tellabs
technical manual
76-816461R
rev B

practice section 816461R

6461R Common Signaling Module

contents

1. general description

1.01 The 6461R Common Signaling Module (figure 1) provides transmission interface between a 4wire carrier facility and 2wire or 4wire station equipment or a PBX or CO trunk. When used in a Tellabs 266XR Registered Network Interface System, the 6461R module provides an interface that complies with Part 68 of the FCC Rules and Regulations (refer to Practice section 8X266XR for FCC registration considerations). The 6461R module provides adjustable transmission attenuation and switch-selectable 4wire-to-2wire conversion. As an alternative to 4wire-to-2wire conversion, the 6461R can be switch-optioned to provide a 4wire-to-4wire pad/transformer interface. In addition, the 6461R accepts several types of optional signaling converter plug-on subassemblies that provide various modes of signaling conversion.

1.02 This practice section is revised to correct table 1 in section 3, to correct the block diagram (section 5), and to provide updated echo return loss specifications in section 6.

1.03 Levels in the transmit and receive channels can be individually prescription-set via front-panel switches that introduce from 0 to 24dB of attenuation, in 0.1dB increments, into the 4wire transmit and receive paths.

1.04 An integral two-coil hybrid provides 4wire-to-2wire conversion of the transmission facility. A switch option, however, conditions the 6461R to provide 4wire transmission on both the terminal side and the facility side. With the 4wire terminal-side option selected, the 6461R provides adjustable transmission attenuation and transformer isolation and balance.

1.05 Switchable 600 or 900-ohm terminating impedance is provided on the terminal side of the 6461R when the module is optioned for 2wire loop operation. Terminal-side terminating impedance is fixed at 600 ohms when the module is optioned for 4wire loop operation. The 600 or 900-ohm resistive component at the 2wire port is in series with a 2.15μF capacitive component. On the facility side of the 6461R, terminating impedances are fixed at 600 ohms.

1.06 The 6461R module is designed to accept Tellabs' series of 9961X Signaling Converter and Pulse Link Repeater plug-on subassemblies. The 9961A subassembly, when used on the 6461R, provides conversion between E&M signaling on the 4wire facility and foreign exchange station-end (FXS) loop signaling. The 9961BR subassembly provides conversion between E&M signaling and foreign-exchange office-end (FXO) 2wire-loop or 4wire-simplex signaling. The 9961E subassembly provides pulse-link-repeater capability, i.e., conversion between E&M signaling (E-lead originate) and E&M signaling (E-lead or M-lead originate). Signaling conversion is provided when the 6461R is optioned for either 2wire or 4wire operation. For complete information on the 9961X subassemblies, refer to the separate Tellabs Practices on these subassemblies.

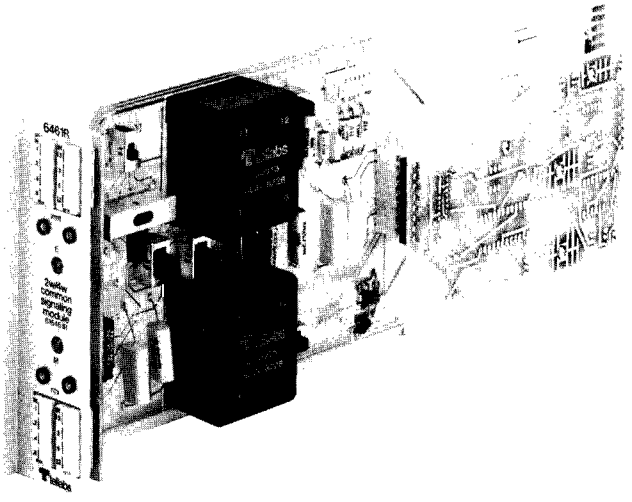


figure 1. 6461R Common Signaling Module

1.07 In the 2wire mode, loop-type signaling is controlled by a 9961A or 9961BR subassembly via A and B leads derived internally on the 6461R module. In the 4wire mode, loop-type signaling can be controlled in either of two ways: (1) if composite signaling (loop-type signaling in the 4wire receive channel) is used, signaling is controlled by a 9961A or 9961BR subassembly via A and B leads derived internally on the 6461R module; or (2) if 4wire simplex signaling is used, signaling is controlled by a 9961A or 9961BR subassembly via SX leads derived internally on the 6461R module (normal or reversed simplex operation can be selected). The signaling mode is selected via a switch option.

1.08 The 6461R contains a cut-and-terminate relay in the receive path. When a 9961BR or 9961E subassembly is used, the cut-and-terminate relay

cuts the receive path and terminates it in both directions when the circuit is idle.

1.09 When the 6461R is optioned for 2wire loop operation, an internal compromise balance network (CBN) automatically provides the same impedance at the hybrid's balance port (600 or 900 ohms in series with 2.15μF) as that selected for the module's 2wire port. Network build-out (NBO) capacitors associated with the balance network provide from 0 to 0.126μF of NBO capacitance in 0.002μF increments. The internal CBN can be switch-optioned out of the circuit when use of a precision balance network (PBN) is preferred. For the 6461R, this PBN is conveniently provided as a Tellabs 993X PBN subassembly, which plugs into a connector on the module's printed circuit board.

1.10 The front panel of the 6461R contains, in addition to the aforementioned attenuation switches, two LED's that light to indicate seizure in either direction (i.e., to indicate E-lead and M-lead status) and test points at both the 4wire transmit output port and the 4wire receive input port.

1.11 When used without an associated 9961X subassembly, the 6461R module is completely passive except for its front-panel LED's and thus requires no external power connections unless it is desired that these LED's be functional. Because the 9961X subassemblies are active devices, however, the 6461R, when equipped with a 9961X, must be powered from filtered, ground-referenced −22 to −56Vdc input. Current requirements are 35mA maximum with one LED on and the CT relay energized. For 9961X current requirements, refer to the separate Tellabs 9961X Practices.

1.12 A Type 15 module, the 6461R module mounts in one position of a Tellabs 266XR Registered Network Interface System assembly or in one position of a Tellabs Type 15 Mounting Shelf. Refer to Practice section 8X266XR for detailed information on the 266XR System assemblies.

2. application

2.01 The 6461R Common Signaling Module is designed specifically for use in the Tellabs 266XR Registered Network Interface System where, in conjunction with a 9961X Signaling Converter or Pulse Link Repeater subassembly, it provides an interface to a privately owned carrier facility in compliance with Part 68 of the FCC Rules and Regulations. The 6461R module and its subassembly perform transmission and signaling conversion and act as a wiring protector, thereby allowing use of non-FCC-registered carrier equipment. The 6461R-9961X combination protects against longitudinal imbalance, hazardous voltages, etc. The carrier owner is responsible for filing an affidavit attesting to the owner's willingness and ability to comply with the signal-power limitations set forth in Part 68 of the FCC Rules and Regulations (see Practice section 8X266XR).

2.02 The following services can be accommodated by the 6461R-9961X combination:

- **2wire OPS.** This requires a 6461R module and a 9961A FXS Signaling Converter subassembly. **Note:** *As of October 1982, no 2wire ground-start or 4wire OPS interfaces are specified in Part 68 of the FCC Rules and Regulations.*
- **2wire CO line or trunk (loop-start or ground-start), 4wire CO line or trunk (loop-start or ground-start), or 2wire loop-start PBX line.** This requires a 6461R module and a 9961BR FXO Signaling Converter subassembly.
- **2wire or 4wire tie trunk with Type I E&M signaling.** This requires a 6461R module and a 9961E Pulse Link Repeater subassembly.

2.03 In applications where the 6461R interfaces a 2wire facility on both sides (2wire-to-2wire transmission), the 6461R is optioned for 4wire-to-4wire transmission and the module's receive path alone is used.

2.04 When a 9961X subassembly is used on a 6461R module optioned for 2wire loop operation, the 6461R's A and B leads are used internally for loop access. With 4wire loop operation, regardless of whether or not a 9961X subassembly is used, the 6461R's transmit-path repeat coil provides A and B leads that are, again, used internally for loop signaling access.

2.05 The 6461R's terminal-side port impedance can be switch-optioned for 600 or 900 ohms (in series with 2.15μF) only when the module is optioned for 2wire loop operation. (The 6461R's terminal-side port impedances are fixed at 600 ohms when the module is optioned for 4wire loop operation, regardless of the settings of the impedance option switches.) The choice of two 2wire port impedances permits interface with a variety of terminal-side facilities and equipment. The 600-ohm option is selected when the 6461R interfaces nonloaded cable or station equipment, while the 900-ohm option is selected when the 6461R interfaces loaded cable or switched networks accessing loaded and nonloaded cable. On the facility side, the impedance at both 4wire ports (transmit output and receive input) is fixed at 600 ohms, as is required for carrier and many nonloaded-cable applications.

2.06 Optioning the 6461R for 2wire loop operation introduces the module's 4wire-to-2wire hybrid into the circuit and configures the terminal-side leads for 2wire operation. Some 2wire applications of the 6461R may require hybrid balance (trans-hybrid loss) greater than that achievable via the module's internal compromise balance network (CBN). For these applications, the CBN can be switch-optioned out of the circuit and a Tellabs 993X Precision Balance Network (PBN) subassembly plugged into a connector on the 6461R's printed circuit board. The 993X subassemblies are available in several versions to approximate the impedances of specific transmission facilities and equipment. Refer to the Tellabs 993X PBN Practice for details.

2.07 The 6461R contains integral network build-out (NBO) capacitors, which are used in conjunction with the balance network in certain applications to achieve optimum hybrid balance (i.e., maximum transhybrid loss). Most often, NBO capacitance is used in conjunction with a PBN for loaded cable. Less frequently, it is used in conjunction with a CBN to compensate for office cable capacitance or for drop build-out (DBO) capacitors on the 2wire loop. From 0 to 0.126μF of NBO capacitance, in 0.002μF increments, can be switch-optioned into the circuit.

2.08 When the 6461R is optioned for 4wire loop operation, the module's transformers, which function as hybrid transformers in 2wire loop operation, function instead as repeat coils, and the terminal-side leads are configured for 4wire composite or simplex signaling.

use with 9961A subassembly

2.09 The 9961A FXS (foreign-exchange, station-end) Signaling Converter subassembly, when mounted on the 6461R module, provides conversion between E&M facility signaling and the loop signaling normally used at the station end of a foreign exchange (FX) circuit. Specifically, the 9961A converts E-lead signals to ringing and tip-ground supervision toward the station and converts loop supervisory and dialing signals from the station to M-lead outputs.

2.10 The 9961A accommodates local ring trip during either ringing or silent intervals and includes an integral ringing interrupter that provides 2-second-on, 4-second-off ringing.

2.11 Use of the 9961A subassembly and associated 6461R module is not restricted to FX applications. The 9961A and 6461R may be used, for example, to provide loop-to-E&M conversion at the station end of an off-premises station (OPS) circuit. Also, automatic ringdown operation can be provided by equipping both ends of an E&M facility with a 6461R and 9961A. For complete information on the 9961A subassembly, refer to the separate Tellabs 9961A Practice.

use with 9961BR subassembly

2.12 The 9961BR FXO (foreign-exchange, office-end) Signaling Converter subassembly, when mounted on the 6461R module, provides conversion between E&M facility signaling and the loop signaling normally used at the office (i.e., switching-equipment) end of a foreign-exchange (FX) circuit. Specifically, the 9961BR converts E-lead signals to loop signaling for operation of the switching equipment and converts loop supervisory and ringing signals from the switching equipment to M-lead outputs.

2.13 Like the 9961A, the 9961BR subassembly is not restricted to FX applications. With its companion 6461R module, the 9961BR can be used to provide loop-to-E&M conversion at the office end of an off-premises station (OPS) circuit. For complete information on the 9961BR, refer to the separate Tellabs 9961B Practice.

use with 9961E subassembly

2.14 The 9961E Pulse Link Repeater subassembly provides conversion between E&M facility signaling (E-lead originate) and E&M loop signaling (E-lead or M-lead originate) and provides wiring protection for the E and M leads. The 9961E subassembly can be used to interface equipment that originates on the E lead to other equipment that also originates on the E lead (e.g., two carrier systems that both originate on the E lead). For complete information on the 9961E, refer to the separate Tellabs 9961E Practice.

3. installation

inspection

3.01 The 6461R Common Signaling 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 6461R mounts in one position of a Tellabs 266XR Registered Network Interface System assembly or in one position of a Tellabs Type 15 Mounting Shelf. The module plugs physically and electrically into a 44-pin connector at the rear of the assembly or shelf.

installer connections

3.03 In most cases, the 6461R module will be installed in 266XR System assemblies that have connectorized backplates. External connections are made via connectorized cables that plug into connectors on the backplate of the assembly. Before inserting modules into the assembly, verify all external connections and input fusing, and ensure that each module is properly optioned.

3.04 If Type 15 Shelves without connectorized backplates are used, external connections to the 6461R are made via wire-wrapping to the 44-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector. Again, modules should be put into place only after verifying wiring, fusing, and option selection. Table 1 lists external connections required when nonconnectorized Type 15 Shelves are used.

options

3.05 All options in the 6461R are selected via slide or DIP switches located as shown in figure 2. Table 2 lists these options and indicates the option choices, which are described in paragraphs 3.06 through 3.11.

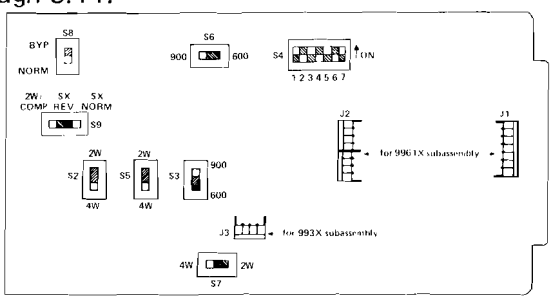


figure 2. 6461R option switch locations

connect:	to pin:
4W XMT OUT T (4wire transmit out tip)*	10
4W XMT OUT R (4wire transmit out ring)*	8
4W RCV IN T (4wire receive in tip)*	42
4W RCV IN R (4wire receive in ring)*	44
4W XMT IN T (4wire transmit in tip)**	9
4W XMT IN R (4wire transmit in ring)**	7
2W/4W RCV OUT T (2wire tip or 4wire receive out tip)**	41
2W/4W RCV OUT R (2wire ring or 4wire receive out ring)**	43
E LEAD	25
M LEAD	21
E1 LEAD	3
M1 LEAD	22
RG (ring generator)	20
RGB (ring generator dc ringing bias)	16
−BATT (−22 to −56Vdc filtered input)	39
GND (ground)	1

*facility side **terminal side

table 1. External connections to 6461R

3.06 Switch *S8* conditions the module's A and B leads for use with or without a 9961X subassembly. When a 9961X **is not** used, set *S8* to the *BYP* position to provide A&B-lead continuity through the module. When a 9961X is used, set *S8* to the *NORM* position to connect the A&B-lead path through the subassembly, and plug the subassembly into connectors *J1* and *J2*.

switch	option	function
S8	NORM or BYP	conditions module for use with (NORM position) or without (BYP position) 9961X Signaling Converter subassembly
S2, S5, and S7	2W or 4W	condition module for 2wire or 4wire loop operation
S9	2W/COMP, SX NORM, or SX REV	selects 2wire-loop or 4wire-composite signaling (2W/COMP position), normal SX signaling (SX NORM position), or reversed SX signaling (SX REV position).
S3* and S6*	600 or 900	condition module for 600 or 900-ohm 2wire port impedance
S4-7*	on (closed) or off (open)	includes (on) or excludes (off) internal compromise balance network from circuit
S4-1* S4-2* S4-3* S4-4* S4-5* S4-6*	on (closed) or off (open)	0.002μF 0.004μF 0.008μF 0.016μF 0.032μF 0.064μF when on, introduce indicated amounts of NBO capacitance

*functional only when 6461R is optioned for 2wire loop operation

table 2. 6461R switch options

Caution: *Connector* J1 *on the 6461R module is a 7-pin female connector; plug* P1 *on the 9961A and 9961BR subassemblies is a 6-pin male connector. Therefore, when mounting the 9961A or 9961BR subassembly on the 6461R module, there will be an extra hole on* J1 *that does not mate with a pin on* P1. *Ensure that this extra hole is at the top of* J1, *that is, toward the top of the 6461R module.*

3.07 Switches *S2, S5,* and *S7* condition the 6461R for either 2wire or 4wire loop operation. Set *S2, S5,* and *S7* to their *2W* positions to introduce the module's integral 4wire-to-2wire hybrid into the circuit and configure the terminal-side leads for 2wire loop operation. Set *S2, S5,* and *S7* to their *4W* positions to arrange the module's transformers and terminal-side leads for 4wire loop operation.

3.08 Switches *S3* and *S6* condition the 6461R for 600 or 900-ohm terminal-side port impedance **only** when the module is optioned for 2wire loop operation. Both switches must be set to their *600* or *900* positions to derive proper terminating impedances at the 2wire port. Switch *S6* also automatically selects the proper internal compromise balance network impedance. When the 6461R is optioned for 4wire loop operation, *S3* and *S6* need not be set to a particular position, as fixed 600-ohm terminating impedance is provided at the terminal-side (4wire) ports regardless of the settings of *S3* and *S6*.

3.09 Switch *S9* conditions the 6461R module for either 2wire-loop or 4wire-composite signaling, normal SX signaling, or reversed SX signaling (see paragraph 1.07). For 2wire-loop or 4wire-composite signaling, set *S9* to the *2W/COMP* position. For normal SX signaling (the internal A and B leads are connected to the receive and transmit transformer center taps, respectively), set *S9* to the *SX NORM* position. For reversed SX signaling (the internal A and B leads are connected to the transmit and receive transformer center taps, respectively), set *S9* to the *SX REV* position.

3.10 Seven-position DIP switch *S4* is associated with the 6461R's internal compromise balance network (CBN) and is functional only when the module is optioned for 2wire loop operation. (Optioning the 6461R for 4wire loop operation automatically excludes the 4wire-to-2wire hybrid and internal compromise network from the circuit and disables switch *S4*.) Six positions of *S4* are used to introduce network build-out (NBO) capacitance (see paragraph 3.11). The seventh position permits a separate precision balance network (in the form of a Tellabs 993X plug-on PBN subassembly) to be used instead of the internal compromise network. When the module's internal CBN is to be used, set position *7* of switch *S4* to the *on* (closed) position to include the CBN in the circuit. When a 993X PBN subassembly is to be used, set *S4-7* to the *off* (open) position to exclude the CBN and plug the subassembly into connector *J3*.

3.11 Network build-out capacitance is introduced via positions *1* through *6* of switch *S4*. Values of these switch positions are listed in table 2. These values are additive; thus, the amount of NBO capacitance introduced is the sum of the positions set to the *on* (closed) position. These switches are to be set during the alignment procedure. **Do not** set these switches without first reading paragraph 3.15.
Note: *At this point, all option switches except the NBO capacitance switches should be set, and the required subassemblies should be plugged into their connectors.*

alignment: 2wire option

3.12 When the 6461R is optioned for 2wire loop operation, alignment consists of adjusting the levels at the 4wire ports (via the module's front-panel attenuation switches) to meet circuit requirements and introducing NBO capacitance as required to maximize transhybrid loss. Align the 6461R as directed below.

Note 1: *If the 6461R is equipped with a 9961X Signaling Converter subassembly, the circuit must be seized locally to remove the idle-line termination inserted by the subassembly.*

Note 2: *The following alignment procedure will be expedited if a Tellabs 9805 Card Extender or an external jackfield is used to access the module's 2wire and 4wire ports. If a card extender or jackfield is not used, these ports can be accessed via the module's connector pins or front-panel test points. However, when applying tone with the transmission measuring set (TMS) (as described below),* **the corresponding facility leads must be temporarily disconnected** *to avoid double termination. Also, when measuring tone,* **the TMS must be arranged for bridging measurement** *(the corresponding facility leads need not be removed). In the following procedure, pin numbers and front-panel test point designations are given in parentheses to permit alignment without a card extender or jackfield.*

Note 3: *Due to the signal-flow conventions defined in Part 68 of the FCC Rules and Regulations, the jack designations on the 9805 Card Extender do not correspond to the 6461R's port designations. In the following alignment procedure, the 9805 Card Extender's front-panel designations are used.*

3.13 Adjust the **transmit attenuator** as follows:

A. Arrange the xmt portion of a TMS for 1000Hz tone output at the level specified for the circuit. If the TMS has a separate xmt impedance setting, select the impedance specified for the circuit. Insert this signal into the *rcv in module* jack on the 9805 Card Extender (pins 41 and 43).
B. Arrange the rcv portion of the TMS for 600-ohm terminated measurement, and measure the transmit level at the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points).
C. Set the front-panel *xmt* attenuation switches to derive the level specified for the circuit.

3.14 Adjust the **receive attenuator** as follows:

A. Arrange the transmit portion of the TMS for 1000Hz tone output at the level specified for the circuit. If the TMS has a separate xmt impedance setting, select 600 ohms. Insert this signal into the *rcv out module* jack on the 9805 Card Extender (pins 42 and 44 or front-panel *rcv* test points).
B. Arrange the rcv portion of the TMS for 600 or 900-ohm terminated measurement (as appropriate), and measure the receive level at the *rcv in module* jack (pins 41 and 43).
C. Set the front-panel *rcv* attenuation switches to derive the level specified for the circuit.

3.15 Introduce **NBO capacitance** as directed below:

Note 1: *Before beginning this procedure, ensure that* **no** *NBO capacitance is introduced by setting positions* 1 *through* 6 *of DIP switch* S4 *to the* OFF *(open) position.*

Note 2: *Before NBO capacitance is introduced, the module must be conditioned for the type of balance network being used. If this is the module's internal CBN, ensure that position 7 of DIP switch* S4 *is set to* ON *(closed). If this is a Tellabs 993X PBN subassembly, ensure that* S4-7 *is set to* OFF *(open) and that the PBN is aligned as directed in its separate Tellabs practice.*

A. Arrange the xmt portion of the TMS for 2000Hz tone output at the level specified for the circuit. If the TMS has a separate xmt impedance setting, select 600 ohms. Insert this signal into the *rcv out module* jack on the 9805 Card Extender (pins 42 and 44 or front-panel *rcv* test points).
B. Arrange the rcv portion of the TMS for 600-ohm terminated measurement and connect it to the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points).
C. Seize the circuit (the 2wire facility must be connected to pins 41 and 43 for this measurement) and add NBO capacitance via DIP switches *S4-1* through *S4-6* until the measured signal level is at its **minimum**. A more precise adjustment may be achieved if the test frequency is varied over the voice band as the NBO adjustment is made.

alignment: 4wire option

3.16 When the 6461R is optioned for 4wire loop operation, alignment consists of setting the levels at the facility-side 4wire ports (via the module's front-panel attenuation switches) to meet circuit requirements. Align the 6461R as directed below.

Note 1: *The following alignment procedure will be expedited if a Tellabs 9805 Card Extender or an external jackfield is used to access the module's 4wire ports. If a card extender or jackfield is not used, these ports can be accessed via the module's connector pins or front-panel test points. However, when applying tone with the transmission measuring set (TMS) (as described below),* **the corresponding facility leads must be temporarily disconnected** *to avoid double termination. Also, when measuring*

tone, **the TMS must be arranged for bridging measurement** *(the corresponding facility leads need not be removed). In the following procedure, pin numbers and front-panel test point designations are given in parentheses to permit alignment without a card extender or jackfield.*

Note 2: *Due to the signal-flow conventions defined in Part 68 of the FCC Rules and Regulations, the jack designations on the 9805 Card Extender do not correspond to the 6461R's port designations. In the following alignment procedure, the 9805 Card Extender's front-panel designations are used.*

3.17 Adjust the **transmit attenuator** as follows:

A. Arrange the xmt portion of a TMS for 1000Hz tone output at the level specified for the circuit. If the TMS has a separate xmt impedance setting, select 600 ohms. Insert this signal into the *xmt out module* jack on the 9805 Card Extender (pins 9 and 7).
B. Arrange the rcv portion of the TMS for 600-ohm terminated measurement, and measure the transmit level at the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points).
C. Set the front-panel *xmt* attenuation switches to derive the level specified for the circuit.

3.18 Adjust the **receive attenuator** as follows:

A. Arrange the xmt portion of the TMS for 1000Hz tone output at the level specified for the circuit. If the TMS has a separate xmt impedance setting, select 600 ohms. Insert this signal into the *rcv out module* jack on the 9805 Card Extender (pins 42 and 44 or front-panel *rcv* test points).
B. Arrange the rcv portion of the TMS for 600-ohm terminated measurement, and measure the receive level at the *rcv in module* jack (pins 41 and 43).
C. Set the front-panel *rcv* attenuation switches to derive the level specified for the circuit.

4. circuit description

Note: *The following circuit description covers only the 6461R module itself; the 9961X subassemblies are covered in the separate Tellabs Practices on these units. Please refer to the associated block diagram (section 5) as an aid in understanding the circuit description.*

4.01 The 6461R Common Signaling Module, when switch-optioned for 2wire loop operation, is a conventional two-transformer hybrid 4wire-to-2wire terminating set that uses capacitive tuning of the 2wire port. Trimming capacitors across both 4wire ports and the balance port mitigate the effects of interwinding capacitances. Trimming resistors across the 4wire ports compensate for dc resistance of both the primary and the secondary windings. The 2wire port impedance is selected via switchable taps on the 4wire ports of both transformers. Adjustable T-pad attenuators in the 4wire transmit and receive paths provide a means of level coordination in each direction of transmission.

4.02 When the 6461R is switch-optioned for 4wire loop operation, its two transformers function as repeat coils and the integral compromise balance network is excluded from the circuit. In this configuration, the 6461R provides adjustable transmission attenuation and transformer isolation and balance on the terminal side.

6. specifications

terminal-side port impedance(s)
2wire option: 600 or 900 ohms, switch-selectable, in series with 2.15μF
4wire option: 600 ohms, resistive

facility-side port impedances
600 ohms, resistive

attenuation range
transmit and receive: 0 to 24dB in 0.1dB increments, switchable

transhybrid loss
44dB minimum, 200 to 4000Hz (measured with open or short on 2wire port and matched termination on balance network port)

echo return loss
2wire option: 30dB minimum vs. 600 or 900 ohms
4wire option: 15dB minimum vs. 600 ohms

insertion loss
2wire option: 4.5dB maximum at 1000Hz
4wire option: 1.2dB maximum at 1000Hz

frequency response
2wire option: +0.5, −1.5dB re 1000Hz level, 300 to 4000Hz
4wire option: ±1.0dB re 1000Hz level, 300 to 4000Hz

facility longitudinal balance
60dB minimum, 200 to 4000Hz, any port

balance network
internal compromise network, 600 or 900 ohms in series with 2.15μF

NBO capacitance
0 to 0.126μF in 0.002μF increments, switchable

dc current capability
no performance degradation for A&B-lead current up to 100mA

input power requirements
voltage: −22 to −56Vdc filtered, ground-referenced
current: 35mA maximum with one LED on and CT relay energized; for 9961X current requirements, refer to separate Tellabs 9961X Practices

operating environment
20° to 130°F (−7° to 54°C), humidity to 95% (no condensation)

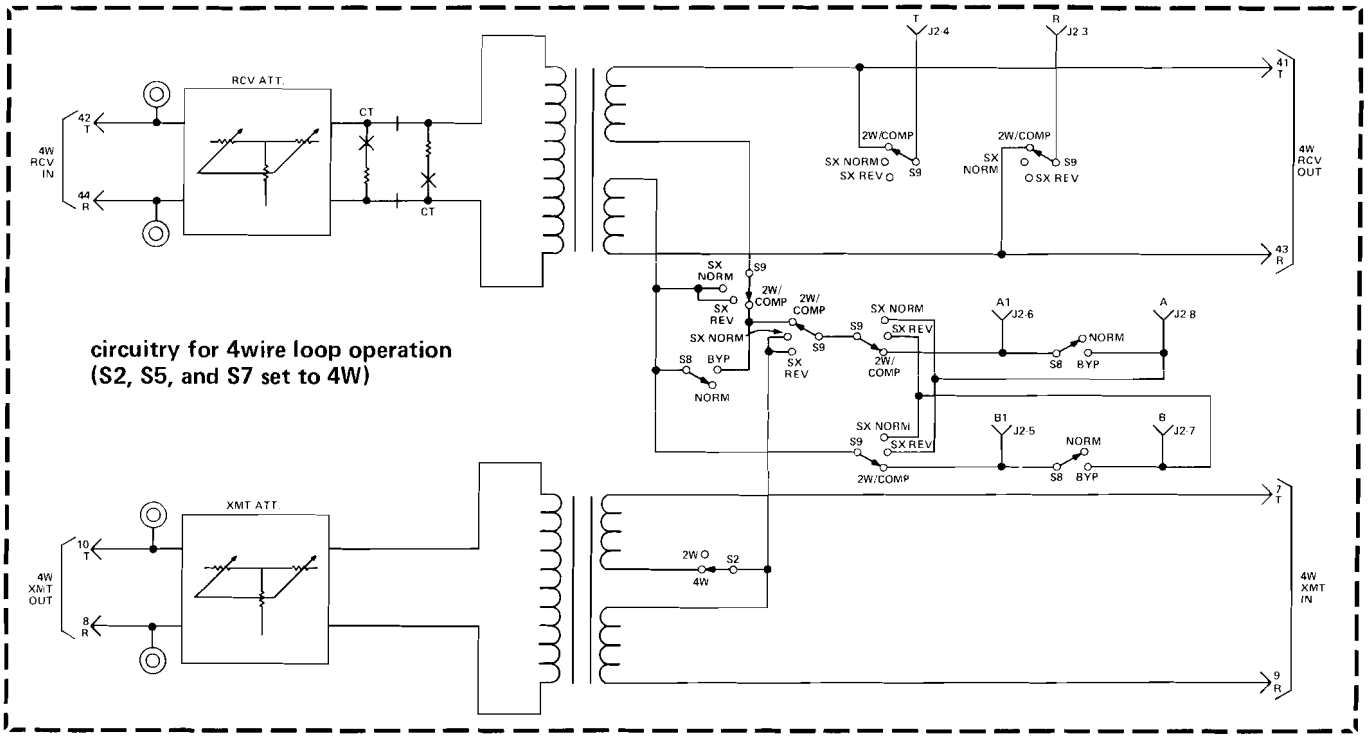
dimensions
4.95 inches (12.57cm) high
1.42 inches (3.61cm) wide
12.94 inches (32.87cm) deep

weight
22 ounces (0.624kg)

mounting
relay rack via one position of Tellabs Type 15 Mounting Shelf

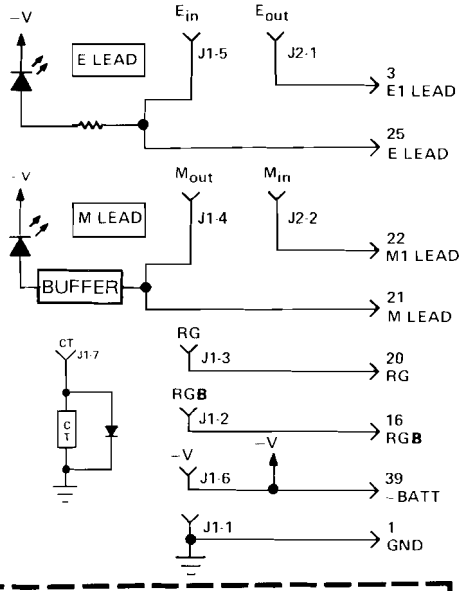
7. testing and troubleshooting

7.01 The *testing guide checklist* in this section may be used to assist in the installation, testing, or troubleshooting of the 6461R Common Signaling module. The checklist is intended as an aid in the

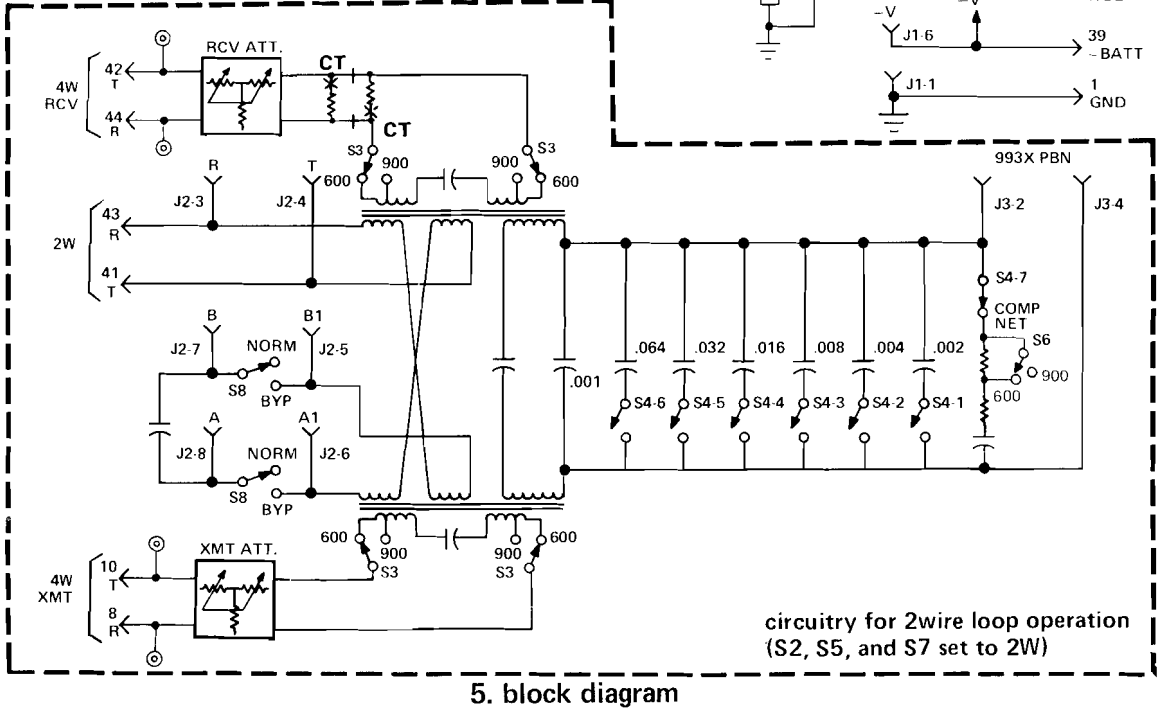


circuitry for 4wire loop operation
(S2, S5, and S7 set to 4W)

Note: *Switches S5 and S7 are not shown in the 4wire mode diagram, and switches S2, S5, and S7 are not shown in the 2wire mode diagram. These three siwtches condition the 6461R for either 2wire or 4wire loop operation and cannot be shown without making the block diagram inordinately complex.*



circuitry common to
both 2wire and 4wire
loop operation



circuitry for 2wire loop operation
(S2, S5, and S7 set to 2W)

5. block diagram

localization of trouble to a specific module. If a module is suspected of being defective, a new one 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 as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 6461R module. Unauthorized testing or repairs may void the module's warranty. Also, if the module is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

Note: *Warranty service does not include removal of permanent customer markings on the front panels of Tellabs modules, although an attempt will be made to do so. If a module must be marked* **defective,** *we recommend that it be done on a piece of tape or on a removable stick-on label.*

7.02 If a situation arises that is not covered in the checklist, contact Tellabs Customer Service as follows (telephone numbers are given below):

USA customers: Contact Tellabs Customer Service at your Tellabs Regional Office.

Canadian customers: Contact Tellabs Customer Service at our Canadian headquarters in Mississauga, Ontario.

International customers: Contact your Tellabs distributor.

US Atlantic Region: (203) 798-0506
US Capital Region: (703) 478-0468
US Central Region: (312) 357-7400
US Southeast Region: (305) 834-8311
US Southwest Region: (214) 869-4114
US Western Region: (714) 850-1300
Canada: (416) 624-0052

7.03 If a 6461R is diagnosed as defective, follow the *replacement* procedure in paragraph 7.04 when a critical service outage exists (e.g., when a system or a critical circuit is down and no spares are available). If the situation is not critical, follow the *repair and return* procedures in paragraph 7.05.

replacement

7.04 To obtain a replacement 6461R module, notify Tellabs via letter or telephone (see addresses and numbers below), or via TWX (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X6461R part number that indicates the issue of the module in question. Upon notification, we shall ship a replacement module to you. If the module in question is in warranty, the replacement will be shipped at no charge. Pack the defective 6461R in the replacment module's carton, sign the packing slip included with the replacement, 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 module prepaid to Tellabs.

repair and return

7.05 Return the defective 6461R module, shipment prepaid, to Tellabs (attn: repair and return).

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 module's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

testing guide checklist

Note 1: *The following test procedure will be expedited if a Tellabs 9805 Card Extender or an external jackfield is used to access the module's 2wire and 4wire ports. If a card extender or jackfield is not used, these ports can be accessed via the module's connector pins or front-panel test points. However, when applying tone with the transmission measuring set (TMS) (as described below),* **the corresponding facility leads must be temporarily disconnected** *to avoid double termination. Also, when measuring tone,* **the TMS must be arranged for bridging measurement** *(the corresponding facility leads need not be removed). In the following procedure, pin numbers and front-panel test point designations are given in parentheses to permit testing without a card extender or jackfield.*
Note 2: *Due to the signal-flow conventions defined in Part 68 of the FCC Rules and Regulations, the jack designations on the 9805 Card Extender do not correspond to the 6461R's port designations. In the following test procedure, the 9805 Card Extender's front-panel designations are used.*
Note 3: *For testing and troubleshooting information on the 9961X subassemblies, refer to the separate Tellabs Practices on these units.*

test	test procedure	normal result	if normal conditions are not met, verify:
2wire option: transmit level	Arrange the xmt portion of a TMS for 1000Hz tone output at the impedance and level specified for the circuit. Insert this signal into the *rcv in module* jack (pins 41 and 43). Arrange the rcv portion of the TMS for 600-ohm terminated measurement and connect it to the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points). Measure the transmit level.	Level within ±0.2dB of specified level, and variable as *xmt* attenuator is adjusted ☐.	Switches *S2, S5,* and *S7* set to *2W* ☐. Impedance switches properly set ☐. If level is too high and the receive portion of the TMS is connected to pins 10 and 8 or front-panel *xmt* test points, circuit may be singing; remove external connections to pins 10 and 8 and retest. If levels now normal, check levels and terminations throughout circuit ☐. If not normal, replace 6461R and retest ☐.
2wire option: receive level	Arrange the xmt portion of the TMS for 1000Hz tone output at 600-ohm impedance and the level specified for the circuit. Insert this signal into the *rcv out module* jack (pins 42 and 44 or front-panel *rcv* test points). Arrange the rcv portion of the TMS for terminated (600 or 900 ohms as required) measurement and connect it to the *rcv in module* jack (pins 41 and 43). Measure the receive level.	Level within ±0.2dB of specified level, and variable as *rcv* attenuator is adjusted ☐.	Switches *S2, S5,* and *S7* set to *2W* ☐. Impedance switches properly set ☐. Replace 6461R and retest ☐.
2wire option: return loss	Arrange the xmt portion of the TMS for 2000Hz tone output at 600-ohm impedance and the level specified for the circuit. Insert this signal into the *rcv out module* jack (pins 42 and 44 or front-panel *rcv* test points). Arrange the rcv portion of the TMS for 600-ohm terminated measurement and connect it to the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points). Seize the circuit and measure the 4wire transmit level.	Signal level at 4wire transmit port below alignment level by required amount (a minimum 10dB singing point margin is suggested) ☐.	Option switch *S4-7* set to *off* (open) if external precision balance network (993X) used ☐. Switch *S4-7* set to *on* (closed) if external PBN not used ☐. Switches *S3* and *S6* set properly ☐. 2wire connection to pins 41 and 43 intact ☐. Front-panel *xmt* and *rcv* attenuators properly adjusted ☐. NBO capacitor selection ☐. Replace 6461R and retest ☐.

checklist continued on next page

test	test procedure	normal result	if normal conditions are not met, verify:
4wire option: transmit level	Arrange the xmt portion of a TMS for 1000Hz tone output at 600-ohm impedance and the level specified for the circuit. Insert this signal into the *xmt out module* jack (pins 9 and 7). Arrange the rcv portion of the TMS for 600-ohm terminated measurement and connect it to the *xmt in module* jack (pins 10 and 8 or front-panel *xmt* test points). Measure the transmit level.	Level within ±0.2dB of specified level, and variable as *xmt* attenuator is adjusted ☐.	Switches *S2, S5,* and *S7* set to *4W* ☐. Impedance switches properly set ☐. Replace 6461R and retest ☐.
4wire option: receive level	Arrange the xmt portion of the TMS for 1000Hz tone output at 600-ohm impedance and the level specified for the circuit. Insert this signal into the *rcv out module* jack (pins 42 and 44 or front-panel *rcv* test points). Arrange the rcv portion of the TMS for 600-ohm terminated measurement and connect it to the *rcv in module* jack (pins 41 and 43). Measure the receive level.	Level within ±0.2dB of specified level, and variable as *rcv* attenuator is adjusted ☐.	Switches *S2, S5,* and *S7* set to *4W* ☐. Impedance switches properly set ☐. Replace 6461R and retest ☐.