MULTIPOINT TONE ALARM SERVICES
SPECIAL VOICEBAND CHANNEL FOR BRIDGED ALARM SYSTEMS
DESCRIPTION, INSTALLATION TESTS, AND MAINTENANCE

Contents Page

1. GENERAL

1.01 This section covers special voiceband channels furnished under California P.U.C. Tariff 111-T. It also provides the circuit order and maintenance test methods and furnishes the requirements.Engineering considerations for these channels are covered in Section 880-420-100PT, Appendix 4.

1.02 It is reissued to:

- Revise the section title.
- Include a more economical bridging arrangement.

Note: Since this is a general revision, marginal arrows used to indicate changes are omitted.

1.03 Terms (with definitions) used in this section are as follows:

(a) *TLP (Transmission Level Point)* — A level reference point on a circuit, numerically equal to the algebraic sum of 1000-Hz gains and losses from an arbitrary reference point (O TLP) to the point of measurement.

(b) *End Link* — Facility between transmission interface at the customer's master station and the first central office (CO) bridge.

(c) *Middle Link* — Facility between CO bridging locations. Connection between two bridges in the same CO is not considered to be a middle link. As used herein, middle link applies to the trunk channel when bridging is done at more than one office.

(d) *Trunk Channel* — The portion of the multipoint channel between a customer's master station and all bridge locations. May be 2-point or multipoint if more than one bridge location is used. It is always 4-wire.

(e) *Station Channel* — The portion of the multipoint channel from a bridge location to an outlying station. It is always 2-wire.

(f) *CPE (Customer-Provided Equipment)* — Includes any equipment provided by the customer and connecting to a telephone company (TELCo) line.

(g) *PCO (Plant Control Office)* — The designated office responsible for all service order or maintenance activities on a circuit or circuit link. The PCO should receive all trouble reports and maintain office records for each circuit or circuit link. To assist the PCO in carrying out its functions, other offices may be assigned responsibility for specified portions of a circuit.

(h) *PSC (Plant Service Center)* — When designated as the PCO, the PSC is responsible for

handling, controlling, and clearing all trouble reports as specified in the definition for PCO. The PSC also dispatches field forces when named PCO or when called by the PCO. This holds true for service order work and trouble reports.

1.04 *References* —

SECTION	TITLE
002-582-903PT	Signal Circuits — Burglar and Fire Alarms — Installation and Maintenance Procedures
024-174-100	KS-20449,L1 Amplifier (part of PJ70065A)
310-405-905PT	Kentrox — Distributing Frame Mounted Conference Bridges — Description and Installation
310-405-906PT	Dorsett — Distributing Frame Mounted Conference Bridge — Description and Installation
314-410-500	Voice Bandwidth Private Line Data Circuits — Tests and Requirements
332-115-10X	849-Type Networks — Description
332-206-100	E6-Type Repeaters
660-295-912PT	Exchange Special Services — STC Controlled — Plant Control Office Selection and Responsibilities
680-895-957PT	Plant Control Office Selection and Responsibilities
807-017-900PT	Multipoint 2-Wire Data Bridge for Private Line Service — Central Office — Data Systems
880-420-100PT Appendix 4	General Design Information — Multipoint Bridged Alarm Services — Engineering Design Considerations
PSD/PCD/PT-70065-01 and PJ70065-1	Data Systems — Central Office — Multipoint 2-Wire Data Bridge for Private Line Service

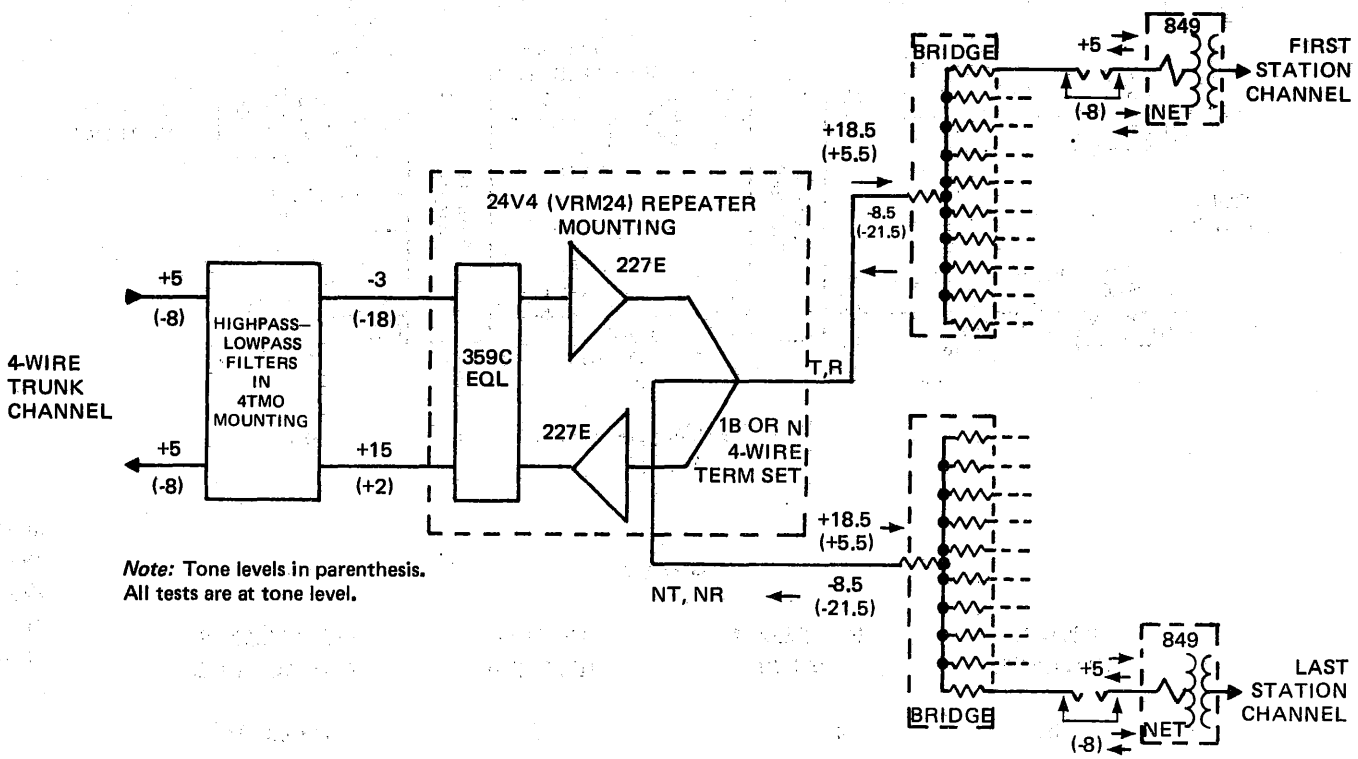
2. DESCRIPTION

2.01 Several makers of equipment for central-station fire and burglar alarm systems have developed tone-type equipment to serve up to 128 protected locations from a single master station. The alarm company equipment interrogates each outlying station with frequencies in either the lower or the upper half of the voice frequency band, that is, above or below about 1200 Hz.

2.02 As each remote station recognizes its specific digital code, it responds in the opposite half of the voiceband with coded tones carrying either an acknowledgement or an alarm signal. Frequencies and bandwidths used depend on the specific alarm manufacturer. The outlying stations do not communicate with each other.

2.03 To satisfy customer needs, a new private line channel is available. It is a special application of a 3002-type voiceband channel for bridged alarm use. The channels are assigned the special circuit number code "PA". The system uses a 4-wire "trunk channel" from the master station to the bridge or bridges, and a 2-wire "station channel" from the bridge(s) to each outlying station. Up to 128 remote stations may be on one circuit. Each circuit section is designed for 8-dB loss, giving an objective of 16 dB overall.

2.04 Actual bridging is done in any combination of three ways, as determined by TELCo needs. For a limited number of stations, typically fewer than 10 or 20 per CO, the bridging may be done with a combination of a 24V4-type repeater and a pair of normal 600-ohm 2-wire bridges, as shown in Fig. 1. This is designated as a "Type A" bridging assembly for reference. A filter assembly to separate send and receive frequency bands is included. The filter may contain a high-pass section transmitting from the master station and a low-pass section receiving, or vice versa.



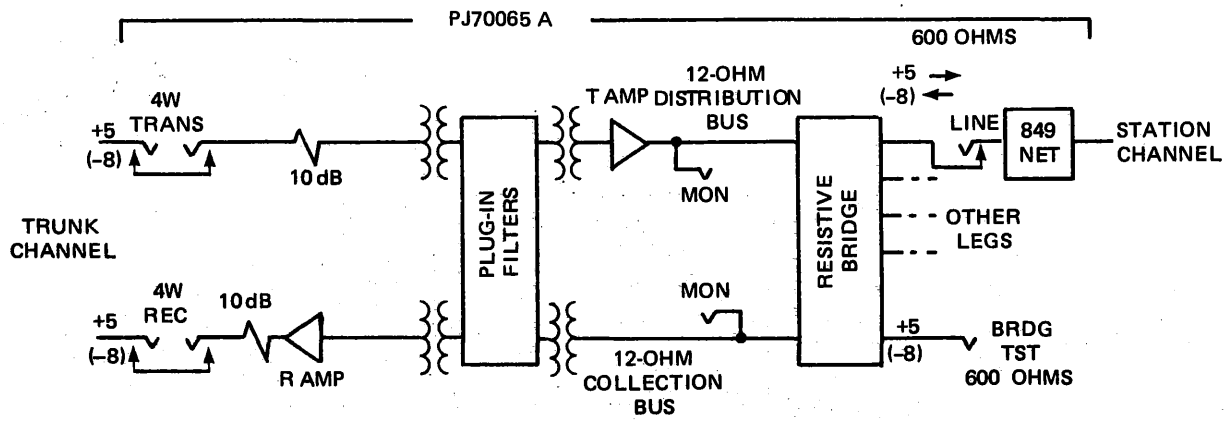
Note: If it is necessary to use interfloor or interbuilding tie cables between the repeater and the bridges, use either general-purpose tie pairs or pairs dedicated to +7 TLP use. Do not use pairs dedicated to a –16 TLP.

Type A Bridging Assembly
Fig. 1

2.05 For larger numbers of stations, up to 128, the "Type B" assembly is used. This assembly is a special bridge per PJ70065A having a 4-wire input and 35, 71, 95, or 131 2-wire outlets. The bridge includes in one unit the necessary equipment:

- Amplifiers for both directions.
- Filters.
- Transformers to match the 10-kilohm impedance of the filters.
- Low-impedance distribution and collection buses.
- Resistive bridges — 4-wire to 2-wire.
- Test jacks.
- 849-type network mountings.

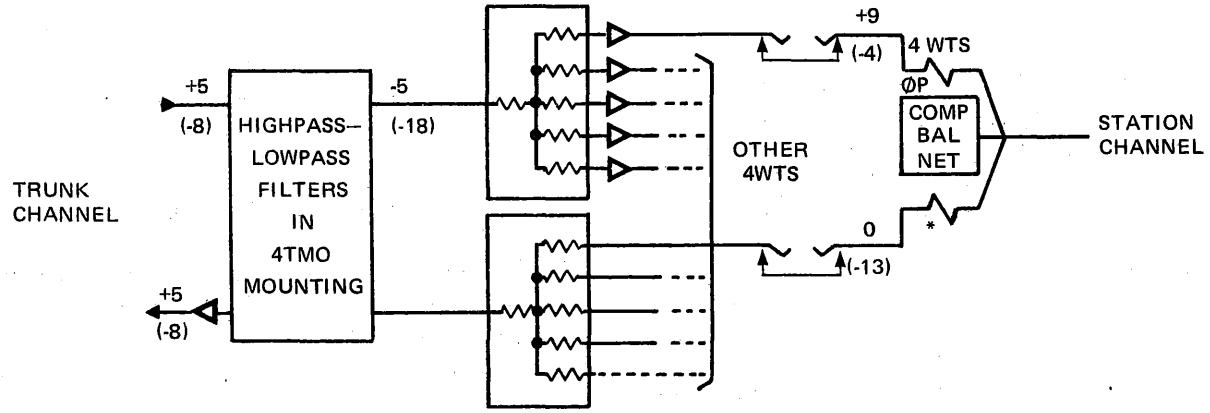
Figure 2 gives details on the bridge. Table A shows the four available sizes. For full circuit details, see PSD- and PCD-70065-01. Because of the use of low-impedance buses, it is unnecessary to terminate unused ports or to equip them with 849-type networks.



Type B Bridging Assembly
Fig. 2

TABLE A

2-WIRE OUTLETS	PJ70065A-1 LIST(S)	HEIGHT (INCHES)	PAC COMMON LANGUAGE CODE
35	4	12	BR2M3501*
71	4 & 5	19	BR2M7101*
95	4, 5, & 6	22	BR2M9501*
131	1	30	BR2M31C3*

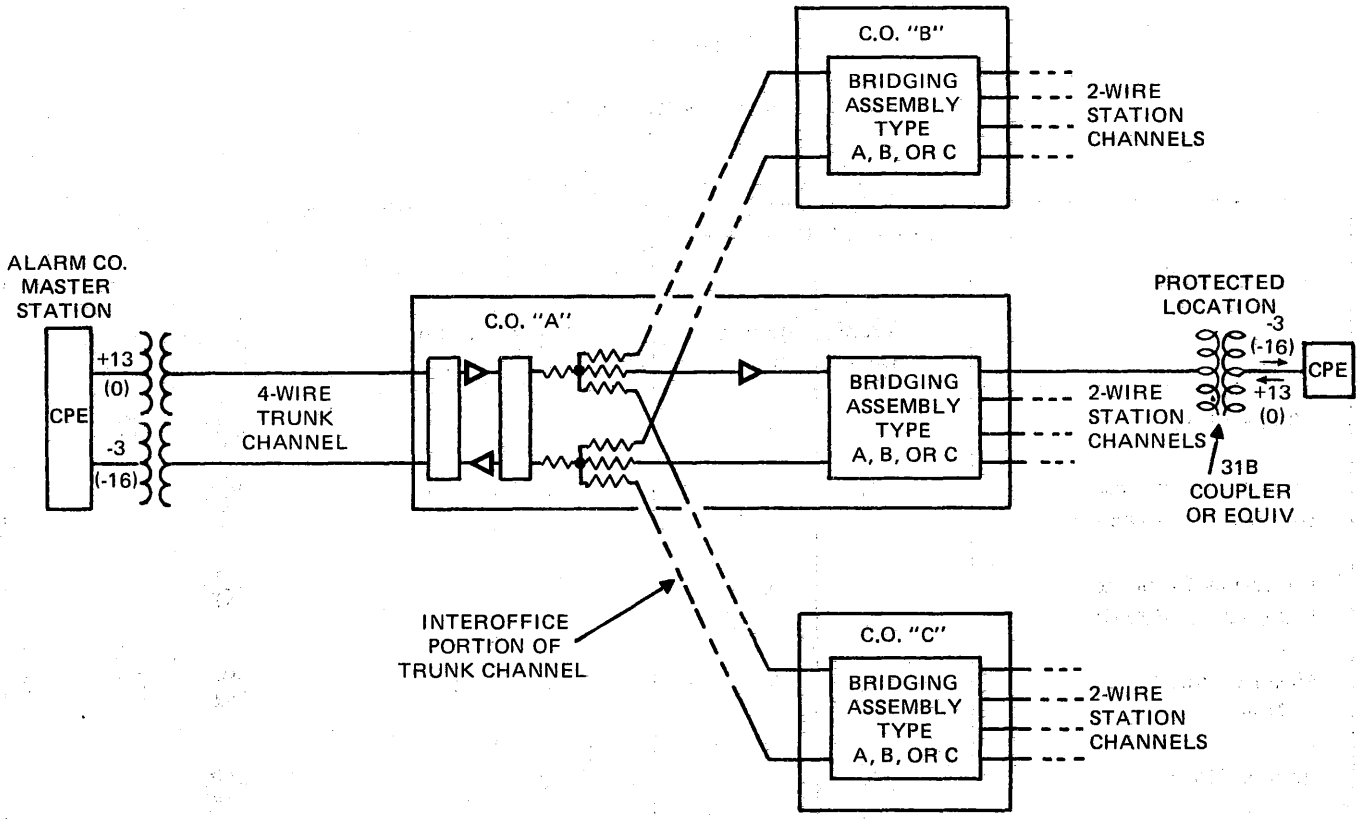


*Depends on loss of the station channel.

Type C Bridging Assembly
Fig. 3

2.06 The bridging may also be done by a "Type C" assembly, as shown in Fig. 3. This method is more expensive and less reliable than the newer Type A and Type B assemblies, and is not recommended for new installations.

2.07 The station channel is a simple 2-wire layout using a 31B coupler or equivalent transformer at the station. It may have a hard-wired extension to another on-premises location.



Typical Complete Circuit
Fig. 4

2.08 A complete circuit with 4-wire trunk channel and bridging is shown in Fig. 4. This channel includes all three types of bridging assemblies, A, B, and C, for purposes of illustration.

3. GENERAL TESTING CONSIDERATIONS

3.01 Circuits are considered to be of 600 ohm impedance at the customer demarcation and all testing is done on that basis.

3.02 As outlined in other practices, the control office has overall responsibility to supervise connection, testing, completion of service order work, and repairs after installation. Because of the highly sensitive nature of these alarm services, all testing work on a newtwork or its legs *MUST* be done only after a proper release by the customer.

3.03 To maintain required channel continuity during power failures, amplifiers are not used at any customer premises. To prevent disruption of the entire network by unauthorized persons, the channel does not generally use a loopback feature. If a loopback system is used, it is controlled only by a key at the same premises.

3.04 The inherent surveillance capability of a customer system permits ready identification of missing or faulty station(s). The customer will identify the station(s) and address(es) when reporting trouble.

3.05 All tone measurements are made with tones at data level (13 dB below TLP at any point in the circuit).

3.06 Required tests are shown in Table B.

TABLE B

REQUIRED TESTS

TEST	Initial Service		Additions		Trouble	
	Trunk Chan	Station Chan	Trunk Chan	Station Chan	Trunk Chan	Station Chan
1000-Hz Loss	X	X	X	X	(1)	(2)
Frequency Response (frequencies in Table F)	X		X		(1)	
Frequency Response (400, 1000, 2800 Hz)		X		X	(2)	
Message Circuit Noise	X	X	X	X	(3)	(3)
Impulse Noise	X		X		(3)	
DC Loop Resistance	X	X	(5)	X		X

(1) If trouble relates to incorrect levels on the trunk.

(2) If frequency response troubles are suspected.

(3) If noise trouble is suspected.

(4) If using cable.

TABLE C
PERMISSIBLE VARIATIONS – 1000-Hz LOSS

	TRUNK CHANNEL		STATION CHANNEL
	END LINK	MIDLINK	
CIRCUIT ORDER	+0.5 dB	+0.5 dB	-0.5, +4.0 dB
TROUBLE LOCATION	±2.0 dB	±1.0 dB	±3.0 dB

4. TEST EQUIPMEMT

4.01 Accurate measurements require good test equipment. Check all equipment prior to use to ensure that it is working and is calibrated properly.

4.02 Suggested equipment for the various tests is listed in Table D. For some tests, there is more than one choice of instrument. In these instances, the preferred test set is listed first followed by other choices. Equivalent test sets may also be used.

TABLE D

TEST EQUIPMENT REQUIRED

MEASUREMENT	EQUIPMENT REQUIRED
1000-Hz Loss	(1) Northeast Electronics TTS-4 ANH Transmission Measuring Set (TMS) (2) WE 21A Transmission Measuring Set
Message Circuit Noise and Impulse Noise	(1) WE 6F Voiceband Noise Measuring Set with C-message* Network (2) WE 3C Noise Measuring Set with C-Message* Network, and WE 6H Impulse Counter, with C-Message* Network
DC Loop Resistance	KS-14510 Volt-Ohm-Milliammeter (VOM)
Dummy Filter	For Type A Bridge Assembly: 4182A Network with Two 10-dB Resistors. For Type B Bridge Assembly: TTE K111 "Allpass" Filter (Supplied with Bridge).

*C-notched network if measuring through N- or T-carrier.

5. TESTS/ADJUSTMENTS — TRUNK CHANNEL

STEP	PROCEDURE
	A. LEVEL ADJUSTMENT AND FREQUENCY RESPONSE
	Level Adjustment
1	Connect test sets using patch 1, Fig. 5.

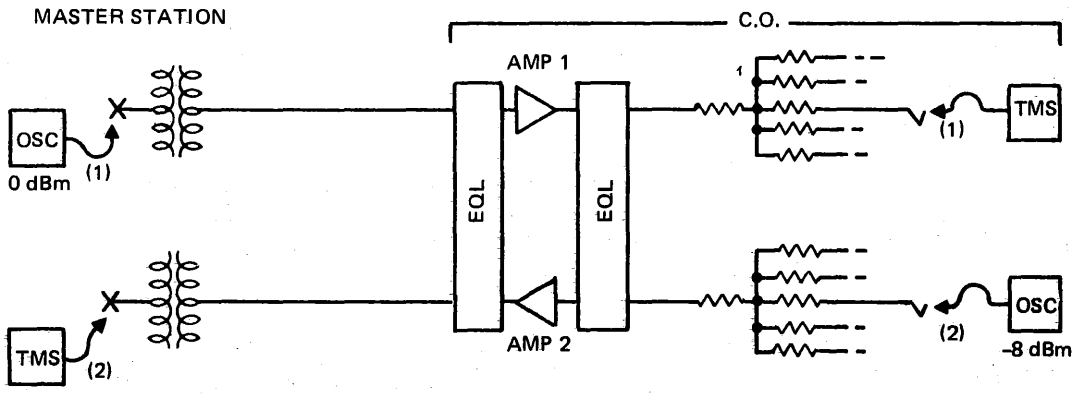


Fig. 5

2	Set oscillator to send 1000 Hz tone at 0 dBm and adjust AMP 1 to indicate -8 dBm on the TMS. *Requirement:* -8 dBm, ±0.5 dB
	Frequency Response
3	With same test set arrangement, send frequencies shown in Table E and measure the received level. a. Set equalizer(s) in the repeater to give a satisfactory frequency response. b. Reset amplifier gain at 1000 Hz if necessary. *Requirement:* Frequency response as shown in Table F.

TABLE E
TEST FREQUENCIES

TRUNK CHANNEL, INCLUDING MIDLINKS		
300	1200	2400
500	1400	
600	1600	2600
800	1800	2800
1000	2000	3000

STEP	PROCEDURE

TABLE F
FREQUENCY RESPONSE REQUIREMENTS
TRUNK CHANNEL, INCLUDING MIDLINKS

FREQUENCY RANGE (Hz)	0 MIDLINK	1 MIDLINK		2 MIDLINKS	
	END LINK	END LINK	MIDLINK	END LINK	MIDLINK
500-2800	-1.5 to +4	-.6 to +1.5	-1.5 to +1.5	-.5 to +1.5	-.5 to +1.5
300-3000	-1.5 to +6	- 1 to +3	- 1 to +3	- 1 to +3	- 1 to +2.5

4 Move TMS and oscillator to patch 2, Fig. 5. Set oscillator for -8 dBm at 1000 Hz.

5 Adjust AMP 2 for a TMS reading of -16 dBm

6 Make frequency response measurements as shown in Step 3.

7 If there are links to other offices, set their gains to give -8 dBm to and from the distant office(s). Measure frequency response as shown in Step 3.

B. NOISE MEASUREMENTS

1 Connect two noise measuring sets with C-message networks as shown in Fig. 6. If 3-type sets are used, switch them to the "600" position.

2 Make listening tests in both directions for crosstalk and interfering tones.

3 Read noise level at the CO, and subtract 5 dB to convert to dBrnc0. Read the noise level at the station and add 3 dB to convert to dBrnc0.

Requirement: Noise levels equal to the end link figures in Table G or lower.

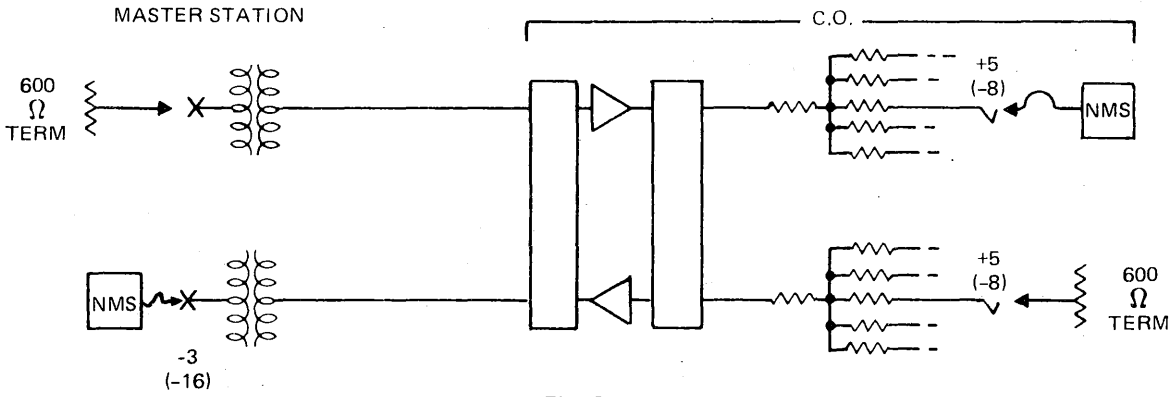


Fig. 6

TABLE G
MESSAGE NOISE LIMITS

CIRCUIT LENGTH MILES	NOISE LIMIT dBrnc0
0 - 50	31
51 - 100	34

STEP	PROCEDURE
4	Set up noise measuring sets to count impulse noise, or replace them with impulse counters. Set counting threshold at the CO to 72 dBrnc, and at the station to 64 dBrnc. Count impulse noise for 15 minutes. *Note:* If a section of N- or T-carrier is between the customer location and bridge office, apply a holding tone at each end at a level of -8 dBm. Use C-notched weighting networks in the noise measuring sets. If the noise sets have 497J networks, use 1004 Hz; if they use 497G, use 2800 Hz. *Requirement:* No more than 15 counts in 15 minutes.
5	If there are links to other offices, terminate each link in 600 ohms and measure the level of message noise in each direction. Subtract 5 dB from the reading to convert to dBrnc0. *Requirement:* Noise levels equal to the figures in Table G or less.
6	If there are links to other offices, terminate each link in 600 ohms and use an impulse counter to check the level of impulse noise. Set the counting threshold to 76 dBrnc, and let each counter run 15 minutes. *Note:* If a section of N- or T-carrier is present on the link being measured, use a holding tone as above.
7	If the trunk channel is routed through a T-carrier channel using D1A, D1B, or D1D channel banks, close the "Y" and "Z" option screws for the channel in question on each carrier group alarm (CGA) panel. If using a D1A bank, close the "Y" option screw on the channel unit at each end.

6. ADJUSTMENTS — TYPE A BRIDGING ASSEMBLY

STEP	PROCEDURE
1	Connect test sets using Patch 1, Fig. 7.

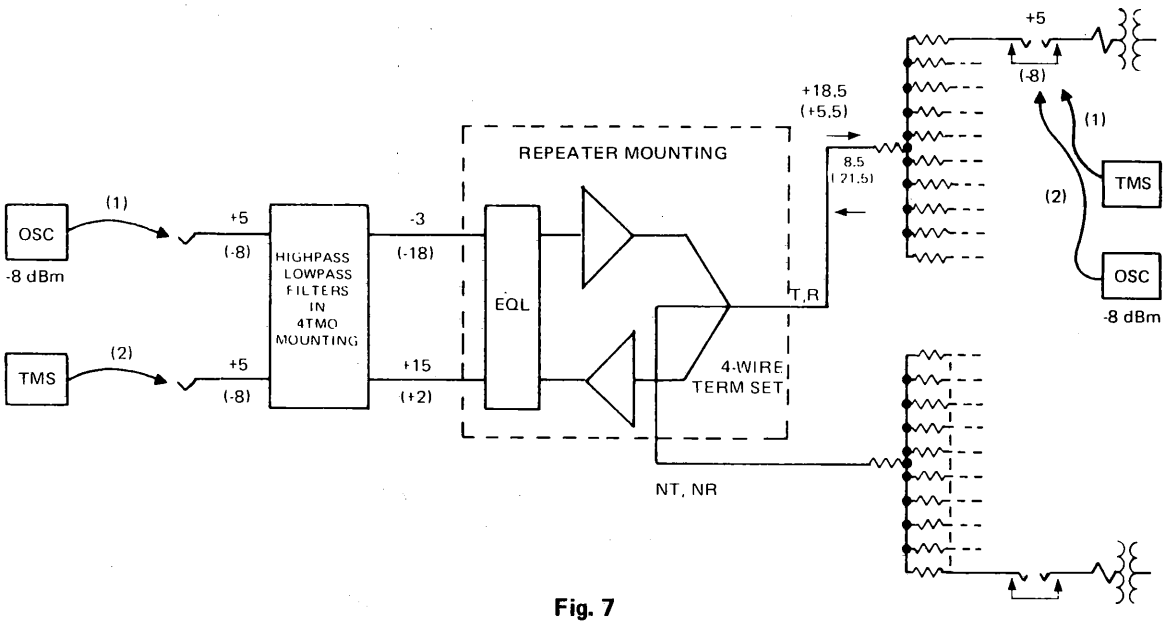


Fig. 7

STEP	PROCEDURE
2	Temporarily replace the filter adapter in the "4TMO" mounting with a 4182A network equipped with 10-dB pads. This gives the same basic loss as the filters but no filter action.
3	Set the options on the 4-wire terminating set as shown in Table H.

TABLE H

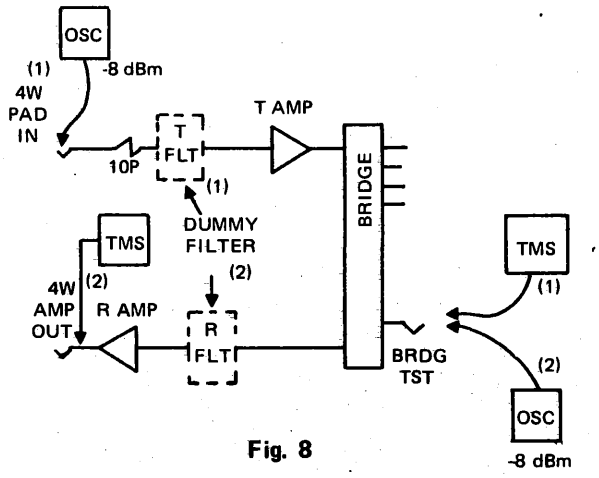
TERMINATING SET OPTIONS

AMPL	Down (if present)
NO AMPL	Up (if present)
COMP NET	Up
NBOC	All up
S1	Down
SX NORM	Down
SX REV	Up
SHORT SX INDR	Up (where present)
T&R PADS	89A ("zero") resistor

4	Be sure all the unused bridge legs are terminated in 849-type networks with 89B ("INF") or 89B ("35") resistors. Any 849-type network will work; the 849C is preferred.
5	Adjust AMP 2 (R AMP on the 24V4C) for a TMS reading of -8 dBm. *Requirement:* -8 ±0.5 dBm
6	Move the test sets to Patch 2, Fig. 7.
7	Adjust AMP 1 (T AMP on the 24V4C) for a TMS reading of -8 dBm. *Requirement:* -8 ±0.5 dBm
8	Remove the test cords.
9	Unplug the 4182A network and replace it with the CSE 5513 filter adapter. Be sure the filters are inserted in the adapter as specified on the CLR. (If the master station is sending high frequencies and receiving low frequencies, the highpass filter must be in the direction toward the 2-wire station. The Security General and Esterline alarm systems send high and receive low; the Larse and Morse systems send low and receive high.

7. ADJUSTMENTS — TYPE B BRIDGING ASSEMBLY

STEP	PROCEDURE
1	Unplug the filters from the bridge. Replace the "T" filter with the dummy filter (T.T.E. Model K1111) supplied with the bridge.
2	Connect test equipment using Patch 1, Fig. 8.

STEP	PROCEDURE
	 **Fig. 8**
3	Set the oscillator for -8 dBm at 1000 Hz.
4	Adjust the T AMP for a TMS reading of -8 dBm. *Requirement:* -8 ±0.5 dBm. *Note:* There is no need to terminate the unused bridge legs, now or at any other time, or to install 849-type networks in the unused sockets.
5	Move the test equipment to Patch 2, Fig. 8. Leave the oscillator at -8 dBm, 1000 Hz. Move the dummy filter to the "R" socket.
6	Set the R AMP for a TMS reading of -8 dBm.
7	Remove the test cords. Remove the dummy filter and store it for future use.
8	Reinsert the highpass and lowpass filters. Be sure the filters are inserted in the bridge as specified on the CLR. (For more details on filters, see Step 9 in Part 6.)

8. TESTS/ADJUSTMENTS — STATION CHANNEL

Note: These tests may be made at any time when adding stations to the bridge. If the alarm network is in operation, use extreme care not to interrupt working branches when adding a leg.

STEP	PROCEDURE
1	Connect test equipment using patch 1, Fig. 9.
2	Set oscillator to send 1000 Hz tone at -8 dBm.
3	Select an 89-type resistor for the 849-type network associated with the loop to deliver a level of -16 dBm at the station interface location. *Requirement:* -16 dBm, ±0.5 dB

STEP	PROCEDURE
	Notes: *1.* Some long loops will fail to deliver a -16 dBm level. In this case, use an 89A (zero) resistor. The level may be as low as -20 dBm without affecting the customer's operation. If the level is lower than -16 dBm, record the actual level on the CLR for future reference. *2.* Occasionally, a station channel will have an on-premises extension bridged onto the same demarcation point. In this case, set the level with the extension open-circuited. The customer will either option the extension station for bridging impedance or operate with the extra losses.

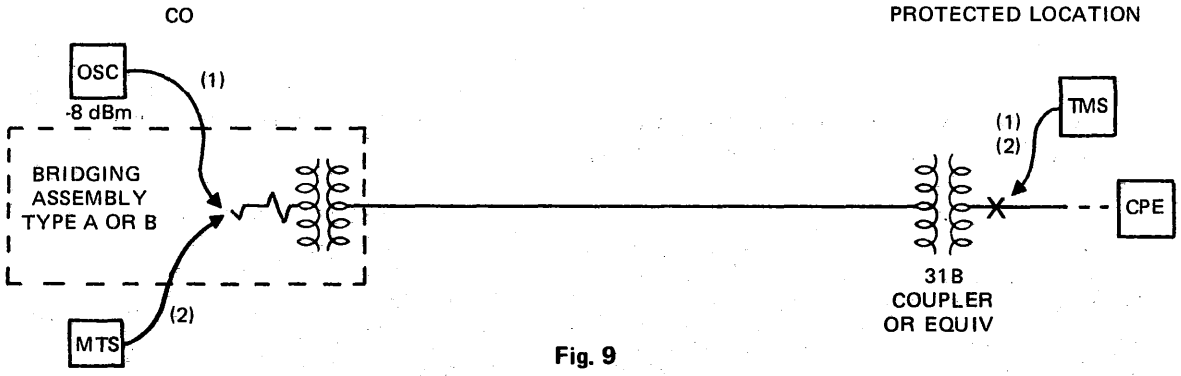


Fig. 9

4	Connect test equipment using patch 2, Fig. 9.
5	If using a 3-type noise measuring set, switch it to the "600" position.
6	Make a listening test for crosstalk or interfering tones.
7	Measure noise level. *Requirement:* less than 26 dBrnc.
8	Disconnect the test equipment.
9	Measure the loop resistance to the station. This can be done by the local test desk, or by temporarily changing the 849-type network to an 849C with 89A ("zero") resistor and measuring with a KS-14510 VOM at the test jack.
10	Record resistance on the CLR for future reference. *Note:* The repeat coil at the station places a permanent loop of about 40 ohms across the line; thus, no test short is necessary.

9. TROUBLE LOCATION — LOCAL LOOP FAULTS

9.01 Customer reports unusually low level from one station:

1. Check loop resistance using procedure in Part 8.

2. Compare the reading against the previously recorded figure. The percentage change is:

$$\frac{\text{PREVIOUS READING} - \text{NEW READING}}{\text{PREVIOUS READING}} \times 100$$

For example, if the present reading is 490 ohms and the previous reading is 470 ohms, the percentage change is:

$$\frac{470 - 490}{470} \times 100 \text{ or } 4.3\%$$

Requirement: No more than 20 percent change for largely aerial cable or 5 percent for largely underground.

3. If the requirement is exceeded, a cable pair change may have occurred or the cable pair may be partially open. Moderate cable pair **changes** can be compensated for by resetting the loop pad with the procedures covered in Part 8. Pad changes must **not** be used to compensate for cable **faults.**

9.02 If the trouble report is a complaint of noise, or high errors toward the master station, from all legs, the bridge circuit packs can be unplugged from the PJ70065A bridge one at a time to find which group of 12 legs is causing the trouble. The test jacks on the bridge can be used to isolate the exact loop(s).

9.03 Due to the customer's highly reliable signaling format, and to the use of bandsplitting filters, the alarm network may operate successfully in the presence of ground leakages (wet cable) on one or more station legs. A complaint may come in only after several legs are in trouble. In cases like this, a noise measuring set should be applied to each leg in turn. Coordinate with the customer before testing.

10. CONVERSION FROM TYPE A BRIDGE ASSEMBLY TO TYPE B

10.01 As a customer's circuit grows, it may be desirable to install a Type B (PJ70065A) bridge in one or more central offices. The station channels can then be swung over to the new bridge.

10.02 To make the conversion:

1. Notify the alarm company that individual legs will be out of service briefly, one at a time, during the conversion.

2. Line up the new bridge per Part 7.

3. Wire the 4-wire side of the bridge to spare legs of the trunk channel bridges.

4. Take each station channel at a time and rejumper it to the new bridge. The 849-type network and resistor now in service on the leg may be moved directly to the new bridge for convenience.

5. Disconnect the old bridging assembly and terminate the trunk-channel bridge legs that it used.

11. CONVERSION FROM TYPE C BRIDGE ASSEMBLY TO TYPE B

11.01 Conversion from a Type C assembly may also be required as a circuit grows. The station channels can then be swung over to the new bridge.

11.02 To make the conversion:

1. Notify the customer that individual legs will be out of service briefly, one at a time, during the conversion.

2. Line up the new bridge per Part 7.

3. Wire the 4-wire side of the bridge to spare legs of the trunk channel bridges.

4. Take each station channel at a time and rejumper it to the new bridge. Equip the new bridge with an 849-type network for the channel being transferred: 849A if loaded, 849E if nonloaded or unknown.

5. Inspect the 89-type resistor in the "R" socket of the 4-wire terminating set for the leg being transferred. Use the size of that resistor to choose a resistor for the new 849-type network as shown in Table I.

6. Convert the other legs in turn.

7. Disconnect the old bridging assembly and terminate the trunk-channel bridge legs that it used.

TABLE I

"R" RESISTOR IN OLD 4WTS	RESISTOR IN NEW 849 NET
0	0
1	0
2	.5
3	1.5
4	2.5
5	3.5
6	4.5
7	5.5
8	6.5
9	7.5