

5A AND 5B TERMINATING NETWORKS

DESCRIPTION

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1. GENERAL

1.01 This section covers the description and operating principles of the 5A and 5B Terminating Networks.

1.02 This section is reissued to include the description of the 5B Terminating Network as well as the 5A Terminating Network. The 5B network has only minor differences with respect to the 5A, the two sets being sufficiently alike that they are described in common and either of these sets may be used where the 5A set is specified in other sections of practices.

1.03 The 5-type Terminating Network is a portable assembly of apparatus designed for use in making voice frequency crosstalk coupling measurements and the discussion below deals particularly with its use in such measurements. The network provides resistance terminations for loaded and non-loaded cable circuits and for open wire circuits and also contains switching arrangements by means of which the sending or receiving ends of circuits may be arranged in such a manner as to facilitate measurements of near-end and far-end crosstalk coupling.

2. DESCRIPTION OF CIRCUIT

2.01 The circuits of the 5A and 5B Terminating Networks are shown on Figs. 1A and 1B, respectively. Rearranged wiring to terminals 1, 2 and 3 on SW2 and the addition of the "TONE OFF" key, K1, in the tone input leads in the 5B set constitute the only differences in these circuits.

2.02 The network is arranged to terminate a phantom group, the phantom circuit being obtained by means of specially balanced 102C repeating coils. These repeating coils have an impedance ratio of 1.62:1 and are a compromise for the various loading systems. Their use should be generally satisfactory for all types of crosstalk coupling measurements except as noted below.

2.03 By means of the switching arrangements provided through SW1 and SW2 the following conditions may be set up:

(1) Any one or all three circuits in the phantom group may be terminated in Resistances R1, R2 and R3.

(2) Any one of the three circuits may be used as a disturbing circuit at the sending end in far-end crosstalk coupling tests, that is, the "TO TONE" terminals may be connected to the disturbing circuit and at the same time the other two circuits terminated in resistances.

(3) The "TO TONE" terminals may be connected through the 40-db pad to the "TO NOISE SET" terminals for near-end crosstalk coupling measurements.

(4) Any one of the three circuits of the phantom group may be connected to the "TO NOISE SET" terminals through a 40-db pad or directly without the pad and the other two circuits terminated in resistances.

2.04 The three 600-ohm resistances R1, R2 and R3 are considered satisfactory for all practical purposes when used in making near-end crosstalk coupling measurements on open wire facilities and on B & H14-25, B & H88-50, H172-63, H174-106 and H245-155 cable facilities. In the case of far-end crosstalk coupling measurements made on the line side of the repeating coils where a 5A or 5B Terminating Network is used, considerable error may be introduced in tests made on H172-63, H174-106 or B88-50 facilities if the R1 resistance is used for terminating the disturbing circuit. Accordingly, a jack labeled "TERM" is provided to which an external 900-ohm resistance can be connected in place of the R1 resistance when tests are made on these types of facilities. If the tests are made on the drop side of the repeating coils normally assigned to these facilities the use of an external impedance will be unnecessary.

2.05 The 5A and 5B Terminating Networks are designed to have a maximum internal phantom-to-side crosstalk coupling of 16 crosstalk units (96 db). The side-to-side crosstalk is expected to be negligible.

2.06 The near-end calibrating position of the 5A or 5B Terminating Network does not include the set repeating coils. Consequently on near-end measurements made on the line side

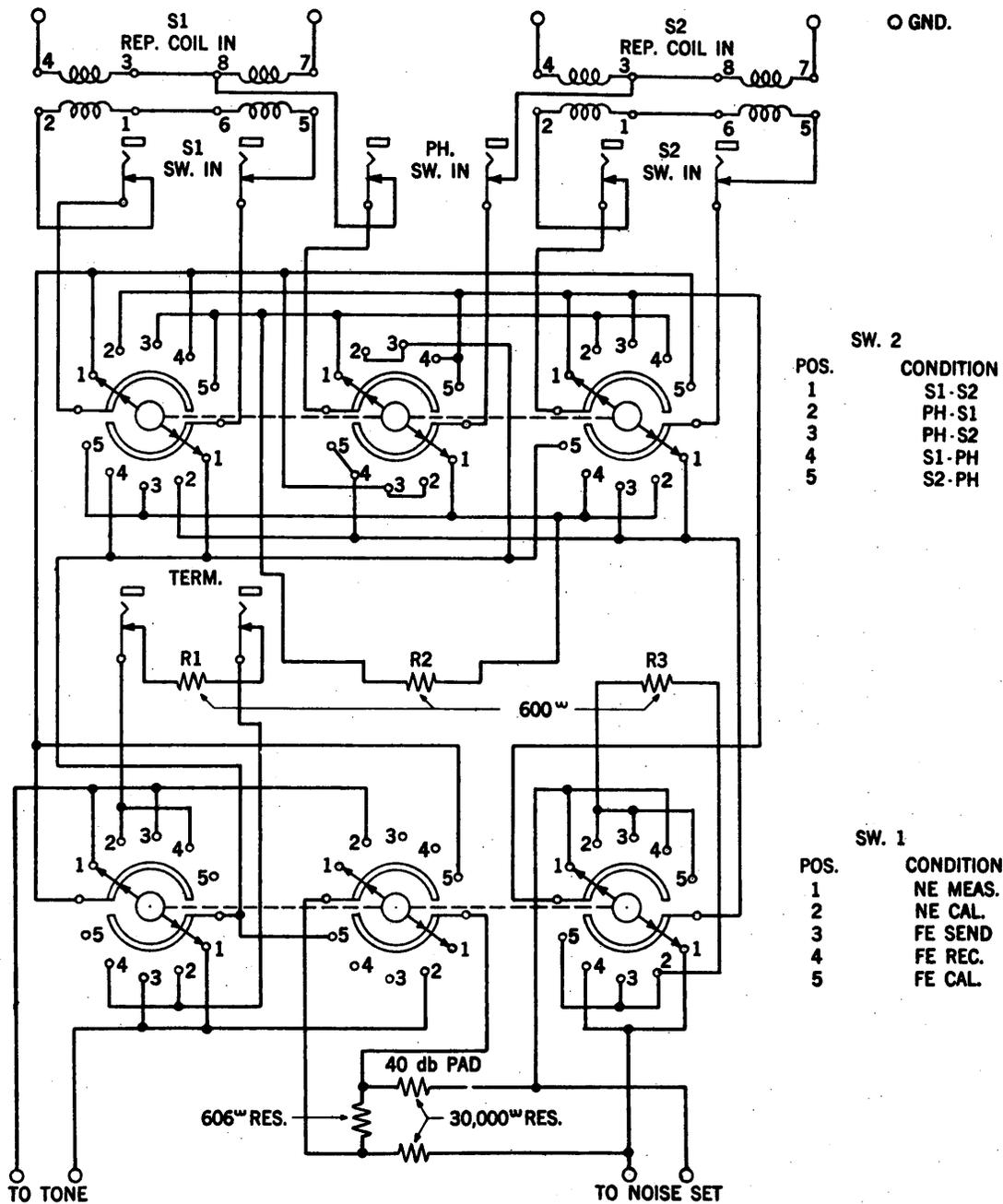


Fig. 1A

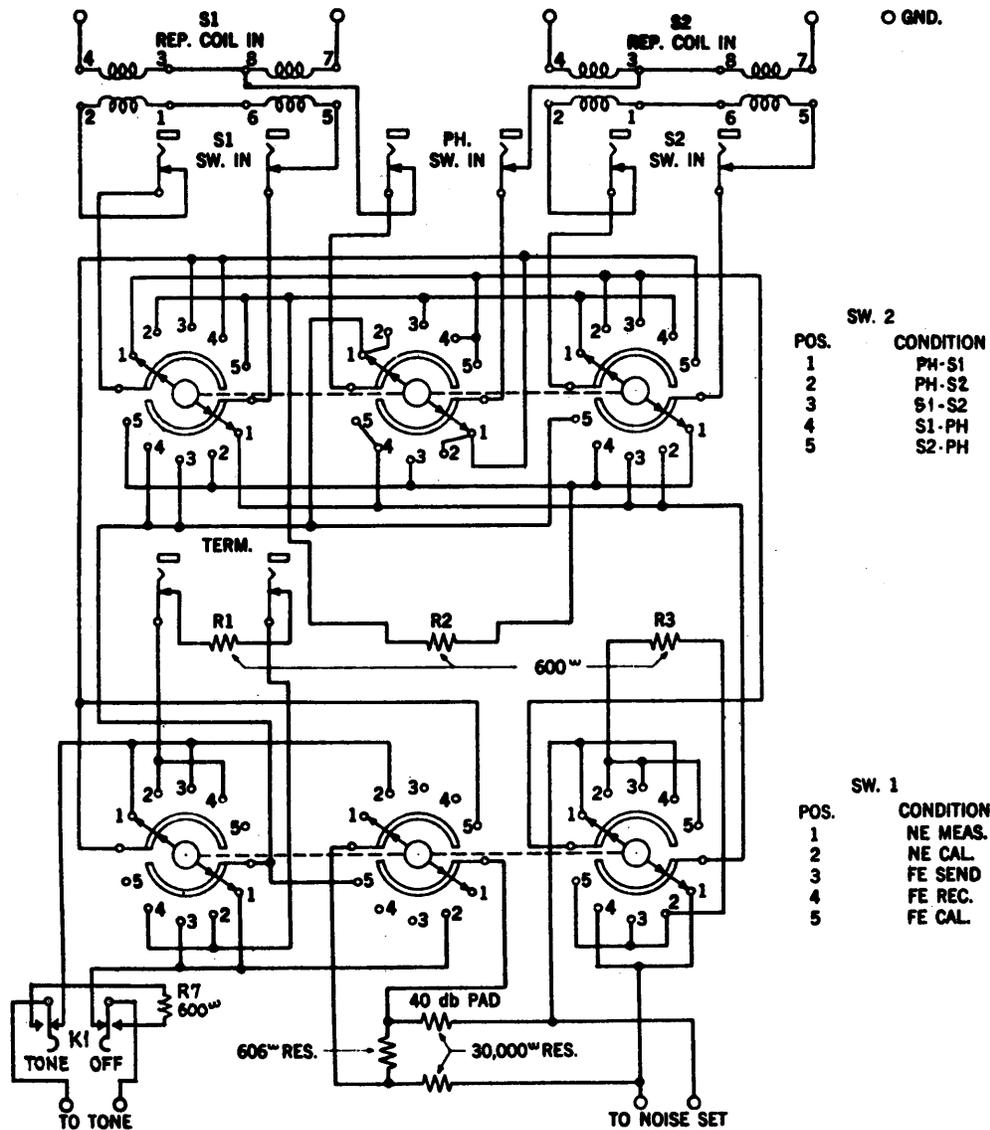


Fig. 1B

of the repeating coils (where the set coils are included in the measurement), a slight error results in addition to the error caused in some cases by the use of the compromise repeating coils discussed in Paragraph 2.02. In view of these two errors the actual crosstalk coupling will be more (numerically less in db) than the measured crosstalk coupling by the amounts in Table I for the various types of facilities. In general these errors are sufficiently small that they can be neglected.

2.07 The total error caused by the above two sources for far-end phantom-to-side or side-to-phantom measurements made on the line side of the repeating coils does not exceed about .5 db for B & H88-50, B & H44-25, H172-63 or H174-106 facilities. For side-to-side measurements it is negligible.

TABLE I

Type of Facility	Total Error - db (Subtract from measured value in db)	
	Phantom-to-Side or Side-to-Phantom	Side-to-Side
H44-25	.5	.9
B44-25	.4	.8
H88-50	.4	.8
B88-50	.9	1.3
H172-63	.8	1.4
H174-106	1.2	1.4
H245-155	1.6	2.0
Open Wire	.9	1.3

3. DESCRIPTION OF APPARATUS

3.01 A face view of the 5B Terminating Network is shown in Fig. 2. The apparatus

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is assembled in an aluminum-finished box of furniture steel construction having a removable cover. The switches, jacks and binding posts shown in Fig. 2 are mounted on a removable steel panel. The 5A network is not equipped with the "TONE OFF" key shown between and just above "SW1" and "SW2." The dimensions of the terminating network are 11" x 5-1/2" x 5-3/4" and its weight is about 15 pounds.

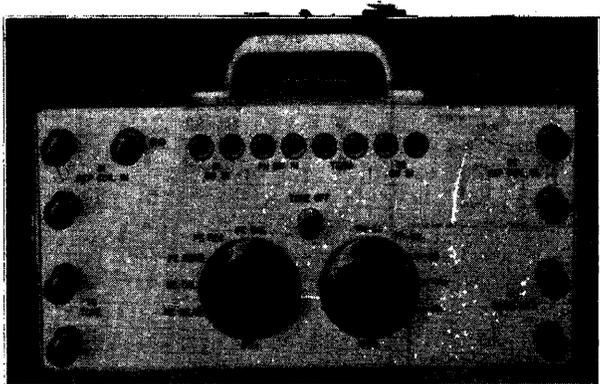


Fig. 2

3.02 The binding posts in the upper left-hand and upper right-hand corners of the sets designated as "S1 REP COIL IN" and "S2 REP COIL IN," respectively, are to be used when the circuit to be measured is not equipped with repeating coils.

3.03 The binding posts in the lower left-hand corner of the set designated "TO TONE" are used to connect the crosstalk testing tone to the network.

3.04 The "TONE OFF" key on the 5B network when pushed down disconnects the testing tone from the network and terminates the testing tone source in a 600-ohm resistance to prevent adverse effects where a common source of office testing power with multiple appearances is used. On the 5A network it is necessary to remove the tone source from the network or disturbing circuit by other means.

3.05 The binding posts in the lower right-hand corner of the set designated "TO NOISE SET" are for the purpose of connecting the 2A or 2B Noise Measuring Set to the network.

3.06 The binding post in the upper left-hand corner of the set designated "GND" serves as a suitable ground connection for the set. It should always be used in all types of measurements.

3.07 The jacks at the top of the set designated "S1 SW IN," "PH SW IN" and "S2 SW IN" are for the purpose of connecting Side 1, Phantom and Side 2 of the group under test to

the network when measurements are to be made on the drop side of the repeating coils.

3.08 The jacks designated "TERM" also at the top of the set are for the purpose (as discussed in Paragraph 2.03) of connecting a special 900-ohm termination to the set when the set is used at the receiving end for far-end crosstalk coupling measurements on H172-63, H174-106 or B88-50 facilities.

3.09 Switches "SW1" and "SW2" which are of the rotary type are used for setting up the desired test conditions. This type of switch with its wiring results in less crosstalk between the disturbing and disturbed circuits than switches of the key type. Furthermore, the number of operations required for setting up the various testing arrangements is reduced by the use of the rotary switches.

3.10 Switch "SW1" is used to set up the test conditions shown on Fig. 1. It provides means for measuring near-end or far-end crosstalk with the necessary calibration of the measuring equipment for either case.

3.11 The following are the testing conditions established by the various positions of switch "SW1."

- (1) "NE MEAS" The "TO TONE" terminals are connected to the disturbing circuit (Side 1, Phantom or Side 2), the particular circuit depending upon the position of "SW2." Side 1, Phantom or Side 2 are either terminated in resistances or connected to the "TO NOISE SET" terminals depending upon the position of "SW2." Fig. 3 shows schematically the circuit for a Side 1-Side 2 measurement.

The "NE MEAS" position of "SW1" is also used when the Terminating Network is employed at the sending end in far-end measurements made on H174-63, H174-106 or B88-50 facilities. For this case an external 900-ohm resistance would be connected to the "TO NOISE SET" terminals to terminate the disturbed circuit.

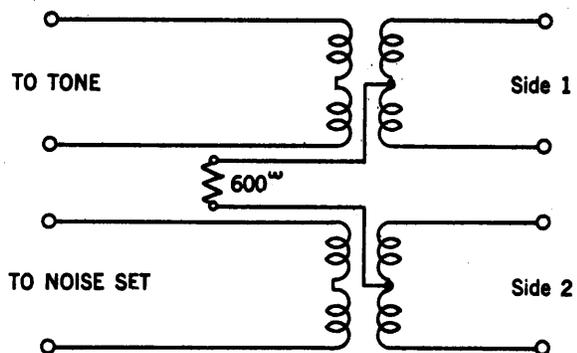


Fig. 3

(2) **"NE CAL"** (also near-end terminate) The **"TO TONE"** terminals are connected to the **"TO NOISE SET"** terminals through a 40-db pad. In this position of **"SW1,"** the sides and phantom of the group under test are terminated in resistances for any position of **"SW2,"** and with this arrangement the set may be used at the distant end as a termination for near-end measurements. This circuit arrangement of the set is shown schematically in Fig. 4.

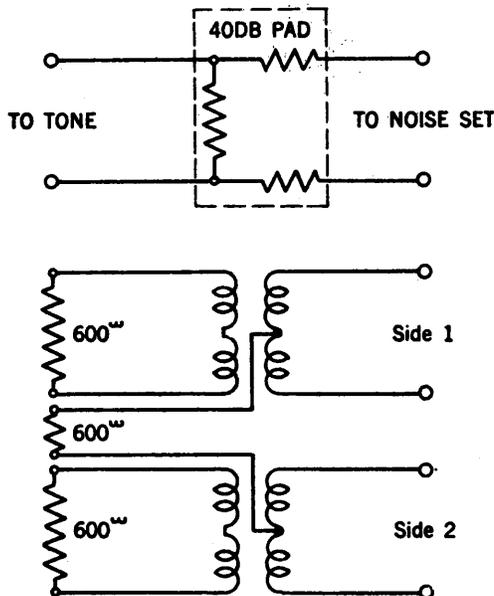


Fig. 4

(3) **"FE SEND"** The **"TO TONE"** terminals are connected to one of the three circuits (the disturbing circuit) of the group under test, the particular circuit depending upon the position of **"SW2."** The other two circuits of the group are terminated in resistances. Fig. 5 shows schematically the circuit for a phantom-to-side measurement.

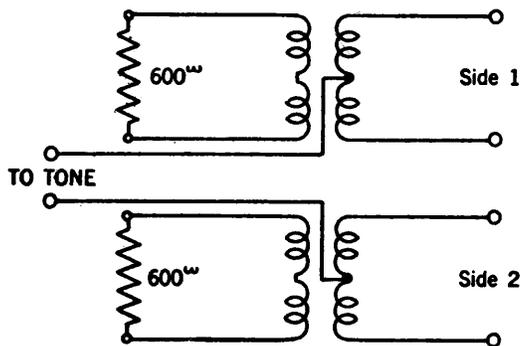


Fig. 5

(4) **"FE REC"** One of the circuits of the group under test is terminated in a resistance. Each of the other two circuits is terminated in a resistance or connected to the **"TO NOISE SET"** terminals depending upon the position of **"SW2."** (If one of these two latter circuits is terminated in a resistance, the other is connected to the **"TO NOISE SET"** terminals and vice versa.) Fig. 6 shows schematically the circuit for a side-to-phantom measurement.

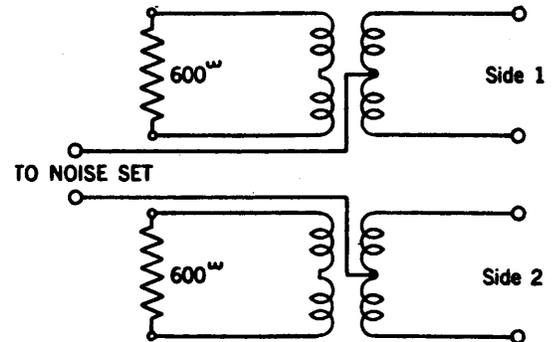


Fig. 6

(5) **"FE CAL"** (This setting is applicable only where the network is used at the receiving end in far-end measurements.) One of the circuits of the group, the disturbing circuit (the particular circuit depends upon the position of **"SW2"**) is connected to the **"TO NOISE SET"** terminals through the 40-db pad. The remaining two circuits of the group are terminated in resistances. Fig. 7 shows schematically the circuit for a phantom-to-side measurement.

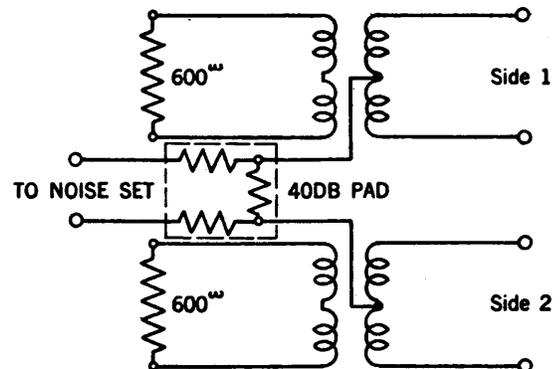


Fig. 7

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3.12 As already indicated, "SW2" is used to select the disturbing and disturbed circuits. The various positions of this switch are shown in Figs. 1A and 1B, respectively, for the 5A and 5B Terminating Networks. The testing combinations provided on "SW2" are:

<u>Disturbing Cct.</u>	<u>Disturbed Cct.</u>
Phantom	-to- Side 1
Phantom	-to- Side 2
Side 1	-to- Side 2
Side 1	-to- Phantom
Side 2	-to- Phantom

No Side 2-to-Side 1 combination is provided. To obtain this condition for near-end measurements and for far-end measurements of H172-63, H174-106 or B88-50 facilities, it is necessary to interchange Sides 1 and 2 on the set terminals and measure in the Side 1-to-Side 2 position of "SW2." For far-end Side 2-to-Side 1 measurements on B & H44-25 and H88-50 facilities the following sequence of settings for "SW1" and "SW2" at the receiving and sending ends will eliminate the necessity for interchanging the sides as above.

	<u>Rec. End</u>			<u>Send. End</u>	
	<u>SW1</u>	<u>SW2</u>		<u>SW1</u>	<u>SW2</u>
Calibrate	FE CAL	S2-PH	}	FE SEND	S2-PH
Measure	FE REC	PH-S1			

3.13 The resistances used in the 40-db pad are not designed to carry testing powers in excess of 16 db above 1 milliwatt continuously. Therefore, precaution should be taken to limit the time during which power in excess of this value is impressed on the set when "SW1" is operated to "NE CAL" or "FE CAL."

4. SPECIAL USES

4.Q1 These terminating networks may be used in noise tests for terminating purposes or in other tests as a means for bringing out the phantom taps. For instance, by operating switch "SW1" to "NE MEAS" and switch "SW2" to "PH-S1" a longitudinal circuit connection can be provided to Side 1 or Side 2 from one of the "TO TONE" terminals.

4.02 The 5A and 5B Terminating Networks are also satisfactory for measurements up to about 8000 cycles and as such may be used for crosstalk coupling tests between 8000-cycle program circuits or for single frequency measurements up to 8000 cycles. The side-to-side crosstalk coupling in the networks at 8000 cycles is negligible.