

## BRIDGING DEVICES

### DESCRIPTION, APPLICATION, AND CONSTRUCTION

	CONTENTS	PAGE
1.	<b>GENERAL</b> . . . . .	1
2.	<b>911 BRIDGING ADAPTER</b> . . . . .	1
	<b>A. Description</b> . . . . .	1
	<b>B. Application</b> . . . . .	1
	<b>Data Distortion Monitoring</b> . . . . .	3
	<b>Sending and Receiving a Test Message         Using the 911A DTS</b> . . . . .	4
	<b>Audio Tone Monitoring</b> . . . . .	6
	<b>C. Construction</b> . . . . .	7
3.	<b>TEST ADAPTER FOR AUDIO BRIDGING</b> . . . . .	7
	<b>A. Description</b> . . . . .	7
	<b>B. Application</b> . . . . .	12
	<b>C. Construction</b> . . . . .	13

**1. GENERAL**

**1.01** This section describes two types of bridging devices that may be used in troubleshooting troubles in low-to-medium speed data transmission facilities and equipment. The 911 Bridging Adapter, hereafter referred to as the bridging adapter, allows a 911A Data Test Set (DTS) or equivalent to monitor, on a high-impedance basis, low-speed data signals up to 150 baud. The test adapter for audio bridging, hereafter referred to as the test adapter, allows monitoring of the data line on a high-impedance basis. The test adapter allows signals to be monitored or recorded for later playback as required. These bridging devices are intended for evaluation of abnormal data problems

which cannot be solved by normal test procedures or equipment. Some typical applications are included in this section.

**1.02** The bridging devices are not orderable items; therefore, detailed information is given in this section so they may be constructed locally as required. Prototype models of the 911 bridging adapter and the test adapter are shown in Fig. 1 and 2, respectively.

**2. 911 BRIDGING ADAPTER**

**A. Description**

**2.01** The bridging adapter consists of two sections: a tone monitor and a data distortion measurement section. Selective bandpass filters, an audio amplifier, and speaker make up the tone monitor section while two EIA driver amplifiers and monitor jacks compose the distortion-measuring section.

**2.02** Physical dimensions and appearance may vary depending upon construction of the individual bridging adapter. The following information is applicable to the prototype model shown in Fig. 1. A carrying case (KS-14132-L2) may be utilized as a housing that will provide adequate space for mounting all circuitry directly to the back of the front panel. A standard Bell System battery (KS-7105) or equivalent 24-volt battery may be mounted beneath the front panel to serve as a power source.

**B. Application**

**2.03** The troubleshooting tests described in this section may cause an interruption in data service to the customer. Therefore, customer permission must be obtained before performing these tests to insure that data service is not interrupted.

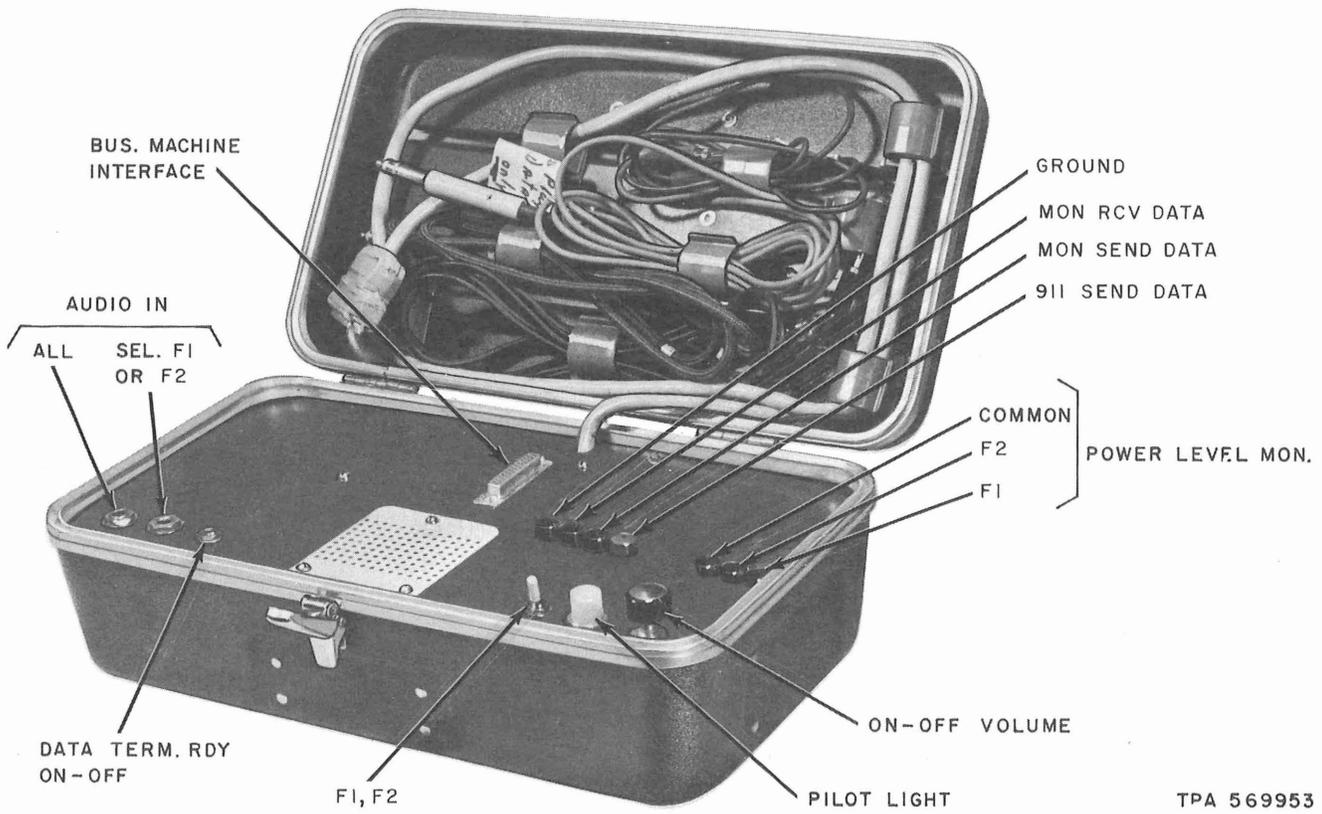
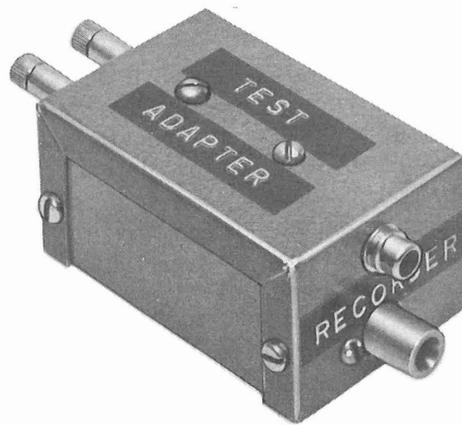


Fig. 1—911 Bridging Adapter



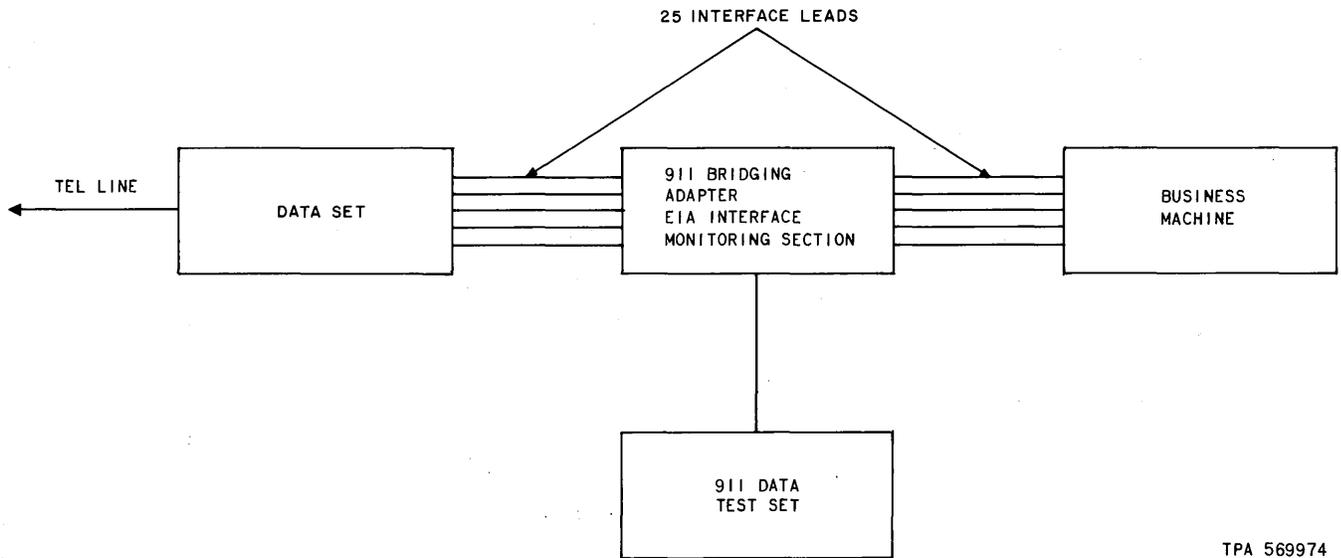
TPA 569954

Fig. 2—Test Adapter

**Data Distortion Monitoring**

**2.04** A typical test setup for monitoring data distortion is shown in the block diagram of

Fig. 3. By observing the 911A Data Test Set (DTS), parity, distortion, and signal bias may be checked during on-line operation.



TPA 569974

**Fig. 3—Block Diagram—EIA Interface Distortion Monitoring**

**2.05 Procedure:**

STEP	PROCEDURE
1	Obtain release from customer to insure data circuit is idle.
2	Remove customer's data set interface cord and insert it into the mating connector on the bridging adapter.
3	Position DTR switch on bridging adapter to OFF.
4	Insert the 25-pin connector cord of the bridging adapter into the data set.
5	Use a test lead to connect the GROUND pin jack of the bridging adapter to GRD of the 911 Distortion Measuring Set (DMS).
6	Connect a test lead from VOLT IN on the 911 DMS to the MON SEND DATA jack on the bridging adapter. <b>Do not use red pin (911 SEND DATA) jack at this time.</b>

SECTION 107-180-100

STEP	PROCEDURE																
7	<p>Position receive controls of 911 DMS as follows:</p> <table border="0" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">SWITCH</th> <th style="text-align: center;">SETTING</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">INPUT</td> <td style="text-align: center;">EIA</td> </tr> <tr> <td style="text-align: center;">CODE</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;">PARITY</td> <td style="text-align: center;">ON</td> </tr> <tr> <td style="text-align: center;">AUTO PK PIP</td> <td style="text-align: center;">PIP</td> </tr> <tr> <td style="text-align: center;">POWER</td> <td style="text-align: center;">ON</td> </tr> <tr> <td style="text-align: center;">DISCR %</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">BAUDS</td> <td style="text-align: center;">†</td> </tr> </tbody> </table> <p style="text-align: center;">† Baud rate of customer service</p>	SWITCH	SETTING	INPUT	EIA	CODE	8	PARITY	ON	AUTO PK PIP	PIP	POWER	ON	DISCR %	3	BAUDS	†
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INPUT	EIA																
CODE	8																
PARITY	ON																
AUTO PK PIP	PIP																
POWER	ON																
DISCR %	3																
BAUDS	†																
8	<p>Position ON-OFF control on bridging adapter to ON.</p> <p><b>Caution: Do not turn on DTR switch or attempt to send data while the customer is on-line.</b></p>																
9	<p>Instruct customer to go on-line and transmit data. Observe the 911 DMS to check distortion, parity, and bias of transmitted data.</p>																
10	<p>To monitor received data, repeat Steps 6, 7, and 8 using the MON RCV DATA jack on the bridging adapter. Observe the 911 DMS to check distortion, parity, and bias of received data.</p>																

**Sending and Receiving a Test Message Using the 911A DTS**

**2.06** Access to the data set interface is gained by using the 911 bridging adapter. A test message is transmitted to and received from a distant data set using a 911A DTS. The local business machine must be disconnected during this test.

**2.07 Procedure:**

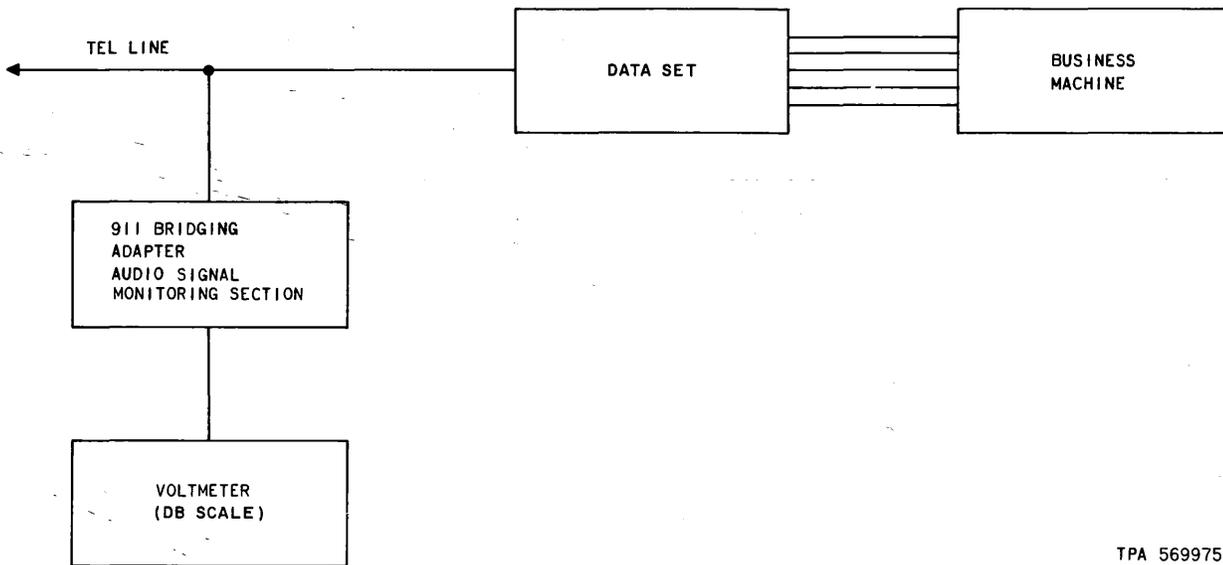
STEP	PROCEDURE
1	Obtain release from customer to insure data circuit is idle.
2	Remove customer's data set interface cord. <b>Do not plug this cord into the bridging adapter.</b>
3	Insert the 25-pin connector cord of the bridging adapter into the data set.

STEP	PROCEDURE																				
4	Position DTR switch to ON.																				
5	Use a test lead to connect the GROUND pin jack of the bridging adapter to GRD of the 911 Test Sentence Generator (TSG).																				
6	Connect a test lead from MON RCV DATA jack on the bridging adapter to VOLT IN of the 911 DMS.																				
7	Connect a test lead from 911 SEND DATA (red pin) jack of the bridging adapter to VOLT OUTPUT on the 911 TSG.																				
8	<p>Position controls of the 911 DMS as follows:</p> <table data-bbox="649 693 1104 966"> <thead> <tr> <th data-bbox="714 693 795 724">SWITCH</th> <th data-bbox="1023 693 1104 724">SETTING</th> </tr> </thead> <tbody> <tr> <td data-bbox="649 735 747 766">INPUT</td> <td data-bbox="1023 735 1104 766">EIA</td> </tr> <tr> <td data-bbox="649 766 747 798">CODE</td> <td data-bbox="1023 766 1104 798">8</td> </tr> <tr> <td data-bbox="649 798 779 829">PARITY</td> <td data-bbox="1023 798 1104 829">ON</td> </tr> <tr> <td data-bbox="649 829 860 861">AUTO PK PIP</td> <td data-bbox="1023 829 1104 861">PIP</td> </tr> <tr> <td data-bbox="649 861 779 892">POWER</td> <td data-bbox="1023 861 1104 892">ON</td> </tr> <tr> <td data-bbox="649 892 795 924">DISCR %</td> <td data-bbox="1023 892 1104 924">3</td> </tr> <tr> <td data-bbox="649 924 763 955">BAUDS</td> <td data-bbox="1023 924 1104 955">†</td> </tr> </tbody> </table> <p data-bbox="617 987 1055 1018">† Baud rate of customer service</p>	SWITCH	SETTING	INPUT	EIA	CODE	8	PARITY	ON	AUTO PK PIP	PIP	POWER	ON	DISCR %	3	BAUDS	†				
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9	<p>Position controls of the 911 TSG as follows:</p> <table data-bbox="568 1155 1153 1501"> <thead> <tr> <th data-bbox="665 1155 747 1186">SWITCH</th> <th data-bbox="974 1155 1055 1186">SETTING</th> </tr> </thead> <tbody> <tr> <td data-bbox="568 1197 844 1228">AUTO. MAN. STEP</td> <td data-bbox="893 1197 974 1228">AUTO</td> </tr> <tr> <td data-bbox="568 1228 649 1260">BIAS</td> <td data-bbox="893 1228 909 1260">0</td> </tr> <tr> <td data-bbox="568 1260 665 1291">CODE</td> <td data-bbox="893 1260 1153 1291">8/10, 8/11M, or 8/11</td> </tr> <tr> <td data-bbox="568 1291 698 1323">DIST 1%</td> <td data-bbox="893 1291 909 1323">0</td> </tr> <tr> <td data-bbox="568 1323 698 1354">DIST 5%</td> <td data-bbox="893 1323 909 1354">0</td> </tr> <tr> <td data-bbox="568 1354 698 1386">REPEAT</td> <td data-bbox="893 1354 958 1386">OFF</td> </tr> <tr> <td data-bbox="568 1386 730 1417">RY OR U*</td> <td data-bbox="893 1386 958 1417">OFF</td> </tr> <tr> <td data-bbox="568 1417 698 1449">OUTPUT</td> <td data-bbox="893 1417 958 1449">EIA</td> </tr> <tr> <td data-bbox="568 1449 682 1480">BAUDS</td> <td data-bbox="893 1449 909 1480">†</td> </tr> </tbody> </table> <p data-bbox="568 1512 1006 1543">† Baud rate of customer service</p>	SWITCH	SETTING	AUTO. MAN. STEP	AUTO	BIAS	0	CODE	8/10, 8/11M, or 8/11	DIST 1%	0	DIST 5%	0	REPEAT	OFF	RY OR U*	OFF	OUTPUT	EIA	BAUDS	†
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BAUDS	†																				

2.08 With the bridging adapter and the 911A DTS conditioned as stated in the preceding step procedure, a call is placed to the test board. The data set is then manually or automatically switched to the data mode. Data may now be transmitted or received in either the half- or full-duplex mode and checked for distortion, parity, or errors. If at any time the DTR switch is turned off, the call will disconnect. A 4-row TTY machine may also be tested with this procedure.

**Audio Tone Monitoring**

2.09 A typical test setup for monitoring the audio frequency tones transmitted by a data set is shown in Fig. 4. Access to tip and ring is necessary to perform this test. The mark and space frequencies, F1 and F2, respectively, will be audible from the front-mounted loudspeaker on the 911 bridging adapter.



TPA 569975

Fig. 4—Block Diagram—Audio Signal Monitoring

2.10 Procedure:

STEP	PROCEDURE
1	Insert a patch cord into either the SEL. F1-F2 jack or the ALL jack.  <i>Note:</i> The SEL. F1-F2 jack allows selection of the F1 or F2 frequencies by the F1-F2 switch while the ALL jack monitors both frequencies simultaneously.
2	Connect the other end of the patch cord to tip and ring of the line to be monitored.
3	Position the ON-OFF VOLUME control to ON and adjust volume.

**2.11** Using the 911 bridging adapter and a high-impedance transmission test set, such as a TTS-28 or an equivalent meter equipped with a dB scale, a relative power level measurement of the F1 and F2 frequencies can be made. Power level measurements performed in this test are approximately 4 dB below the line signal level.

**2.12 Procedure:**

STEP	PROCEDURE
1	Insert one end of the patch cord into the SEL. F1 or F2 jack on the bridging adapter.
2	Connect the other end of the patch cord to tip and ring.
3	Connect the TTS-28, or the meter, between COMMON and either F1 or F2 jack on the bridging adapter. Disregard F1-F2 switch position.
4	Read signal level on TTS-28 and add 4 dB. For example, a meter indication of -16 dBm results in a relative signal level of -12 dBm.

**C. Construction**

**2.13** Components needed for construction of the bridging adapter are listed in Table A. Equivalent components may be substituted in cases where those listed in Table A are not locally available. Two basic components for the prototype bridging adapter are taken from local stock of Bell System apparatus: the audio amplifier and speaker of a 106-type loudspeaker set and the filter unit (768B card) of a Data Set 103E-type.

**2.14** The EIA driver amplifiers are constructed on a suitable circuit board and mounted directly to the filter unit. The two amplifiers are identical and are wired in accordance with Fig. 5. If desired, this circuit board may be encapsulated for protection. When completed, the driver amplifier circuit board is wired into the EIA interface monitoring section of the bridging adapter as shown in Fig. 6.

**2.15** The filter unit (768B card) and the audio amplifier circuit board are mounted directly to the back side of the front panel. Figure 7 gives the interconnections for the audio signal monitoring section. An inside view of the prototype bridging adapter is shown in Fig. 8.

**2.16** An interface cord (M25A-61) is terminated by a female jack mounted on the front panel. At this point, pin numbers 2, 3, 7, 9, and 20 are wired into the circuitry of the bridging adapter as shown in Fig. 6. Six test leads equipped with pin plugs are needed for interconnection of external test equipment.

**3. TEST ADAPTER FOR AUDIO BRIDGING**

**A. Description**

**3.01** The test adapter provides transformer isolation from the data line while matching the relatively low line impedance to a high-impedance device, such as a tape recorder. The adapter is suitable for use on both private line data services and the direct distance dialing (DDD) network data services using the data access arrangement. Since all components are passive, the test adapter may be used for both recording and playback.

**3.02** The following functional characteristics are exhibited by the test adapter. Frequency response (with 50K ohm load) is:

1 kHz (reference)—0 dB

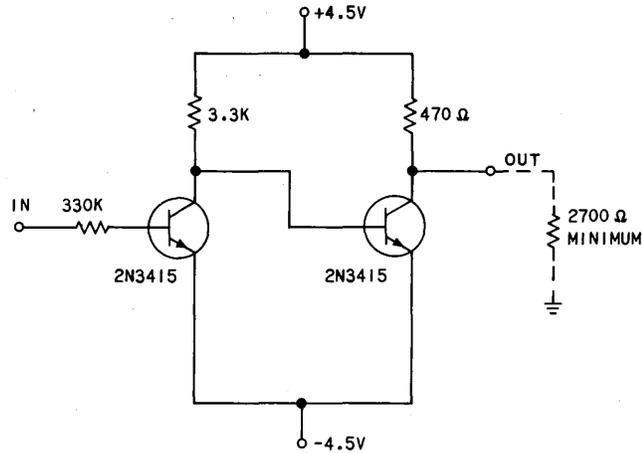
100 Hz—-1 dB

93 kHz—-1 dB

**TABLE A**  
**911 BRIDGING ADAPTER COMPONENT LIST**

COMPONENTS	QUANTITY
Audio amplifier and speaker (106-type loudspeaker set)	1
Filter unit (Data Set 103E-type 768B card)	1
Cord — M25A-61	1
Battery — KS-7105 (24 volts)	1
Case — KS-14132-L2	1
Capacitors — .05 $\mu$ f @ 50 volts	3
Transistors — 2N3415	4
Resistors — 330K, 1/4 watt, $\pm 10\%$	2
Resistors — 3.3K, 1/4 watt, $\pm 10\%$	2
Resistors — 470 ohms, 1/4 watt, $\pm 10\%$	2
Resistor — 1K, 1/2 watt, $\pm 10\%$	1
Resistor — 1.2K, 2 watts, $\pm 10\%$	1
Potentiometer — 50K, e/w on-off switch	1
Pilot lamp — 6 volts	1
Pin jacks	7
Telephone jacks — 1/4 inch	2
Test leads e/w pin plugs	6
Switches — toggle	2
Panel — custom cut and drilled	1
Miscellaneous mounting hardware and wire	

**Note:** Equivalent components may be substituted for those listed above.



NOTE:  
 ALL RESISTORS ARE 1/2 WATT, 10%. THE 2N3415 HAS A DCB  $\cong$  200. INPUT IMPEDANCE IS ABOUT 330K OHMS MINIMUM. OUTPUT LOAD SHOULD NOT BE MUCH LESS THAN 2700 OHMS.

TPA 569972

Fig. 5—EIA Driver—Schematic Diagram

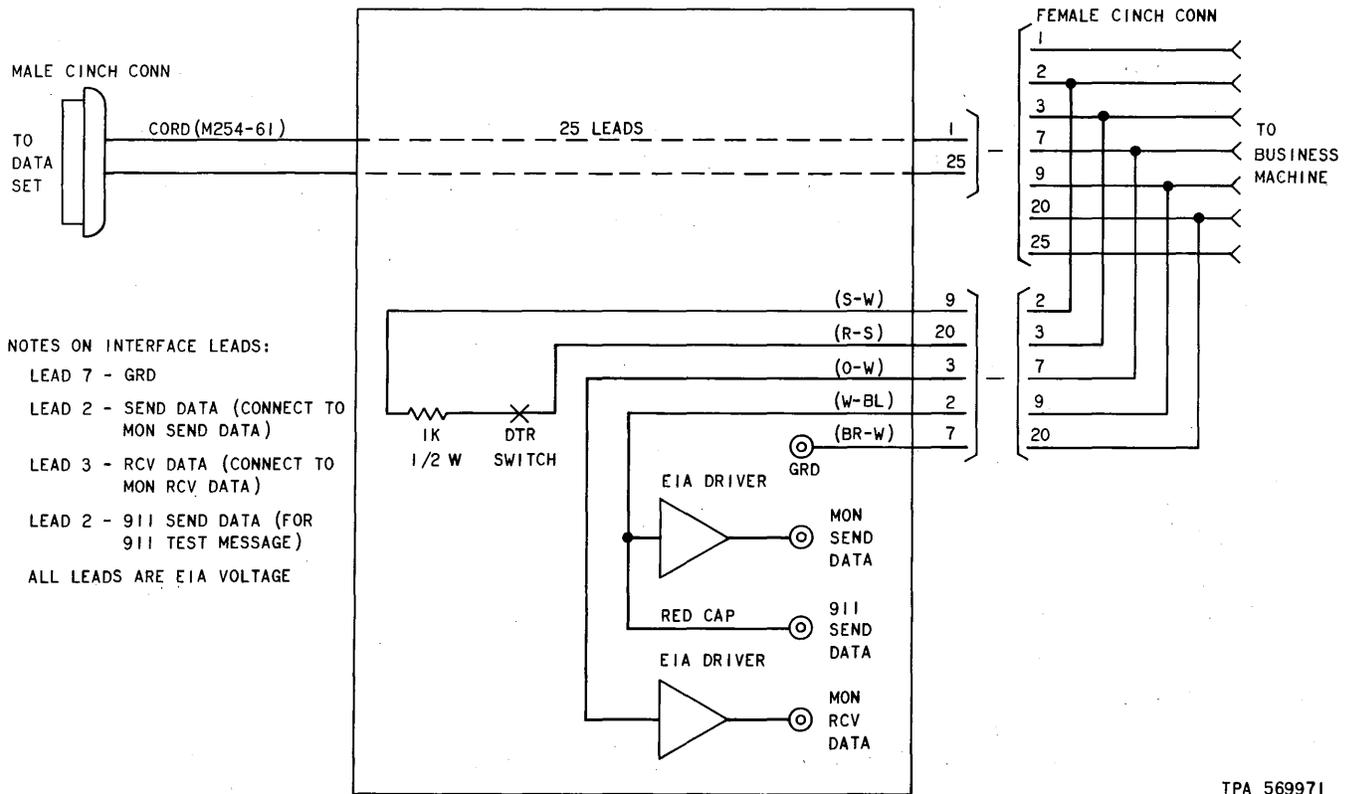
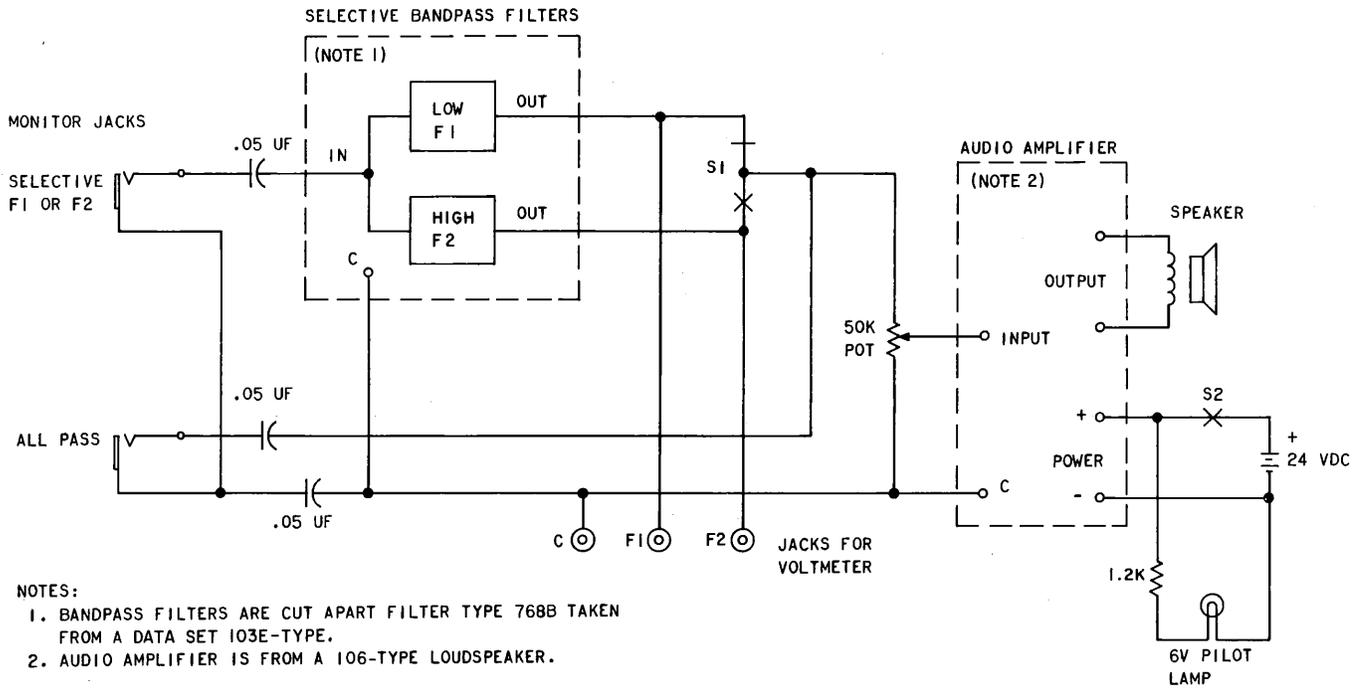
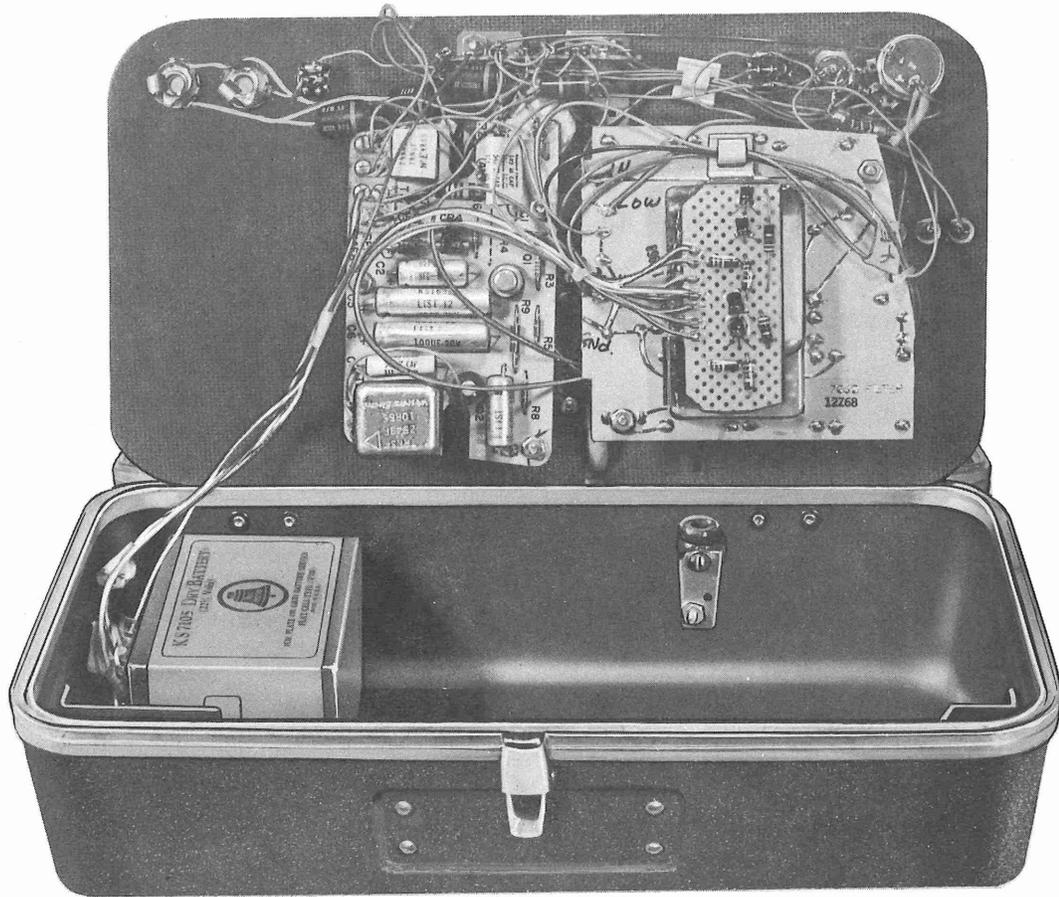


Fig. 6—911 Bridging Adapter—EIA Interface Monitoring Section



TPA 569970

Fig. 7—911 Bridging Adapter—Audio Signal Monitoring Section



TPA 569956

Fig. 8—911 Bridging Adapter—Inside View

## SECTION 107-180-100

Bridging loss at 1 kHz to a 900-ohm line is:

50K ohm recorder—0.6 dB

Output shorted—1.1 dB

Voltage loss through the test adapter is:

Record (50K ohm impedance @ 1 kHz)—1.1 dB gain

Playback (50K ohm source, 450-ohm load; 1 kHz)—24.5 dB

**3.03** When the adapter ground is connected to the recorder frame ground, the ground loop thus established provides the telephone line protection against ac from the recorder. The data set will provide lightning protection for the recorder.

### B. Application

**3.04** Use of the test adapter is not intended to replace normal troubleshooting tests found in 59X-YYY-500 BSP sections. However, certain problems which involve timing may occur intermittently and become extremely difficult to isolate with standard test equipment. These problems may be analyzed and resolved by use of the test adapter, audio tape recorder, multichannel recording oscillograph, and signal-conditioning amplifiers.

**3.05** To accommodate high-speed modems operating at up to 4800 bps, an oscillograph must have sufficient frequency response and paper-chart speed to provide good resolution of the interface signals. In addition, it must be reasonably portable for field use. Several manufacturers supply oscillographs which may be used. The Honeywell Test Instruments Division model 1508A Visicorder\* which can be equipped with seven M13000 galvanometers, for example, will meet these requirements. Option A (.15 to 120 in./sec chart speed) should be specified in order to obtain sufficient resolution on modems of 2400 bps and above. In addition, the Honeywell Accudata 117\* e/w seven channel amplifiers will provide the required impedance matching, sensitivity adjustment, and galvanometer overload protection. A tape recorder, such as the Wollensack model

6200 stereo tape recorder, may be used to record data for playback in conjunction with the oscillograph and amplifier.

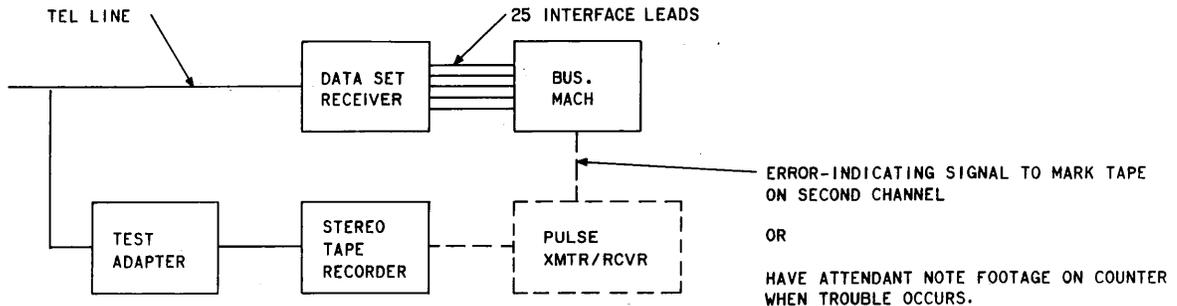
\*Trademark of Honeywell, Inc.



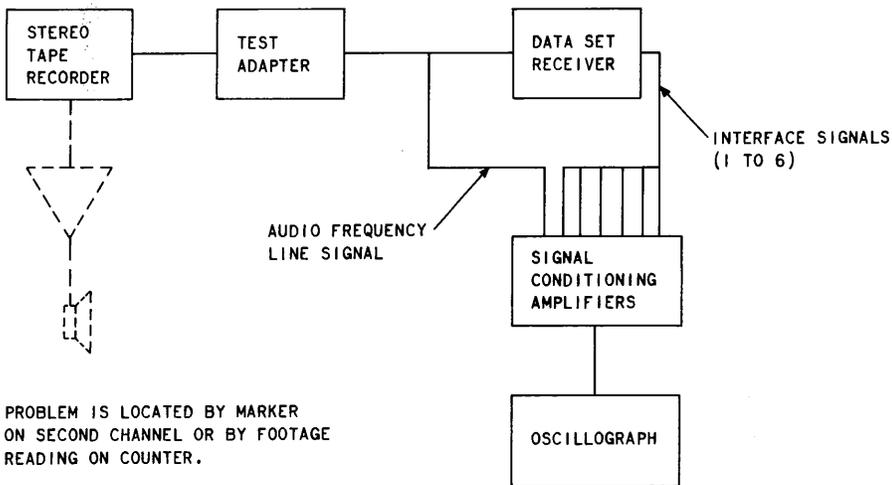
***Customer permission to record transmitted data should be obtained either by Telco personnel or business machine personnel and, in cases where any uncertainty exists, permission should be detailed and confirmed in writing with the signature of a customer management employee. In instances where transmission facilities are shared by more than one customer, permission of all customers should be obtained. Any uncertainty concerning the legality of permission to record should be referred first to the Legal Department of the appropriate company and then, if necessary, to the Legal Department at AT&T.***

**3.06** The tape recorder should be operated by Telco personnel, but in the event recording is to be performed by business machine company personnel, such operation should only be performed under the supervision of Telco personnel. Telco personnel should always connect the test adapter to the line side of the data set, data access arrangement, or interconnecting device with the most probable point being the connecting block. To insure proper usage, Telco personnel should measure the level of the line signal during recording and maintain this same level during playback. Playback should always be to the local data set for conversion into dc signals, never to the remote data set. The block diagram of Fig. 9 gives a typical arrangement for recording and playback. To establish the proper line conditions for playback and to prevent transmission of the signals down-line, Telco personnel should establish connection to a quiet termination in the serving central office or to a local telephone. This procedure will establish impedances equivalent to those present during recording, provide loop current required to hold the data set in the data mode, and prevent transmission of the recorded signals into the switched network.

RECORD:



PLAYBACK:



TPA 570045

Fig. 9—Oscillograph and Tape Recorder Monitoring of Intermittent Problems

**3.07** Detailed step-by-step procedures for use of the adapter are not given because of the varied applications possible. It is expected that Telco personnel using the device will have sufficient knowledge of the legal, technical, and service-related aspects to know the procedures required.



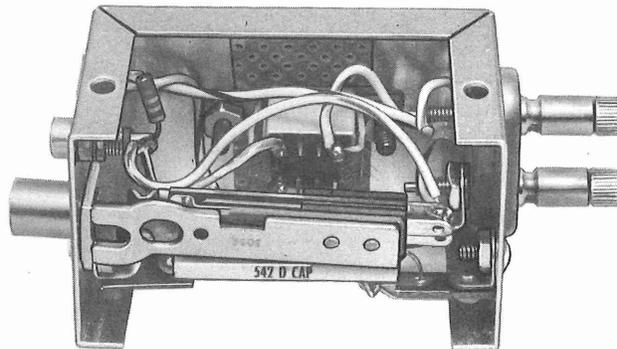
*Unless further need for the recording exists, Telco personnel should erase the recorded tape in the presence of customer personnel or the recorded tape should be given to the customer. If a recording is to be retained for*

*future use, the customer's permission should be obtained.*

**C. Construction**

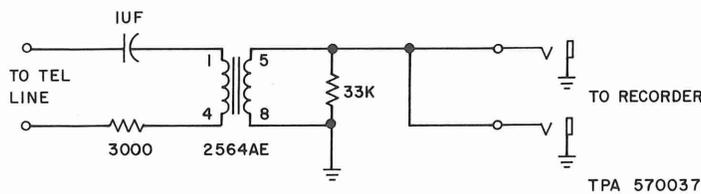
**3.08** Components needed for construction of the test adapter are listed in Table B. Equivalent components may be substituted when those specified are not locally available.

**3.09** The mini-box is custom drilled and the components mounted as shown in Fig. 10. Wiring is done in accordance with Fig. 11. Lettering is then applied to the finished test adapter.



TPA 569955

Fig. 10—Test Adapter—Inside View



TPA 570037

Fig. 11—Test Adapter—Schematic Diagram

TABLE B

TEST ADAPTER COMPONENT LIST

COMPONENTS	QUANTITY
Transformer — WEC Co #2564AE	1
Resistor — 33K ohm, 1/2 watt, ±5%	1
Resistor — 3K ohm, 1/2 watt, ±5%	1
Capacitor — 1 μf ±10% @ 200 volts	1
Telephone jack — WEC Co 215A	1
Phono jack — Switchcraft 3501FP or equivalent	1
Insulator plates — Millen 37202 or equivalent	2
Line terminals — Millen 37222 or equivalent	2
Mini-box — Bud Radio Inc. CU-2101-A or equivalent	1

**Note:** Equivalent components may be substituted for those recommended above.