tellabs
technical manual
76-816132
rev A

practice section 816132

6132 2Wire-to-4Wire or 4Wire-to-4Wire Network Terminal Interface Module

contents

1. general description

1.01 The 6132 2Wire-to-4Wire or 4Wire-to-4Wire Network Terminal Interface Module (figure 1) provides transmission interface between a 2wire or 4wire metallic facility and a carrier channel or PBX. Both adjustable prescription-set gain or loss and switch-selectable 2wire-to-4wire or 4wire-to-4wire operation are available. In addition, the 6132 accepts any plug-on Tellabs 6008X Signaling Converter subassembly to provide optional signaling conversion between a variety of facility-side signaling formats and terminal-side E&M signaling.

1.02 In the event that this practice section is revised or reissued, the reason for revision or reissue will be stated in this paragraph.

1.03 The 6132 module offers the following features:

- Printed-circuit-board connectors for optional use of any Tellabs 6008X plug-on Signaling Converter subassembly, in which case the module-subassembly combination, known as the 6132X, functions as both a transmission-interface device and a signaling converter (see paragraph 1.04).
- From 0 to 24dB of prescription-set loss or gain in 0.1dB increments in both the receive and transmit channels.
- Maximum transmit and receive noise levels of 17dBrnC at 24dB of gain.
- Switch-selectable 2wire or 4wire facility-side interface, with an integral magnetic hybrid providing the 2wire-to-4wire conversion when 2wire facility interface is selected.
- Transformer isolation at all ports in either the 2wire-to-4wire or 4wire-to-4wire mode.
- Balanced, switch-selectable 900 or 600-ohm terminating impedance in series with 2.15μF of capacitance at the facility-side 2wire port in the 2wire-to-4wire mode.
- Fixed, balanced 600-ohm terminating impedances at the module's terminal-side 4wire ports and also at both facility-side 4wire ports in the 4wire-to-4wire mode.
- An integral compromise balance network (CBN) that provides either 900 or 600 ohms (switch-selectable) or 0 to 2000 ohms (continuously adjustable) in series with 2.15μF at the hybrid's balance port.

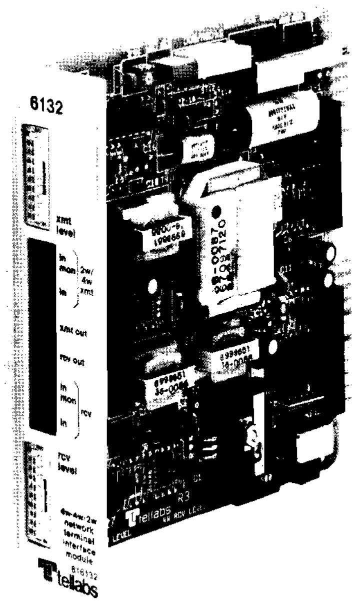


figure 1. 6132 2Wire-to-4Wire or 4Wire-to-4Wire Network Interface Module

- From 0 to 0.062μF of network build-out (NBO) capacitance in switch-selectable 0.002μF increments, for use with the module's integral CBN.
- Lightning surge protection at the facility-side transmission port(s).
- Reverse-battery protection, transient-limiting circuitry, and RC (resistance-capacitance) filtering and decoupling networks to minimize crosstalk coupling and the effects of noise on the input power leads.
- Six front-panel bantam-type test jacks: an opening jack facing the module at all four ports plus a monitoring (bridging) jack at the two input ports to facilitate alignment and maintenance.
- Operation on filtered, ground-referenced −22 to −56Vdc input power, with current requirements of 45mA at idle (typical) and 75mA maximum.
- Type 10 module for mounting in a variety of Tellabs Type 10 Mounting Shelves, which are available in versions for relay-rack (occupying 6 inches of vertical rack space) and apparatus-case installation.

1.04 As described above, when a Tellabs 6008X Signaling Converter subassembly is installed on the 6132 module, the resulting module-subassembly combination is referred to as a *Tellabs 6132X module*, where X indicates the alphabetic suffix of the 6008A, B, C, or D subassembly used on the module.

Please note that while the 6132 module and 6008X subassemblies are available separately, module-subassembly combinations can be ordered from Tellabs with the desired subassembly factory-installed on the module. These modules are designated the 6132A, 6132B, 6132C, and 6132D, depending upon the particular subassembly installed. Table 1 summarizes the module-subassembly combinations currently available.

2. application

general

2.01 The 6132 2Wire/4Wire-to-4Wire Network Terminal Interface Module provides a switch-selectable 2wire or 4wire interface on the facility side and a 4wire interface on the terminal side. The module's transmit and receive paths can be individually optioned to provide from 0 to 24dB of prescription-set loss or gain in switch-selectable 0.1dB increments.

2.02 The 6132 can be used by itself as a 2wire-to-4wire or 4wire-to-4wire transmission interface module, or it can be equipped with a plug-on Tellabs 6008X Signaling Converter subasssembly for conversion between various facility-side signaling formats and terminal-side E&M signaling as required by an associated carrier channel or PBX.

2.03 When equipped with a 6008A, 6008B, or 6008C subassembly, the A&B leads on the 6132 are used internally for loop access in both the 2wire and 4wire facility-side modes. When the 6132 is used alone or with the 6008D subassembly, the 6132's A&B leads (2wire facility side) or simplex (SX) leads (4wire facility side) remain available for use with external equipment.

terminating impedances

2.04 When optioned for 2wire-to-4wire operation, the 6132's facility-side 2wire port can be switch-optioned for 600 or 900-ohm terminating impedance in series with 2.15μF. In 4wire-to-4wire operation, the facility-side port impedances are restricted to 600 ohms only. The choice of two 2wire-port impedances permits interface with a variety of 2wire facilities and equipment. The 600-ohm option is selected when the 6132 interfaces nonloaded cable or station equipment, while the 900-ohm option is selected when the 6132 interfaces loaded cable, switched networks involving both loaded and nonloaded cable, or 900-ohm equipment. On the terminal side, the impedance at both 4wire ports (transmit output and receive input) is fixed at 600 ohms, as required for carrier and many nonloaded-cable applications. Both terminal-side transformers are center-tapped to derive balanced SX leads.

SX/A&B signaling leads

2.05 Optioning the 6132 for 2wire interface on the facility side introduces the module's 2wire-to-4wire hybrid into the circuit and conditions the module's facility-side leads for 2wire operation. With 2wire facility interface selected, A&B leads are derived on the 6132's facility side, and external access to these leads is available at the card-edge connector for signaling interface to the hybrid. The 6132's A&B leads can accommodate up to 40mA of direct current without significant degradation of performance. With 4wire facility interface selected, both facility-side transformers are center-tapped to derive balanced SX leads, which, like the A&B leads with a 2wire interface, are externally available at the card-edge connector for signaling interface.

balance network and NBO capacitance (2wire facility interface only)

2.06 To ensure that adequate hybrid balance (i.e., enough transhybrid loss) is provided in any 2wire facility-interface application, the 6132's hybrid can be optioned to function with the module's internal compromise balance network (CBN). The CBN can be optioned for the same impedances as the 2wire port: 900 ohms (in series with 2.15μF) when the 2wire port interfaces loaded cable, switched networks, or 900-ohm equipment, or 600 ohms (in series with 2.15μF) when the 2wire port interfaces nonloaded cable or 600-ohm station-end equipment. A third CBN option allows the module user to manually introduce from 0 to 2000 ohms of balancing impedance (in series with 2.15μF) via a continuously adjustable control on the 6132's printed

function	subassembly	module-subassembly designation
2/4wire-to-4wire (facility-to-terminal) interface with no signaling conversion	none	6132 (no subassembly)
2/4wire-to-4wire FXS-to-E&M (facility-to-terminal) interface	6008A FXS-to-E&M Signaling Converter subassembly	6132A
2/4wire-to-4wire FXO-toE&M (facility-to-terminal) interface	6008A FXO-to-E&M Signaling Converter subassembly	6132B
2/4wire-to-4wire DX-to-E&M (facility-to-terminal) interface	6008C DX-to-E&M Signaling Converter subassembly	6132C
2/4wire-to-4wire E&M-to-E&M (facility-to-terminal) interface	6008D E&M-to-E&M Signaling Converter subassembly	6132D

table 1. Functions of 6132 module and associated 6008X subassemblies

circuit board. This CBN option can be used as an economical alternative to a precision balance network (PBN) in many applications.

2.07 To further improve hybrid balance in 2wire facility-interface applications, from 0 to 0.062μF of network build-out (NBO) capacitance can be introduced across the module's balance port. This NBO capacitance can also be used to compensate for the capacitance of station cables or other equipment or to compensate for drop build-out (DBO) capacitors on the 2wire loop. Please note that while NBO capacitance **can be used** with a CBN for nonloaded cable or a tel set, the NBO capacitance introduced in these cases may or may not result in significantly improved hybrid balance. The amount of additional transhybrid loss obtained in such applications depends upon individual circuit characteristics.

3. installation

inspection

3.01 The 6132 2Wire/4Wire-to-4Wire Network Terminal Interface Module should be visually inspected upon arrival 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.

mounting

3.02 The 6132 module mounts in one position of a Tellabs Type 10 Mounting Shelf and plugs physically and electrically into a 56-pin connector at the rear of the shelf.

installer connections

3.03 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.

3.04 Table 2 lists external connections to the 6132 module. All connections are made via wirewrapping to the 56-pin connector at the rear of the module's mounting-shelf position. Pin numbers are found on the body of the connector.

option selection

Note: *If your 6132 module is equipped with a Tellabs 6008X Signaling Converter subassembly, be certain to properly option the subassembly as directed in its separate Tellabs practice.*

3.05 All 6132 options are selected via slide or DIP switches. Locations of these switches on the module's printed circuit board are shown in figure 2. Table 3 gives a brief explanation of the function and settings of each option switch, along with a convenient optioning and alignment checklist. The checklist can be filled out (by checking the appropriate box for each switch) either prior to installation to allow for prescription optioning and alignment of the module, or as the module is being optioned and aligned to provide a record for future reference. Detailed instructions for optioning the 6132 are provided in paragraphs 3.06 through 3.09.

Note: *Introduction of NBO capacitance is covered under* **alignment** *in paragraphs 3.18 and 3.19 of this practice.*

connect:	to pin:
4WIRE RECEIVE OUT TIP*	5
4WIRE RECEIVE OUT RING*	15
B LEAD/4WIRE RECEIVE OUT SIMPLEX*	3
4WIRE TRANSMIT OUT TIP**	41
4WIRE TRANSMIT OUT RING**	47
4WIRE TRANSMIT OUT SIMPLEX**	43
4WIRE RECEIVE IN TIP**	7
4WIRE RECEIVE IN RING**	13
4WIRE RECEIVE IN SIMPLEX**	9 and 11
2WIRE TIP/4WIRE TRANSMIT IN TIP*	55
2WIRE RING/4WIRE TRANSMIT IN RING*	49
A LEAD/4WIRE TRANSMIT IN SIMPLEX*	51 and 53
−BATT (−22 to −56Vdc filtered input)	35
GND (ground)	17
E1 LEAD**†	23
M1 LEAD**†	21
RG (ringing generator)**†	45 and 46
SG1 (signal ground 1) LEAD**†	19
SB1 (signal battery 1) LEAD**†	1
E2 LEAD*†	14
M2 LEAD*†	10
SG2 (signal ground 2) LEAD*†	6
SB2 (signal battery 2) LEAD*†	8

* Facility side.
** Terminal side.
† Applies only when a Tellabs 6008X Signaling Converter plug-on subassembly is present on 6132.

table 2. External connections to 6132

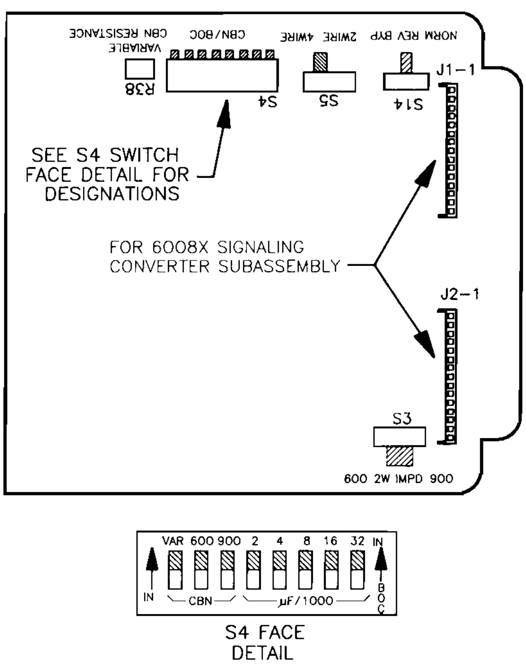


figure 2. 6132 option switch locations

text continued on page 5

switch option	switch	selection	setting	checklist
2wire or 4wire facility-side transmission interface	*S5 (2WIRE/4WIRE)*	2wire interface	2WIRE	
		4wire interface	4WIRE	
2wire-port terminating impedance (with *S5* set for *2WIRE* facility interface). **Note:** With *S5* set to *4WIRE*, *S3* must always be set to *600*.	*S3 (2W IMPD)*	600 ohms plus 2.15μF in 2wire mode, 600 ohms resistive in 4wire mode (required with 4wire facility interface)	600	
		900 ohms plus 2.15μF (not available with 4wire facility interface)	900	
facility-side signaling-lead arrangement	*S14 (NORM/REV/BYP)*	bypass: A&B-lead (2wire mode) or SX-lead (4wire mode) interface available at card-edge connector pins; required when 6132 is used alone (without 6008X subassembly)	BYP	
		normal: A&B leads derived via 2wire T&R leads, respectively, in 2wire mode; RCV OUT SX and XMT IN SX leads derived via RCV OUT and XMT IN pairs, respectively, in 4wire mode.	NORM	
		reverse: A&B leads derived via 2wire R&T leads, respectively, in 2wire mode; RCV OUT SX and XMT IN SX leads derived via XMT IN and RCV OUT pairs, respectively, in 4wire mode	REV	
internal compromise balance network (CBN) options	*S4 (CBN/BOC), CBN* positions only *(VAR, 600, 900)*	900 ohms with 2.15μF	VAR to OUT**, 600 to OUT, 900 to IN	
		600 ohms with 2.15μF	VAR to OUT, 600 to IN, 900 to OUT	
		user-adjustable 0 to 2000 ohms (via *VARIABLE CBN RESISTANCE* potentiometer *R38*) with 2.15μF	VAR to IN, 600 to OUT, 900 to OUT	
selection of receive-channel flat gain or loss	*GN* and *LS* positions of front-panel *rcv fac level* DIP switch	gain	GN to IN, LS to OUT	
		loss	GN to OUT, LS to IN	
amount of receive-channel gain or loss, as selected above*	front-panel *rcv level* DIP switch, dB-value positions*	0.1dB	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	
selection of transmit-channel flat gain or loss	*GN* and *LS* positions of front-panel *xmt fac level* DIP switch	gain	GN to IN, LS to OUT	
		loss	GN to OUT, LS to IN	

table continued on next page

switch option	switch	selection	setting	checklist
amount of transmit-channel gain or loss, as selected above*	front-panel *xmt level* DIP switch, dB-value positions*	0.1dB	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	
network build-out (NBO) capacitance***	*S4 (CBN/BOC), μF/1000* positions only (*2, 4, 8, 16* and *32*)***	0.002μF	2 to IN	
		0.004μF	4 to IN	
		0.008μF	8 to IN	
		0.016μF	16 to IN	
		0.032μF	32 to IN	

* The dB-value positions of the 6132's front-panel *rcv level* and *xmt level* DIP switches are cumulative. Total gain or loss introduced into a channel is the sum of that channel's dB-value DIP-switch positions set to *IN.* For zero gain or loss in a channel, set all dB-value positions of that channel's front-panel *level* DIP switch to *OUT.*

** Setting a switch to the *OUT* position means moving the switch away from the *IN* position.

*** The 6132's network build-out capacitance (*BOC*) switch positions on DIP switch *S4* are cumulative. Total NBO capacitance introduced is the sum of those *NBOC* DIP-switch positons set to *IN*. For zero NBO capacitance, set all five *BOC* DIP-switch positions on *S4* to *OUT.*

table 3. 6132 option and alignment switch summary and checklist

3.06 **2Wire or 4Wire Facility-Side Transmission Interface.** Two-position slide switch *S5* selects either a 2wire or 4wire transmission interface on the 6132's facility side. Set *S5* as follows:

- To the *2WIRE* position for a 2wire facility interface.
- To the *4WIRE* position for a 4wire facility interface.

3.07 **2Wire-Port Terminating Impedance.** Two-position slide switch *S3 (2W IMPD)* selects either 900-ohm or 600-ohm terminating impedance (in series with 2.15μF) at the 6132's 2wire port when the module is optioned for 2wire facility interface (*S5* set to *2WIRE*). Switch *S3* also conditions the 6132 to provide 600-ohm terminating impedance at both facility-side ports when the module is optioned for 4wire facility interface (*S5* set to *4WIRE*). Set *S3 (2W IMPD)* as follows:

- To the *900* position for 900 ohms in series with 2.15μF, as is normally required for interface with loaded cable, switched networks, or 900-ohm equipment.
- To the *600* position for 600 ohms in series with 2.15μF, as is normally required for interface with nonloaded cable or 600-ohm equipment.
- To the *600* position for 600-ohm impedance at both facility side ports in **all** applications where **4wire facility interface** is selected (*S5* set to *4WIRE*).

3.08 **Facility-Side Signaling-Lead Arrangement.** Three-position slide switch *S14* selects either a bypass, normal, or reverse signaling-lead arrangement on the 6132's facility side. Set *S14* as follows:

- To the *BYP* (bypass) position when card-edge connector-pin access to the 6132's A&B leads (2wire mode) or to the receive output SX and transmit input SX leads (4wire mode) is desired. **The *BYP* setting is required in all applications where the 6132 is used alone, i.e., without a Tellabs 6008X Signaling Converter subassembly.**
- To the *NORM* (normal) position when it is desired that the 6132's signaling leads be derived as follows:
  - ★ In the 2wire mode, A lead derived from 2wire tip lead and B lead derived from 2wire ring lead.
  - ★ In the 4wire mode, RCV OUT SX lead derived from receive output pair and XMT IN SX lead derived from transmit input pair.
- To the *REV* (reverse) position when it is desired that the 6132's signaling leads be derived as follows:
  - ★ In the 2wire mode, A lead derived from 2wire ring lead and B lead derived from 2wire tip lead.
  - ★ In the 4wire mode, RCV OUT SX lead derived from transmit input pair and XMT IN SX lead derived from receive output pair.

3.09 **Internal CBN Options.** The first three positions of eight-position DIP switch *S4 (CBN/BOC)* select the 6132's internal compromise-balance-network (CBN) options. These are the CBN posititons labeled *VAR, 600,* and *900*. Set the *CBN* positions of DIP switch *S4* as follows:

- To select 900-ohm impedance in series with 2.15μF, set *VAR* to OUT (see note below), *600* to OUT, and *900* to *IN*.
- To select 600-ohm impedance in series with 2.15μF, set *VAR* to OUT, *600* to *IN*, and *900* to OUT.

- To select user-adjustable 0 to 2000-ohm impedance (via *VARIABLE CBN RESISTANCE* potentiometer *R38*) in series with 2.15μF, set *VAR* to *IN*, *600* to OUT, and *900* to OUT.

Note: *Setting a switch to the* **OUT** *position means moving the switch* **away from** *the* **IN** *position.*

installing optional 6008X subassembly

3.10 In applications where an optional Tellabs 6008X Signaling Converter subassembly is to be used on the 6132, refer to figure 2 for the appropriate connector locations and install the subassembly as follows:

A. Remove the small plastic filler panel at the upper righthand corner of the 6132's front panel by pushing it outward from the rear of the panel.

B. Orient the 6008X subassembly so that male connector *P1* on the 6008X lines up with female connector *J1* on the 6132, male connector *P2* on the 6008X lines up with female connector *J2* on the 6132, and the small rectangular plastic panel on the 6008X lines up with the opening at the upper righthand corner of the 6132's front panel adjacent to the 6132 model number.

C. Carefully plug the 6008X onto the host 6132, ensuring that all connector pins on the 6008X fit properly into their receptacles on the 6132's female connectors and also ensuring that the small plastic panel on the 6008X fits properly into the opening in the 6132's front panel.

D. Finally, install and tighten the screws (supplied) that secure the 6008X's four standoff posts to the 6132's printed circuit board.

alignment

3.11 Alignment of the 6132 consists of setting the receive and transmit transmission levels and, where required in 2wire facility-interface applications, introducing user-adjustable CBN resistance and/or NBO capacitance to achieve optimum hybrid balance. After all options on the 6132 are selected, two methods of alignment are available: *prescription* and *direct measurement* (non-prescription). With the prescription method, the 6132's front-panel *rcv level* and *xmt level* switches and the printed-circuit-board *BOC* DIP switches are set in accordance with the specifications on the circuit layout record (CLR). Procedures for prescription alignment of the 6132 are given in paragraphs 3.12 and 3.13. In applications where the information provided by the CLR is inadequate, it is necessary to perform the direct-measurement (non-prescription) alignment procedure. The non-prescription procedure consists of making measurements at the 6132's ports to determine the required settings of the alignment switches. The non-prescription alignment procedures are given in paragraphs 3.14 through 3.19.

prescription level adjustment, transmit and receive

3.12 To adjust the transmit and receive levels on the 6132, proceed as follows: From table 3 or the CLR, determine whether loss or gain is required in each channel. If loss is required in a channel, set the *LS* position of that channel's front-panel *level* DIP switch to *IN* and the adjacent *GN* position of the same DIP switch to OUT. If gain is required in a channel, set the *GN* position of that channel's *level* DIP-switch to *IN* and the adjacent *LS* position of the same switch to OUT. Next, determine (from the CLR) the amount of loss or gain required in each channel. Then, to achieve the required levels, set the appropriate combinations of *rcv level* and *xmt level* dB-value DIP switches to the *IN* position. The specific amount of loss or gain introduced by each dB-value DIP-switch position is indicated on the front panel adjacent to the switch position. These switch positions are cumulative; the total amount of loss or gain introduced into a channel is the sum of that channel's *level* DIP-switch positions set to *IN*.

post-alignment testing

3.13 After the transmission levels are set and, where applicable, NBO capacitance is introduced, it may be desirable to confirm the results via end-to-end tests. Where computer-controlled test equipment is used, a printout will verify the alignment results. Any deviation from the required levels can then be adjusted via the front-panel *level* switches and printed-circuit-board *BOC* switches. If computer-controlled test equipment is not available, the alignment results can be confirmed by performing the measurements in the non-prescription alignment procedure below.

prealignment switch settings for non-prescription alignment

3.14 Before beginning actual non-prescription alignment of the 6132, do the following:

A. Ensure that all option switches (see table 3), especially those that select the module's facility-side terminating impedance(s), are properly set.

B. Ensure that the user-adjustable *VARIABLE CBN RESISTANCE* potentiometer (*R38*) is adjusted fully counterclockwise for zero CBN resistance.

C. Ensure that no NBO capacitance is introduced (all five *BOC* positions of the *CBN/BOC* DIP switch set to OUT).

D. Set all dB-value positions of the front-panel *rcv level* and *xmt level* DIP switches to the OUT position for zero gain or loss in each channel.

non-prescription transmit-level adjustment

3.15 To adjust the transmit level of the 6132 when prescription level settings are not given in the CLR or when the given settings do not provide adequate results, proceed as follows:

A. Arrange the receive portion of a transmission measuring set (TMS) for 600-ohm terminated measurement, and connect it to the 6132's *xmt out* jack.

B. Request the distant facility-side location to send 1004Hz test tone at that location's CLR-specified output level.

C. If the measured transmit output level is the same as the local CLR-specified transmit output level, proceed to **non-prescription receive level adjustment**, paragraph 3.16. If the measured transmit output level is different from the specified transmit output level, proceed to step D or E, as appropriate.

D. If the specified transmit output level is **lower than** the measured transmit output level, loss is required. Set the *LS* position of the front-panel *xmt level* DIP switch to *IN* and the *GN* position to OUT. Then set to *IN* that combination of *xmt level* dB-value DIP switches which equals the required amount of loss (see note below). This amount is the difference between the transmit output level measured in step C and the CLR-specified transmit output level. Proceed to paragraph 3.16.

E. If the specified transmit output level is **higher than** the measured transmit output level, gain is required. Set the *LS* position of the front-panel *xmt level* DIP switch to OUT and the *GN* position to *IN*. Then set to *IN* that combination of *xmt level* dB-value DIP switches which equals the required amount of gain (see note below). This amount is the difference between the transmit output-level measured in step C and the CLR-specified transmit output level.

F. Remove the opening plug (if present) from the *rcv in* jack, and disconnect the TMS. Proceed to paragraph 3.16.

Note: *The dB-value positions of the front-panel* **xmt level** *DIP switch are cumulative. Total loss or gain introduced into the 6132's transmit channel is the sum of those* **xmt level** *dB-value switches set to* **IN.**

non-prescription receive-level adjustment

3.16 To adjust the receive level of the 6132 when prescription level settings are not given in the CLR or when the given settings do not provide adequate results, proceed as follows:

A. Arrange the receive portion of the TMS for 900 or 600-ohm terminated measurement, as appropriate, and connect it to the 6132's *rcv out* jack.

B. Request the distant terminal-side location to send 1004Hz test tone at that location's CLR-specified output level.

C. If the measured receive output level is the same as the local CLR-specified receive/2wire output level, level adjustment is complete, so disconnect the TMS. If the 6132 is optioned for 2wire facility-side interface, proceed to paragraph 3.17. If the 6132 is optioned for 4wire facility interface, alignment is complete. If, however, the measured receive/2wire level is different from the specified receive/2wire output level, proceed to step D or E, as appropriate.

D. If the specified receive/2wire output level is **lower than** the measured receive/2wire output level, loss is required. Set the *LS* position of the front-panel *rcv level* DIP switch to *IN* and the *GN* position to OUT. Then set to *IN* that combination of *rcv level* dB-value DIP switches which equals the amount of required loss (see note below). This amount is the difference between the receive/2wire output level measured in step C and the CLR-specified receive/2wire output level. If the 6132 is optioned for 2wire facility-side interface, proceed to paragraph 3.17. If not, alignment is complete.

E. If the specified receive/2wire output level is **higher than** the measured receive/2wire output level, gain is required. Set the *LS* position of the front-panel *rcv level* DIP switch to OUT and the *GN* position to *IN*. Then set to *IN* that combination of *rcv level* dB-value DIP switches which equals the required amount of gain (see note below). This amount is the difference between the receive/2wire output level measured in step C and the CLR-specified receive/2wire output level. If the 6132 is optioned for 2wire facility-side interface, proceed to paragraph 3.17. If not, alignment is complete.

Note: *The dB-value positions of the front-panel* **rcv level** *DIP switch are cumulative. Total loss or gain introduced into the 6132's receive channel is the sum of those* **rcv level** *dB-value switches set to* **IN.**

non-prescription balance-network alignment and introduction of NBO capacitance (2wire mode only)

3.17 **Determining Transhybrid Loss and Adjusting Internal CBN When User-Adjustable Option Is Selected.** If it is not known whether the module's internal CBN will provide adequate hybrid balance (transhybrid loss) in a particular application, make this determination as follows (use of a Tellabs 9801 or 9802 Card Extender, or equivalent, is recommended for this procedure):

A. Ensure that the CBN is inserted and properly optioned (via the *VAR*, *600*, and *900* positions of the *CBN/BOC* DIP switch, *S4*) for either 600 ohms in series with 2.15μF, 900 ohms in series with 2.15μF, or a user-adjustable (via potentiometer *R38*) range of 0 to 2000 ohms in series with 2.15μF. See table 3 or paragraph 3.09 for CBN optioning information.

B. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified receive input level. (If the transmit portion of the TMS has a separate impedance setting, select 600 ohms.) Connect this signal to the *rcv in* jack.

C. Arrange the receive portion of the TMS for 600-ohm terminated measurement, and connect it to the *xmt out* jack.

D. If the user-adjustable CBN option is selected, adjust potentiometer *R38* on the 6132's printed circuit board (see figure 2) until the output-level reading on the TMS reaches its **lowest** point. If either the 600-ohm or 900-ohm CBN option is selected, simply observe the output-level reading on the TMS. Regardless of which CBN option is in effect, if the measured output level is too high (i.e., if transhybrid loss is insufficient) to meet the circuit requirements of the application, introduction of NBO capacitance in conjunction with the CBN may be necessary to compensate for terminal cable capacitance or for drop build-out (DBO) capacitors on the 2wire loop. These situations are covered in paragraphs 3.18 through 3.19.

3.18 **Introducing NBO Capacitance by TMS Measurement When Required Amount Is Unknown (CBN Applications).** To introduce NBO capacitance to compensate for office cable capacitance or for DBO capacitors on the 2wire loop or to achieve optimum hybrid balance when the required amount of NBO capacitance is unspecified, proceed as follows (use of a Tellabs 9801 or 9802 Card Extender is recommended for this procedure):

A. Ensure that the CBN is included in the circuit and properly optioned if it is being used (*VAR*, *600*, and *900* positions of the *CBN/BOC* DIP switch, *S4*).

B. Arrange the transmit portion of the TMS for 2000Hz tone output at the CLR-specified receive input level. (If the transmit portion of the TMS has a separate impedance setting, select 600 ohms.) Connect this signal to the *rcv in* jack.

C. Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the *xmt out* jack.

D. Using the five *μF/1000* positions of DIP switch *S4 (CBN/BOC)* add NBO capacitance until the TMS level reading is at its **lowest** point (i.e., add NBO capacitance until the TMS reading reaches a minimum and then starts to rise; then return to the setting of the *μF/1000* positions of *S4* that produced the minimum reading). Disconnect the TMS from the module. At this point, alignment of the 6132 is complete. If a card extender was used, unplug both it and the 6132 module; then plug the module back into the shelf or assembly position.

3.19 **Introducing NBO Capacitance by Formula When Required Amount Is Unknown (Some CBN Applications).** If the module's internal CBN is being used and an easier method of introducing NBO capacitance (generally, to compensate for office cable capacitance) is desired than the procedure in paragraph 3.18, proceed as follows:

Note: *The amount of NBO capacitance introduced by this method should provide adequate results in most applications. If it does not, the procedure in paragraph 3.18 must be performed.*

A. From table 4, calculate the required amount of NBO capacitance for the type and length of cable interfacing the module's 2wire port. (For example, if 1.2 kilofeet of high-capacitance cable interfaces the module's 2wire port, multiply 1.2 kilofeet by 0.016μF per kilofoot to obtain 0.0192μF).

B. Set to *IN* that combination of the *μF/1000* positions of DIP switch *S4 (CBN/BOC)* that most closely approximates the calculated amount of NBO capacitance. (For the example in step A, you would set positions *4* and *16* to *IN* to introduce 0.020μF, the closest possible amount to 0.0192μF.) At this point, alignment of the 6132 is complete. If a card extender was used, unplug both it and the 6132 module; then plug the module back into the shelf or assembly position.

type of cable interfacing 2wire port:	amount of NBO capacitance to be introduced for each kilofoot of cable between module and local facility-side equipment:
high capacitance (0.083μF per mile)	0.016μF per kilofoot
low capacitance (0.066μF per mile)	0.012μF per kilofoot

table 4. Guidelines for introducing NBO capacitance (in conjunction with CBN) by formula to compensate for facility-side cable capacitance

4. circuit description

4.01 This circuit description is intended to familiarize you with the 6132 2Wire/4Wire-to-4Wire Network Terminal Interface Module for engineering and application purposes only. Attempts to test or troubleshoot the 6132 internally are not recommended. Procedures for recommended testing and troubleshooting in the field are limited to those prescribed in section 7 of this practice. Refer to the 6132 block diagram, section 5 of this practice, as an aid in following the circuit description.

power supply

4.02 The *power supply* in the 6132 is a series-regulated bipolar supply. A series diode in the negative input lead protects the circuit against reversed input power connections.

lightning protection

4.03 Lightning protection is provided at the facility-side transmission port(s) of the 6132 module.

2wire facility interface

4.04 When the 6132 is switch-optioned for 2wire-to-4wire (facility-to-terminal) operation, a magnetic 2wire-to-4wire (facility-to-terminal) *hybrid* with switch-selectable 900 or 600-ohm terminating impedance in series with 2.15μF provides the 2wire-side interface. A&B leads derived via the 2wire T&R leads are available at the 6132's card-edge connector for signaling interface to the hybrid.

4.05 An internal *compromise balance network (CBN)* associated with the hybrid offers a switch-selectable choice of 900 or 600-ohm impedance in series with 2.15μF or user-adjustable 0 to 2000-ohm impedance (via potentiometer *R38*) in series with 2.15μF. From 0 to 0.062μF of *network build-out (NBO) capacitance*, in switch-selectable 0.002μF increments, is available for use with the 6132's internal CBN.

receive channel

4.06 The receive-channel input uses a transformer to interface the transmission facility and to derive the receive input tip, ring, and simplex (SX) leads. The secondary winding of the transformer is coupled to the *receive attenuator/amplifier*. The output of this *attenuator/amplifier* is coupled to the magnetic *hybrid* in the 2wire mode or to the 4wire receive output transformer in the 4wire mode. The receive output transformer derives the receive output tip, ring, and SX leads in the 4wire mode.

transmit channel

4.07 In the 4wire mode, the transmit-channel input uses a transformer to derive the transmit input tip, ring, and SX leads. The secondary winding of the transmit input transformer is coupled to the *transmit attenuator/amplifier*. The transmit-channel input in the 2wire mode is from the magnetic 2wire-to-4wire *hybrid*, which is coupled to the *transmit attenuator/amplifier*. The output of this *attenuator/amplifier* is coupled to the transmit output transformer, which derives the transmit output tip, ring, and SX leads.

signaling interface

4.08 When the 6132 is used alone, i.e., without a Tellabs 6008X Signaling Converter plug-on subassembly, the 6132's signaling interface in the 4wire mode is available via the terminal-side and facility-side SX leads and in the 2wire mode, via the A&B leads. When the 6132 is used with a 6008X subassembly, the signaling interface is available via various interface combinations of the following leads, depending upon the subassembly used: facility-side E&M leads, terminal-side E&M leads, facility-side SX or A&B leads, and/or terminal-side SX leads. Signaling information is passed between the 6132 and the 6008X via 15-pin female connectors *J1* and *J2* on the 6132.

6. specifications

Note: *Some specifications may change when a Tellabs 6008X Signaling Converter subassembly is used on the 6132 module; see the applicable Tellabs 6008X practice for specifications affected by the presence of a particular subassembly.*

attenuation and amplification range (transmit and receive)
0 to 24dB of loss or gain in switch-selectable 0.1dB increments

maximum 2wire input and output levels (2wire mode)
+3dBm at 600 ohms
+3dBm at 900 ohms

maximum 4wire input and output levels (any 4wire port)
+5dBm

frequency response (at 600 ohms)
2wire receive path (2wire mode): −1.0, +0.2dB re 1004Hz level, 300 to 1004Hz; −1.0, +0.5dB re 1004Hz level, 1004 to 4000Hz
4wire receive path (4wire mode): −0.9, +0.2dB re 1004Hz level, 300 to 1004Hz; −0.9, +0.5dB re 1004Hz level, 1004 to 4000Hz
2wire transmit path (2wire mode): −1.0, +0.4dB re 1004Hz level, 300 to 1004Hz; −1.0, +0.5dB re 1004Hz level, 1004 to 4000Hz
4wire transmit path (4wire mode): −0.9, +0.2dB re 1004Hz level, 300 to 1004Hz level, 300 to 1004Hz; −0.6, +0.5dB re 1004Hz level, 1004 to 4000Hz

4wire-port terminating impedances (any 4wire port)
600 ohms, balanced

2wire-port terminating impedance
switch-selectable 900 or 600 ohms in series with 2.15μF, balanced

2wire dc current capability
40mA maximum with no significant performance degradation

2wire dc resistance (with A&B leads shorted)
50 ohms nominal

insertion loss (with 0dB gain or loss)
±0.2dB maximum at 600 ohms

total harmonic distortion
less than 1% at maximum output level, 500 to 4000Hz

crosstalk loss between units in adjacent shelf slots
80dB minimum, 200 to 3000Hz

channel-to-channel crosstalk loss (4wire mode)
75dB minimum, 200 to 3000Hz

4wire-port echo return loss (any 4wire port)
20dB minimum vs. 600 ohms

2wire echo return loss (2wire mode)
25dB minimum vs. 600 or 900 ohms in series with 2.15μF

noise (transmit and receive)
17dBrnC maximum at 24dB of gain

peak-to-average ratio (P/AR)
greater than 98

transhybrid loss
30dB ERL minimum with internal CBN inserted and with precision termination on 2wire port

compromise balance network
switch-selectable for 600 ohms, 900 ohms, or a user-adjustable range of 0 to 2000 ohms, all in series with 2.15μF

network build-out (NBO) capacitance
0 to 0.062μF in switch-selectable 0.002μF increments

longitudinal balance
4wire: 60dB minimum, 200 to 1000Hz; 50dB minimum, 4000Hz
2wire: 60dB minimum, 200 to 1000Hz; 50dB minimum, 4000Hz

input power requirements (without 6008X subassembly)
voltage: −22 to −56Vdc, filtered, ground-referenced
current: 45mA idle (typical), 75mA maximum

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.16cm) wide
5.96 inches (15.14cm) deep

weight
9 ounces (255 grams) without 6008X subassembly

mounting
relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf

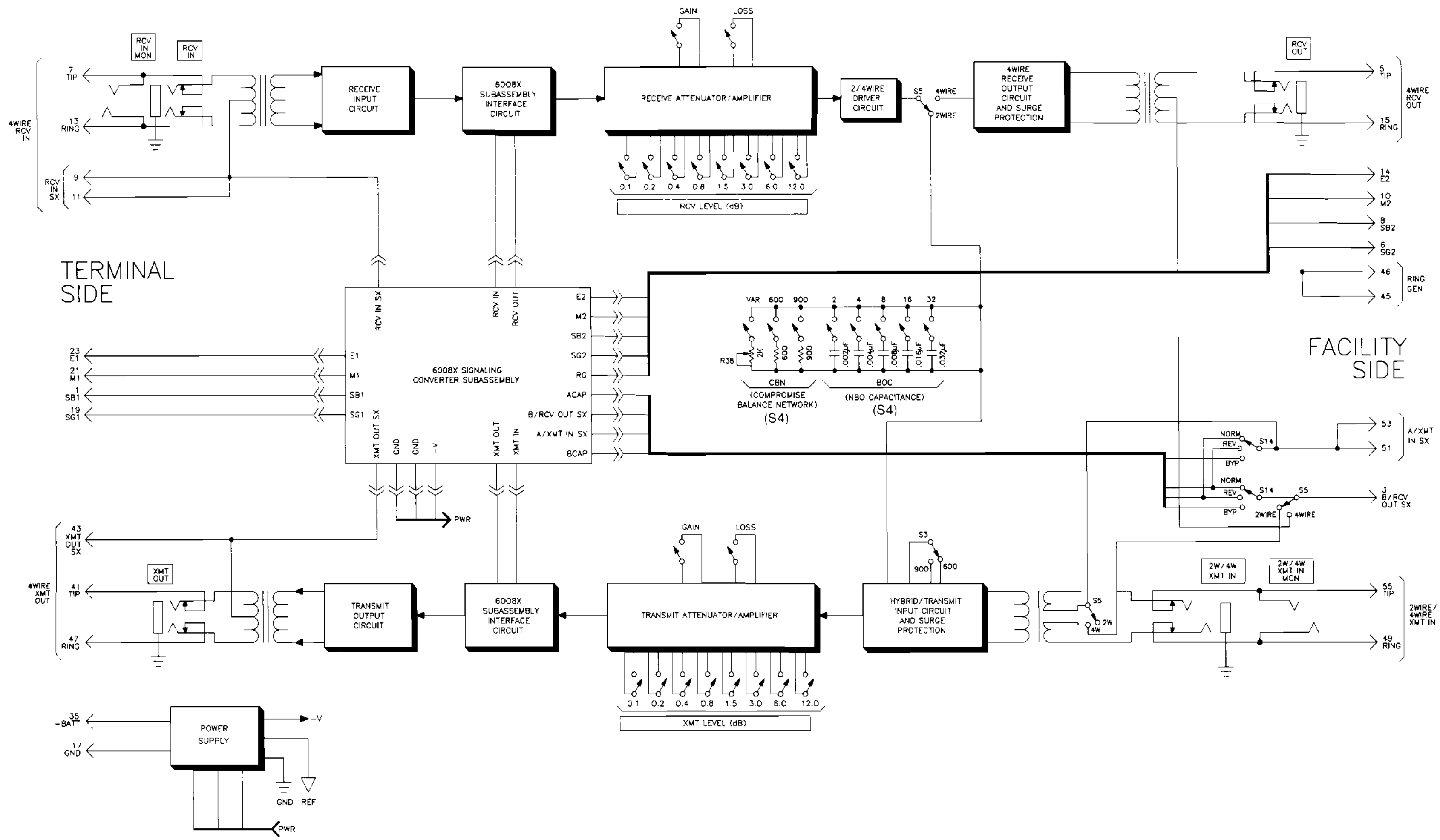
7. testing and troubleshooting

7.01 The **testing guide checklist** in this section may be used to assist in the installation, testing, or troubleshooting of the 6132 2Wire-to-4Wire or 4Wire-to-4Wire Network Terminal Interface Module.

text continued on page 11

TERMINAL SIDE

FACILITY SIDE



6132 2Wire-to-4Wire or 4Wire-to-4Wire Network Terminal Interface Module 816132

5. block diagram

The checklist is intended as an aid in the localization of trouble to this specific equipment. If the equipment is suspected of being defective, substitute new equipment (if possible) and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment. Unauthorized testing or repairs may void its warranty. Also, if the equipment is part of a registered system, unauthorized repairs will result in noncompliance with Parts 15 and/or 68 of the FCC Rules and Regulations.

Note: *Although repair service always includes an attempt to remove any permanent markings made by customers on Tellabs equipment, the success of such attempts cannot be guaranteed. Therefore, if equipment must be marked* **defective** *or* **bad**, *we recommend that it be done on a piece of tape or on a removable stick-on label.*

technical assistance via telephone

7.02 If a situation arises that is not covered in the **testing guide checklist**, contact Tellabs Customer Service as follows:

USA customers: Contact your Tellabs Regional Office listed below.

region	telephone	office location
US Atlantic	(203)798-0506	Danbury, CT
US Capital	(703)359-9166	Washington, DC
US Central	(312)357-7400	Chicago, IL
US Southeast	(305)834-8311	Orlando, FL
US Southwest	(214)869-4114	Dallas, TX
US Western	(714)850-1300	Orange County, CA

Canadian customers: Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)624-0052.

International customers: Contact your Tellabs distributor.

selecting correct product service procedure

7.03 If equipment is diagnosed as defective or if in-service equipment needs repair, follow the **product return procedure** in paragraph 7.04 in all cases except those where a critical service outage exists (e.g., where a system or a critical circuit is down and no spares are available). In critical situations, or if you wish to return equipment for reasons other than repair, follow the **product replacement procedure** in paragraph 7.05.

product return procedure (for repair)

7.04 To return equipment for repair, first contact Tellabs Product Services (see addresses and numbers below) to obtain a Material Return Authorization (MRA). A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the repair transaction). The service representative will then give you an MRA number that identifies your particular transaction. After you obtain the MRA number, send the equipment prepaid to Tellabs (attn: Product Services).

in the USA:
Tellabs, Inc.
4951 Indiana Avenue
Lisle, Illinois 60532
telephone (312)969-8800

in Canada:
Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7
telephone (416)624-0052

Enclose an explanation of the malfunction, your company's name and address, the name of a person to contact for further information, and the purchase order number for the transaction. Be sure to write the MRA number clearly on the outside of the carton being returned. Tellabs will inspect, repair, and retest the equipment so that it meets its original performance specifications and then ship the equipment back to you. If the equipment is in warranty, no invoice will be issued. Should you need to contact Tellabs regarding the status of a repair, call or write the Product Services department at our Lisle or Mississauga headquarters as directed above.

product replacement procedure

7.05 For critical service outages, Tellabs offers a choice of two replacement services (if the product is in replacement stock) in lieu of the 15-day repair and return service described above. These are **overnight express service** (at extra cost) anywhere in the USA and **five-day expedited delivery** (at no extra cost) anywhere in the USA and Canada. To obtain replacement equipment via either of these services, contact your Tellabs Regional Office in the USA or our Canadian headquarters in Mississauga, Ontario, for details, costs (if applicable), and instructions. Telephone numbers are given in paragraph 7.02. A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the replacement transaction). Tellabs will then ship the replacement to you in accordance with the replacement service you request. An invoice in the amount of the replacement's current price plus any applicable service charges will be issued after the replacement is shipped. When you receive the replacement, pack the equipment to be returned in the replacement's carton, sign and enclose the packing list, affix to the carton the preaddressed label provided, and ship the carton prepaid to Tellabs at our USA or Canadian headquarters. When we receive the defective equipment (within 30 days of our issuing the replacement), the invoice will be adjusted to reflect only service charges (if applicable). Please note that OEM, modified, and manufacture-discontinued equipment is not available via overnight express service.

troubleshooting guide on next page

testing guide checklist

Note: *Do not use an unbalanced measuring device or signal source for 2wire level measurements, or erroneous readings will occur.*

test	procedure	normal result	if normal conditions are not met, verify:
receive-path loss or gain, 2wire or 4wire mode	Connect properly terminated TMS (rcv) to *rcv out* jack. Use TMS (xmt) to insert 1004Hz test tone at −18dBm into *rcv in* jack. Vary *rcv level* switches over their entire loss and/or gain range.	Signal level corresponds to loss or gain settings, with maximum loss or gain of 24dB □.	Power □. Wiring □. Impedance terminations (check for double terminations) □. Option switch setting □. Level settings □. Replace 6132 and retest □.
transmit-path loss or gain, 2wire mode	Connect properly terminated TMS (rcv) to *xmt out* jack. Use TMS (xmt) to insert 1004Hz test tone at −18dBm into *rcv out* jack. Vary *xmt level* switches over their entire loss and/or gain range.	Signal level corresponds to loss or gain settings, with maximum loss or gain of 24dB □.	Same as above □.
transmit-path loss or gain, 4wire mode	Connect properly terminated TMS (rcv) to *xmt out* jack. Use TMS (xmt) to insert 1004Hz test tone at 0dBm into *2w/4w xmt in* jack. Vary *xmt level* switches over their entire loss and/or gain range.	Signal level corresponds to loss or gain settings, with maximum loss or gain of 24dB □.	Same as above □.