

SHEET INDEX

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CIRCUIT NOTES:

DESIG	FUSE AMP	POTENTIAL	ONE PER
	1-1/3	48V SIG	CKT, V OPTION
A	1/2	+24V SIG	CKT, T OPTION
B	1/4	+24V SIG	CKT, T OPTION
		GRD	CKT

BATTERY SYMBOL	VOLTAGE RANGE
-49	45 - 50V OR 42.75 - 52.5V
+24	20.75 - 27V

CIRCUIT NOTES (CONT):

- 105. PRIOR TO ISSUE 6D LEAD "ST" WAS DESIGNATED "ST" DR "G". THE USE OF LEAD "G" IS RATED MFR DISC ON ISSUE 6D, SO AS TO PROVIDE A PAIRED "ST" AND "STI" LEADS, WHEN EXTERNAL START IS REQUIRED.
- 106. PROVIDE S OPTION ON CIRCUITS INSTALLED PRIOR TO ISSUE 6D, ONLY WHERE HIGH FREQUENCY RINGING OCCURS IN THE OUTPUT OF AN INDIVIDUAL OSCILLATOR.

FEATURE OR OPTION	PROVIDE	
	APP FIG. OR WRG	QUANTITY
SIGNAL GENERATOR CIRCUIT	1, 2, 3, 4, 5	1 PER SWBD OR TST BD POS
OUTPUT LEVEL OF -8 DBM REQD OR WHEN CKT IS USED IN 5D TOLL SWBD, TST BD NO. 19A, 21A, 22A, OR 23B, OR TEST POS NO. 51A		Z
OUTPUT LEVEL OF -6 DBM REQD OR WHEN CKT IS USED IN LOCAL TEST DESK NO. 14 OR 15B		Y
EXTERNAL START	REQUIRED	W
	NOT REQUIRED	X
BATTERY SUPPLY	-48V	V
	+24V	T

RECORD OF APP FIGURES, WIRING AND APPARATUS CHANGES						
CHANGED ON ISS	IF JOB RECORDS DO NOT SPECIFY	THIS OPTION WAS FURN	SEE NOTE	USE IN CIRCUIT		
				STD	R&M	MO
4D	X OR W	X	102	X OR W		
5D	V OR T	V	102	V OR T		
6D	S	NONE	106	S		
7D		RESISTORS		211A	145A	
9D		RESISTORS		KS-20810, L1A	221A	
10D		CAPACITORS		KS-16742, L32	KS-13368, L13	
		CAPACITORS		KS-16742, L31	KS-13368, L14	
		CAPACITORS		KS-16958, L32	KS-14056, L11	
		RESISTORS		KS-8512, L10C	KS-8512, L17B	
		RESISTORS		KS-20289, L6C	KS-14603, L3C	
		RESISTORS		KS-8512, L4C	KS-8512, L1B	

EQUIPMENT NOTES:

- 201. VALUES FOR CAPACITORS (CA1-8) AND (DA1-6) ARE AS SHOWN IN NOTE 303 FOR TRIMMER CAPACITORS.
- 202. WHERE POSSIBLE MOUNT AND FUSE SIGNAL GENERATOR ON SAME FRAME AS OUTLET CIRCUIT AND INCLUDE CONNECTIONS IN LOCAL CABLE. WHEN NOT MOUNTED IN SAME FRAME AS OUTLET CIRCUIT KEEP CABLE RUN TO OUTLET CIRCUIT TO NOT MORE THAN 20 FEET BETWEEN FRAMES.
- 203. LEADS F1 TO F8 SHALL BE C2 WIRING, EXCEPT WHEN THE CONNECTING CKT SPECIFIES OTHERWISE (e.g. SHIELDING, PAIRING, ETC.).
- 204. THE (VR1) DIODE MUST BE MOUNTED ON A HEAT SINK WHICH SHALL BE INSULATED FROM THE MOUNTING PLATE.

NETWORK VALUES		
NETWORK NO.	RESISTANCE IN OHMS	CAPACITANCE IN UF
1	470	0.11

OPTION INDEX

APP OR WIRING	LOCATION
Z	3B2, 3B4, 3B7, 3B9, 3C4, 3C6.
Y	3B2, 3B4, 3B7, 3B9, 3C4, 3C6.
X	3H6
W	3H6
V	3H6, 3H1, 3H3, APP FIG. 1, 3D9
T	3H6, 3H1, 3H3, APP FIG. 1, 3D9
S	3D1, 3D2, 3D4, 3D5, 3D6, 3D7, 3D9, 3F1, 3F2, 3F4, 3F5, 3F6, 3F7, 3F9, APP FIG. 1

SUPPORTING INFORMATION

CATEGORY	NO.
EQUIPMENT DRAWINGS	J1C041A-()
	J1C042A-()
	J1C042B-()
	J1P000A-()
	J617668-()
	J99235BK-()
	Jy9320D-()
	ED-1C234-01
	ED-6G010-01
	ED-6G226-01
	ED-64500-01
	ED-99369-()
ED-99370-()	
ED-99371-()	
ED-99372-()	
CONNECTORS	910A
	KS-9198
KEYSHEET DRAWINGS	COM-LTD NO. 15B
	COM-SWBD NO. 5A, 5C, 5D, & TEST UNIT 5A
	COM-TST BD NO. 21A
	COM-TST BD NO. 23B
	COM-TST POS NO. 50A
	SD-1C463-01
	SD-99440-01
	SD-2A039-01
	SD-1C466-01
	SD-1C221-01

DWG ISSUE	EE OR CD ISSUE	DATE ISSUED	DRWNG	APPD
1	1	7-23-63	JK	FPP
			RE	AAB
				POB
2A	2A	1-2-64	WM	FPP
			LL	RAM
				POB
3D	2A	7-20-65	JFM	FPP
	APP 1D			RAM
				POB
				GAS
				PDE
4D	2A	11-29-66	SFL	N.S.
	APP 2D			NRS
				POB
				GAS
5D	3D	3-6-68	SFL	NRS
				POB
				WAM
				PD
6D	3D	2-24-65	DC	JER
	APP 1D			WAM
				PD
				WE
7D	3D	4-1-70	JDC	JAG
	APP 2D			ES
				WFO
				GB
8D	4D	5-14-71	CDI	PAK
				ES
				WFO
9D	4D	4-20-72	CDI	JAC
	APP 1D			ES
				DR
				GCB
10D	4D	5-28-73	WFM	WAC
	APP 2D			ES
				WAM
				WAC

REPLACES SD-99903-01

SD-99328-01

COMMON SYSTEMS
SIGNAL GENERATOR CIRCUIT
FOR SUPPLYING FREQUENCIES
TO KEYSETS ARRANGED TO PU, SE
2/6 AND 4X4 FREQUENCIES

AT&TCO STANDARD

SD-99328-01-1
6 SHEETS

BELL TELEPHONE LABORATORIES
INCORPORATED

ISSUE 10D

INFORMATION NOTES:

301. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS. VALUES PRECEDED BY THE SYMBOL + (PLUS) OR - (MINUS) ARE IN VOLTS.

302. BEFORE ANY ADJUSTMENTS ARE MADE CONNECT GROUND TO TERMINAL B11 (B1 TERMINAL STRIP, PUNCHING 11) AND THEN:

- A. WITH V OPTION, CONNECT -48V BATTERY TO TERMINAL B41.
- B. WITH T OPTION, CONNECT +24V BATTERY TO TERMINAL B41 AND ALSO CONNECT +24V THROUGH AN 8 OHM RESISTOR TO TERMINAL B13.

ADJUST FREQUENCY GENERATOR OUTPUT LEVEL AS FOLLOWS: PROVIDE A MEANS WHEREBY LOAD RESISTORS OF 1100 OHMS ± 1% AND 275 OHMS ± 1% CAN BE CONNECTED ALTERNATELY TO THE OSCILLATOR OUTPUT (FROM TERMINAL NO. 5 OF TRANSFORMER) AND CONNECT THE OTHER SIDE OF THE LOAD RESISTOR AS FOLLOWS:

- A. WITH V OPTION, CONNECT TO TERMINAL B11.
- B. WITH T OPTION, CONNECT TO TERMINAL A42.

USE TERMINALS A11, A21, A31, A41, A13, A23, A33, AND A43 FOR OSCILLATORS, 1, 2, 3, 4, 5, 6, 7, AND 8. CONNECT A VACUUM TUBE VOLTMETER, VOLTOHMYST WV97A OR EQUIVALENT FROM THE TEST TERMINAL TO GROUND. WHERE TERMINALS A16, A26, A36, A46, A18, A28, A38, AND A48 ARE NOT ALREADY CONNECTED TO ONE OF THE TERMINALS A27, A32 AND A47. CONNECT TERMINALS A16, A26, A36, A46, A18, A28, A38, AND A48 TO TERMINAL A47. ADJUST (P-) POTENTIOMETER FOR EACH OSCILLATOR TO OBTAIN AN OUTPUT OF 1.5 VOLTS AC WITH A LOAD RESISTOR OF 275 OHMS. THIS TEST SHOULD BE MADE WITH (TR) RELAY NORMAL. THE OUTPUT VOLTAGE OF ALL OSCILLATORS SHOULD BE WITHIN 0.15 VOLTS OF EACH OTHER WITH AN 1400 OHM LOAD APPLIED. THE OUTPUT VOLTAGE OF THE INDIVIDUAL OSCILLATORS CAN BE RAISED OR LOWERED TO MEET THIS REQUIREMENT BY SHIFTING THE A16, A26, A36, A46, A18, A28, A38, OR A48 TERMINAL FROM A32 TO A47 OR A27 RESPECTIVELY. THIS TEST MEASUREMENT SHOULD BE MADE AFTER ALL OSCILLATOR POTENTIOMETERS HAVE BEEN ADJUSTED.

THE FREQUENCY OF THE OSCILLATORS UNDER FIELD TEST CONDITIONS SHOULD BE:

OSCILLATOR NO.	1	2	3	4	5	6	7	8
FREQUENCY * 4X4	697	941	1209	1336	1477	1633	770	852
2/6	700	900	1100	1300	1500	1700		

* ± 1% CPS

303. FOR FIELD REPLACEMENT OF TRANSFORMERS, TRANSISTORS OR CAPACITORS OF THE FREQUENCY GENERATOR OF FS1.

- A. THE INDIVIDUAL OSCILLATORS SHOULD BE ADJUSTED AS SPECIFIED IN NOTE 302.
- B. THE FREQUENCY OF EACH OSCILLATOR SHOULD BE MEASURED WITH A LOAD RESISTOR OF 1100 OHMS, ONE SIDE CONNECTED TO THE TEST TERMINAL A11, A21, A31, A41, A13, A23, A33, OR A43 AND THE OTHER SIDE OF THE LOAD RESISTOR CONNECTED AS FOLLOWS:
 1. WITH V OPTION, CONNECT TO TERMINAL B11.
 2. WITH T OPTION, CONNECT TO TERMINAL A42.

CONNECT ONE SIDE OF A BERKLEY EPUT METER WITH A 10 SEC GATE OR EQUIVALENT TO OUTPUT TERMINAL B17, B27, B37, B47, B18, B28, B38, OR B48 RESPECTIVELY, AND THE OTHER SIDE OF THE METER TO TERMINAL B11 (GROUND). (SEE THE FOLLOWING TABLE FOR THE OUTPUT AND TEST TERMINAL CONNECTIONS OF THE VARIOUS OSCILLATORS). THE FREQUENCY OF EACH OSCILLATOR SHOULD MEET THE LIMITS GIVEN IN THE FOLLOWING TABLE. TRIMMER CAPACITORS (CA1-8) AND (DA1-6) CAN BE ADDED TO LOWER THE FREQUENCY IF REQUIRED. WHEN TESTING THE 4X4 FREQUENCIES, (TR) RELAY SHOULD BE NORMAL AND WHEN TESTING THE 2/6 FREQUENCIES, (TR) RELAY SHOULD BE OPERATED.

INFORMATION NOTES: (CONT)

303.

(CONT)

NO.	TEST TERM.	OUTPUT TERM.	FREQUENCY		LIMITS CPS		FOR FREQ WITHOUT TRIMMER BETWEEN LIMITS OF	ADD TRIMMER VALUE (UUF) OF
			2/6	4X4				
1	A11	B17	700		698	705	705-707 708-711	100 200
1	A11	B17			697	695	702-704 705-707	100 200
2	A21	B27	900		897	906	906-910 911-914 915-918	100 150 200
2	A21	B27			941	938	947-950 951-954 955-958	51 100 150
3	A31	B37	1100		1097	1108	1108-1111 1112-1114 1115-1118 1119-1124	100 150 200 240
3	A31	B47			1209	1205	1217-1220 1221-1225 1226-1230 1231-1235 1236-1239	51 100 150 200 252
4	A41	B47	1300		1296	1309	1309-1312 1313-1318 1319-1324 1325-1329 1330-1332	51 100 150 200 240
4	A41	B18			1336	1332	1345-1348 1349-1352 1353-1356 1357-1360 1361-1365	51 100 150 200 252
5	A13	B18	1500		1495	1510	1510-1518 1519-1524 1525-1530 1531-1534	100 150 200 240
5	A13	B28			1477	1473	1487-1492 1493-1498 1499-1503 1504-1508 1509-1515	51 100 150 200 252
6	A23	B28	1700		1695	1712	1712-1717 1718-1727 1728-1736 1737-1739	51 100 150 200
6	A23	B37			1633	1628	1644-1649 1650-1659 1660-1668 1669-1673 1674-1680	51 100 150 200 252
7	A33	B38			770	768	775-777 778-781 782-784 785-787	100 150 200 252
8	A43	B48			852	849	858-862 863-865 866-868 869-871	100 150 200 252

INFORMATION NOTES: (CONT)

304. JOB RECORDS NEED NOT BE MAINTAINED FOR VALUES OF THE TRIMMER CAPACITORS (CA1-8) AND (DA1-6) USED FOR ADJUSTING FREQUENCIES AS SHOWN IN NOTE 303.

305. CIRCUIT VOLTAGES FOR THE OSCILLATOR PACKAGE UNITS ARE LISTED IN THE TABLE BELOW. ALL MEASUREMENTS ARE WITH RESPECT TO TERM. B11 (GRD) AND SHOULD BE MADE WITH A VACUUM TUBE VOLTMETER, VOLTOHMYST WV97A OR EQUIVALENT. ALL VOLTAGES ± 10%, (TR) RELAY NORMAL.

OSC PACKAGE UNIT NO.	TEST POINT TERMINAL NUMBER													
	2A	5A	8A	11A	1B	3B	4B	5B	6B	7B	8B	9B	10B	11B
1,2		2.0		2.0	14.6		14.6	14.6		14.6		14.6	14.6	0.23
3,4		2.0		2.0	14.6	14.6	14.6			14.6		14.6	14.6	0.23
5,6		2.0		2.0	14.6	14.6	14.6			14.6		14.6	14.6	0.23
7,8	2.0		2.0			14.6	14.6		14.6	14.6	0.23	14.6	14.6	

306. FOR ROUTINE TESTS BY THE CUSTOMER (AFTER INITIAL ADJUSTMENT PER NOTE 302) PROCEED AS FOLLOWS: THE OUTPUT VOLTAGE OF EACH OSCILLATOR SHOULD BE MEASURED WITH A 275 OHM LOAD RESISTOR. EACH OSCILLATOR SHOULD MEASURE 1.5 ± .25 VOLTS AC. IF ANY OSCILLATOR FAILS THIS TEST, ALL OSCILLATORS SHOULD BE READJUSTED PER NOTE 302.

SD-99328-01-2

ISSUE 10D

SIGNAL GENERATOR CIRCUIT	②	SD-99328-01-2
BELL TELEPHONE LABORATORIES INCORPORATED	65	PRINTED IN U.S.A.

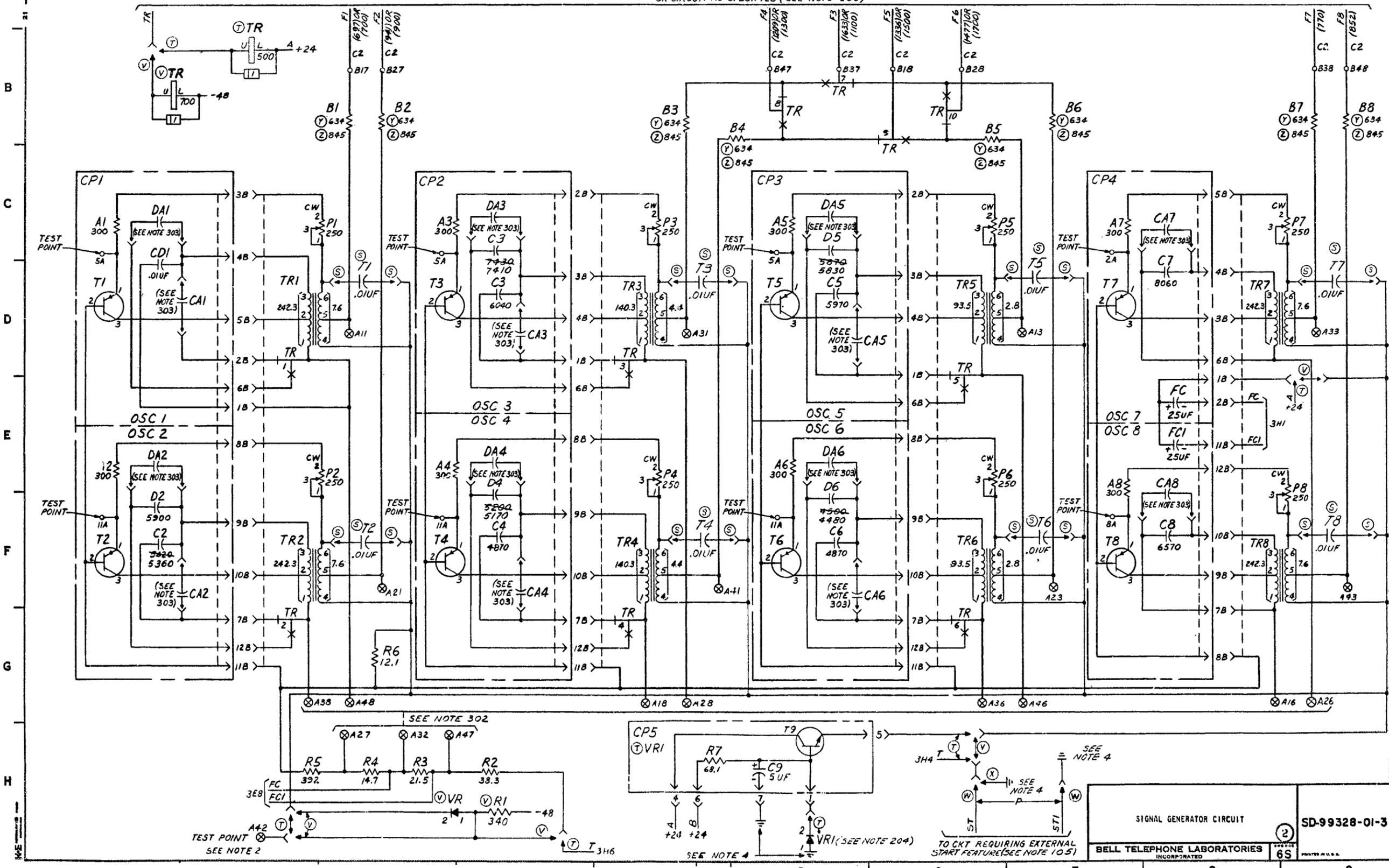
FS I SIGNAL GENERATOR CIRCUIT (SEE NOTES 1 & 3)

TO KEYSER CIRCUIT, TESTBOARD POSITION CIRCUIT
OR CIRCUIT AS SPECIFIED (SEE NOTE 203)

- SHEET NOTES:**
1. NOT MORE THAN ONE PLUG-IN UNIT SHOULD BE REMOVED FROM THE CIRCUIT AT ANY ONE TIME.
 2. AT TEST POINT A42 READ 16.2 TO 19.8V DC WITH RESPECT TO GRD. WITH V OPTION THIS WILL BE MINUS (-) POTENTIAL AND WITH T OPTION PLUS (+) POTENTIAL.
 3. FOR ADJUSTMENTS SEE NOTES 302 & 306.
 4. GROUND SHALL BE CONNECTED TO A FUSE GROUND ONLY.

DRAWING ISSUE	
1	JR
2A	RE
3D	LE
4D	POB
5D	POB
6D	POB
7D	POB
8D	POB

ISSUE	
10D	



SD-99328-01-3

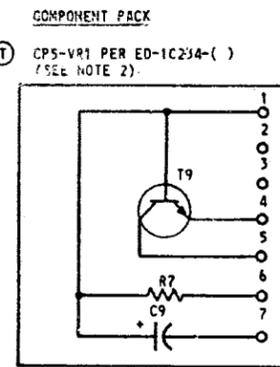
SIGNAL GENERATOR CIRCUIT

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SD-99328-01-3

6S

APP FIG. 1



RELAY		TR		TR	
DESIG	TR	DESIG	TR	DESIG	TR
CODE	AJ12	CODE	AJ81	CODE	AJ81
OPTION	V	OPTION	T	OPTION	T
12	EBM	CONT ARR	LOC	CONT ARR	LOC
11	EBM	CONT ARR	LOC	CONT ARR	LOC
10	EBM	3B6	EBM	3B6	EBM
9	EBM	3C6	EBM	3C6	EBM
8	EBM	3B5	EBM	3B5	EBM
7	EBM	3B5	EBM	3B5	EBM
6	EBM	3G6	EBM	3G6	EBM
5	EBM	3D6	EBM	3D6	EBM
4	EBM	3G4	EBM	3G4	EBM
3	EBM	3D4	EBM	3D4	EBM
2	EBM	3G1	EBM	3G1	EBM
1	EBM	3D1	EBM	3D1	EBM
COIL		3B0		3B1	

SEE NOTE 3

CAPACITOR		
DESIG	LOC	CODE
C9	3H5	601A
T1	3D2	
T2	3F2	
T3	3D4	
T4	3F4	
T5	3D7	594G.01UF
T6	3F7	
T7	3D9	
T8	3F9	

DIODE		
DESIG	LOC	CODE
VR	3H2	426R
VR1	3H5	485D

NETWORK		
DESIG	LOC	CODE
TR	3B0	185A
TR	3B1	185A

RESISTOR		
DESIG	LOC	CODE
B1	3B2	
B2	3B2	
B3	3B4	
B4	3B5	
B5	3B6	
B6	3B7	
B7	3B9	
B8	3B9	

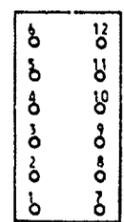
145A, 224A, KS-20810, L1A, 634
845

SEE NOTE 3

TRANSFORMER		
DESIG	LOC	CODE
R1	3H3	KS-8512, L17B, KS-8512, L10C, 340
R2	3H3	145A, 224A, KS-20810, L1A, 38.3
R3	3H2	145A, 224A, KS-20810, L1A, 21.5
R4	3H2	145A, 224A, KS-20810, L1A, 14.7
R5	3H1	KS-8512, L1B, KS-8512, L4C, 392
R6	3G2	145A, 224A, KS-20810, L1A, 12.1
R7	3H4	KS-14603, L3C, KS-20289, L6C, 68.1

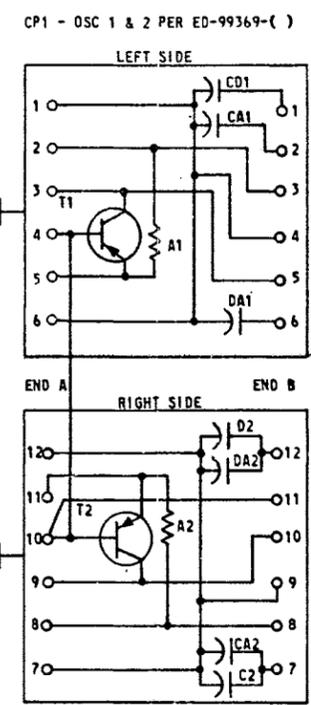
POTENTIOMETER		
DESIG	LOC	CODE
P1	3C2	
P2	3E2	
P3	3C4	
P4	3E4	
P5	3C6	KS-13790, L25, 250
P6	3E6	
P7	3C9	
P8	3E9	

SHEET NOTES:
1. OSC 1&2 PER ED-99369-(), OSC 3&4 PER ED-99370-(),
OSC 5&6 PER ED-99371-(), OSC 7&8 PER ED-99372-(),
SHALL CONNECT TO KS-19198 CONNECTOR AS SHOWN:



2. ASSOCIATED WITH 910A CONNECTOR.
3. ASSOCIATED WITH CP5.

APP FIG. 2 (SEE NOTE 1)



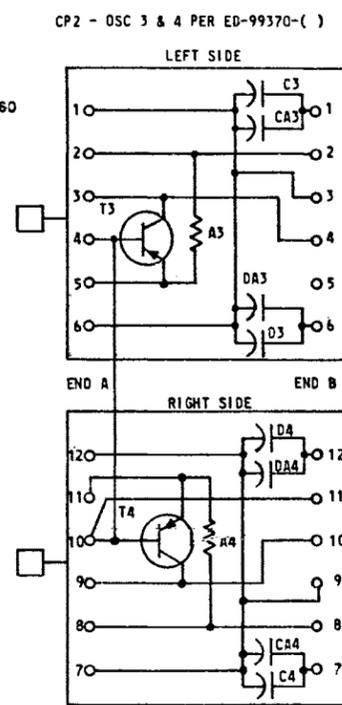
COMPONENT PACK
CP1 - OSC 1 & 2 PER ED-99369-()

CAPACITOR		
DESIG	LOC	CODE
C2	3F0	
CA1	3D1	
CA2	3F1	
C01	3C0	
C02	3F0	
DA1	3C0	
DA2	3E0	

RESISTOR		
DESIG	LOC	CODE
A1	3C0	KS-13490, L1, 300
A2	3E0	KS-13490, L1, 300

TRANSISTOR		
DESIG	LOC	CODE
T1	3D0	12D
T2	3F0	12D

APP FIG. 3 (SEE NOTE 1)



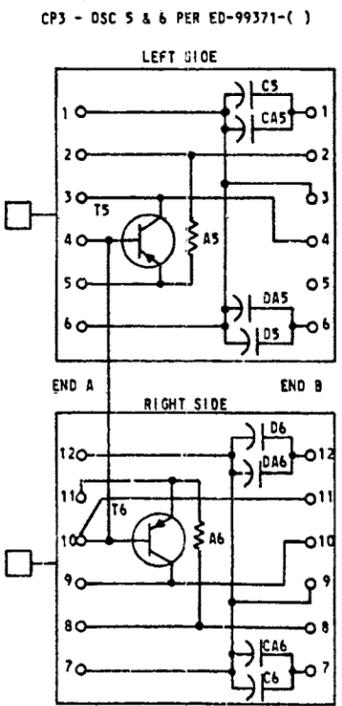
COMPONENT PACK
CP2 - OSC 3 & 4 PER ED-99370-()

CAPACITOR		
DESIG	LOC	CODE
C3	3D3	KS-13368, L13, 6040
CA	3F3	KS-13368, L13, 4870
CA3	3D3	KS-14056, L11
CA4	3F3	KS-14056, L11
D3	3C3	KS-13368, L13, 7430 7410
D4	3E3	KS-13368, L13, 52005170
DA3	3C3	KS-14056, L11
DA4	3E3	KS-14056, L11
		KS-16958, L34
		KS-16742, L32

RESISTOR		
DESIG	LOC	CODE
A3	3C2	KS-13490, L1, 300
A4	3E2	KS-13490, L1, 300

TRANSISTOR		
DESIG	LOC	CODE
T3	3D2	12D
T4	3F2	12D

APP FIG. 4 (SEE NOTE 1)



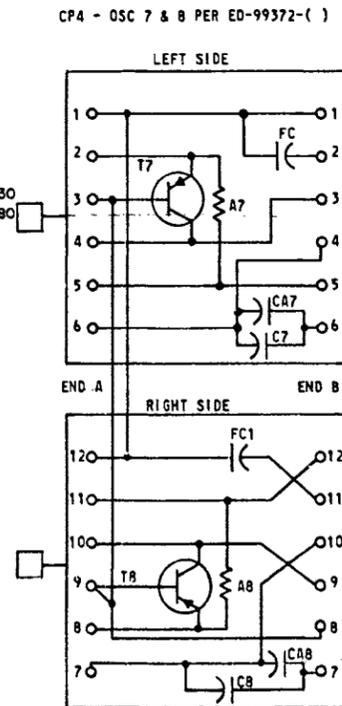
COMPONENT PACK
CP3 - OSC 5 & 6 PER ED-99371-()

CAPACITOR		
DESIG	LOC	CODE
C5	3D5	
C6	3F5	
CA5	3D6	
CA6	3F6	
D5	3C5	
DA	3F5	
DA5	3C5	
DA6	3E5	

RESISTOR		
DESIG	LOC	CODE
A5	3C5	KS-13490, L1, 300
A6	3E5	KS-13490, L1, 300

TRANSISTOR		
DESIG	LOC	CODE
T5	3D5	12D
T6	3F5	12D

APP FIG. 5 (SEE NOTE 1)



COMPONENT PACK
CP4 - OSC 7 & 8 PER ED-99372-()

CAPACITOR		
DESIG	LOC	CODE
C7	3D8	KS-13368, L13, 8060
C8	3F8	KS-13368, L13, 6570
CA7	3C8	KS-14056, L11
CAB	3E8	KS-14056, L11
FC	3E8	KS-16390, L1, 25UF
FC1	3E8	KS-16390, L1, 25UF
		KS-16958, L34
		KS-16742, L32

RESISTOR		
DESIG	LOC	CODE
A7	3C7	KS-13490, L1, 300
A8	3E7	KS-13490, L1, 300

TRANSISTOR		
DESIG	LOC	CODE
T7	3D7	12D
T8	3F7	12D

SD-99328-01-4

SIGNAL GENERATOR CIRCUIT

SD-99328-01-4

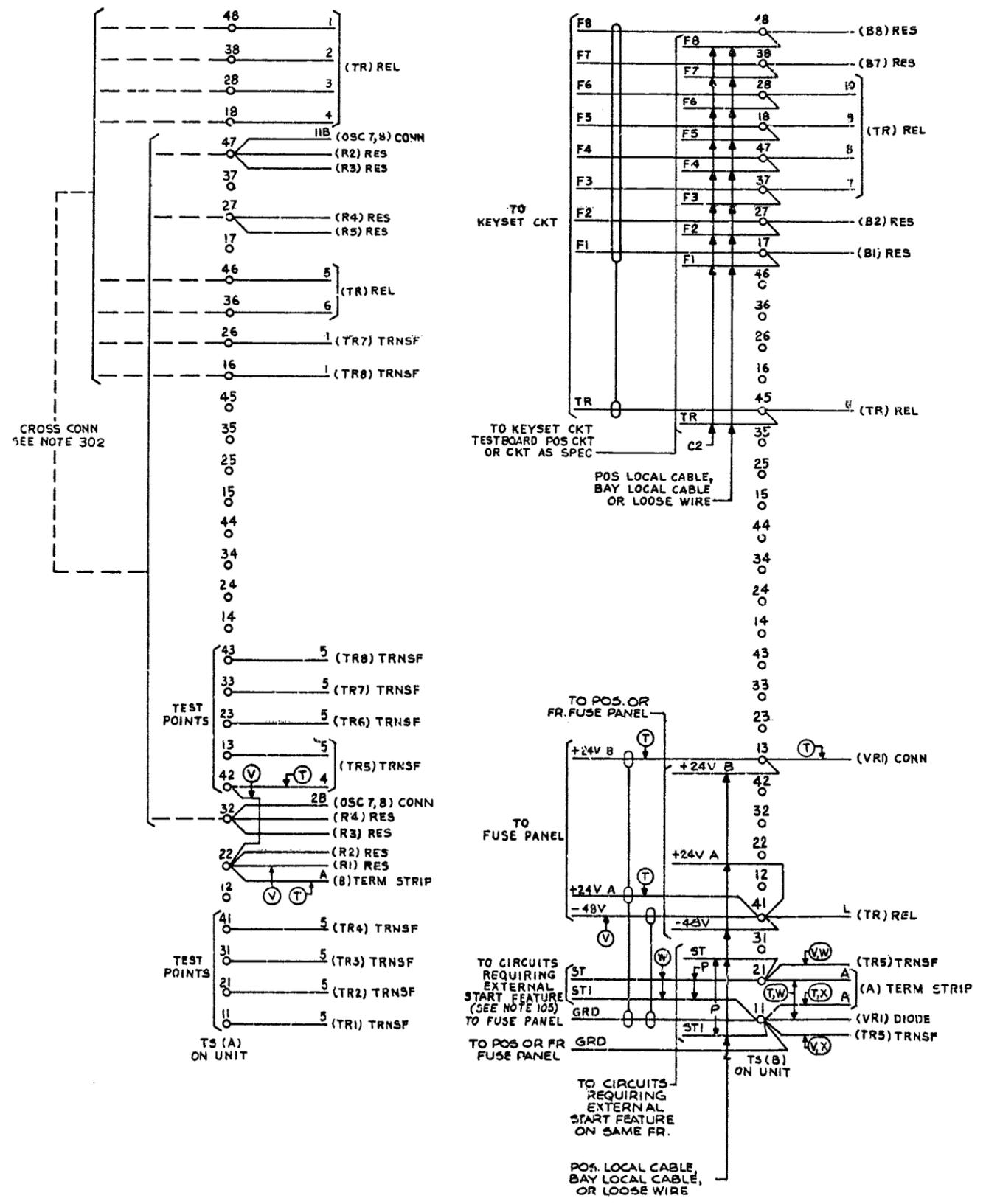
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0 1 2 3 4 5 6 7 8 9

CAD 2

(FOR FIG. 1 AND T OR V OPTION)
(SEE NOTE 203)

DRAWING
ISSUE
5D
6D
7D
8D



CROSS CONN
SEE NOTE 302

TEST POINTS

TEST POINTS

TO KEYSCT CKT
TESTBOARD POS CKT
OR CKT AS SPEC

TO FUSE PANEL

TO CIRCUITS
REQUIRING
EXTERNAL
START FEATURE
(SEE NOTE 105)
TO FUSE PANEL

TO POS OR FR.
FUSE PANEL

TO CIRCUITS
REQUIRING
EXTERNAL
START FEATURE
ON SAME FR.

POS. LOCAL CABLE,
BAY LOCAL CABLE,
OR LOOSE WIRE

SD-99328-01-6

ISSUE
10D

SIGNAL GENERATOR CIRCUIT	SD-99328-01-6
BELL TELEPHONE LABORATORIES	66