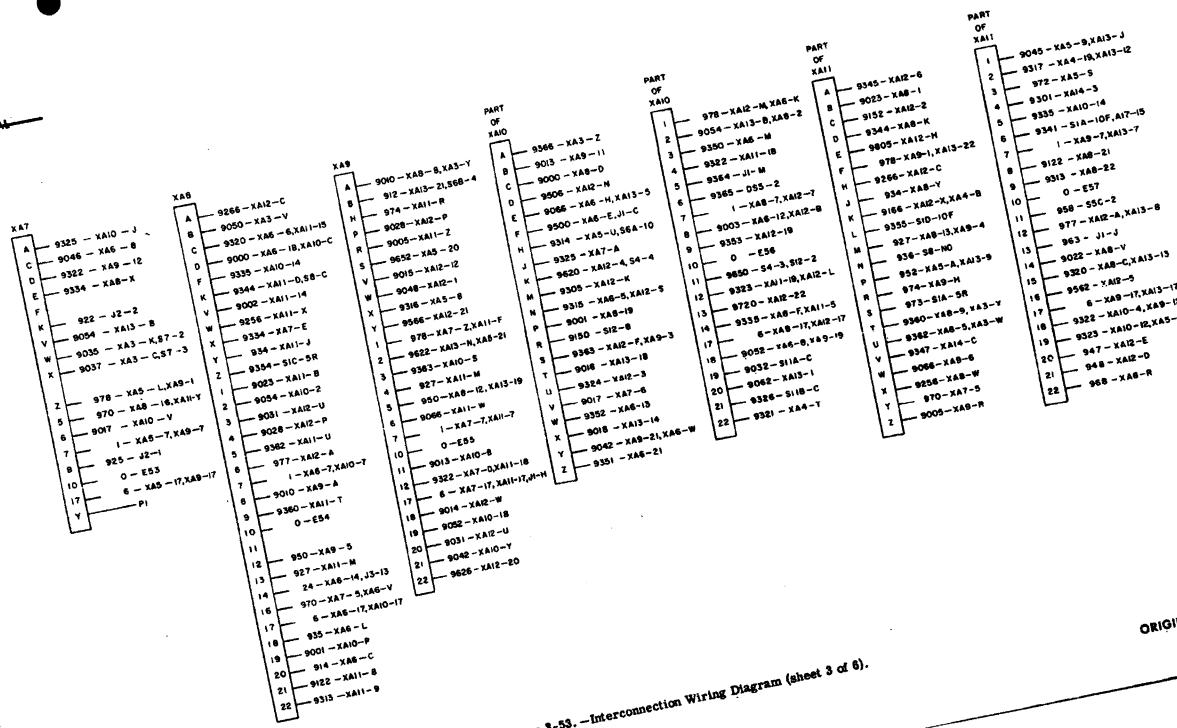


Figure 3-53. —Interconnection Wiring Diagram (sheet 3 of 6).

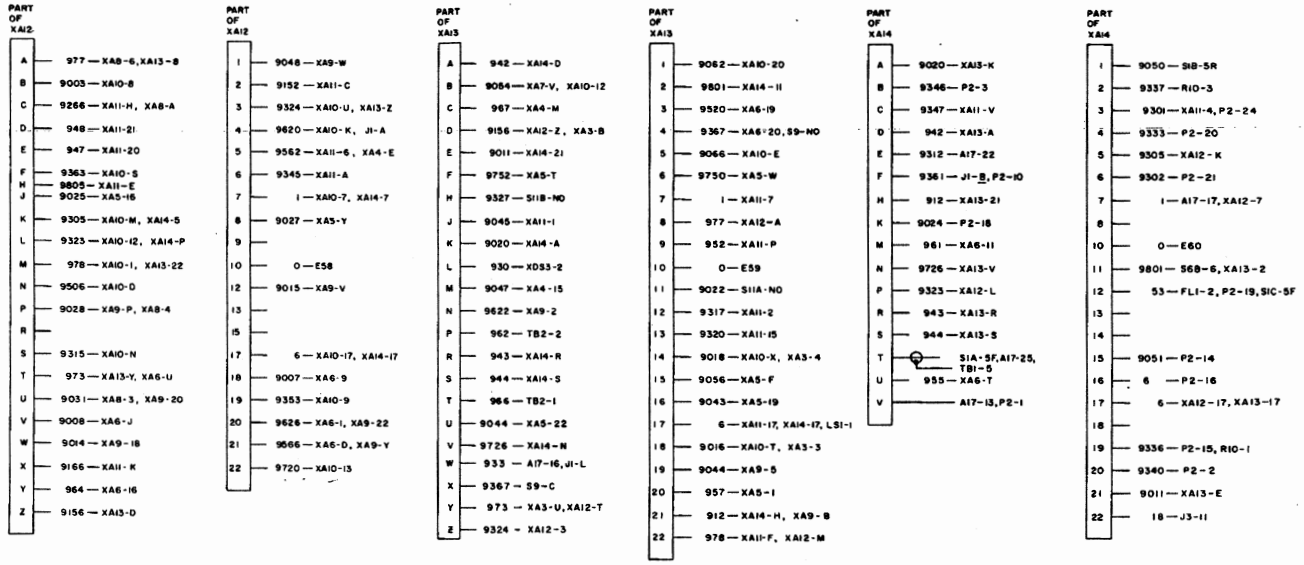


Figure 3-53. —Interconnection Wiring Diagram (sheet 4 of 6).

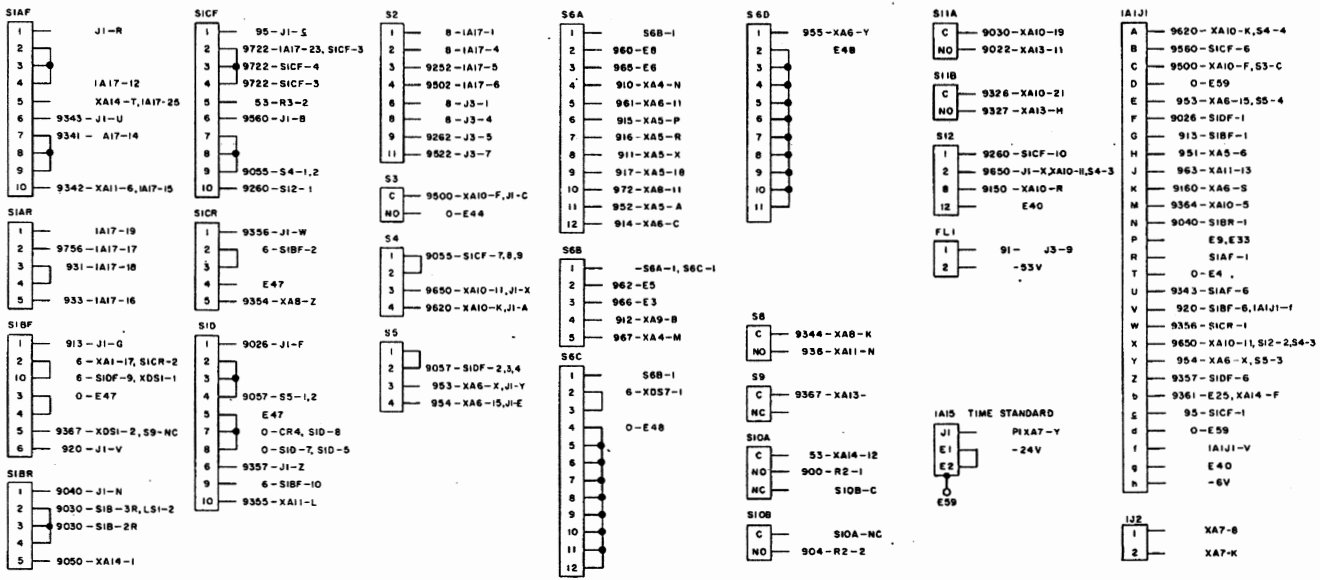


Figure 3-53. —Interconnection Wiring Diagram (sheet 5 of 6).

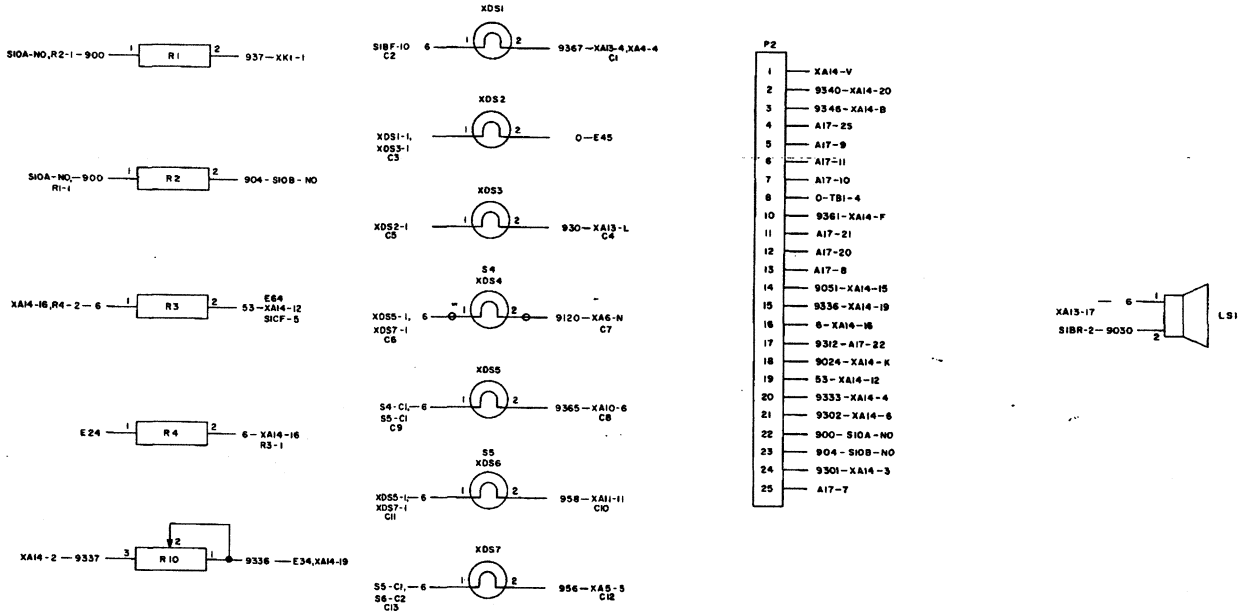
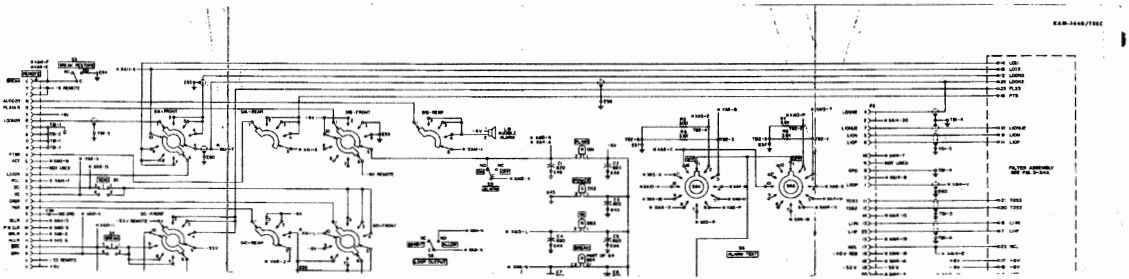


Figure 3-53. —Interconnection Wiring Diagram (sheet 6 of 6).

DOCID: 3559657



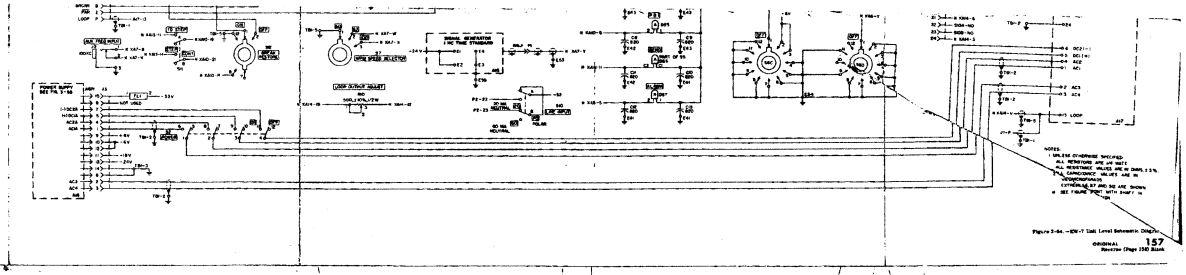
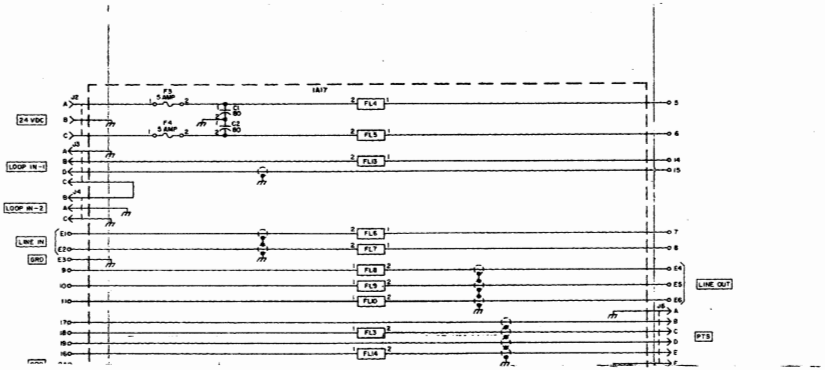
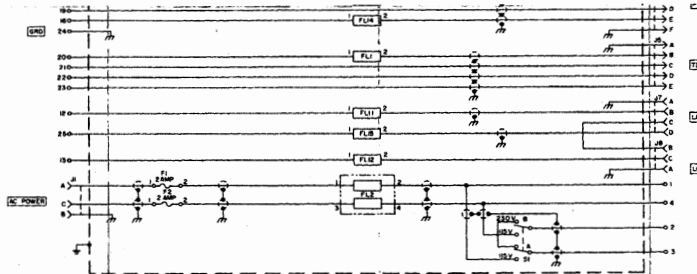


Figure 3-64. —IDV-7 Unit Level Schematic Diagram

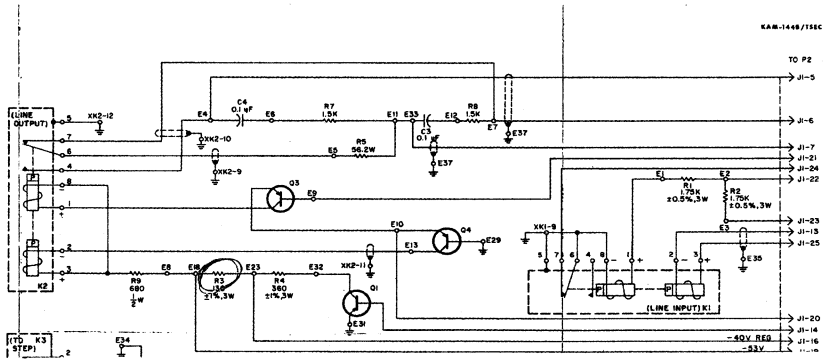


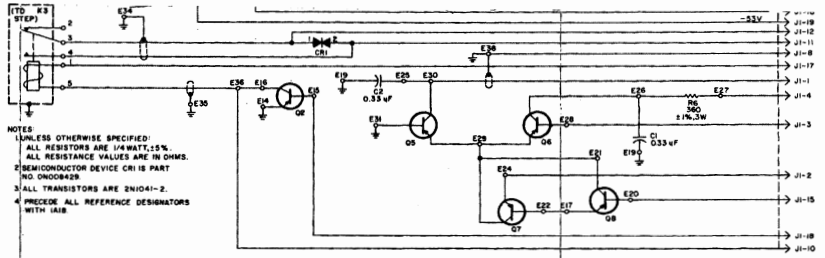


NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL CAPACITANCE VALUES ARE IN MICROFARADS, 50 V.
2. FL1 THRU FL15 ARE CASE GROUNDED

Figure 3-34A. – Filter Assembly (A17) Schematic Diagram.

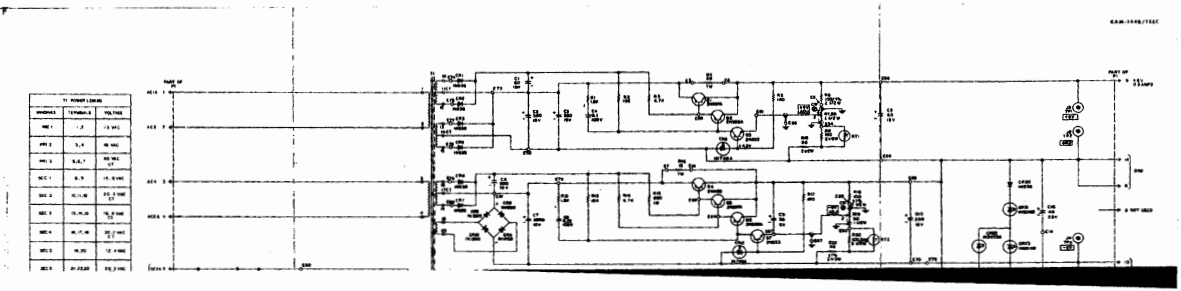
DOCID: 3559657





NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE 1/4 WATT, ±5%.
   ALL RESISTANCE VALUES ARE IN OHMS.
2. SEMICONDUCTOR DEVICE CR1 IS PART NO. ON0084429.
3. ALL TRANSISTORS ARE 2N1041-2.
4. PRECEDE ALL REFERENCE DESIGNATORS WITH 1A1B.

Figure 3-54B. – Relay Assembly (A1B) Schematic Diagram.



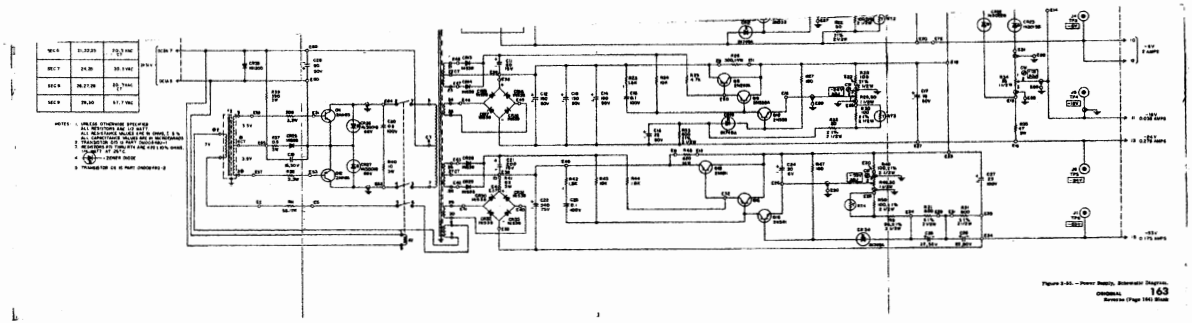
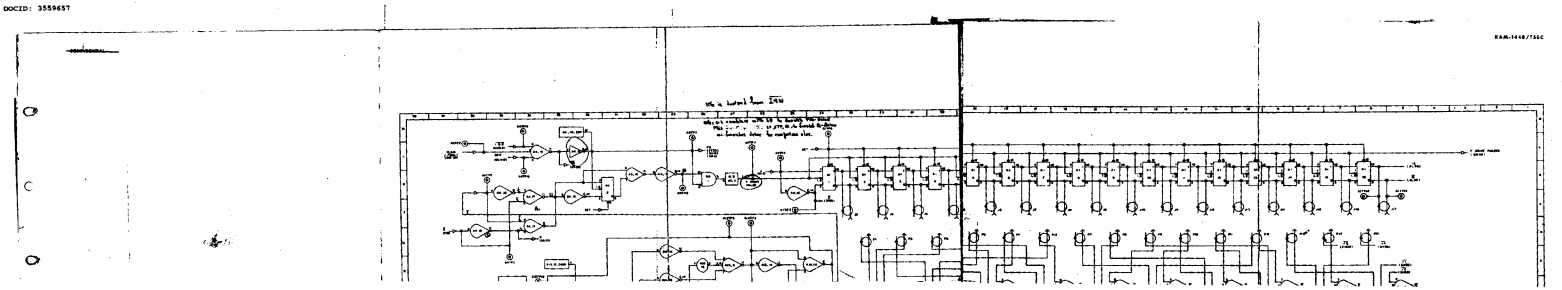
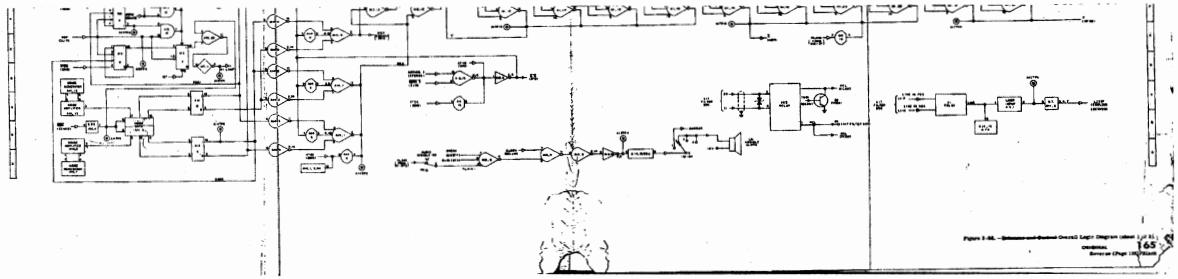
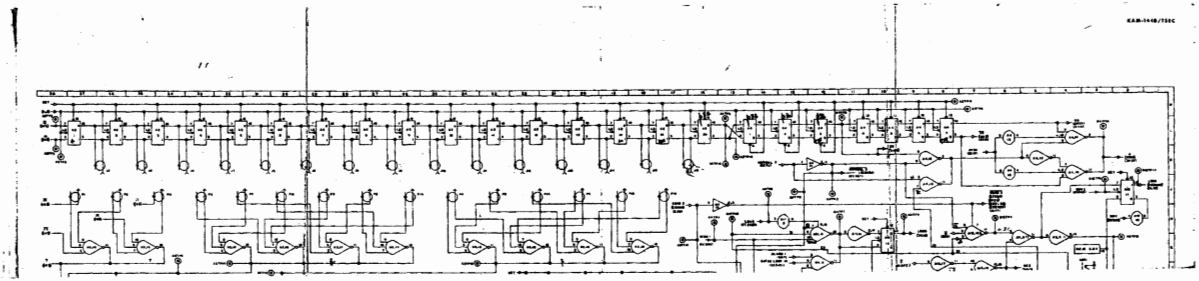
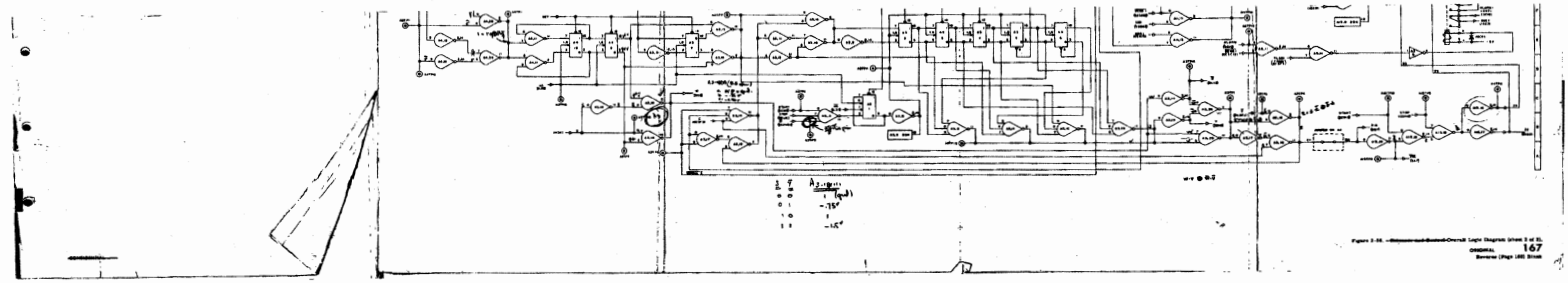


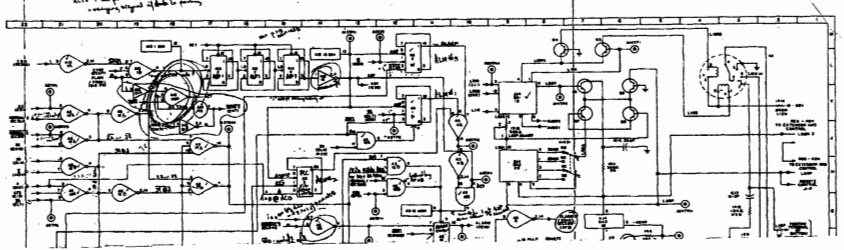
Figure 3-40. – Power Supply, Schematic Diagram











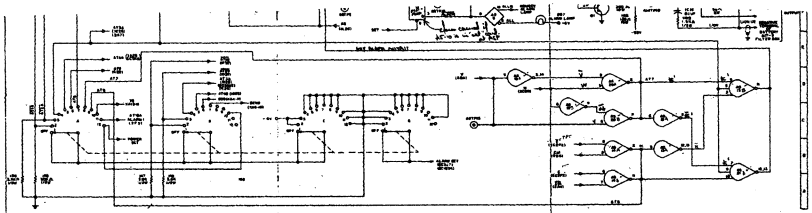
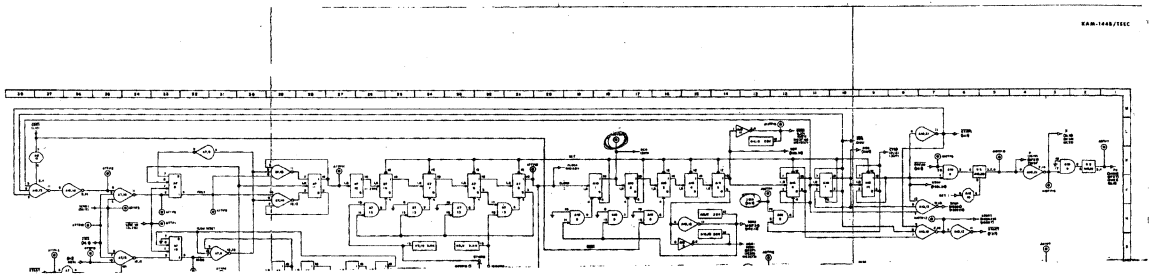


Figure 3-56. – Resource-and-Control Overall Logic Diagram (sheet 3 of 3).



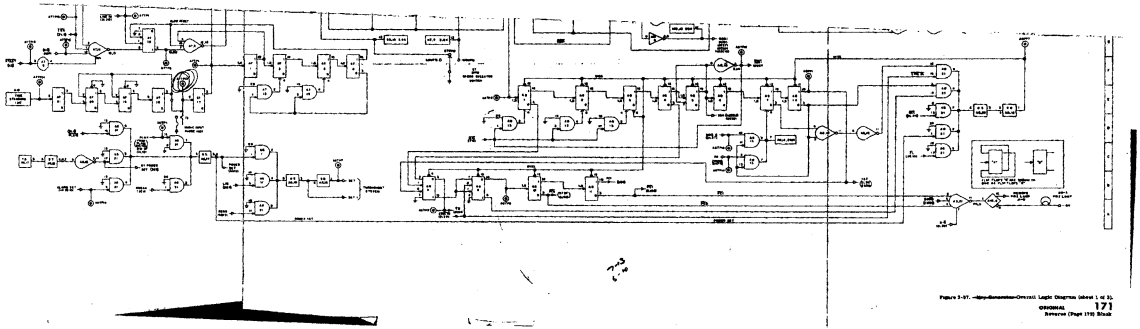
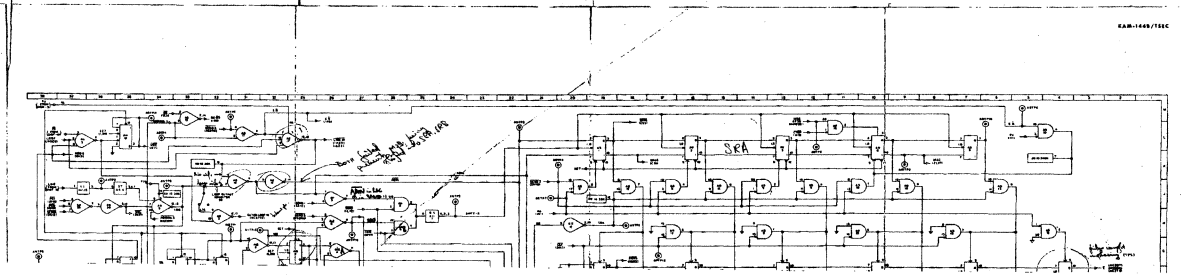


Figure 3-97. —Gyro-Generator-Control Logic Diagram (sheet 1 of 3)



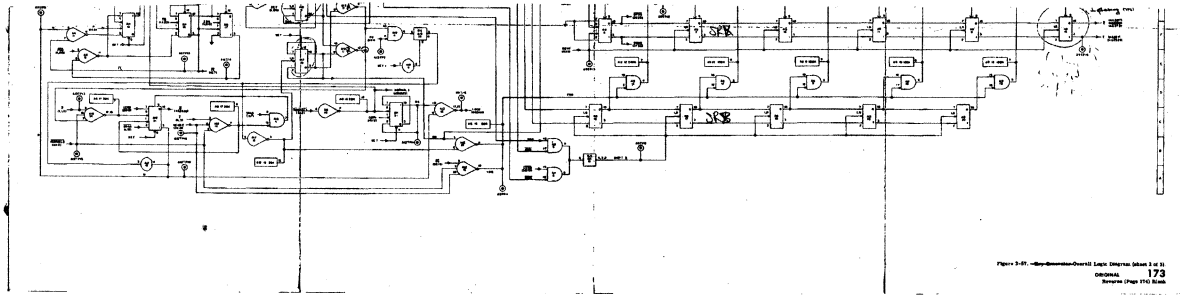
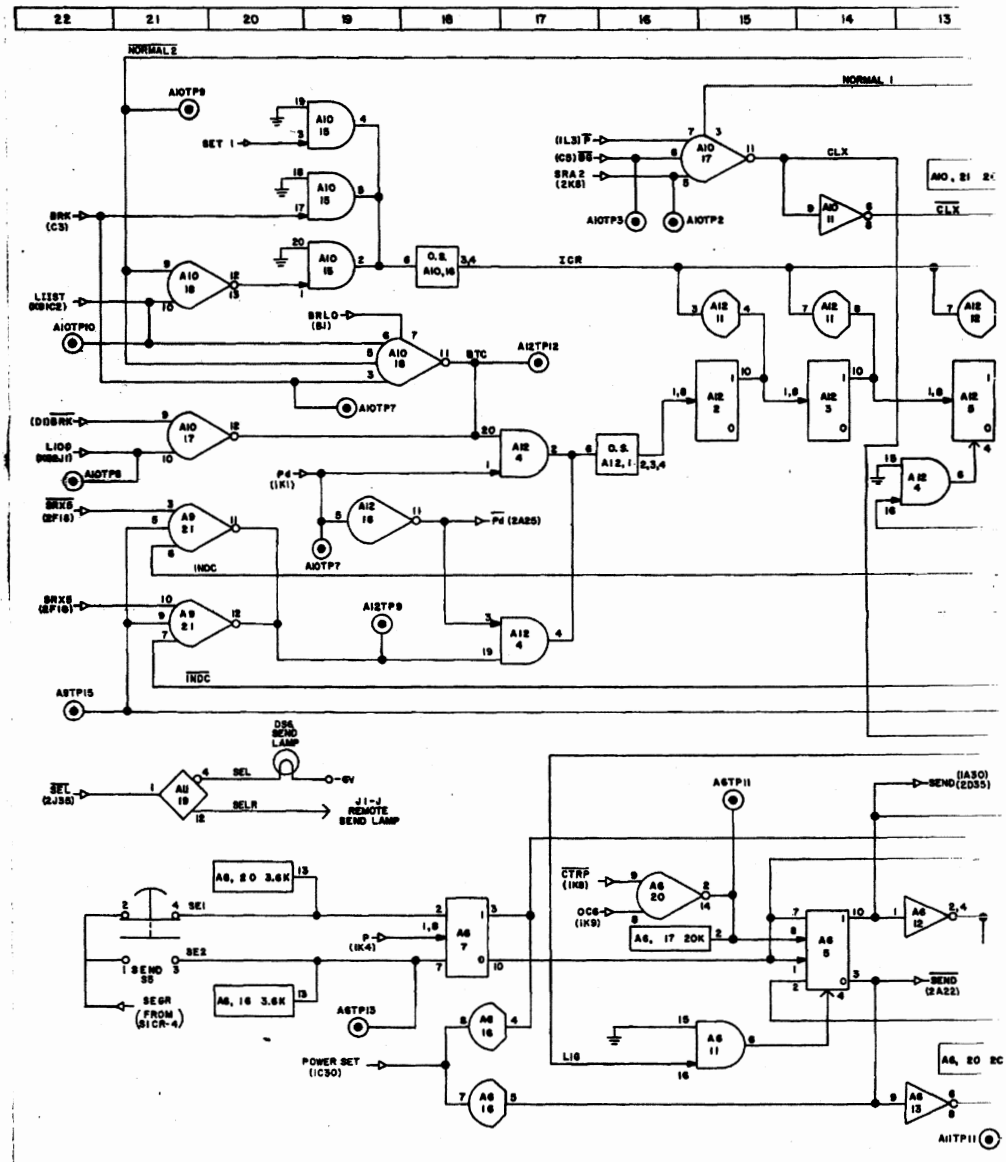


Figure 3-97. —Sys-Generation-Overall Logic Diagram (sheet 3 of 3)


22
21
20
19
18
17
16
15
14
13
NORMAL 2
NORMAL 1
A10TP9
SET 1
BRK (C3)
LIIST (SYNC2)
A10TP10
BRLO (BJ)
A12TP12
A10TP7
(DS)BRK
LIOS (MSBJ1)
A10TP8
BRX8 (EF16)
Pd (1K1)
A10TP7
Pd (2A25)
INDC
BRX8 (EF16)
A12TP9
INDC
A8TP15
DS6 SEND LAMP
SEL (2J36)
SEL
SELR
J1-J REMOTE SEND LAMP
-6V
(IL3) F
(C8) BS
SRA2 (2K8)
A10TP3
A10TP2
CLX
ICR
A8TP11
SEND (2D33)
CTRP (1K8)
OCS (1K9)
A6, 17 20K
BEND (2A22)
A6, 20 3.6K
SEL
SEL2
SEND SS
SEGR (FROM B1CR-4)
A6, 16 3.6K
P- (1K4)
A8TP13
POWER SET (1C30)
LIS
A6, 20 8C
A11TP11

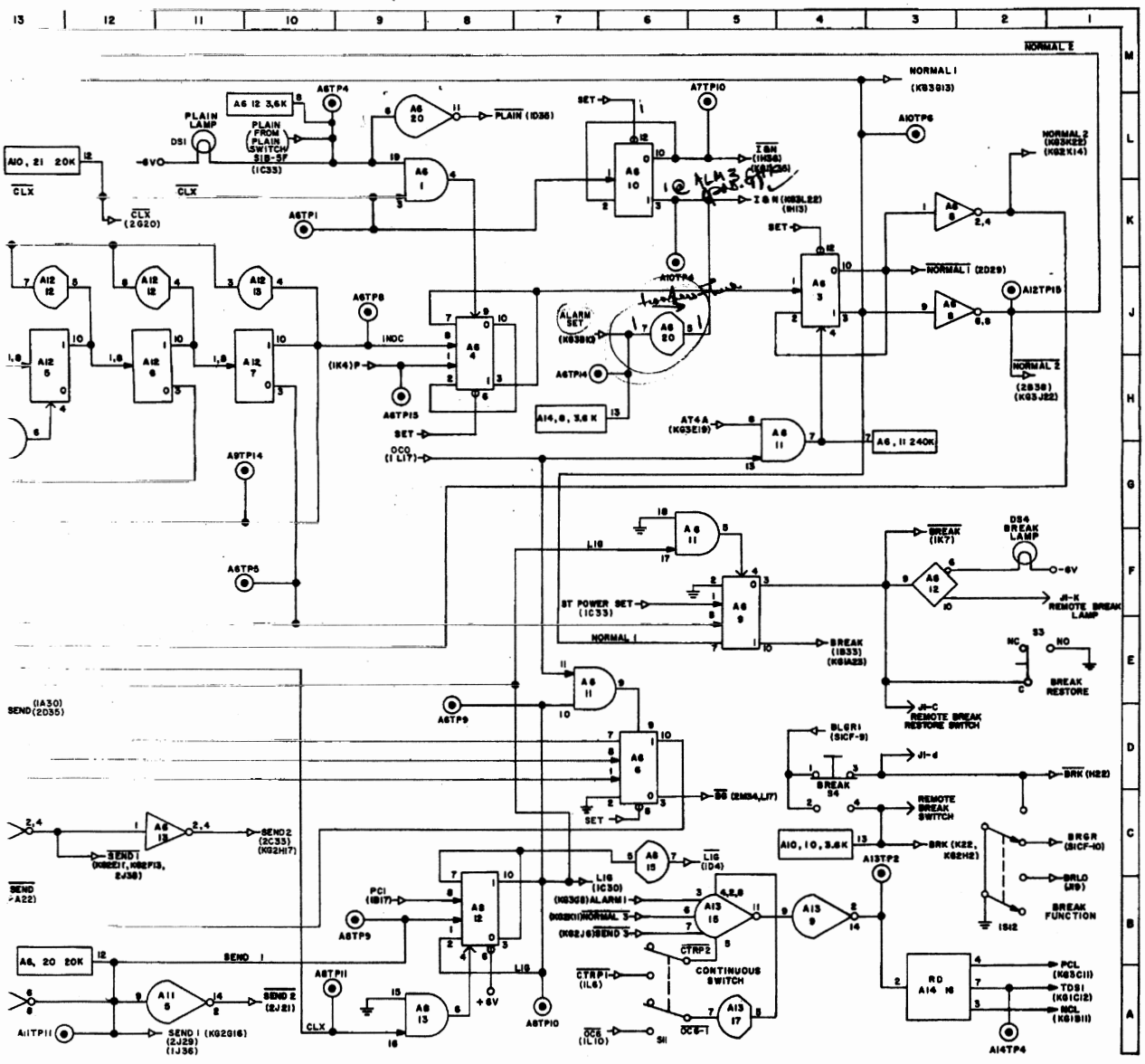


Figure 3-57. ~~Key Generator~~ Overall Logic Diagram (sheet 3 of 3).