# ADJUSTMENT OF LINE BUILD-OUT NETWORKS
# AUTOMATIC OUTGOING TRUNK TEST FRAME SD-32504-01
# STEP-BY-STEP SYSTEMS

## 1. GENERAL

**1.01** This section provides procedures for adjusting the build-out resistor networks of the Automatic Outgoing Trunk Test Frame (AOTT) SD-32504-01. The AOTT directs calls to terminating test line numbers in far-end offices or to a remote office test line (ROTL) in a remote office. The build-out resistors must be strapped properly to obtain accurate measurements when performing transmission tests.

**1.02** The adjustments covered are:



**1.03** Build-out resistor assemblies are provided in the AOTT to compensate for the office cabling between the outgoing selector levels and the outgoing trunk circuits, repeaters, etc (Point A to Point C in Fig. 1). The test tone power level generated by the automatic transmission measuring system (ATMS) director is adjusted by means of the build-out resistors so that the test tone power loss from Point B to Point C in Fig. 1 is equal to the loss from Point A to Point C.

**1.04** A 22A milliwatt reference meter (22 MRM) in conjunction with a 36A attenuator is specified to be used when performing the build-out adjustments. If another type of measuring set is used in lieu of the 22A MRM, determine its accuracy to be as good as or better than that of the 22A MRM. If another type of set is used, reference should be made to the manufacturer's instruction manual for operating and calibrating procedures pertaining to the set. Measurements with the 22A MRM approach a high degree of accuracy only in the area between the red lines on the light beam scale of the meter. Whenever possible, rotate the selector switch on the 36A attenuator to the position which causes the light beam to be within the red lines.

**1.05** Four precautions should be exercised when making these adjustments. ***First, the 22A MRM must be recalibrated each time it is moved and at 15-minute intervals when it is in continuous use. Failure to recalibrate may result in excessive inaccuracies. The calibration procedure is engraved on the face of the meter panel and should be followed precisely. Second,*** the recommended cords for connection of the 22A MRM to the circuits to be measured must be used. Other cords may introduce excessive loss and lead to errors in the adjustments. ***Third,*** measurements must be made at the 900-ohm impedance. The control on the 36A attenuator must also be set to the 900-ohm range to correspond with the setting of the FUNCTION switch of the 22A MRM. ***Fourth,*** low resistance wire and tight fitting connections must be used when providing temporary straps on the buildout resistor assemblies during the build-out process. Once the proper resistor strapping has been determined, the temporary straps are to be replaced with soldered connections and a final measurement must be made.

**1.06** Before any build-out adjustment procedures can be performed, the source of test tone power, a 1000-Hz generator circuit in the AOTT ATMS director, must be adjusted. The procedure is given in Adjustment A. Since measurements and adjustments are being carried out to tenths of decibels, it is essential that the ATMS director test tone output be precisely adjusted.

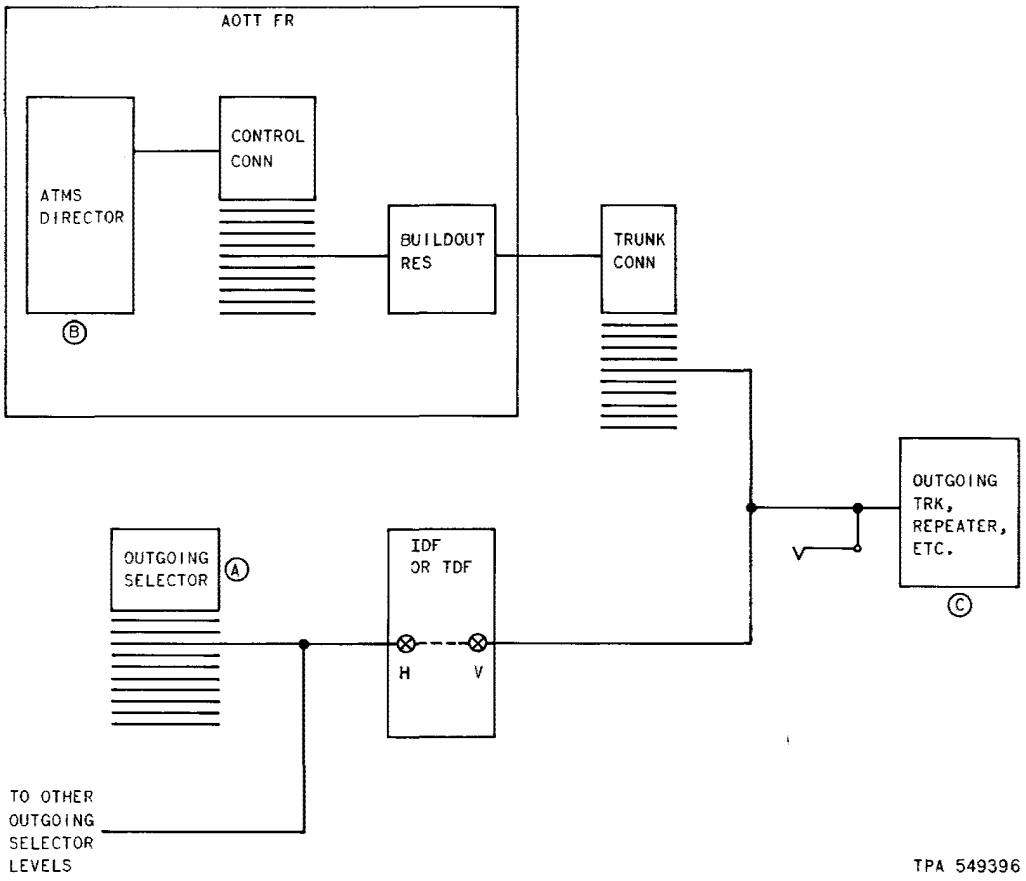



**Fig. 1—AOTT and Outgoing Selector Connections to Trunk, Repeater, etc.**

**1.07** The build-out resistor assemblies are provided as pairs, one assembly for each lead of a transmission path. The two assemblies of a pair ***must*** be identically strapped to minimize the effects of unbalance.

**1.08** There are a maximum of 24 compensating network build-out packages associated with the AOTT. Each compensating network build-out package contains build-out resistors for four trunk connectors (see Fig. 2). Resistance can be inserted between the output leads from the control connector and the input leads to the trunk connectors by removing the straps across the associated build-out resistors. Resistance from 0 to 33.0 ohms can be added in approximate 2.15-ohm steps by selecting the proper combination of resistors.

**1.09** A build-out resistor adjustment consists of the following.

(1) Strap out all build-out resistors at AOTT.

(2) Select several trunks which are associated with a particular trunk connector and measure transmission loss from outgoing selector to outgoing trunk, repeater, etc. Include measurements from longest, average, and shortest cable runs and compute average loss.

(3) Select several trunks which are accessible from AOTT control connector to outgoing trunks, repeaters, etc, and measure transmission loss. Include measurements from longest, average, and shortest connections and compute average loss.

(4) Access a trunk from the control connector which represents an average loss and send 1000-Hz, 0 dBm tone. Remove straps on associated build-out network until loss measured at outgoing

trunk, repeater, etc, is equal to the loss described in Step 2.

(5) Repeat Steps 1 through 4 for remaining equipped trunk connectors.

**1.10** Adjustment B can be performed more easily by using the aid of an assistant.

**1.11** Adjustment A ***must*** be performed prior to performing Adjustment B.

**1.12** Adjustment B can be performed more easily during periods of light traffic.

**1.13** Periodic checks of the 45-volt battery in the 71B milliwatt reference meter should be made to insure reliability of milliwatt output level. ***It is important that the battery be replaced before the voltage reaches 35 volts.*** The battery voltage is checked under a load condition by means of a KS-20538 (or equivalent) volt-ohm-milliammeter (VOM). If it is necessary to change the batteries in the 71B milliwatt reference meter, follow the procedures outlined in Section 103-326-100.

**1.14** Circuit pack CP205C of the ATMS director contains the 1000-Hz test tone supply. The accuracy of future measurements through the control and trunk connectors is dependent upon the adjustment of this supply.

**1.15** ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 3 or 4 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step, or a series of lettered steps, should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

## 2. APPARATUS

### Adjustments A and B

**2.01** One 22A milliwatt reference meter (22A MRM) J94022A (see 1.04).

**2.02** One KS-20538 (or equivalent) volt-ohm-milliammeter (VOM).

**2.03** One 36A auxiliary attenuator (see Section 103-222-101).

**2.04** One 3P15A cord, consisting of a P3K cord, 6 feet long, equipped with 310 plugs on each end.

### Adjustment A

**2.05** ATMS alignment unit J94051D containing an ATMS director calibration unit (CP101DT) and an extender circuit pack.

**2.06** One 258-type (dummy) plug.

### Adjustment B

**2.07** One 71B (portable) milliwatt reference generator.

**2.08** One 1014A or equivalent dial hand test set equipped with 240-type plug.

**2.09** One 2W17A cord, consisting of a W2W cord, 6 feet long, equipped with a 310 plug on one end and 360B and 360C tools on the other end. Equip 360B and 360C tools with KS-6278 connecting clips.

**2.10** One patching cord, 6 feet (or less) long, equipped with a 309 or 310 plug on one end, and appropriate type of plug, test clips, etc, necessary to connect to incoming T and R leads of outgoing trunk.

**2.11** One KS-16363, L1 wire wrapping tool.

**2.12** One KS-16450, L1 or KS−16492, L2 wire unwrapping tool.

**2.13** Four 6-inch straps with connectors or KS-6278 test clips, or equivalent (for making temporary connections on build-out resistor assemblies).

**2.14** 716C test receiver.

**2.15** 477A (make-busy) tool.

**2.16** Blocking and insulating tools (as required). Use and apply as covered in Section 069-020-801.

## 3. PREPARATION

| STEP | ACTION | VERIFICATION |
|---|---|---|
| **Adjustments A and B** | | |
| 1 | ***Calibrate 22A MRM in accordance with Section 103-222-100 and instructions on faceplate of 22A MRM.*** | |
| 2 | At 22A MRM—<br>Connect 36A attenuator to IN T, R, and S binding posts. | |
| 3 | Set FUNCTION control to 900. | |
| 4 | Set REFERENCE LEVEL DBM control to 0. | |
| 5 | Set selector switch to 36A attenuator to 900.0 position. | |
| 6 | Using 3P15A cord, connect IN jack of 22A MRM to 900Ω OUT jack of 71B milliwatt generator. | |
| 7 | At 71B milliwatt generator—<br>Prepare VOM to measure 45 volts dc. | |
| 8 | Connect VOM test leads to −BAT TST and +35V DC MIN jacks.<br><br>***Note:*** Minus (−) side of VOM connects to −BAT TST jack and plus (+) side of VOM connects to +35V DC MIN. | VOM indicates a minimum of 35 volts. |
| 9a | If VOM does not indicate at least 35 volts in Step 8—<br>Replace the battery in the 71B milliwatt generator in accordance with Section 103-326-100. | |
| 10 | Remove VOM test leads from −BAT TST and +35V DC MIN jacks. | VOM indicates 0. |
| 11 | At 22A MRM—<br>Operate PUSH TO READ key. | Light beam on 22A MRM indicates 0±.03 dBm (within red lines on scale). |
| 12 | Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 13 | Remove cord connection from 22A MRM and 71B milliwatt generator. | |
| 14 | Repeat Steps 3 through 13 at least every 15 minutes throughout both Adjustments A and B. | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| **Adjustment A** | | |
| 15 | At AOTT frame—<br>Restore all keys to normal. | |
| 16 | Momentarily operate RLS key. | CT lamp remains extinguished. |
| 17 | At ATMS director—<br>Remove circuit packs CP101D and CP310D from their in-service positions. | |
| 18 | Remove the blank filler frame assembly from position 102. | |
| 19 | Insert ATMS director calibration unit CP101DT into position 101. | |
| 20 | Operate all turnbutton keys on CP101DT to their vertical positions. | |
| **Adjustment B** | | |
| 21 | Reproduce (locally) Tables A and B number of times equivalent to number of equipped trunk connectors. | |
| 22 | Consult office records to obtain location of outgoing selector switch appearances associated with connections A to C in Fig. 1 for trunk connector to be built out. | |
| 23 | Record information in first two columns of Table A.<br><br>***Note:*** Record five longest connections, five average connections, and five shortest length connections. | |
| 24 | Repeat Steps 22 and 23 for all equipped trunk connectors. | |
| 25 | At build-out resistors associated with trunk connector to be built out—<br>Verify that resistors are strapped out. (Check at rear of build-out resistor assembly.)<br><br>***Note:*** Resistors ***must*** be strapped out in pairs. Fig. 2 shows an AOTT compensating network arrangement (see 1.07 - 1.08). | |
| 26b | If resistors are not strapped out—<br>At rear of build-out resistor assembly— | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| | Temporarily strap out build-out resistors associated with trunk connector. | |

**4. METHOD**

| STEP | ACTION | VERIFICATION |
|---|---|---|
| **A. ATMS Director Test Tone Output Level** | | |
| 21 | At ATMS director—<br>Remove circuit pack CP205C from its in-service position and place in ATMS director alignment unit extender. | |
| 22 | Connect extender card (with CP205C attached) to CP205C in-service position jack. | |
| 23 | At 22A MRM—<br>Set FUNCTION switch to 600. | |
| 24 | Set REFERENCE LEVEL DBM switch to 0. | |
| 25 | Set selector switch on 36A attenuator to 600 .0 position. | |
| 26 | Calibrate 22A MRM in accordance with instructions on face of test set. | |
| 27 | Using 3P15A cord, connect IN jack of 36A attenuator to MW jack on CP101DT circuit pack. | |
| 28 | Operate PUSH TO READ key on 22A MRM. | Light beam on 22A MRM indicates exactly 0 dBm. |
| 29 | Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 30b | If requirement of Step 28 is not met—<br>Operate and hold PUSH TO READ key and rotate R3 potentiometer at CP205C until 22A MRM indicates exactly 0 dBm. | |
| 31b | Restore PUSH TO READ key to normal. | |
| 32 | At CP101DT circuit pack—<br>Remove cord connection from MW jack and insert into 2W jack. | |
| 33 | At 22A MRM—<br>Operate PUSH TO READ key. | Light beam on 22A MRM indicates exactly 0 dBm. |
| 34 | Restore PUSH TO READ key to normal. | Light beam extinguished. |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 35c | If requirement of Step 33 is not met—<br>Operate and hold PUSH TO READ key and rotate R7 potentiometer at CP205C until 22A MRM indicates exactly 0 dBm. | |
| 36c | Restore PUSH TO READ key to normal. | |
| 37 | At CP101DT circuit pack—<br>Remove cord connection from 2W jack and insert into 4W jack. | |
| 38 | Insert 258 dummy plug into 2W jack. | |
| 39 | At 22A MRM—<br>Operate PUSH TO READ key. | Light beam on 22A MRM indicates 0 $\pm$.03 dBm. |
| 40 | Restore PUSH TO READ key to normal. | Light beam on 22A MRM extinguished. |
| 41 | At CP101DT circuit pack—<br>Remove 310 plug of 3P15A cord from 4W jack. | |
| 42 | Remove 258 dummy plug from 2W jack. | |
| 43 | At CP205C circuit pack—<br>Remove CP205C circuit pack from extender and return to its in-service position. | |
| 44 | Repeat Steps 27 through 29 and 32 through 34. | |
| 45d | If requirements of Steps 28 and 33 ***cannot*** be met—<br>Repeat Steps 21 through 44. | |
| 46 | Remove circuit pack CP101DT from 101 in-service position. | |
| 47 | Place circuit pack CP101D on extender and insert into 101 in-service position. | |
| 48 | Return blank filler assembly to position 102. | |
| 49 | At circuit pack CP317D—<br>Operate 2W key. | |
| 50 | At AOTT—<br>Using 3P15A cord, connect MEAS jack to IN jack of 36A attenuator. | |
| 51 | At 22A MRM—<br>Set selector switch on 36A attenuator to 900 .0 position. | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 52 | Set FUNCTION control to 900. | |
| 53 | Operate PUSH TO READ key. | Scale on 22A MRM lighted. |
| 54 | Rotate selector switch on 36A attenuator clockwise until light beam on 22A MRM indicates nearest to 0 dBm. | |
| 55 | Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 56 | Determine from setting of 36A attenuator and 22A MRM indication in Step 54 the approximate level of tone received at the 22A MRM. | |
| 57 | Refer to Table C and determine resistors to be strapped out to give 0 dBm indication. | |
| 58 | At circuit pack CP101D—<br>Temporarily strap out proper combination of R1.1 through R2.4 resistors to give 0 dBm indication (see 1.07 and Fig. 3). | |
| 59 | At 22A MRM—<br>Operate PUSH TO READ key. | Light beam on 22A MRM indicates exactly 0 dBm. |
| 60 | Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 61e | If 22A MRM does not indicate exactly 0 dBm in Step 59—<br>Repeat Steps 58 through 60. | |
| 62 | At circuit pack CP101D—<br>Strap R3.1 through R4.4 the same as final strapping of R1.1 through R2.4 resistors (see Fig. 3). | |
| 63 | Solder all connections. | |
| 64 | Repeat Steps 59 and 60. | |
| 65 | At circuit pack CP317D—<br>Restore 2W key to normal. | |
| 66 | Remove CP101D from card extender and return to its in-service position. | |

**B. Build-Out Resistor Adjustment**

| | | |
|---|---|---|
| 27 | At outgoing selector bay associated with first trunk of first trunk connector to be built out (see Table A)— | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| | Calibrate 22A MRM in accordance with instructions on face of test set. | |
| 28 | At 22A MRM—<br>Set selector switch on 36A attenuator to 900 1.0 position. | |
| 29 | Set FUNCTION control to 900. | |
| 30 | Make trunk (A to C in Fig. 1) busy in accordance with local instructions. | |
| 31 | At trunk circuit, repeater, etc, associated with trunk made busy—<br>Insulate contacts, block operated or nonoperated relay/s etc (as required), to open talking path between incoming T and R leads and outgoing T and R leads.<br><br>***Note:*** The following is a typical example. Assume outgoing repeater SD-31779-01 is associated with the trunk connector. The action at the repeater would be to insulate contacts 2/3 and 5/6 of "D" relay. | |
| 32 | Using cord described in 2.10, connect IN jack of 36A attenuator to outgoing trunk, repeater, etc, input T and R leads. | |
| 33 | At outgoing selector bay terminals associated with first trunk of first trunk connector to be built out (see Table A)—<br>Using 2W17A cord, connect 900Ω OUT jack of 71B milliwatt generator to T and R terminals. | |
| 34 | At 22A MRM—<br>Operate REFERENCE LEVEL DBM control to −1. | |
| 35 | Operate PUSH TO READ key. | Scale on 22A MRM lighted. |
| 36 | At 36A attenuator—<br>Rotate selector switch counterclockwise until light beam on 22A MRM indicates as near to 0 as possible. | Actual measured loss (AML) of trunk equals −1.0 dB plus setting of 36A attenuator selector switch. |
| 37 | Record AML on Table A associated with trunk under test. | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| | *Note:* Round off to nearest tenth. | |
| 38 | At 22A MRM—<br>Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 39 | Set selector switch on 36A attenuator to 900 1.0 position. | |
| 40 | At outgoing selector, repeater, etc—<br>Remove cord connection from input T and R leads. | |
| 41 | Remove blocking tools, insulators, etc (as required). | |
| 42 | At outgoing selector terminals associated with trunk under test—<br>Remove cord connection from T and R leads and 71B milliwatt generator. | |
| 43 | Restore trunk under test to service. | |
| 44 | Repeat Steps 27 through 43 for other trunks associated with same trunk connector, substituting trunk under test for "first trunk" in Steps 27 and 33. | |
| 45 | Compute Column 6 of Table A. | Average AML shall meet the following two requirements:<br>(1) The average of the average cable runs (5B in Table A) shall not deviate more than .05 dB from the average of the longest (5A in Table A) and shortest (5C in Table A) cable runs combined.<br>(2) The difference in loss between the lowest AML and the highest AML shall not exceed .2 dB.<br><br>*Note:* If either of these requirements is not met, it would indicate an excessive amount of loss in one or more of the cable runs to the trunks associated with the trunk connectors being built out. This could be caused either by wiring (false grounds, false cable bridges, etc) or by improper assignment of trunks to the trunk connectors. |
| 46 | Compute Column 7 of Table A.<br><br>*Note:* Figure 4 is an example of a completed Table A form for one trunk connector. | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 47 | Repeat Steps 27 through 46 for other trunk connectors to be built out. | |
| 48 | Consult office records to obtain AOTT access codes associated with connections B to C in Fig. 1. | |
| 49 | Record information in first two columns of Table B.<br><br>***Note 1:*** Record five longest connections, five average connections, and five shortest length connections.<br><br>***Note 2:*** The connections chosen for Table B are not necessarily to the same outgoing trunks, repeaters, etc, as those that were chosen for Table A. | |
| 50 | Repeat Steps 48 and 49 for all equipped trunk connectors. | |
| 51 | Refer to Table B to obtain identification of access code associated with "first trunk" of first trunk connector to be built out. | |
| 52 | At AOTT control connector—<br>Using dial hand test set, insert test plug into TST jack and dial first two digits of access code obtained in Step 51. | Control connector steps to vertical and horizontal bank terminals corresponding to digits dialed. |
| 53 | Insulate contacts 1/2 of VON springs. | |
| 54 | Remove dial hand test set plug from TST jack. | Control connector ***does not*** release. |
| 55 | At trunk connector to be built out—<br>Insert test plug of dial hand test set into 1/2 of TST jack and dial last two digits of access code obtained in Step 51. | Trunk connector steps to vertical and horizontal bank terminals corresponding to digits dialed. |
| 56 | Insulate contacts 1/2 of VON springs. | |
| 57 | Remove dial hand test set plug from TST jack. | Trunk connector ***does not*** release. |
| 58 | Check for presence of ground on 3 spring of TST jack.<br><br>***Note:*** The presence of ground indicates a busy condition for trunk associated with access code. ***Do not continue this adjusting procedure until the ground condition is absent.*** | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 59 | Insert 477A tool into 3/4 springs of TST jack. | |
| 60 | At outgoing trunk, repeater, etc, associated with trunk which was dialed—<br>Block relay/s operated, nonoperated, insulate contacts, etc (as required) to open talking path between incoming T and R leads and outgoing T and R leads (see note after Step 31). | |
| 61 | Using cord described in 2.10, connect IN jack of 36A attenuator to input T and R leads of trunk. | |
| 62 | At AOTT frame—<br>Block operated CT relay. | |
| 63 | At ATMS circuit pack CP317D—<br>Operate 2W key. | 1MW transmitted from ATMS director towards AOTT. |
| 64 | At 22A MRM—<br>Operate PUSH TO READ key. | Scale on 22A MRM lighted. |
| 65 | Rotate selector switch on 36A attenuator counterclockwise until light beam on 22A MRM indicates nearest to 0 dBm. | |
| 66 | Restore PUSH TO READ key to normal. | Light beam extinguished. |
| 67 | Determine from setting of 36A attenuator and 22A MRM indication in Step 65 the approximate level of tone received at the 22A MRM. | |
| 68 | Record value obtained (AML) in Table B associated with trunk connector to be built out.<br><br>***Note:*** Round off to nearest tenths. | |
| 69 | Rotate selector switch on 36A attenuator to 900 1,0 position. | |
| 70 | At AOTT—<br>Remove blocking tool from CT relay. | |
| 71 | At outgoing trunk, repeater, etc, associated with "first trunk" of trunk connector being built out—<br>Remove cord connection from input T and R leads. | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 72 | Remove blocking tools, insulators, etc. | |
| 73 | At trunk connector—<br>Remove insulator from 1/2 of VON springs. | Trunk connector restores to normal. |
| 74 | Remove 477A (make-busy)) tool from 3/4 springs of TST jack. | |
| 75 | Repeat Steps 51 and 55 through 74 in turn for remaining trunks associated with trunk connector being built out, substituting trunk under test for "first trunk" in Steps 51 and 71. | |
| 76 | Compute column 6 of Table B associated with trunk connector being built out. | Average AML shall meet the following two requirements:<br>(1) The average of the average length connections (5B in Table B) shall not deviate more than .05 dB from the average of the shortest (5C in Table B) and longest (5A in Table B) connections combined.<br>(2) The difference in loss between the lowest AML and the highest AML shall not exceed .2 dB.<br><br>***Note:*** If either of these requirements is not met, it would indicate an excessive amount of loss in one or more of the cable runs to the trunks associated with the trunk conectors being built out. This could be caused either by wiring (false grounds, false cable bridges, etc) or by improper assignment of trunks to the trunk connectors. |
| 77 | Compute Column 7 of Table B.<br><br>***Note:*** Figure 5 is an example of a completed Table B form for one trunk connector. | |
| 78 | Subtract the value obtained in Column 7 of Table B from that obtained in Column 7 of Table A associated with same trunk connector. | |
| 79 | Locate difference obtained in Step 78 (dB value) on Table C to determine corresponding resistor values. | |
| 80 | At build-out resistors (rear terminals)—<br>Temporarily strap out resistors (determined from Table C) associated with trunk connector. (Use Fig. 2 to locate resistors within compensating network.) | |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 81 | Select a trunk from Table B (associated with trunk connector being built out) that most nearly represents value obtained in Column 7 of Step 77. | |
| 82 | At trunk connector being built out—<br>Insert plug of dial hand test set into TST jack and dial last two digits of access code associated with trunk selected in Step 81. | |
| 83 | Repeat Steps 55 through 66. | |
| 84 | Determine from setting of 36A attenuator and 22A MRM indication the approximate level of tone received at the 22A MRM. | Computed loss obtained should equal value of Column 7, Table A (associated with trunk connector being built out [see Step 46]). |
| 85c | If value obtained in Step 84 does not equal value obtained in Step 46—<br>Repeat Step 80. | |
| 86c | At 22A MRM—<br>Operate PUSH TO READ key. | Scale on 22A MRM lighted. |
| 87c | Rotate selector switch (within 900 range) of 36A attenuator until light beam on 22A MRM indicates nearest to 0 dBm. | |
| 88c | Compute AML from setting of 36A attenuator and 22A MRM indication. | |
| 89c | Restore PUSH TO READ key to normal. | Light beam on 22A MRM extinguished. |
| 90c | Set selector switch on 36A attenuator to 900 1.0 position. | |
| 91c | Repeat Steps 85c through 90c until value obtained in Step 88c equals value of Column 7, Table A (Step 46). | |
| 92 | Permanently strap and solder all final build-out resistors. | |
| 93 | Repeat Steps 64 through 67. | 22A MRM indication ***does not*** change from Step 84 or 88c. |
| 94 | Repeat Steps 70 through 74 substituting trunk under test for "first trunk" in Step 71. | |
| 95 | At AOTT control connector—<br>Remove insulator from 1/2 of VON springs. | Control connector releases. |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 96 | At ATMS circuit pack CP317D—<br>Restore 2W key to normal. | 1MW removed by ATMS director from AOTT. |
| 97 | Repeat Steps 51 through 96 for other trunk connectors to be built out, substituting trunk connector to be built out for first trunk connector in Step 51. | |
| 98 | At test sets—<br>Remove all cords; restore all keys. | |

## TABLE A

| 1 | 2 | 3 | 4 | 5 | | 6 | 7 |
|---|---|---|---|---|---|---|---|
| TRK CONN. NO. | A-C IN FIG. 1 | BAY & TERMINAL (POINT A IN FIG 1) | OUTGOING TRK, REPEATER, ETC. (POINT C IN FIG. 1) | ACTUAL MEASURED LOSS (AML) | | AVERAGE AML FOR LONGEST, AVERAGE, & SHORTEST TRKS<br>COLUMN 5A, 5B, 5C<br>5 | AVERAGE AML FOR TRK CONN.<br>COLUMN 15<br>15 |
| TRK CONN. NO. ____ | LONGEST CABLE RUNS | B- | | 5A | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | AVERAGE CABLE RUNS | B- | | 5B | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | SHORTEST CABLE RUNS | B- | | 5C | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |
| | | B- | | | | | |

## TABLE B

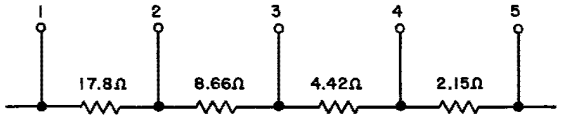
| 1 | 2 | 3 | 4 | 5 | | 6 | 7 |
|---|---|---|---|---|---|---|---|
| TRK CONN. NO. | B-C IN FIG. 1 | ACCESS CODE TO OUTGOING TRK, REPEATER ETC. | OUTGOING TRK, REPEATER, ETC. (POINT C IN FIG. 1) | ACTUAL MEASURED LOSS (AML) | | AVERAGE AML FOR LONGEST, AVERAGE, & SHORTEST TRKS<br>COLUMN 5A, 5B, 5C<br>5 | AVERAGE AML FOR TRK CONN.<br>COLUMN 15<br>15 |
| TRK CONN. NO. ___ | LONGEST CABLE RUNS | | | 5A | | | |
| | AVERAGE CABLE RUNS | | | 5B | | | |
| | SHORTEST CABLE RUNS | | | 5C | | | |

## TABLE C

### BUILD-OUT RESISTOR STRAPPING

| REQUIRED LOSS — DB | TERMINAL STRAPPING (EACH SIDE OF LINE) |
|---|---|
| .00 | 1-5 |
| .02 | 1-4 |
| .04 | 1-3, 4-5 |
| .06 | 1-3 |
| .08 | 1-2, 3-5 |
| .10 | 1-2, 3-4 |
| .12 | 1-2, 4-5 |
| .14 | 1-2 |
| .16 | 2-5 |
| .18 | 2-4 |
| .20 | 2-3, 4-5 |
| .22 | 2-3 |
| .24 | 3-5 |
| .26 | 3-4 |
| .28 | 4-5 |
| .30 | NONE |

BUILD-OUT RESISTORS




*Notes: 1.* The terminal numbers shown are for reference purposes only.

*2.* The same type of resistors are used in each side of the line.

| CP- | CR1 | CR2 | CR3 | CR4 | CR5 | CR6 | CR7 | CR8 | CR9 | CR10 | CR11 | CR12 | CR13 | CR14 | CR15 | CR16 | CR17 | CR18 | CR19 | CR20 | CR21 | CR22 | CR23 | CR24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NETWORK NO. | CONTROL CONN LEVEL TERMINAL AND TRUNK CONN NO. | | | | | | | | | | | | | | | | | | | | | | | |
| CCN1 | 1-1 | 1-5 | 1-9 | 2-3 | 2-7 | 3-1 | 3-5 | 3-9 | 4-3 | 4-7 | 5-1 | 5-5 | 5-9 | 6-3 | 6-7 | 7-1 | 7-5 | 7-9 | 8-3 | 8-7 | 9-1 | 9-5 | 9-9 | 0-3 |
| CCN2 | 1-2 | 1-6 | 1-0 | 2-4 | 2-8 | 3-2 | 3-6 | 3-0 | 4-4 | 4-8 | 5-2 | 5-6 | 5-0 | 6-4 | 6-8 | 7-2 | 7-6 | 7-0 | 8-4 | 8-8 | 9-2 | 9-6 | 9-0 | 0-4 |
| CCN3 | 1-3 | 1-7 | 2-1 | 2-5 | 2-9 | 3-3 | 3-7 | 4-1 | 4-5 | 4-9 | 5-3 | 5-7 | 6-1 | 6-5 | 6-9 | 7-3 | 7-7 | 8-1 | 8-5 | 8-9 | 9-3 | 9-7 | 0-1 | 0-5 |
| CCN4 | 1-4 | 1-8 | 2-2 | 2-6 | 2-0 | 3-4 | 3-8 | 4-2 | 4-6 | 4-0 | 5-4 | 5-8 | 6-2 | 6-6 | 6-0 | 7-4 | 7-8 | 8-2 | 8-6 | 8-0 | 9-4 | 9-8 | 0-2 | 0-6 |

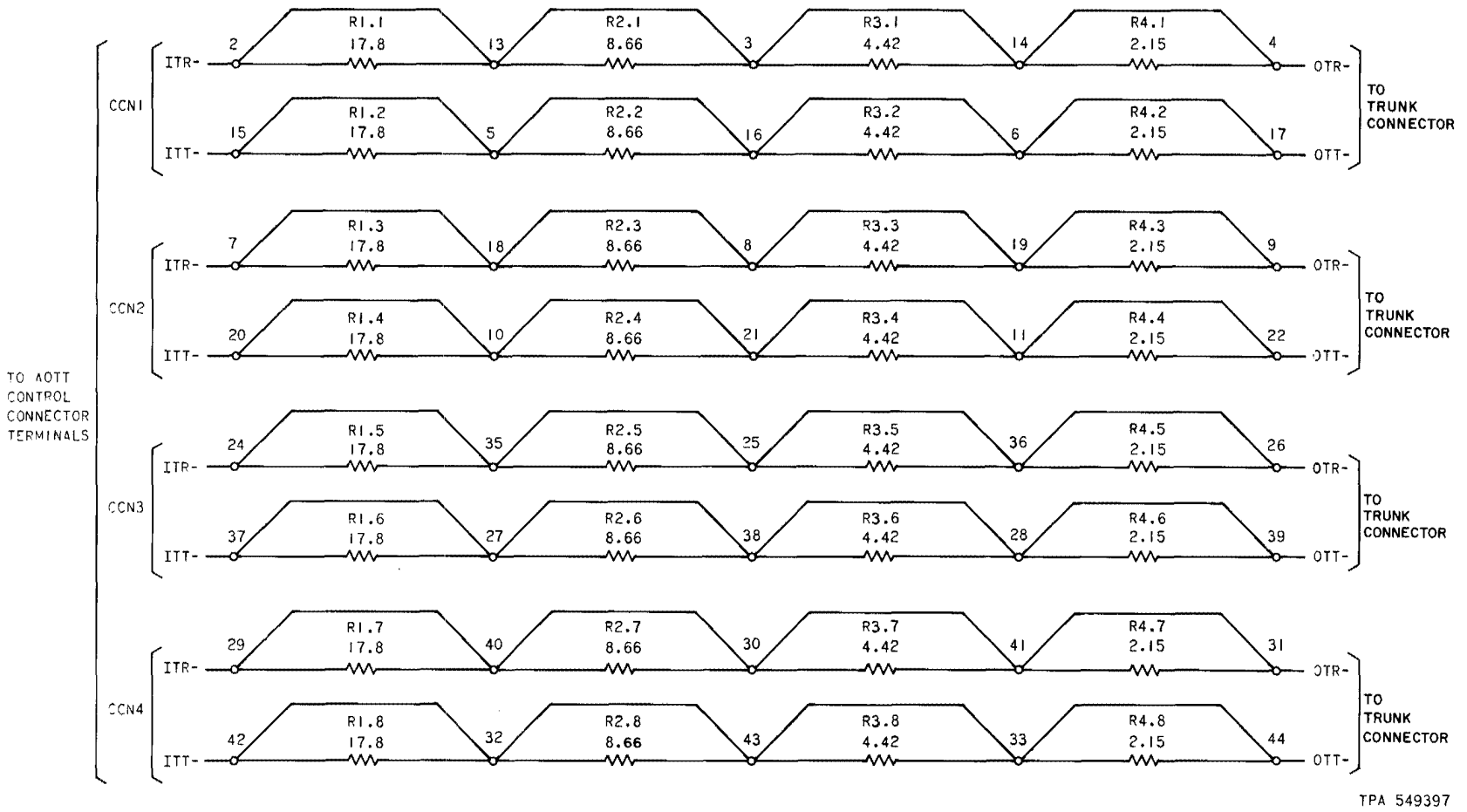



**Fig. 2—AOTT Build-out Resistors**

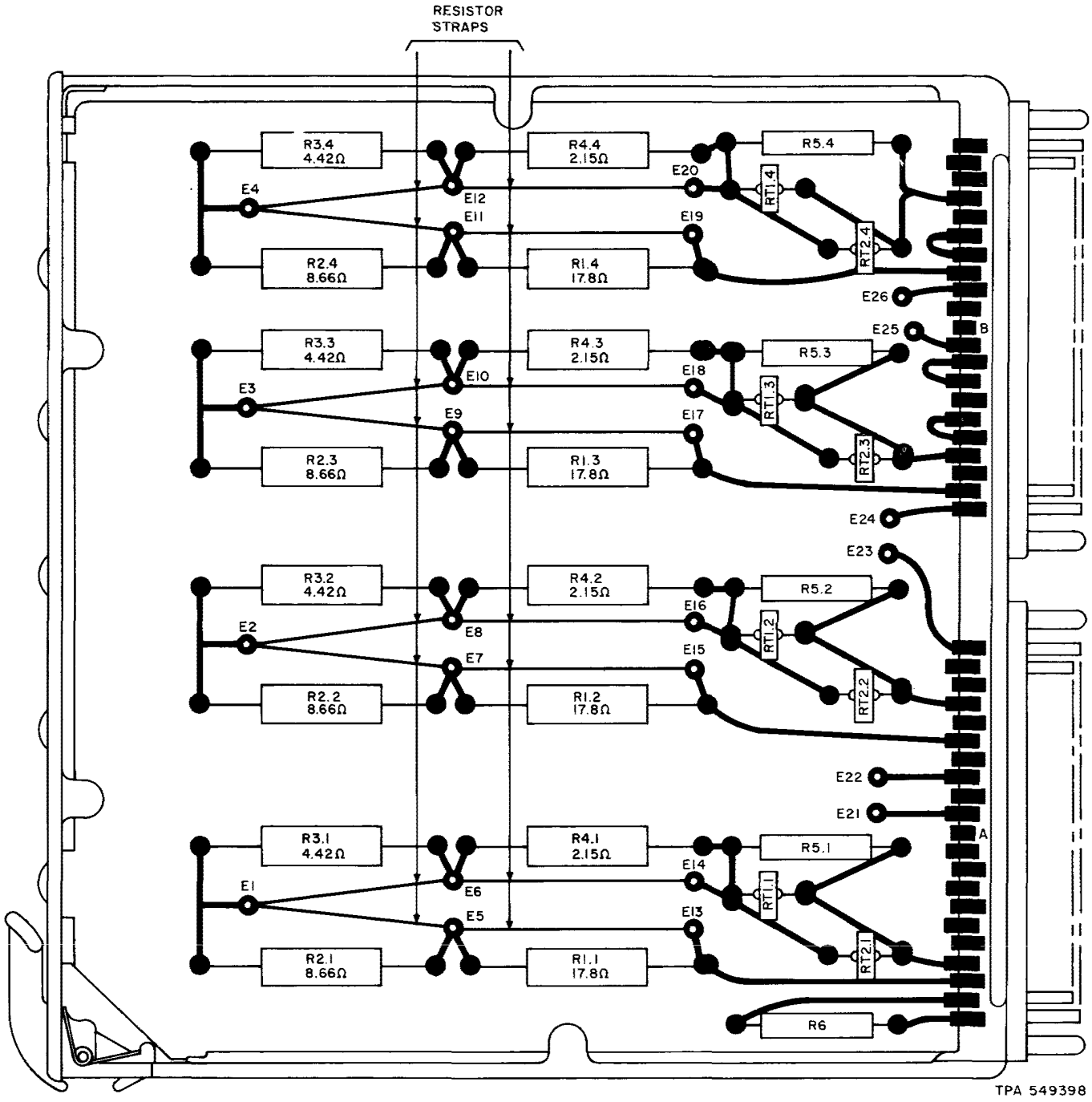



**Fig. 3—Location of Build-out Resistors in ATMS Circuit Pack CP101D**

**TABLE A**

| 1 | 2 | 3 | 4 | 5 | | 6 | 7 |
|---|---|---|---|---|---|---|---|
| TRK CONN. NO. | A-C IN FIG. 1 | BAY & TERMINAL (POINT A IN FIG 1) | OUTGOING TRK, REPEATER, ETC. (POINT C IN FIG. 1) | ACTUAL MEASURED LOSS (AML) | | AVERAGE AML FOR LONGEST, AVERAGE, & SHORTEST TRKS<br>COLUMN 5A, 5B, 5C<br>5 | AVERAGE AML FOR TRK CONN.<br>COLUMN 15<br>15 |
| TRK CONN. NO. 47 | LONGEST CABLE RUNS | B- 201-121 | R1-21 | 5A | .2 | .26 | .22 |
| | | B- 211-131 | R2-23 | | .3 | | |
| | | B- 206-141 | R2-113 | | .3 | | |
| | | B- 203- 61 | R4-7 | | .2 | | |
| | | B- 209- 81 | R3-45 | | .3 | | |
| | AVERAGE CABLE RUNS | B- 231- 82 | P.C. 128-34 | 5B | .2 | .22 | |
| | | B- 232- 97 | P.C. 128-39 | | .3 | | |
| | | B- 237- 65 | P.C. 129-42 | | .2 | | |
| | | B- 234-225 | P.C. 129-48 | | .2 | | |
| | | B- 239- 42 | P.C. 130-52 | | .2 | | |
| | SHORTEST CABLE RUNS | B- 301- 88 | OGT 21-1 | 5C | .2 | .18 | |
| | | B- 306- 42 | OGT 32-7 | | .2 | | |
| | | B- 303-211 | OGT 41-8 | | .2 | | |
| | | B- 308- 22 | OGT 49-2 | | .1 | | |
| | | B- 309-117 | OGT 11-3 | | .2 | | |

**Fig. 4—Typical Example of Table A After Completion**

TABLE B

| 1 | 2 | 3 | 4 | 5 | | 6 | 7 |
|---|---|---|---|---|---|---|---|
| TRK CONN. NO. | B-C IN FIG. 1 | ACCESS CODE TO OUTGOING TRK, REPEATER ETC. | OUTGOING TRK, REPEATER, ETC. (POINT C IN FIG. 1) | ACTUAL MEASURED LOSS (AML) | | AVERAGE AML FOR LONGEST, AVERAGE, & SHORTEST TRKS<br>COLUMN 5A, 5B, 5C | AVERAGE AML FOR TRK CONN.<br>COLUMN 15 |
| | | | | | | 5 | 15 |
| TRK CONN. NO. 47 | LONGEST CABLE RUNS | 4750 | R1-22 | 5A | .1 | .16 | .12 |
| | | 4751 | R1-28 | | .2 | | |
| | | 4753 | R3-66 | | .1 | | |
| | | 4757 | R4-27 | | .2 | | |
| | | 4759 | R4-30 | | .2 | | |
| | AVERAGE CABLE RUNS | 4718 | P.C. 101-22 | 5B | .2 | .12 | |
| | | 4719 | P.C. 101-23 | | .1 | | |
| | | 4720 | P.C. 102-25 | | .1 | | |
| | | 4723 | P.C. 102-34 | | .1 | | |
| | | 4726 | P.C. 103-39 | | .1 | | |
| | SHORTEST CABLE RUNS | 4773 | OGT 17-7 | 5C | .1 | .08 | |
| | | 4774 | OGT 17-8 | | .0 | | |
| | | 4777 | OGT 18-6 | | .1 | | |
| | | 4778 | OGT 32-2 | | .1 | | |
| | | 4779 | OGT 47-6 | | .1 | | |

Fig. 5—Typical Example of Table B After Completion