

9961A Signaling Converter FXS Subassembly

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1. general description

1.01 The 9961A Signaling Converter FXS (foreign exchange, station) subassembly (figure 1) provides conversion between E and M signaling and loop signaling conventionally used at the station end of a foreign exchange (FX) or off-premise extension (OPX) circuit. It may also be used at both ends of an E and M facility to provide automatic ringdown operation. Specifically, the 9961A converts E-lead signals to ringing and tip-ground supervision toward the station and converts loop supervisory and dialing signals originating at the station to M-lead output.

1.02 The 9961A subassembly is designed expressly for use with the Tellabs 6461 Common Signaling (2Wire/4Wire) Module. The 9961A makes electrical and physical connection to the 6461 by means of male connectors on the 9961A and receptacles on the module's printed circuit board. A standoff mounting near the center of the subassembly adds rigidity. *The 6461 module provides transmission interface between a 4wire facility and 2wire or 4wire telephone station equipment or a PBX trunk. Both adjustable transmission level control (attenuation) and switch-selectable 4wire-to-2wire or 4wire-to-4wire interface are provided. In the 4wire-to-2wire mode, the 6461 functions, in effect, as a hybrid terminating set; in the 4wire-to-4wire mode, it functions as a pad/transformer. In addition, the 6461 may (and, in most applications, will) be equipped with a Tellabs 9961X Signaling Converter subassembly such as the 9961A described herein. These subassemblies are available in several versions to provide various modes of loop-to-E and M conversion. For complete information on the 6461 module and the other 9961X subassemblies, refer to their respective Tellabs Practices.*

1.03 Functions, options, and features of the 9961A include the following: switch-selectable normal or inverted E-lead operation; switch-selectable 2-second-on, 4-second-off ringing interruption; ring-up and ring-trip circuitry compatible with any type of biased ringing arrangement; M-lead current limiting; transient suppression during dialing and idle; and idle circuit termination.

1.04 Input power is supplied to the 9961A subassembly via the host 6461 module. A voltage reg-

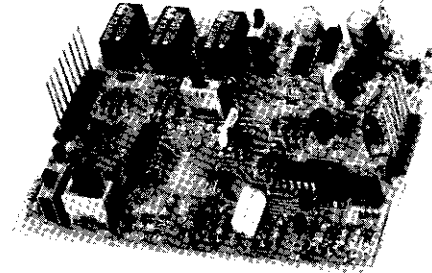


figure 1. 9961A Signaling Converter FXS subassembly
ulator integral to the subassembly permits operation on -22 to -56Vdc input. Current requirement is 70mA plus loop current. Both M-lead and B-lead power are derived from input power prior to regulation to allow operation with conventional external M-lead and B-lead potentials.

1.05 Reliable operation in the presence of large longitudinal voltages is ensured through use of precision-balanced loop current detection circuitry.

1.06 As stated above, the 9961A plugs onto the printed circuit board of its host 6461 module. The 6461, in turn, plugs into one position of the Tellabs Type 15 Mounting Shelf, versions of which are available for 19 and 23 inch relay rack installation. All Type 15 Shelves accommodate up to 12 modules and occupy 3 mounting spaces (5¼ vertical inches) in a standard relay rack.

2. application

2.01 The 9961A Signaling Converter FXS subassembly, when mounted on a host 6461 Common Signaling Module, interfaces a 4wire E and M transmission facility (typically, a carrier channel) with a termination employing loop signaling of the type conventionally used at the station end of a foreign exchange (FX) or off-premise extension (OPX) circuit. This termination may be either 2wire or 4wire telephone station equipment. (The host 6461 module accommodates either 2wire or 4wire loop operation via a switch option on the module.)

2.02 Use of the 9961A and host 6461 module is not limited to FX and OPX applications. Automatic ringdown operation may be provided, if desired, by equipping both ends of an E and M facility with a 6461 and 9961A.

2.03 The 9961A provides dial pulse transient suppression in FX and OPX applications and idle circuit termination in all applications.

2.04 In any of its intended applications, the 9961A may be switch-optional for loop-start or ground-start operation and for normal or inverted E-lead operation. During **normal** E-lead operation, receipt of incoming E-lead open in the loop-start

mode or ground in the ground-start mode is interpreted as incoming seizure and activates local ringing. During **inverted** E-lead operation, receipt of incoming E-lead ground in the loop-start mode or open in the ground-start mode is interpreted as incoming seizure and activates local ringing. In the ground-start mode only, receipt of incoming E-lead ground (normal operation) or open (inverted operation) also causes the tip lead to be connected to ground. Local ringing (either continuous or interrupted, depending upon optioning; see paragraph 2.05) persists throughout the duration of the incoming seizure condition, as does the tip-ground connection in the ground-start mode.

2.05 In all applications (FX, OPX, and ringdown), ringing energy to a station must be provided from a local ringing source. In FX and OPX loop-start applications, the 9961A must be optioned for continuous ringing, in which case the 9961A follows central office ringing. In FX and OPX ground-start applications and in all ringdown applications, either interrupted (2-second-on, 4-second-off) or continuous ringing may be selected.

2.06 To accommodate local ring trip during the ringing interval, some type of dc ringing bias must be provided. Either negative or positive superimposed ringing or grounded ringing may be employed to this end. (In superimposed ringing applications, one side of the ringing generator is connected through the 9961A to the ring side of the line; the other side of the ringing generator is connected to a dc potential, e.g., office battery. In grounded ringing applications, one side of the ringing generator is connected through the 9961A to the ring side of the line; the other side of the ringing generator is connected to ground; and an external dc potential must be provided between the ring generator bias lead of the 9961A and ground.) An option switch on the 9961A conditions the subassembly for superimposed or grounded ringing.

2.07 While all internal circuitry of the 9961A receives power via an internal regulator that permits operation on -22 to -56Vdc input, M-lead and B-lead potentials are derived directly from the external power source. This means that, if the associated carrier channel unit (or other facility-side signaling equipment) requires a -48Vdc M-lead potential, the 9961A **must** be powered from a nominal -48Vdc source. This also means that loop sensing limits are dependent upon the external source. Loop sensing circuitry in the 9961A will operate to 3000 ohms at -48Vdc and to 1200 ohms at -24Vdc. Loop limits (cable plus station instrument) for 23mA loop current are 1600 ohms at -48Vdc and 650 ohms at -24Vdc B-lead potentials. In applications involving a short loop (100 ohms or less), -24Vdc operation is recommended.

3. installation inspection

3.01 The 9961A Signaling Converter FXS subassembly 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 subassembly should be visually inspected again prior to installation.

mounting and connections

3.02 The 9961A subassembly makes physical and electrical connection to the host 6461 module via six-pin connector *P1* and eight-pin connector *P2* located on the component side of the subassembly. Connector *P1* on the 9961A plugs into receptacle *J1* on the 6461, and connector *P2* plugs into receptacle *J2*. The subassembly is further secured to the 6461's printed circuit board via a standoff mounting. Connections to the subassembly and their corresponding pinouts on the host 6461 module are listed in table 1.

9961A connector pin*	designation/function	externally accessible via 6461 pin
P1-1	GND (ground input)	1
P1-6	-BATT (battery input)	39
P2-8	A LEAD (external)	7
P2-7	B LEAD (external)	9
P1-3	RING GEN (ring generator)	20
P1-2	RING GEN BIAS (ring generator dc ringing bias)**	16**
P1-5	E1 LEAD	25
P1-4	M1 LEAD	21
P2-4	TIP LEAD	41
P2-6	A1 LEAD (internal)	none
P2-5	B1 LEAD (internal)	none
P2-1	none	none
P2-2	none	none
P2-3	none	none

* Corresponding receptacles on 6461 module are designated J1-1, J1-6, J2-8, etc., respectively.
 ** This connection is required only in grounded ringing applications (see paragraph 2.05).

table 1. Connections to 9961A subassembly via host 6461

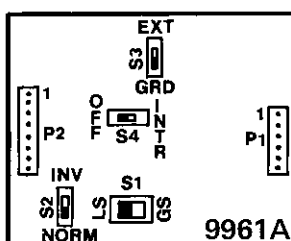


figure 2. Switch locations

options and alignment

3.03 No alignment of the 9961A subassembly is required. Before the subassembly is placed into service, however, four option switches must be set. Locations of these switches on the subassembly are shown in figure 2.

3.04 Option switch *S1* conditions the subassembly for loop-start or ground-start operation. Set *S1* to the *LS* position for loop-start operation or to the *GS* position for ground-start operation.

3.05 Option switch *S2* conditions the subassembly for normal or inverted E-lead operation. Set *S2* to the *NORM* position for normal E-lead operation or to the *INV* position for inverted E-lead operation (see paragraph 2.04).

3.06 Option switch *S3* conditions the subassembly for superimposed or grounded ringing. If the local ringing source is referenced to a dc potential (superimposed ringing), set *S3* to the *GRD* (internal

ground) position. If the ringing source is grounded, set *S3* to the *EXT* (external battery) position and connect a source of dc potential (± 24 or ± 48 Vdc) to the ring generator bias lead (pin 16) of the host 6461 module.

3.07 Option switch *S4* is used to select continuous or interrupted ringing. Set *S4* to the *OFF* position if continuous ringing is desired at the local station. Set *S4* to the *INTR* position if interrupted ringing (2 seconds on, 4 seconds off) is desired.

Note: In *FX* and *OPX* loop-start applications, switch *S4* must be set to the *OFF* position to ensure proper ringing operation.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 9961A Signaling Converter FXS subassembly for engineering and application purposes only. Attempts to troubleshoot the 9961A internally are not recommended. Troubleshooting procedures should be limited to those prescribed in section 7 of this Practice. Refer to the block diagram, section 5 of this Practice, as an aid in understanding the circuit description.

4.02 The 9961A provides ringing and loop supervision toward a PBX trunk circuit or a local telephone instrument. Incoming E-lead signaling to the 9961A is detected via an E-lead sensing circuit. Option switch *S2* (for selection of normal or inverted E-lead operation) derives the appropriate logic state for control of local ringing and, in the ground-start operating mode, for application of ground to the local tip lead. Selection of the loop-start or ground-start mode is made via option switch *S1*. In the loop-start mode and with normal E-lead operation, an incoming E-lead open will activate the ring-up (RU) relay after a nominal delay of 100ms. The RU relay, when activated, applies ringing to the local loop. In the loop-start mode and with inverted E-lead operation, an incoming E-lead ground will activate the RU relay.

4.03 When the 9961A is optioned for ground-start operation, a sensing circuit operating from the E lead activates the tip-ground (TG) relay upon receipt of E-lead ground (normal E-lead operation) or E-lead open (inverted E-lead operation) to provide local tip-lead ground. This same E-lead input also activates the RU relay, which applies ringing to the local loop. A nominal 50ms delay occurs between E-lead seizure and local application of tip-lead ground.

4.04 An integral ringing interrupter may be optioned into the circuit via switch *S4* in either the loop-start or ground-start mode. This interrupter provides nominal 2-second-on, 4-second-off ringing interruption. Continuous ringing is provided when the interrupter is optioned out of the circuit.

4.05 At the station (or PBX) interface port, the 9961A supplies local loop current through a pair of matched 200-ohm battery-feed resistors. A balanced loop-current detector senses local loop current and,

after a nominal 15ms delay, provides M-lead output that is at input power potential when the circuit is busy and at ground when the circuit is idle. An idle-line-termination relay, operating from the output of the loop-current detector, provides both idle-line termination for the 4wire-to-2wire hybrid of the host 6461 module and dial pulse transient suppression during dialing.

4.06 Local ring trip is provided via an optocoupler and associated circuitry. Either grounded or biased ringing may be used with the 9961A, but applications employing grounded ring generators require external ring generator biasing introduced via option switch *S3*.

4.07 An active series regulator integral to the 9961A supplies -11 and -22 Vdc power to the subassembly's internal circuitry from -22 to -56 Vdc input. The regulator uses a zener diode for establishing the reference potential and a series pass transistor for voltage limiting.

6. specifications

E-lead (incoming) signaling states, normal operation

loop-start mode: E lead at ground during idle and busy; local ringing activated by application of E-lead open
ground-start mode: E-lead ground activates local ringing and establishes tip-ground continuity; E-lead open removes tip ground (idle state)

E-lead (incoming) signaling states, inverted operation

loop-start mode: E lead open during idle and busy; local ringing activated by E-lead ground
ground-start mode: E-lead open activates local ringing and establishes tip-ground continuity; E-lead ground removes tip ground (idle state)

M-lead (outgoing) signaling states

M lead at ground during idle, at battery during busy, alternating battery and ground during dialing

external E-lead resistance

maximum resistance to ground: 10 kilohms in normal mode, 1 kilohm in inverted mode

M-lead current

200mA maximum

ringing voltage and frequency

85 to 130Vac, 16 to 67Hz

ring-trip sensitivity

2000 ohms external loop resistance with 48-volt ring generator bias

pre-trip margin

will not pre-trip with up to 4 μ F capacitance and 30 kilohm loop leakage

tip-ground release delay

150ms nominal

tip-ground seizure delay

80 to 120ms

outgoing seizure delay

15 \pm 5ms

pulsing rate

8 to 14pps

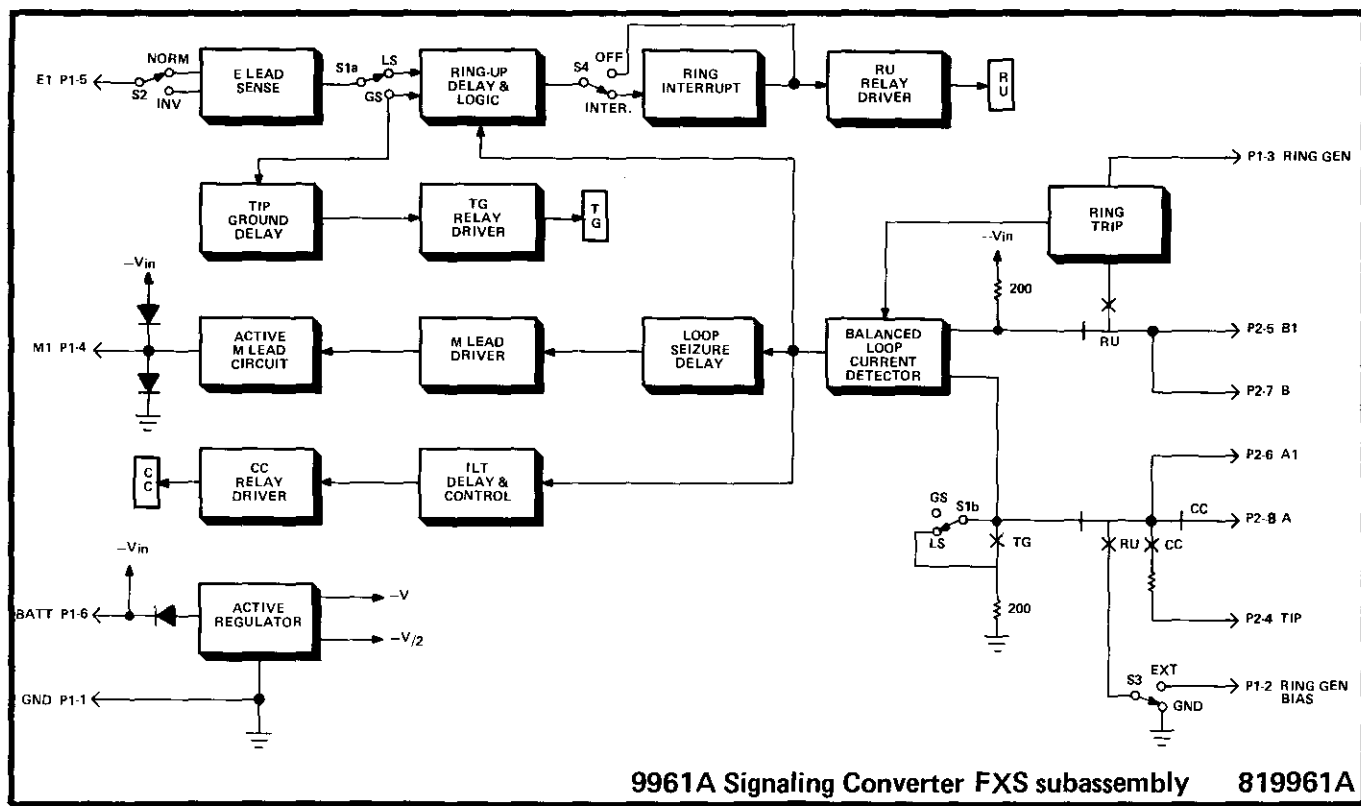
pulse distortion

4% maximum at 58% break and 10pps

ringing interrupter

2 seconds ringing, 4 seconds silent, nominal

specifications continued on page 4



9961A Signaling Converter FXS subassembly 819961A

5. block diagram

power requirements

-22 to -56Vdc (ground referenced); 70mA maximum plus loop current

operating environment

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

dimensions

4.1 inches (10.4cm) high
1.2 inches (3.0cm) wide
5.1 inches (13.0cm) deep

weight

5 ounces (142 grams)

mounting

mounts on printed circuit board of 6461 Common Signaling Module via two male connectors on 9961A and two receptacles on 6461

7. testing and troubleshooting

7.01 The Testing Guide Checklist may be used to assist in the installation, testing or troubleshooting of the 9961A Signaling Converter FXS subassembly. The Testing Guide Checklist is intended as an aid in the localization of trouble to a specific module and subassembly. If a subassembly is suspected of being defective, a new subassembly should be substituted and the test conducted again. If the substitute subassembly operates correctly, the original subassembly 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

9961A subassembly. Unauthorized testing or repairs may void the 9961A warranty.

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

7.03 If a 9961A is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is the more expedient method, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

7.04 If a defective 9961A is encountered, notify Tellabs via telephone [(312) 969-8800], letter [see below], or twx [910-695-3530]. Notification should include all relevant information, including the 8X9961A part number (from which we can determine the issue of the subassembly in question). Upon notification, we shall ship a replacement subassembly to you. If the warranty period of the defective subassembly has not elapsed, the replacement subassembly will be shipped at no charge. Package the defective 9961A in the replacement subassembly's carton; sign the packing list included with the replacement subassembly and enclose it with the defective subassembly (this is your return authorization); affix the preaddressed label provided with the replacement subassembly to the carton being returned; and ship the equipment prepaid to Tellabs.

repair and return

7.05 Return the defective 9961A subassembly, shipment prepaid, to: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: repair and return dept.

Enclose an explanation of the subassembly's malfunction. Follow your company's standard procedure with respect to administrative paperwork. Tellabs will repair the subassembly and ship it back to you. If the subassembly is in warranty, no invoice will be issued.

testing guide checklist

Note: *The 9961A must be tested in place (i.e., while mounted on the host 6461 module).*

test	test procedure	normal result	if normal conditions are not met, verify:
power and ringing	Measure voltage at pins 39 (<i>-BATT</i>) and 1 (<i>GND</i>) of host 6461 module. Measure ringing potential at pins 20 and 16 of 6461.	From -22 to -56Vdc (referenced to ground) present at pin 39 <input type="checkbox"/> . Ringing voltage of 50 to 130Vac (20 to 67Hz) present across pins 20 and 16 <input type="checkbox"/> .	External power <input type="checkbox"/> . External ringing source <input type="checkbox"/> .
circuit idle, loop start mode, normal E-lead operation	During idle circuit condition, measure E-lead voltage (to ground) at pin 25 of host 6461.	Voltage less than 2Vdc, indicating E-lead ground <input type="checkbox"/> . Ringing voltage does not appear across station tip and ring leads <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>NORM</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>LS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Associated signaling equipment properly connected <input type="checkbox"/> . Distant-end M lead idle <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
circuit idle, loop start mode, inverted E-lead operation	During idle circuit condition, measure E-lead voltage (to ground) at pin 25 of host 6461.	Voltage -36Vdc or greater with -48Vdc input power, approx. -20Vdc with -24Vdc input power, indicating E-lead open <input type="checkbox"/> . Ringing voltage does not appear across tip and ring leads <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>INV</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>LS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Associated signaling equipment properly connected <input type="checkbox"/> . Distant-end M lead idle <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
circuit idle, ground start mode, normal E-lead operation	During idle circuit condition, measure E-lead voltage (to ground) at pin 25 of host 6461. Also measure tip-lead continuity (to ground) at pin 41 of host 6461.	Voltage at pin 25 is -36Vdc or greater with -48Vdc input power, approx. -20Vdc with -24Vdc input power, indicating E-lead open <input type="checkbox"/> . Tip lead (pin 41) open to ground <input type="checkbox"/> . Ringing voltage does not appear across station tip and ring leads <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>NORM</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>GS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Associated signaling equipment properly connected <input type="checkbox"/> . Distant-end M lead idle <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
circuit idle, ground start mode, inverted E-lead operation	During idle circuit condition, measure E-lead voltage (to ground) at pin 25 of host 6461 module. Also measure tip-lead continuity (to ground) at pin 41 of host 6461.	Voltage at pin 25 less than 2Vdc, indicating E-lead ground <input type="checkbox"/> . Tip lead (pin 41) open to ground <input type="checkbox"/> . Ringing voltage does not appear across station tip and ring leads <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>INV</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>GS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Associated signaling equipment properly connected <input type="checkbox"/> . Distant-end M lead idle <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
incoming seizure, loop-start mode, normal E-lead operation	Open E lead to host 6461 either by transmitting M-lead ground from distant location or by temporarily disconnecting E1 lead from pin 25 of 6461. Observe station ringing (or observe T and R leads with ac meter). Reconnect E1 lead before proceeding to next test.	Local ringing commences within 150ms of occurrence of E-lead open <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>NORM</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>LS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Station wiring correct and station on-hook <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .

testing guide checklist continued on page 6

test	test procedure	normal result	if normal conditions are not met, verify:
incoming seizure, loop-start mode, inverted E-lead operation	Ground E lead to host 6461 either by transmitting M-lead battery from distant location or by applying ground to E1 lead (pin 25) of host 6461. Observe station ringing (or observe T and R leads with ac meter).	Local ringing commences within 150ms of occurrence of E-lead ground <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>INV</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>LS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Station wiring correct and station on-hook <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
incoming seizure, ground-start mode, normal E-lead operation	Ground E lead to host 6461 either by transmitting M-lead battery from distant location or by applying ground to E1 lead (pin 25) of host 6461. Observe station ringing (or observe T and R leads with ac meter).	Tip-lead connection to ground established <input type="checkbox"/> . Local ringing commences within 150ms of occurrence of E-lead ground <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>NORM</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>GS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Station wiring correct and station on-hook <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
incoming seizure, ground-start mode, inverted E-lead operation	Open E lead to host 6461 either by transmitting M-lead ground from distant location or by temporarily disconnecting E1 lead from pin 25 of 6461. Observe station ringing (or observe T and R leads with ac meter). Reconnect E1 lead before proceeding to next test.	Tip-lead connection to ground established <input type="checkbox"/> . Local ringing commences within 150ms of occurrence of E-lead open <input type="checkbox"/> .	Option switch <i>S2</i> set to <i>INV</i> position <input type="checkbox"/> . Option switch <i>S1</i> set to <i>GS</i> position <input type="checkbox"/> . Host 6461 module properly optioned <input type="checkbox"/> . Station wiring correct and station on-hook <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
ringing interruption	With option switch <i>S4</i> set to <i>INTR</i> position, observe local station ringing.	Interrupted ringing (2 seconds on, 4 seconds off) occurs <input type="checkbox"/> .	Switch <i>S4</i> set to <i>INTR</i> <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
local ring trip	While local station ringing, place station in off-hook condition.	Ringing ceases as soon as station goes off-hook, with no audible ringing in station receiver <input type="checkbox"/> .	Ringing source referenced to dc potential and option switch <i>S3</i> set to <i>INT</i> position <input type="checkbox"/> ; or ringing source grounded, dc bias potential connected to pin 16 of host 6461, and <i>S3</i> set to <i>EXT</i> position <input type="checkbox"/> . Station wiring correct <input type="checkbox"/> . Local loop limits not exceeded <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
circuit idle, M lead	Measure voltage between M1 lead (pin 21) and ground.	With circuit idle, M1 lead at ground potential (0Vdc) <input type="checkbox"/> .	Local station on-hook <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .
outgoing seizure	Place local station off-hook.	When station goes off-hook, M1-lead potential changes to -24 or -48Vdc, depending upon input voltage <input type="checkbox"/> .	Station wiring correct <input type="checkbox"/> . Local loop limits not exceeded <input type="checkbox"/> . 9961A in LS mode, or incoming seizure condition exists in GS mode <input type="checkbox"/> . Input power to host module <input type="checkbox"/> . Temporarily remove external connection at pin 21 of host 6461 and verify that no external impedances are affecting signaling state <input type="checkbox"/> . Replace 9961A and retest <input type="checkbox"/> .