

## 3-A TERMINATING NETWORK OPERATION

### 1. GENERAL

1.01 This section describes methods of using the 3-A terminating network in terminating loaded cable circuits for crosstalk measurements. Certain maintenance adjustments on the 3-A network which may be necessary from time to time are also included.

1.02 The discussion below covers the use of the 3-A terminating network in connection with crosstalk tests on parts of complete circuits, such as repeater sections. For regulator sections or for repeaters, all circuit combinations may be tested in the manner described below for side-to-side or pair-to-pair combinations. A pair-to-pair combination would include a side of one quad and a side of a different quad.

### 2. USE OF BUILDING-OUT CONDENSERS

2.01 The use of building-out condensers for building-out short end sections in the manner indicated below is important when accurate measurements of circuits having net losses (equivalents) of less than 5 db are desired. In tests on circuits having net losses (equivalents) greater than 5 db, if 3-A networks are used for reasons other than building-out, it is also desirable to use the building-out condensers, as discussed below.

2.02 On H-174-63, H-172-63 or H-174-106 circuits, the building-out condensers should be used when the length from the last loading point to the terminating point in near-end measurements, or to the sending or measuring point in far-end measurements, is less than .3 of a loading section.

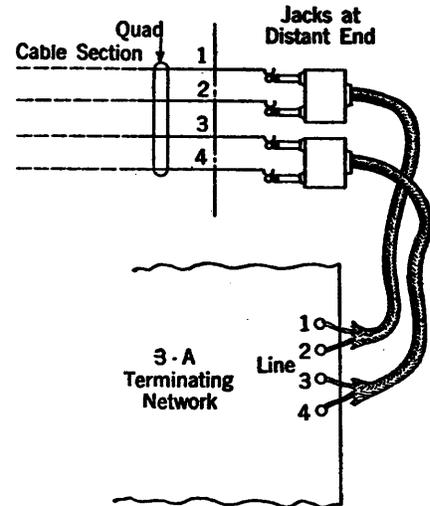
2.03 On H-44-25 circuits, the building-out condensers should be used when the conductor length from the last loading point to the terminating point in near-end measurements, or to the sending or measuring point in far-end measurements, is less than .75 of a loading section.

### 3. CONNECTING APPARATUS FOR TEST

**Near-End Crosstalk Measurements** (see Figures 1, 2, 3, 4 and 5)

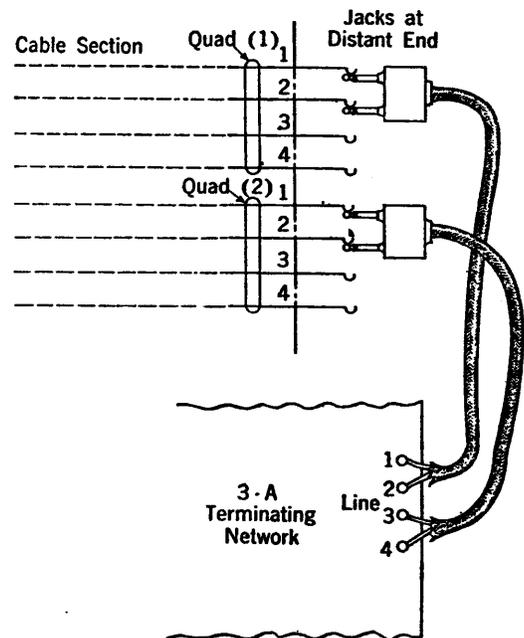
3.01 A 3-A terminating network will be required in all of the terminations for near-end crosstalk measurements in addition to the apparatus listed below.

**Phantom Group or Two Side Circuits of Different Phantom Groups with Same Type of Loading**



Arrangement for Terminating Circuits in Same Phantom Group

Fig. 1



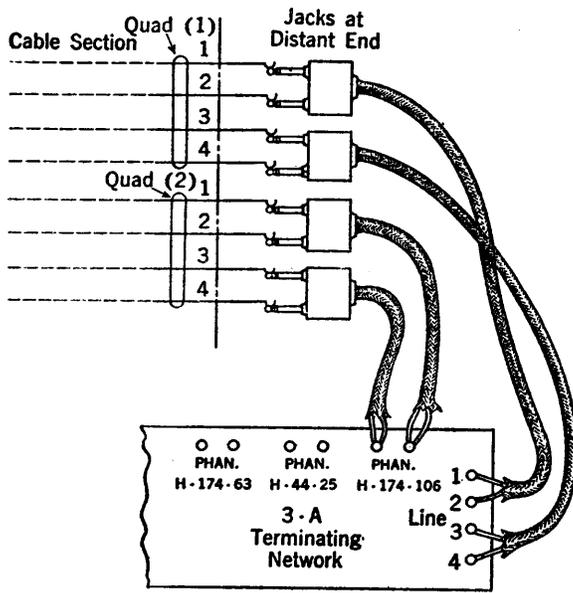
Arrangement for Terminating Two Side Circuits of Different Phantom Groups with Loading of Same Type

Fig. 2

### 3.02 Apparatus

Two 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

**Two Phantom Circuits**



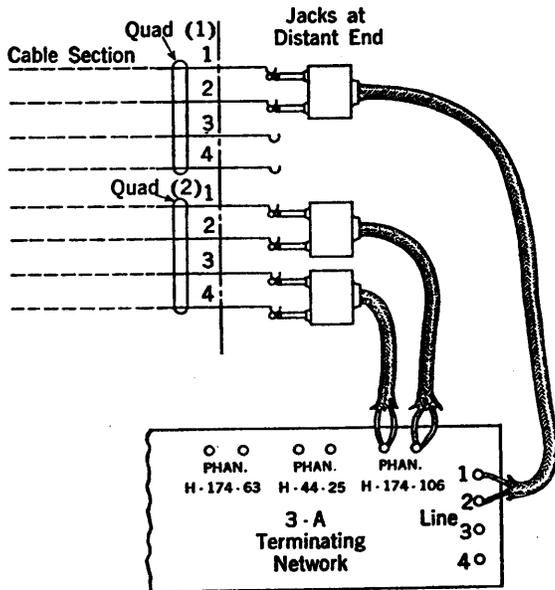
Arrangement for Terminating Two Phantom Circuits

Fig. 3

**3.03 Apparatus**

Four 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

**Side Circuit of One Group and Phantom Circuit of Second Group**



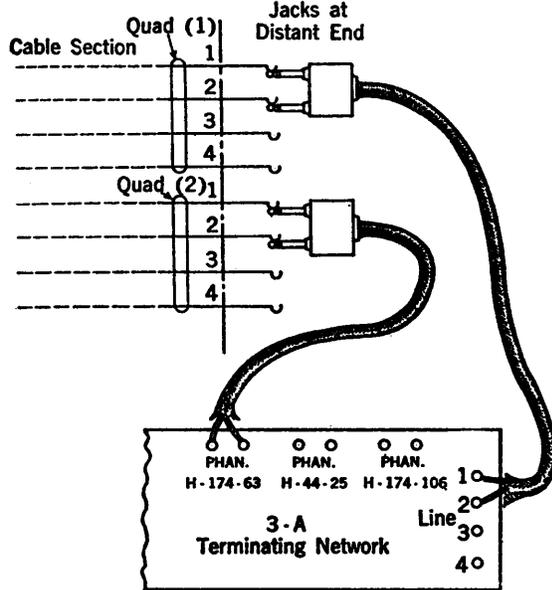
Arrangement for Terminating Side of One Phantom Group and Phantom of Second Group

Fig. 4

**3.04 Apparatus**

Three 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

**Two Side Circuits Having Different Types of Loading**



Arrangement for Terminating Two Side Circuits having Different Types of Loading

Fig. 5

**3.05 Apparatus**

Two 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

**Far-End Crosstalk Measurements (see Figures 6, 7, 8, 9, 10 and 11)**

3.06 For the sake of completeness the 50-B crosstalk set and oscillator are shown in all of the circuit arrangements for far-end crosstalk measurements in addition to the apparatus listed below. The same connections apply for the 50-A crosstalk set.

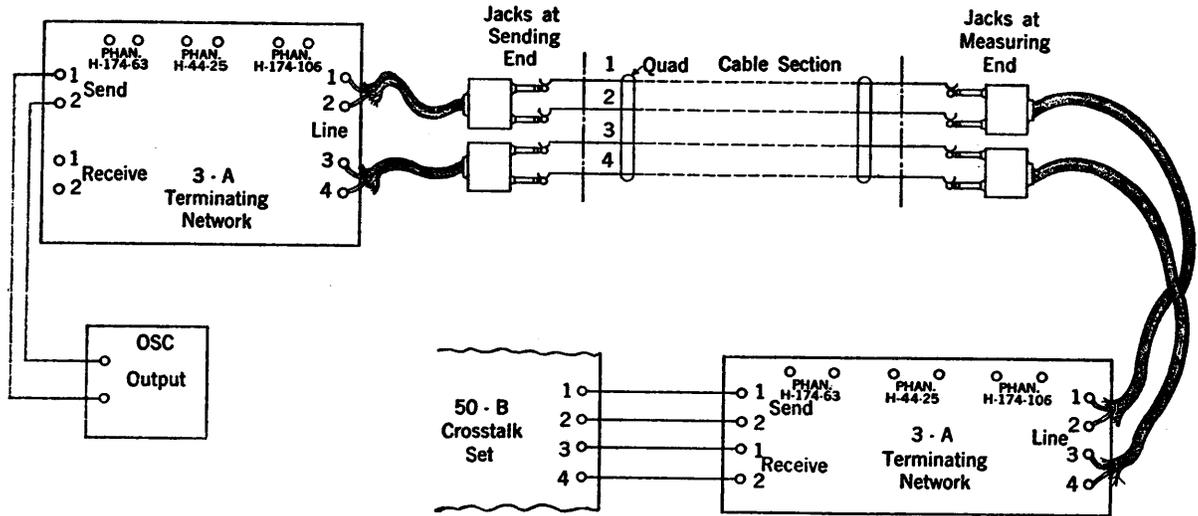
**Phantom Group or Two Side Circuits of Different Phantom Groups with the Same Type of Loading**

**3.07 Apparatus**

Four 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

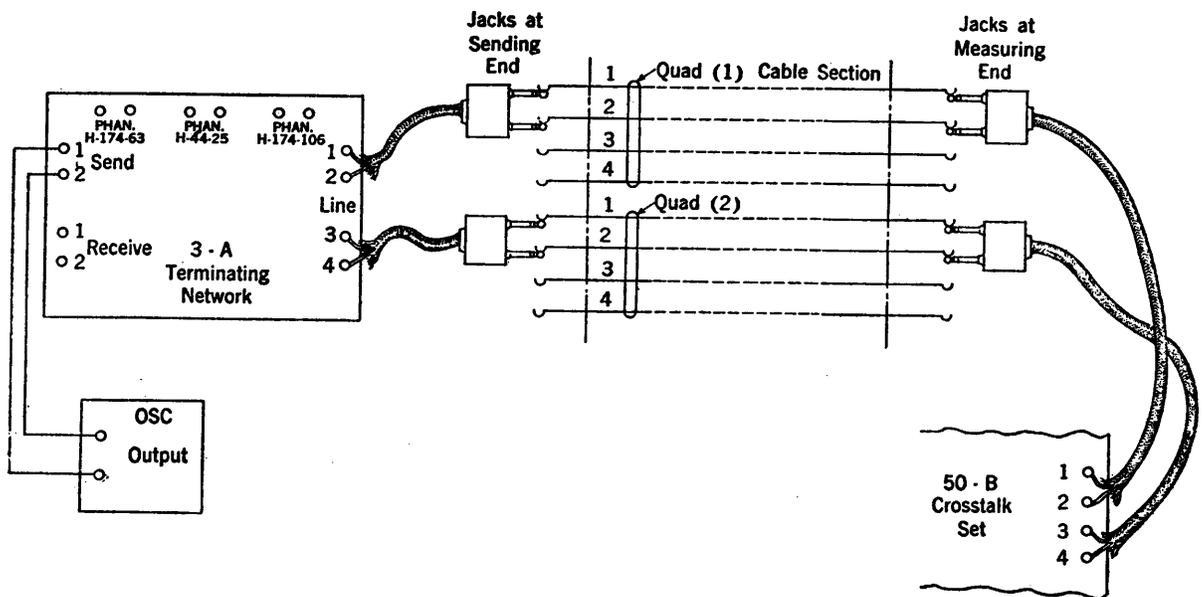
Two 3-A terminating networks.

Miscellaneous wire.



Arrangement for Terminating Circuits in Same Phantom Group

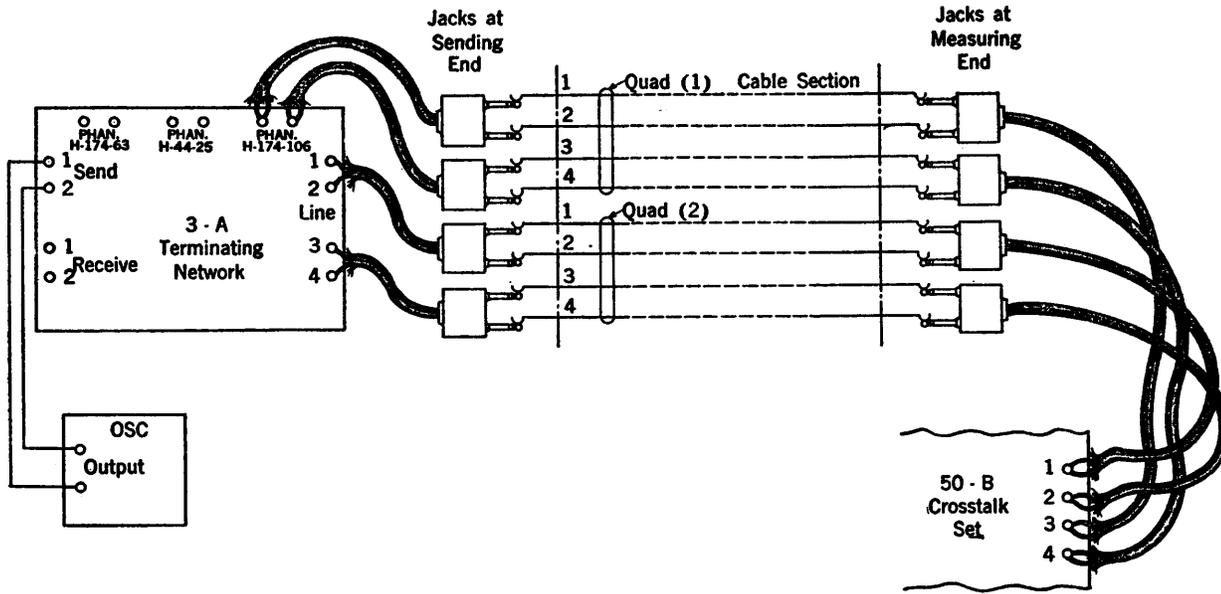
Fig. 6



Arrangement for Terminating Two Side Circuits of Different Phantom Groups with Loading of Same Type

Fig. 7

Two Phantom Circuits



Arrangement for Terminating Two Phantom Circuits

Fig. 8

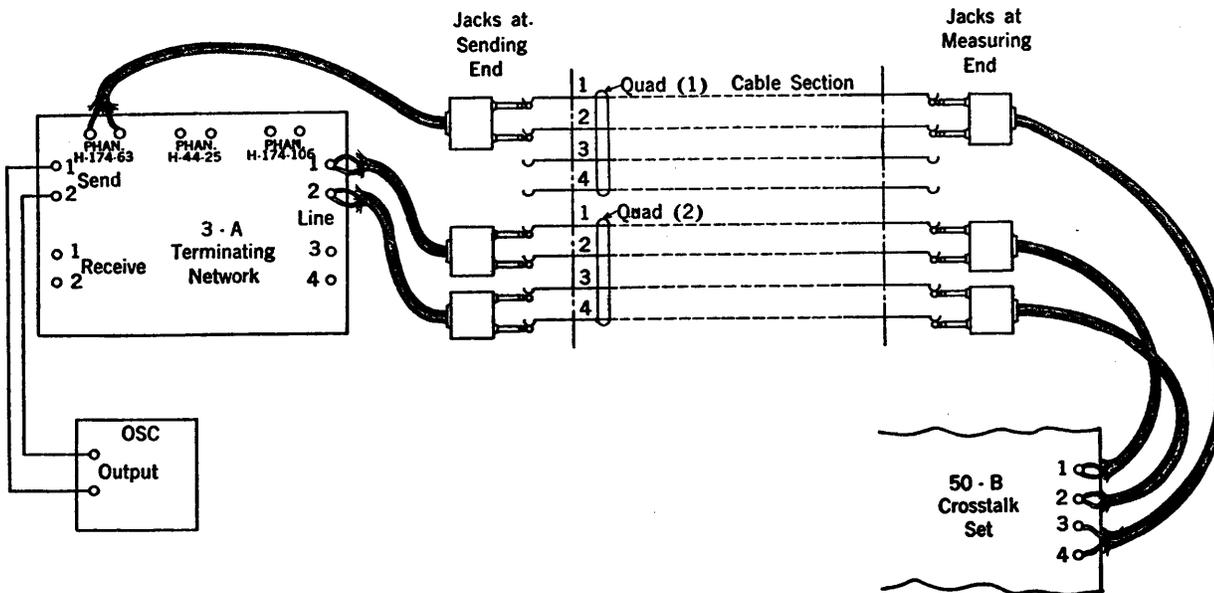
3.08 Apparatus

Eight 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

One 3-A terminating network.

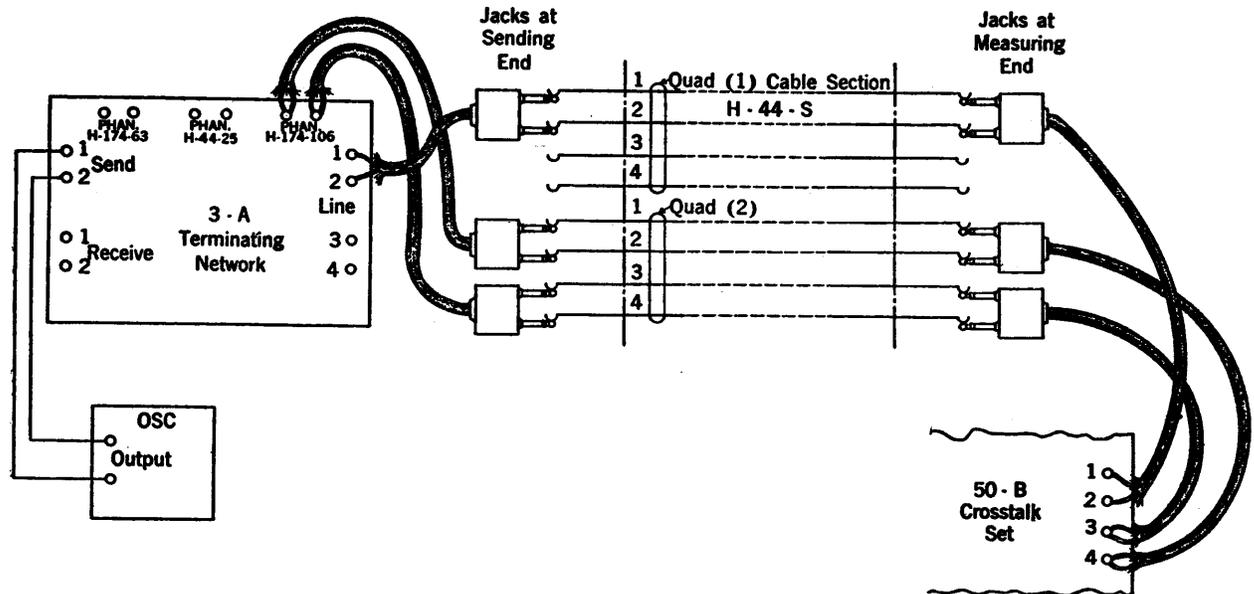
Miscellaneous wire.

3.09 As shown in Figure 8, at the sending end connect the four wires of one group to the "Line" terminals of the 3-A terminating network. Connect the other phantom circuit to the proper set of "Phan" terminals at the back of the net-



Arrangement for Terminating Phantom of One Group and Side of Second Group for Phantom to Pair Measurement

Fig. 9



Arrangement for Terminating Phantom of One Group and Side of Second Group for Pair to Phantom Measurement

Fig. 10

work. The oscillator should be connected to the "Send" terminals of the network. At the measuring end connect the disturbing phantom circuit and the other phantom circuit to "Line" terminals 1-2 and 3-4 respectively, of the crosstalk set.

#### Phantom Circuit of One Group and Side Circuit of Second Group

3.10 It will be noted in connection with these measurements that it is only possible to make a phantom-to-pair measurement using the 3-A terminating network where the side circuit is an H-44 type.

#### 3.11 Apparatus

Six 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

One 3-A terminating network.

Miscellaneous wire.

3.12 As indicated in Figure 9 for a phantom-to-pair measurement at the sending end connect the disturbing phantom circuit to "Line" terminals 1-2 of the 3-A terminating network. Connect the disturbed side circuit to the set of "Phan" terminals whose resistance corresponds to the characteristic impedance of the disturbed circuit. Next connect the oscillator to the "Send" terminals of the 3-A network. At the measuring end connect the disturbing phantom circuit to terminals 1 and 2 of the crosstalk set and the disturbed side

circuit to terminals 3 and 4 of the crosstalk set. For a pair-to-phantom measurement as shown in Figure 10 connect the disturbing side circuit to "Line" terminals 1-2 of the 3-A terminating network. Connect the disturbed phantom circuit to the proper set of "Phan" terminals. Next connect the oscillator to the "Send" terminals of the 3-A network. At the measuring end connect the disturbing side circuit and the disturbed phantom circuit to terminals 1-2 and 3-4 respectively, of the crosstalk set.

#### Sides of Two Quads with Different Types of Loading. (Pair-to-Pair Measurement)

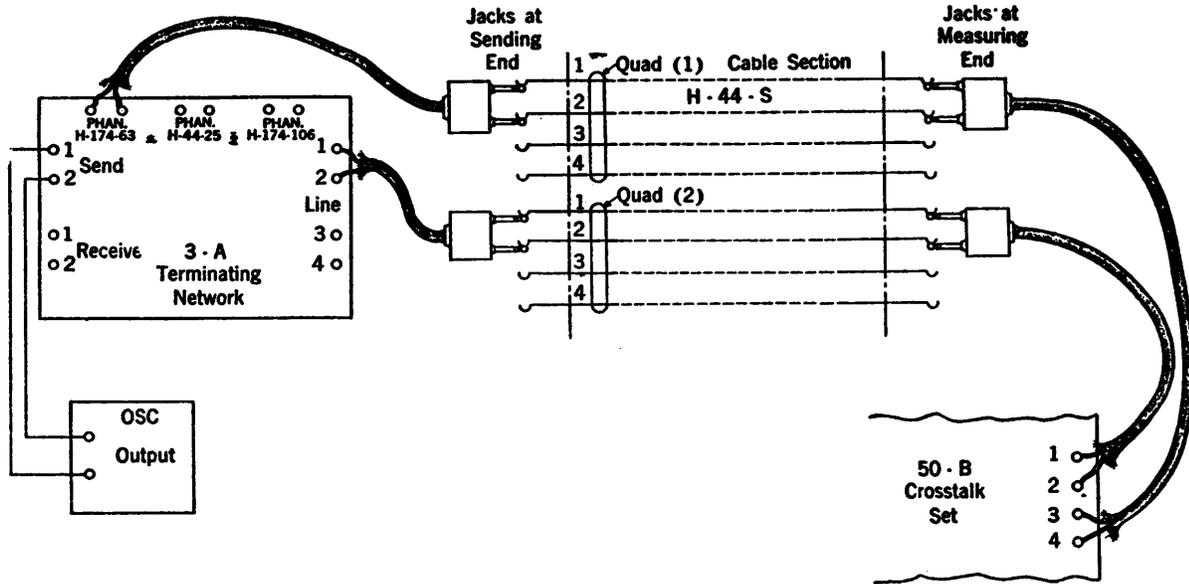
#### 3.13 Apparatus

Four 2-conductor cords P-2AA type, each equipped with a 241-A plug at one end and spade tips at the other.

One 3-A terminating network.

Miscellaneous wire.

3.14 At the sending end connect the disturbing circuit to "Line" terminals 1-2 of the network. Connect the disturbed circuit to the set of "Phan" terminals whose resistance corresponds to the characteristic impedance of the disturbed circuit. At the measuring end connect the disturbing and disturbed circuits to terminals 1-2 and 3-4, respectively, of the crosstalk set. It may be noted as shown in Figure 11 that one of the sides must be an H-44 type where a Pr-Pr measurement is made using the 3-A terminating network.



Arrangement for Terminating Sides of Two Quads with  
Different Types of Loading  
Fig. 11

#### 4. OPERATION

##### Near-End Crosstalk Measurements (Distant End)

4.01 Set the loading key to H-174-106, H-174-63 or H-44-25, depending on the impedance of the circuits connected to the "Line" terminals. Set "B.O. Cond." key to the "On" or "Off" position, in accordance with the instructions given in Part 2 of this section. Set "Side 1-2," "Side 3-4" and "Phantom" keys to "Term."

##### Far-End Crosstalk Measurements

###### Sending-End

4.02 Operate one of the keys marked "Side 1-2," "Side 3-4" or "Phantom" to "Send," depending upon which circuit is the disturbing circuit. Set the other two keys at "Term." Operate the "Loading" key to H-44-25, H-174-106 or H-174-63 to correspond with the type of loading on the disturbed circuit. Set "B.O. Cond." key to the "On" or "Off" position, in accordance with the instructions given in Part 2 of this section.

###### Measuring End

4.03 Inasmuch as the 3-A terminating network is only necessary in connection with the arrangements shown in Figure 6 above, the method of operation will refer only to this figure.

###### Side-to-Side Measurement

4.04 Operate one of the two keys marked "Side 1-2" or "Side 3-4" to "Send," depending on which side circuit is the disturbing circuit. Operate the other of the two keys to "Receive." Operate the "Phantom" key to "Term." It is immaterial in which position the "Loading" key is set. Set "B.O. Cond." key to the "On" or "Off"

position in accordance with instructions given in Part 2 of this section.

###### Phantom-to-Side Measurement

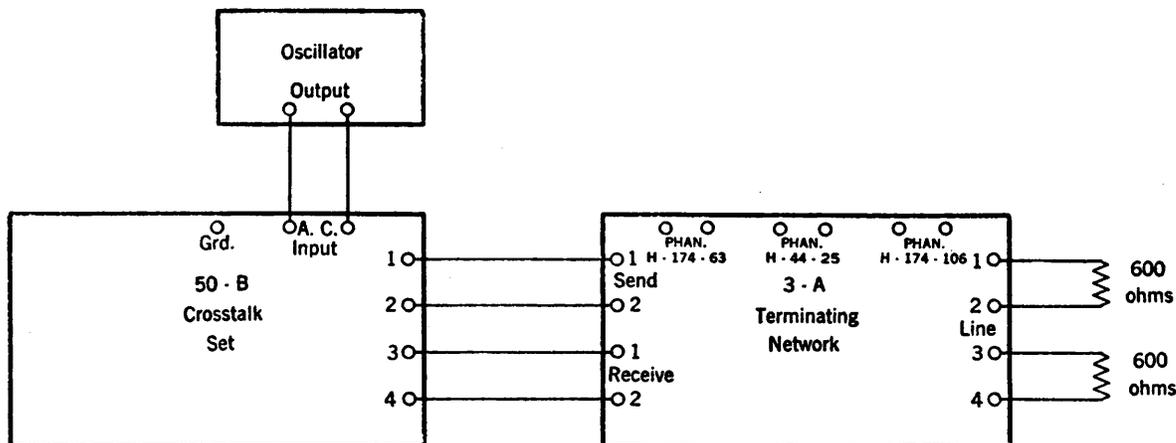
4.05 Operate the "Phantom" key to "Send." Operate one of the two keys marked "Side 1-2" or "Side 3-4" to "Receive," depending on which side circuit is the disturbed circuit. Operate the other key to "Term." It is immaterial, in which position the "Loading" key is set. Set "B.O. Cond." key to the "On" or "Off" position in accordance with the instructions given in Part 2 of this section.

###### Side-to-Phantom Measurement

4.06 Operate one of the two keys "Side 1-2" or "Side 3-4" to "Send," depending on which side circuit is the disturbing circuit. Operate the other of the two keys to "Term." Operate the "Phantom" key to "Receive." It is immaterial in which position the "Loading" key is set. Set "B.O. Cond." key to the "On" or "Off" position in accordance with the instructions given in Part 2 of this section.

#### 5. MAINTENANCE

5.01 The presence of opens or high resistances in the key contacts of the 3-A terminating network may result in incorrect measurements. This is especially true of the contacts associated with the "Send" and "Receive" positions of Keys 1 and 2. Certain maintenance tests are outlined below in order to make sure that the network is in proper working condition. These tests should be made at six months' intervals or more often if trouble is indicated.



Arrangement for Checking Key Contacts of "Send" and "Receive" Positions of Keys 1 and 2 of 3 - A Terminating Network

Fig. 12

**Crosstalk Measurements**

5.02 Connect the apparatus as shown in Figure 12. Make near-end phantom to side crosstalk measurements as indicated below for the various key settings. Values of measured crosstalk appreciably in excess of 50 units would indicate trouble in the contacts of Keys 1 and 2.

Measurement	Key Settings				Loading Key
	Key 1	Key 2	Key 3	Key 4	
P-S-1-2	Send	Receive	Term.	Off	H-174-106
P-S-1-2	Receive	Send	Term.	Off	H-174-106
P-S-3-4	Send	Receive	Term.	Off	H-174-106
P-S-3-4	Receive	Send	Term.	Off	H-174-106

5.03 In case all of the measurements are approximately the same and appreciably in excess of 50 units, trouble would be indicated in the crosstalk measuring set, in which case the network should be checked with another crosstalk set.

**Impedance Measurements**

5.04 Make 1000-Cycle impedance measurements of the various elements of the 3-A terminating network, as shown below. The connections and various key settings are shown together with approximate values of measured impedances.

Impedance Bridge Connected to	Key Settings		Approximate Measured Impedance— Ohms
	Key 4	Loading Key	
Phan. H-174- 63	—	—	800
Phan. H- 44- 25	—	—	500
Phan. H-174-106	—	—	1050
Line 1-2 or Line 3-4	Off	H-174-106	1640
	On	H-174-106	1570
	Off	H-174- 63	1640
	On	H-174- 63	1570
	Off	H- 44- 25	800
	On	H- 44- 25	790
Line 1-2 and 3-4, that is, 1-2 strapped and 3-4 strapped	Off	H-174-106	1090
	On	H-174-106	1005
	Off	H-174- 63	840
	On	H-174- 63	800
	Off	H- 44- 25	540
	On	H- 44- 25	525

5.05 The impedance values given above should only be used as a guide in locating trouble. Values may be measured which vary considerably from this, even 5 per cent. It should be noted, however, in this connection that the placing of the building-out condensers in the circuit reduces the impedance being measured. This indication may be used to check whether or not the key associated with the building-out condensers is working properly.

5.06 The "Send" and "Receive" contacts of Key 3 may be checked for continuity by a tone or low voltage d-c. measurement.

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