TELLABS 9194
2 WIRE CONFERENCE AMPLIFIER

1. GENERAL

1.01 This Section describes the 9194 2 Wire Conference Amplifier manufactured by TELLABS Inc. and approved for use by Southwestern Bell Telephone Company.

1.02 This Section is issued to provide guidelines for the installation and maintenance of TELLABS 9194 2 Wire Conference Amplifier.

2. GENERAL DESCRIPTION

2.01 The TELLABS 9194 2 Wire Conference Amplifier module supplies controlled gain to maintain satisfactory transmission levels in 2 wire telephone conference applications of up to 36 lines. A primary use of the 9194 is in TELLABS' 291 Conference/Alerting System (see paragraph 3.02).

2.02 A negative-impedance operational amplifier (op amp) permits the 9194 to maintain a maximum transmission level of +5dBm. Maximum bridging loss is 4dB for conferences involving 2 to 36 lines.

2.03 Front panel monitor jacks bridge the input and output of the 9194's op amp to allow tone to be applied and transmission level measurements to be made during initial alignment of the module. Two front-panel potentiometers, level and gain ratio, are included as a means of balancing the module's output during alignment.

2.04 Internal voltage regulation permits the 9194 to operate on -22 to -56Vdc with positive ground. Current requirement is 20mA in the quiescent state and 45mA at maximum output.

2.05 As a Type 10 module, the 9194 mounts in one position of a TELLABS Type 10 Mounting Shelf, versions of which are available for relay rack and KTU apparatus case installations. In relay rack applications, a maximum of 12 modules may be mounted across a 19 inch rack, and up to 14 modules may be mounted across a 23 inch rack. In either case, 6 inches of vertical rack space is used.

3. APPLICATION

3.01 The 9124 2 Wire Conference Amplifier module supplies controlled gain for 2 wire conference applications of up to 36 participating lines. The 9194 maintains satisfactory transmission levels by automatically increasing gain as successive stations bridge the conference circuit. Maximum bridging loss is only 4dB, regardless of the number of stations (up to 36) accessing the conference.

3.02 Primary application of the 9194 is in the TELLABS 291 Conference/Alerting system. The 291 System is a multistation ringdown conference circuit designed for emergency reporting and business conference applications. The 291 System provides simultaneous access of up to 30 local stations from a dedicated master telephone or from any local telephone via a listed directory number. In the 291 System, the 9194 is capable of maintaining a maximum transmission level of +5dBm, regardless of the number of System stations participating in the conference.

When used in the 291 System, the 9194 mounts in position 6 of the System's common equipment shelf. For specific information on use of the 9194 in the 291 System, refer to the TELLABS 291 Conference/Alerting System Practice (Section 310-530-900SW).

4. INSTALLATION

A INSPECTION

4.01 The 9194 2 Wire Conference Amplifier module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

B MOUNTING

4.02 The 9194 module mounts in one position of a TELLABS Type 10 Mounting Shelf or in position 6 of the 291 System's common equipment shelf. The module plugs physically and electrically into a 56-pin connector at the rear of the shelf.

C INSTALLER CONNECTIONS

4.03 Before making any connections to the mounting shelf, make sure that power is off and modules are removed. Modules should be put into place only after they are properly optioned and after wiring is completed.

4.04 Figure 1 lists external connections to the 9194 module. All connections are made via wire wrap at the 56-pin connector at the rear of each module's mounting shelf position. Pin numbers are found on the body of the connector.

CONNECT:	TO PIN:
T (tip)	37
R (ring)	39
COMMON (reference voltage bus)	19
-BATT (-22 to -56Vdc battery input)	35
GND (ground)	17

LINE CIRCUIT TERMINATIONS

LINE CIRCUIT NUMBER:	PIN:	LINE CIRCUIT NUMBER:	PIN:
1	55	19	27
2	56	20	25
3	53	21	23
4	54	22	22
5	51	23	21
6	52	24	15
7	49	25	12
8	50	26	13
9	47	27	10
10	45	28	11
11	43	29	9
12	42	30	7
13	41	31	6
14	33	32	5
15	31	33	4
16	30	34	3
17	29	35	2
18	28	36	1

FIGURE 1

4.05 When the 9194 module is supplied as part of the 291 System, all intermodule wiring is factory-wired and external wiring is simplified through the use of connectorized cables. Refer to Section 310-530-900SW for more detailed information regarding wiring procedures and distributing frame terminations.

D ALIGNMENT

4.06 When all wiring is completed and all modules are installed, the two front-panel potentiometers, level and gain ratio, may have to be balanced to provide sufficient gain to overcome the bridging loss as level adjustment, proceed as follows:

(1) Arrange the transmit portion of a Transmission Measuring Set (TMS) terminated into 600 ohms, to output 1400Hz tone at -10dBm.

(2) Initiate a conference. (If the conference circuit is singing, turn the level control on the 9194 counterclockwise (CCW) until the circuit is stable.) Request all conference subscribers to leave their station instrument off-hook for about 15 minutes while the circuit is being aligned. Inform subscribers that tone will be present during level measure-ments.

(3) Disconnect the 25-pair J2 connectors (to the switching equipment) from the rear of all 291 System station equipment shelves. This will allow you to maintain control of the conference stations during alignment.

(4) Place the Transmission Measuring Set (TMS) in the bridging mode and, using test cords equipped with type 310 plugs, connect the transmit and receive portions of the TMS to the parallel monitor jacks on the 9194.

(5) Using the TMS's frequency-selection control, sweep the 300 to 3000Hz frequency range and observe the level reading portion of the TMS for the highest level (peak amplitude) within this frequency range. Do not adjust the output level of TMS. Leave the frequency selection control of the TMS set for the frequency at which the peak amplitude was observed.

(6) Turn the level control on the 9194 until the TMS indicates -14dB.

(7) Remove one station fuse from a 9021 module and, noting the resultant level change at the TMS, proceed as directed below:

(a) If the TMS level is above -14dB, turn the gain ratio control on the 9194 approximately one-half turn CCW and turn 9194's level control clockwise (CW) until the TMS level returns to -14dB.

(b) If the TMS level is below -14dB, turn the gain ratio control approximately one-half turn CW and turn the level control CCW until the TMS level returns to -14dB.

(8) Repeat step 7 until the level remains constant (-1dB).

(9) Reinsert all removed fuses, reconnect the J2 connectors and reinitiate the conference.

(10) Repeat the ablve procedure, but remove five fuses instead of one each time. This allows closer adjustment of the gain per station.

(11) When alignment is completed, reinsert fuses, reconnect J2 connectors to the station equipment shelves and inform conference subscribers that alignment is completed.

5. CIRCUIT DESCRIPTION

5.01 This circuit description is intended to familiarize you with the 9194 2 Wire Conference Amplifier module for engineering and application purposes only. Attempts to troubleshoot the 9194 module internally are not recommended. Procedures for recommended troubleshooting in the field are limited to those prescribed in Part 7. Reference to the block diagram (Exhibit 1) will aid in following this circuit description.

5.02 The 9194 module is designed for use in the 291 Conference/Alerting System or in other 2 Wire multistation telephone conference applications as a means of providing adequate transmission levels by reducing the bridging losses caused when multiple connections are made in parellel across two points.

5.03 The 9194 module contains an operational amplifier (op amp) with a totem-pole output stage arranged to return the op amp's output to the input in phase. As long as the op amp's gain remains less than unity, it will not oscillate or sing. Up to unity gain, the op amp acts as a negative-impedance amplifier, cancelling a portion of the bridging loss. As successive loads are bridged across the op amp's output, gain is increased to compensate for the lower impedance. Thus the termination appears to remain at 600 ohms impedance, and the resultant audio level appears to remain constant.

5.04 A negative-feedback ratio, derived from the level and gain ratio potentiometers and the number of resistors connected in parallel with the gain ratio potentiometer controls the gain of the op amp. As each station accesses the conference, it provides a closure between the reference voltage bus (pin 19) and the gate of a Field-Effect Transistor (FET) on the 9191 2W ARD Conference Terminate Line Circuit module associated with the station (in the 291 System).

5.05 Once activated, the FET completes the circuit by bridging another resistor across the gain ratio potentiometer. As additional lines access the conference, the resistance between the inverted input and the reference voltage diminishes, increasing the gain of the op amp. In this manner, op amp gain is switched in reference to the total number of lines accessing the conference at a given time. Careful adjustment of the level and gain ratio potentiometers can provide an increase in gain sufficient to offset the loss caused when each successive line bridges onto the conference. Monitor jacks are provided across the input and output of the op amp for measuring transmission levels and applying tone during initial alignment of the module.

5.06 The power supply integral to the 9194 contains its own internal voltage regulator, which allows operation from any source between -22 and -56dc. Maximum current requirement is 45mA.

6. SPECIFICATIONS

- MAXIMUM LEVEL
  +5dBm at 36 lines

- MAXIMUM BRIDGING LOSS
  4dB, 2 to 36 lines, 800 to 1000Hz

- POWER REQUIREMENTS
  input voltage: -22 to -56Vdc with positive ground
  input current: 20mA idle, 45mA at full load

- OPERATING ENVIRONMENT
  -40° to +140°F (-40° to +60°C), humidity to 95%, (no condensation)

- DIMENSIONS
  5.58 inches (14.17cm) high
  1.42 inches (3.61cm) wide
  5.96 inches (15.14cm) deep

- WEIGHT
  15 ounces (426 grams)

- MOUNTING
  position 6 of common equipment shelf of 291 Conference/Alerting System, or one position of a TELLABS Type 10 Mounting Shelf

7. TESTING AND TROUBLESHOOTING

7.01 The Testing Guide Checklist (Exhibit 2) may be used to assist in the installation, testing or troubleshooting of the 9194 2 Wire Conference Amplifier module. The Guide is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective, a new module should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to TELLABS for repair or replacement. It is strongly recommended that no internal (component level) testing or repairs be attempted on the 9194 module. Unauthorized testing or repairs may void the 9194's warranty.

7.02 If a situation arises that is not covered in the Guide, contact TELLABS Customer Service at (312) 969-8800 for further assistance.

7.03 If a 9194 is diagnosed as defective, the situation may be remedied by either replacement or repair and return. Becuase it is the more expedient method, the replacememt procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

A REPLACEMENT

7.04 If a defective 9194 module is encountered on central office installed equipment, Network Maintenance will arrange for a replacement by notifying TELLABS via telephone 312-969-8800, leter (see Below), or TWX 910-969-3530. Notification should include all relevant information, including the 8X9194 part number (from which TELLABS can determine the issue of the module in question). Upon notification, TELLABS will ship a replacement module to the site or other designated address. If the warranty period of the defective module has not elapsed, the replacement module will be shipped at no charge. Package the defective module in the replacement module's carton; sign the packing list included with the replacement module and enclose it with the defective module (this is your return authorization); affix the preaddressed label provided with the replacement module to the carton being returned; and ship the equipment prepaid to TELLABS.

7.05 For defective customer premise installed units, Business I/M will return the defective module to their Supplies Attendent or Material Management

coordinate for Repair and Return handling as covered in paragraph 7.06.

B REPAIR AND RETURN

7.06 Return the defective 9194 module shipment prepaid, to:

TELLABS Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: Repair and Return Dept.

7.07 Enclose an explanation of the module's malfunction. TELLABS will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

EXHIBIT 1

9194 BLOCK DIAGRAM

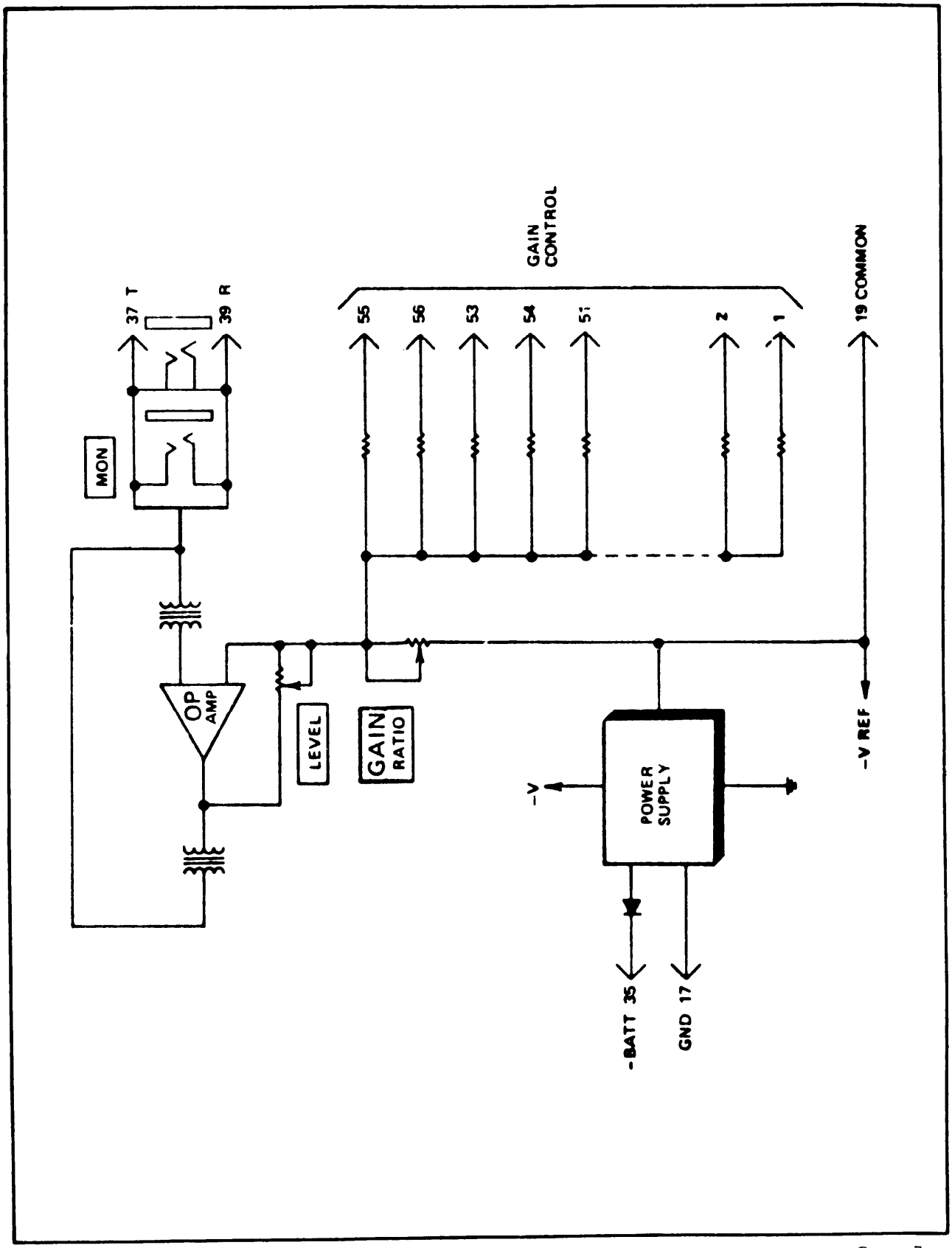

EXHIBIT 2

9194 TESTING GUIDE CHECKLIST

TEST	TEST PROCEDURE	NORMAL RESULT	IF NORMAL CONDITIONS ARE NOT MET, VERIFY:
Functional integrity of 9194	Set gain ratio and level potentiometers on 9194 front panel fully counterclockwise (CCW). Connect an oscillator set for 1004Hz with VTVM bridged across it to front-panel monitor jack by means of 310 plug. Connect a 600-ohm resistor in parallel with the VTVM and adjust the oscillator to obtain -20dBm level on the VTVM.		
	Replace 600-ohm resistor with a 20-ohm or greater resistor (other values may be used; however, 20 ohms simulates 30 stations accessed simultaneously), but do not adjust oscillator. Alternately adjust gain ratio and level potentiometers on 9194 slowly clockwise (CW) to obtain -20dBm level on VTVM. CAUTION: Do not attempt to derive gain in excess of original input level as unit will go into self-oscillation.	VTVM indicates -20dBm.	1. Verify power. 2. Verify wiring. 3. Replace 9194 and retest.
Transmission level	Adjust 9194 for correct transmission level as instructed in Paragraph 4.06.	Level remains constant ±1dB.	Same as above.