

1515 S. Manchester Avenue, Anaheim, California

TECHNICAL LETTER NO. 222

APPLICATION OF TELECOMMUNICATION PRODUCTS
TO COMMERCIAL SOUND USE

By

P. B. Spranger and J. M. Noone

Altec's Telecommunication Products have a definite use in the Commercial Sound market. Many applications are possible where these products may be used to advantage from the system design standpoint, as well as a savings in cost to the contractor. The lack of application of these products in this area can be attributed to insufficient knowledge of these products. The intent of this technical letter is to familiarize the contractor with the Telecommunications line and a few of the beneficial applications.

In order to understand the specifications called out for the Telecommunication Products, it is necessary to understand terminology peculiar to Telecommunication Products.

The following list describes this terminology:

Table 1. Telephone Terminology

Term	Definition
Repeater: (2 Wire)	Usually allows amplification of both the transmit and receive direction signals in a two-wire circuit.
Terminal Repeater: (Term Set)	Either a voice or pulse repeater designed for use at the end of a trunk or circuit, as contrasted with a repeater designed for use at an intermediate point (repeater 2 wire). Usually a 2 wire to 4 wire (hybrid) with or without amplifiers in the 4 wire side.
Hybrid:	Four winding repeating coil. Wound and connected so that incoming and outgoing currents in a two wire path are separated and kept from interfering with each other. This function is usually performed with two coils (transformers - connected).
Simplex:	Signalling circuit derived from a two wire circuit without interference to the two wire circuit. A <u>phantom</u> may also be simplexed.
Phantom:	Circuit superimposed on two, 2 wire circuits. All three circuits suitable for transmitting currents in the same frequency range without mutual interference.
Insertion Loss: (Gain)	Insertion loss (gain) of a piece of equipment or a line section is the added loss (gain) introduced when that equipment or section is interposed between two elements of a circuit.
Return Loss:	Loss between two paths on a transmission line or loss in a repeater or a terminal unit. A measurement of return loss will indicate the degree of balance between the impedance of the line and network of a hybrid. A measure of the gain that can be introduced into a system before singing occurs.
Longitudinal Balance: (Common Mode)	A measurement of the output that results from a balanced circuit (center-tapped transformer, differential amplifier, etc.) when the input is a voltage that causes current flow in the same direction in the two wires of a pair using the earth as its return path.
Singing:	Undesired state of oscillation in a circuit equipped with telephone repeaters due to unbalance of the hybrid coil terminations.
Singing Point:	The point at which the total gain of a circuit is sufficient to cause it to sing.
Transhybrid Loss:	A measurement of the amount of signal present on one four wire port when the other four wire port is driven. This indicates the degree of balance of the hybrid.
Loop:	Portion of a connection from the central office to a subscriber in a toll connection.
Unloaded Line:	A line whose transmission characteristics are determined by the line. Does not contain additional elements to correct any undesirable characteristic.
Loaded Line:	A system of adding inductance to a transmission line. The line capacity is tuned out and the impedance and transmission characteristics are maintained relatively flat.

Available components having direct application in the Commercial Sound area are as follows:

1. Amplifiers
2. Attenuators
3. Splitting and Mixing Network
4. Transformers —
 General Application
 Special Application
5. Signalling
6. Power Supplies
7. Mountings and Accessories
8. Systems

A brief description of each of the eight categories is as follows:

1. Amplifiers

- a. Operation from either -24V DC or -48V DC.
- b. Power supplies — either separate or integral to power from 120V AC.
- c. 250 Hz to 6000 Hz limited bandwidth.

Passes good quality voice signal and eliminates many of the noise problems inherent in broadband equipment.

- d. Balanced input and output.

Various impedances available 150 Ω /600 Ω /900 Ω /1200 Ω .

Available as 24K Ω input for bridging purposes.

Power amplifiers - 2 watts, 4 ohms.

- e. Nonlinear application available.

460A, 460B - new units.

460A and 460B averaging limiters (about 35 millisecond attack).

New unit - switchable - averaging 25 milliseconds.

- peak 100 milliseconds.

Use peak unit for quiet environment with changing signal level.

Use averaging unit for changing signal level with random short duration noise spikes.

Use 481A equalizing amplifier to compensate for high frequency rolloff caused by capacitive loading e.g. inherent capacity of cable.

Most amplifier applications can probably be limited to the following:

456B or 7504A - General application, -24V DC or -48V DC.

460B or new unit - Limiter (varying signal levels).

480A - Bridging (24K Ω)

481A - Equalizer Amplifier (200 Hz to 3000 Hz).

489A - Preamp/Power Amplifier, 2 watts (can be used as distribution amplifier with various networks).

2. Attenuators

- a. Complete range (see page 7 of Telecommunications brochure).
- b. See applications.

3. Splitting and Mixing Network

- a. See pages 8 and 9 of the Telecommunications brochure.
- b. See applications.
- c. Note the four and five way networks.

4. Transformers

- a. Mount compatibly with other Altec components.
- b. Note special hybrid units.
- c. See applications.

5. Signalling

- a. Probably limited application.
- b. Use of some basic component, i.e. relay can provide many simple selections or alarm purposes.

6. Power Supplies

- a. Available to power all units from 24V at 20 mA for one line amplifier to 48V at 2 amperes.
- b. Complete short circuit protection.
- c. Samples periodically and automatically reactivates circuit when short is removed (544A and 545A).

7. Mountings and Accessories

- a. Large amount available both unwired and wired.
- b. Use for special application (flexibility for other uses).

8. Systems

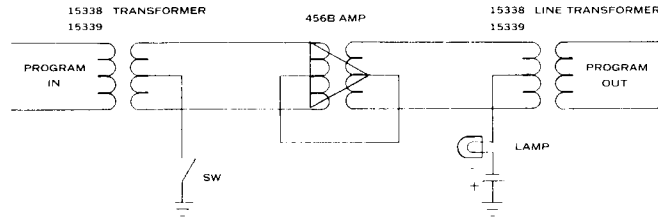
- a. 129B - 8 watt power amplifier for broadband application
 - 30 Hz to 15,000 Hz, 4 ohm load
 - Can be used as a distribution amplifier (up to 40 line output)
 - Network optional
 - Equalizer optional - 8 kHz and 15 kHz
- b. S17T Program Amplifiers
 - Good for data (used by many telephone companies, NASA and U.S. Air Force)
 - Voice or music
 - 20 Hz to 20,000 Hz bandwidth
- c. S19 Hands-Free Loudspeaking Telephone System
 - Use for conference rooms
 - Hands-free telephone conversation to remote locations via telephone company lines

The following illustrations show the application of Telecommunication Products in the Commercial Sound area:

SIMPLEX SIGNALLING

SIGNALLING OR SECURITY FUNCTION MAY BE ACHIEVED OVER AN AUDIO CIRCUIT CONTAINING BOTH TRANSFORMERS AND AMPLIFICATION.

TYPICAL CIRCUIT —



ALL TELEPHONE AMPLIFIERS AND TRANSFORMERS HAVE CENTER TAPS FOR THIS USE.

UP TO 100MA MAY BE PASSED IN THIS FASHION

LAMP MAY BE REPLACED WITH RELAY TO PERFORM OTHER FUNCTIONS—E.G. ACTIVATE REMOTE AMPLIFIER FROM CENTRAL POINT.

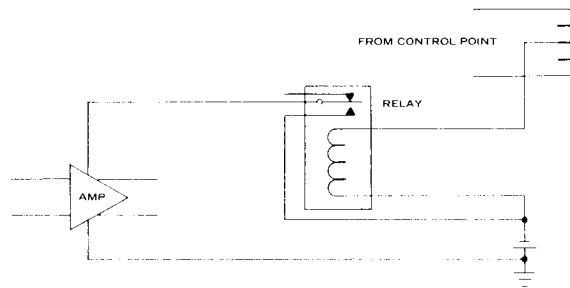
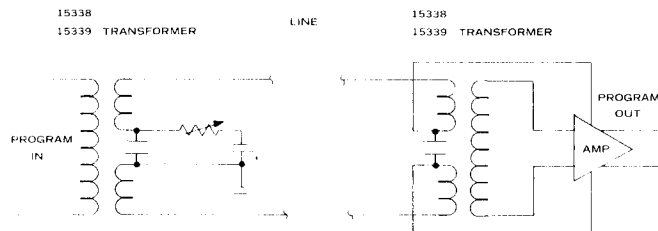


Figure 1. Simplex Signalling

REMOTE POWERING



POWERING REMOTE AMPLIFIER FROM LOCAL SOURCE.

THE 15338 AND 15339 TRANSFORMERS ARE DESIGNED TO OPERATE WITHOUT DEGRADATION OF FREQUENCY RESPONSE WITH UP TO 100 MA OF UNBALANCED D.C.

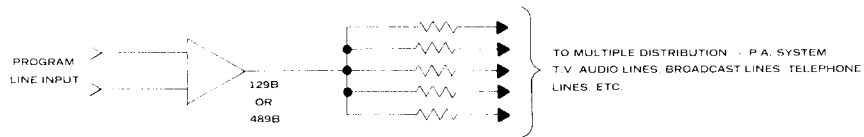
MOST OF THE AMPLIFIERS ARE DESIGNED TO OPERATE FROM 24 OR 48 VOLTS THUS WITH A 48 VOLT POWER SUPPLY COULD POWER OVER 240 OHMS OF CABLE AND STILL DELIVER 24 VOLTS AT AMPLIFIER.

MANY AMPLIFIERS—E.G. 456B—TAKE ONLY 20 MA AND COULD BE POWERED OVER 1200 OHMS OF CABLE RESISTANCE.

THIS NOT ONLY SAVES POWER SUPPLY AT REMOTE SITE BUT ALLOWS THE LOCAL SITE TO SWITCH OFF WHEN NOT REQUIRED.

Figure 2. Remote Powering

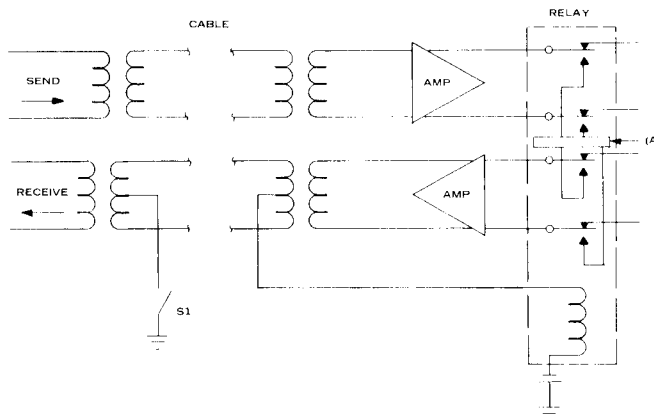
DISTRIBUTION SYSTEM



PRODUCT	MOUNTING	POWER	ACCESSORIES
129B 8 WATT AMPLIFIER	19 RACK	24V. 48V. 120VAC	1 OR 2 41829A NETWORK INTEGRAL MOUNTING 20 TO 40 DISTRIBUTION POINTS
489B 42399A 2 WATT AMPLIFIER	KTU 42399A	24V. 48V OR 120VAC WITH 7506A POWER SUPPLY	42460A NETWORK 4 DISTRIBUTION POINTS NOTE MAY BE PARALLEL FOR ADDITIONAL LINES 7506A POWER SUPPLY

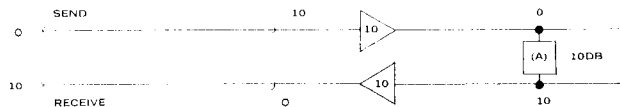
Figure 3. Distribution System

REMOTE CIRCUIT TESTING FROM LOCAL SOURCE
(ASSUMES 4-WIRE CIRCUIT)



THIS MAY HAVE LIMITED APPLICATION, THE USE OF THE 14252A RELAY WILL ALLOW THE LOCAL SITE TO CHECK A MALFUNCTION AND AT LEAST DETERMINE THAT THE CABLE AND AMPLIFIER ARE OPERATIVE.

BY INSERTION OF AN ATTENUATOR AT (A) SIGNAL LEVEL COMPATIBILITY IS MAINTAINED—WHICH ALLOWS CHECK OF KNOWN AMPLIFIER GAIN.



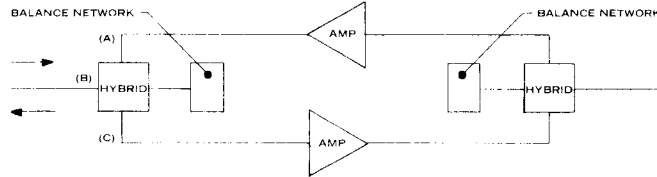
ANY DEVIATION FROM 10 DB AT RECEIVE WILL INDICATE SOME CIRCUIT MALADJUSTMENT.

Figure 4. Remote Circuit Testing From Local Source (Assumes 4 Wire Circuit)

TWO WAY AMPLIFICATION OVER SINGLE PAIR OF WIRES

THIS CAN BE ACHIEVED BY THE ALTEC 7306B AND AS AN OPTION ON THE 7300B, 7303B, 7301B AND 7334B.

THIS IS ACHIEVED BY THE USE OF HYBRID TRANSFORMERS—THE FOLLOWING BLOCK ILLUSTRATES THE METHOD.

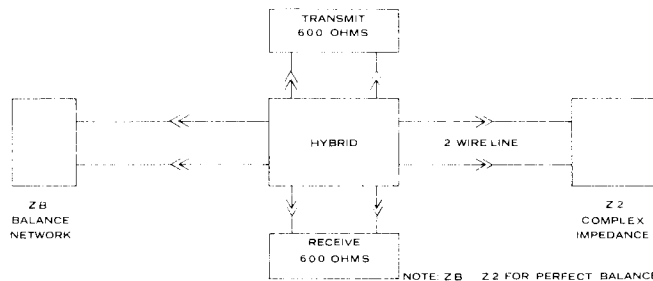
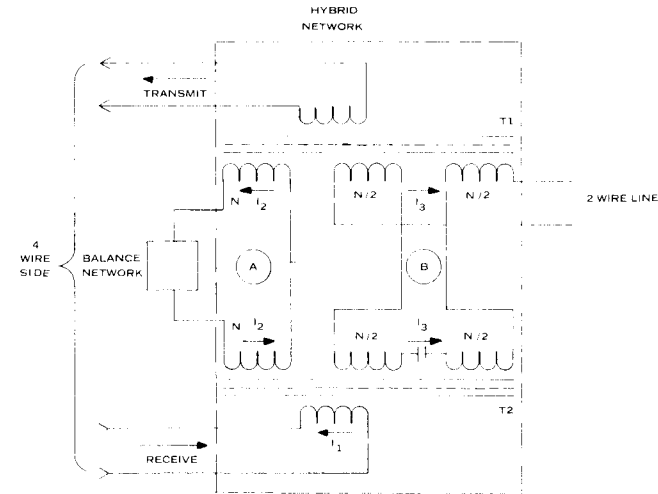


SIGNAL IS PASSED FROM A TO B AND B TO C WITH ABOUT A 4DB LOSS HOWEVER, FROM A TO C DUE TO THE SPECIAL WINDING OF THE TRANSFORMER AND THE ASSOCIATED BALANCE NETWORK A LOSS OF ABOUT 50DB CAN BE ACHIEVED IN THE IDEAL SITUATION --- ABOUT 30DB CAN OFTEN BE REALIZED IN A REAL CONDITION.

THESE UNITS CAN BE PLACED IN AN INTERMEDIATE POINT IN THE CIRCUIT OR AT EITHER TERMINAL POSITION.

Figure 5. Two Way Amplification Over Single Pair Of Wires

TWO WIRE TO FOUR WIRE TRANSMISSION



NOTE: ZB = Z2 FOR PERFECT BALANCE

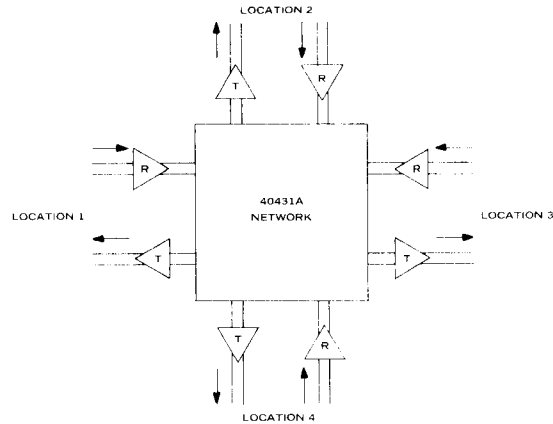
Figure 6. Two Wire To Four Wire Transmission

TRANSMISSION OVER 4 WIRE CIRCUIT FROM AND TO MULTIPLE POINTS

BY USE OF ALTEC 14727A 4 WIRE 6 WAY BRIDGE OR 40431A 4 WIRE 4 WAY BRIDGE IT IS POSSIBLE TO SET UP CONFERENCE SYSTEM AMONG EITHER 4 OR 6 REMOTE LOCATIONS.

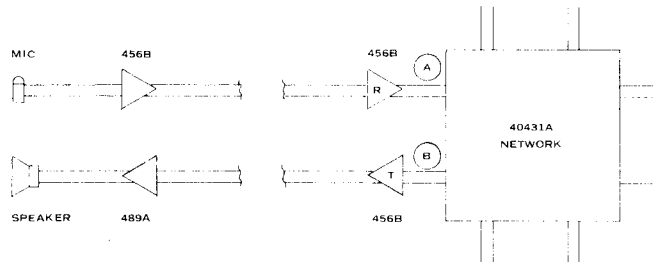
THE 7313A OR 7314A PROVIDES THIS ON A PRE-WIRED BASIS. HOWEVER, BY THE USE OF SUITABLE COMPONENTS THESE SYSTEMS CAN BE TAILORED TO MANY CONDITIONS.

THE BASIS SYSTEM IS AS SHOWN.



A SIGNAL INCOMING FROM LOCATION 1 IS TRANSMITTED TO 2, 3 AND 4, HOWEVER IS SEVERELY ATTENUATED ON ITS OWN TRANSMIT PATH THUS ALLOWING THE USE OF OPEN MICROPHONE AND LOUDSPEAKERS AS THE REMOTE LOCATION.

Figure 7. Transmission Over 4 Wire Circuit From And To Multiple Points



EVEN THOUGH THERE IS ACOUSTICAL COUPLING AT THE CONFERENCE LOCATION THIS DOES NOT CREATE A PROBLEM AS THERE IS A LOSS OF ABOUT 75DB BETWEEN A AND B.

THIS CAN BE EXPANDED UPON BY MAKING ONE LOCATION THE PABX THUS ALLOWING CONFERRING OF A PERSON OVER A REGULAR TELEPHONE CIRCUIT.

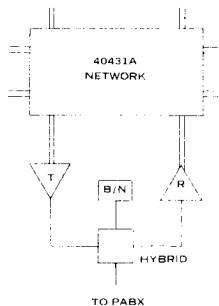


Figure 7a. Transmission Over 4 Wire Circuit From And To Multiple Points (Cont'd)

THE HYBRID BALANCING PROBLEM IS NOT
SO ACUTE HERE DUE TO THE INHERENT
LOSS OF THE 4 WIRE NETWORK.

THIS IS JUST AN OVERVIEW OF SOME OF A
MULTITUDE OF APPLICATIONS WHICH MAY
BE USEFUL IN THE GENERAL SOUND AREA —
AT LEAST WHERE VOICE ONLY IS REQUIRED
AND THE HIGH FIDELITY EQUIPMENT MAY BE
BOTH UNNECESSARY AND MORE TROUBLESOME.