

9961B Signaling Converter FXO Subassembly

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1. general description

1.01 The 9961B Signaling Converter FXO (foreign exchange, office) subassembly (figure 1) provides conversion between E and M-lead signaling and loop signaling conventionally used at the switching-equipment end of a foreign exchange (FX) or off-premise extension (OPX) circuit. Specifically, the 9961B 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 output.

1.02 The 9961B subassembly is designed expressly for use with the Tellabs 6461 Common Signaling (2Wire/4Wire) Module. The 9961B makes electrical and physical connection to the 6461 by means of male connectors on the 9961B 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 or switching equipment. Both adjustable transmission attenuation and switch-selectable 4wire-to-2wire conversion are provided. As an alternative to 4wire-to-2wire conversion, the 6461 may be switch-optioned to provide a 4wire-to-4wire attenuator-transformer interface. In addition, the 6461 may (and, in most applications, will) be equipped with a Tellabs 9961X Signaling Converter subassembly such as the 9961B 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 9961B include the following: switch-selectable loop-start or ground-start operation, with accommodation of office-side signaling via either A and B or local transmission leads; switch-selectable normal or inverted M-lead operation; M-lead current limiting; active loop-current limiting; transient suppression during dialing and idle; and idle circuit termination.

1.04 Input power is supplied to the 9961B subassembly via the host 6461 module. A voltage regulator integral to the subassembly permits operation

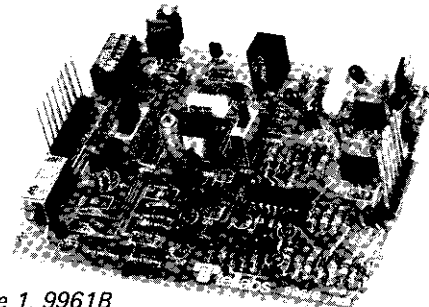


figure 1. 9961B
Signaling Converter FXO subassembly

on -22 to -56Vdc input. Current requirement is 60mA. Both M-lead and tip-ground (ground start) sensing circuitry access input power prior to regulation, thus permitting conventional external M-lead potentials and loop supervisory ranges to be used.

1.05 As stated above, the 9961B 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 9961B Signaling Converter FXO 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 office end of a foreign exchange (FX) or off-premise extension (OPX) circuit. Typically, this termination is a central office switching system or a PBX (both are 2wire terminations), although it may in some cases be a 4wire facility to a remote PBX. (The host 6461 module accommodates either 2wire or 4wire loop operation via a switch option on the module.)

2.02 Signaling interface between the 9961B and the host 6461 module is accomplished via local A and B leads.

2.03 A loop-current regulator on the 9961 limits dc loop current to approximately 35mA, thereby eliminating the need for line build-out resistors. Also, because the impedance of the loop-current regulator is approximately 6000 ohms throughout the voice frequency range, A-and-B-lead inductors are not required in the 4wire-to-2wire hybrid terminating set of the host 6461.

2.04 In any application, the 9961B may be switch-optioned for loop-start or ground-start operation and for normal or inverted M-lead operation. In

normal M-lead operation, local seizure will produce M-lead ground in the loop-start mode and M-lead battery in the ground-start mode. In inverted M-lead operation, local seizure will produce M-lead battery in the loop-start mode and M-lead ground in the ground-start mode.

2.05 Depending upon the type of facility signaling used, it may be desirable in certain loop-start applications to use idle-state signaling (M-lead ground) to characterize the idle state. With such an arrangement, a failure of the facility results in seizure at the distant end, where the resultant continuous ringing provides an immediate, audible indication of facility failure. In applications where this arrangement is desired, the inverted mode of M-lead operation should be selected. In most applications, however, it is not desirable to seize the distant end when the facility fails. In these applications, the normal M-lead operating mode should be selected.

2.06 In all modes of operation, normal E-lead signaling states (open during idle and ground during busy) are used.

2.07 The 9961B and host 6461 may be physically located in the circuit at any distance from the serving central office or PBX consistent with the loop supervisory limits of the switching equipment. Facility-side range is determined by the limitations of the associated signaling equipment.

2.08 All internal circuitry of the 9961B receives power from an integral regulator that permits operation on -22 to -56Vdc input. Please note that, to ensure proper tip-lead sensing in ground-start applications, the power supplied to the 9961B must be of the same dc voltage as that of the serving switching equipment. M-lead power is derived directly from the external power source. Thus, if the associated carrier channel (or other facility-side switching equipment) requires a -48Vdc M-lead potential, the 9961B must be powered from a nominal -48Vdc source.

3. installation inspection

3.01 The 9961B Signaling Converter FXO 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 9961B 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 9961B 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.

9961B connector pin*	designation/function	externally accessible via 6461 pin
P1-1	GND (ground input)	1
P1-6	-BATT (-22 to -56Vdc input)	39
P2-4	TIP	41
P2-3	RING	43
P2-8	A (A lead)	7
P2-7	B (B lead)	9
P2-6	A1 (internal A lead)	none
P2-5	B1 (internal B lead)	none
P1-5	E1 (E1 lead)	25
P1-4	M1 (M1 lead)	21
P1-2	none	none
P1-3	none	none
P2-1	none	none
P2-2	none	none

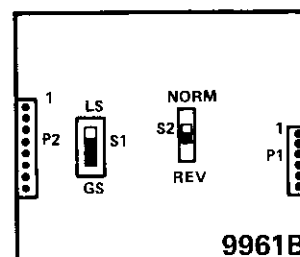
*Corresponding receptacles on 6461 module are designated J1-1, J1-6, J2-4, etc.

table 1. Connections to 9961B subassembly via host 6461 module

options and alignment

3.03 No alignment of the 9961B subassembly is required. Before the subassembly is placed into service, however, two 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 M-lead operation. Set *S2* to the *NORM* position if it is desired that local seizure produce M-lead ground in the loop-start mode or M-lead battery in the ground-start mode. Set *S2* to the *REV* position if it is desired that local seizure produce M-lead battery in the loop-start mode or M-lead ground in the ground-start mode.

figure 2. Switch locations

4. circuit description

4.01 This circuit description is intended to familiarize you with the 9961B Signaling Converter FXO subassembly for engineering and application purposes only. Attempts to troubleshoot the 9961B 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 9961B provides seizure and loop dial pulsing toward a central office or PBX line circuit in response to an external E-lead input. In the loop-

start mode (switch *S1* set to *LS*), an E-lead ground operates the A relay. This closes the local loop through an active current limiter that limits loop current to approximately 40mA. Loop dial pulses are generated via the A-relay contacts in response to incoming E-lead pulses. An idle-line-termination relay, the CC relay, is also activated from the input E lead and provides fast-operate, slow-release operation. This relay provides resistive termination of the host 6461's 4wire-to-2wire hybrid during idle conditions and while dial pulses are being received.

4.03 In the ground-start mode (switch *S1* set to *GS*), the input E lead controls seizure/release logic as well as the A and CC relays. The seizure/release logic circuit provides input to the ground-start seizure-control circuit, which places ground on the CO or PBX ring lead in response to an input E-lead transition from open to ground. When the CO or PBX responds to incoming seizure by placing ground on the tip conductor, a tip-ground sensing circuit indicates outgoing seizure via the M lead and provides input to the seizure/release logic, enabling operation of the A relay. Detection of CO or PBX tip-lead ground also causes removal of the ring-lead-seizure ground via the seizure/release logic circuit. After this conversion from the ground-start to the loop supervisory mode is completed, incoming dial pulses are repeated by the A relay, while supervisory continuity is maintained via the seizure/release logic and timing circuit. The local loop is released in response to either a long E-lead open interval or removal of the CO or PBX tip-lead ground.

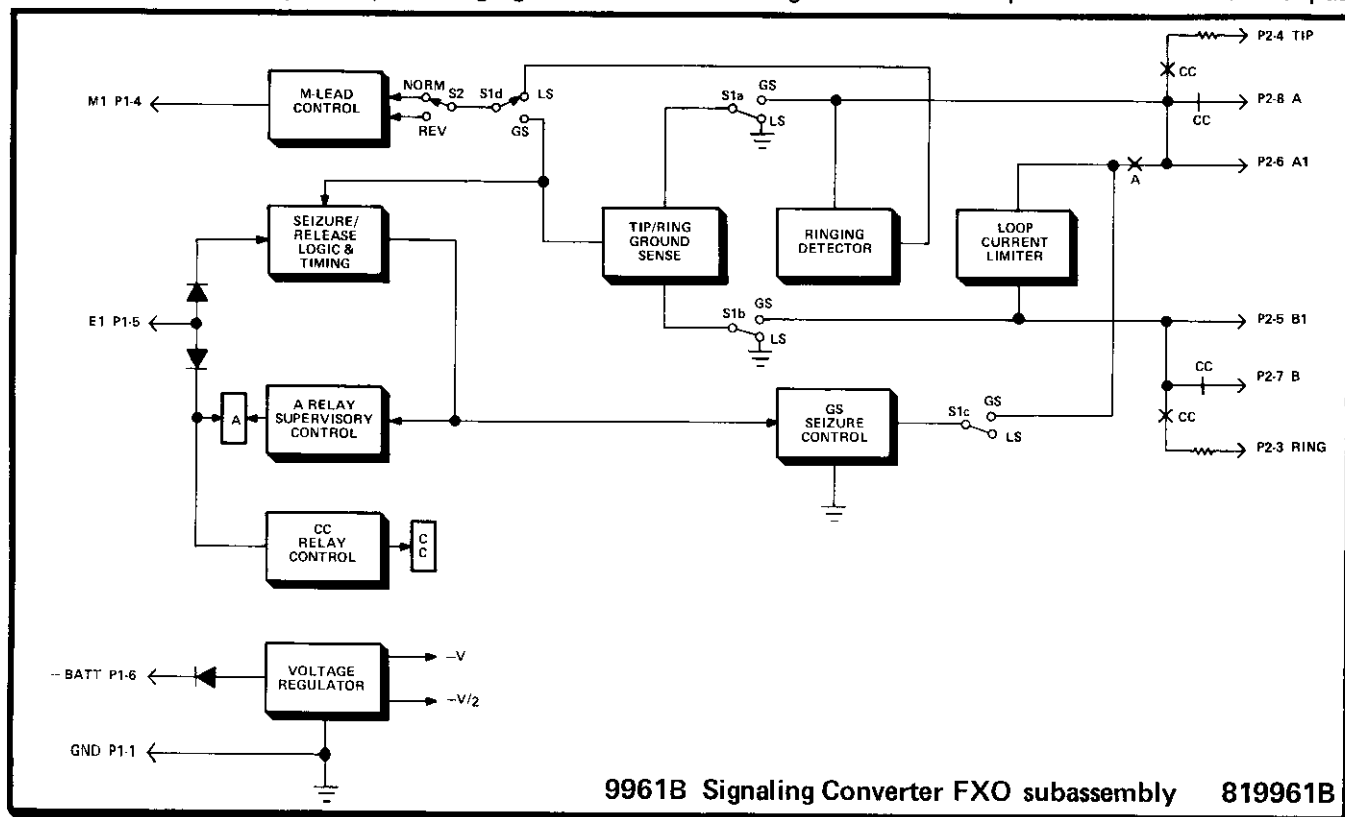
4.04 Outgoing signaling in the loop-start mode is controlled by an optocoupler ringing detector

bridged across the local A and B leads. When ringing is detected in the loop-start mode, input is provided to the M-lead control circuit through switch *S2*, which conditions the M lead for normal or reversed operation. When *S2* is set to *NORM*, the outgoing M lead is at input battery potential during both busy and idle and at ground potential during ringing. When *S2* is set to *REV*, these states are reversed.

4.05 In the ground-start mode of operation, outgoing signaling is controlled by the tip/ring ground sensing circuit. Detection of ground on either the tip or ring lead will cause the M lead to change state. When *S2* is set to *NORM*, the M lead is at ground potential in the absence of tip-lead ground (idle state) and at input battery potential when ground is detected on either the local tip or ring lead (busy condition). M-lead control is not obtained from the ringing detection circuit in the ground-start mode.

4.06 Idle circuit termination in the 9961B is controlled by fast-operate, slow-release circuitry, including the CC relay. This relay is operated when the circuit is idle and released when the E lead is at ground. The control circuit is arranged for fast-operate, slow-release operation so that the CC relay remains operated during dial pulsing. When operated, the CC relay places resistive terminations between the tip and A leads and between the ring and B leads of the host 6461's hybrid.

4.07 An active series regulator integral to the 9961B 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



9961B Signaling Converter FXO subassembly 819961B

transistor for voltage limiting. The external M-lead potential is derived from the input power potential and thus provides either -24 or -48Vdc potential, depending upon input powering.

6. specifications

outgoing signaling

ring detector

detection sensitivity: 50 volts rms

ringing frequency range: 16 to 67Hz

M-lead signaling states

- loop start, normal M-lead operation: ground during ringing, input battery potential during busy and idle
- loop start, inverted M-lead operation: input battery potential during ringing, ground during busy and idle
- ground start, normal M-lead operation: ground during idle, input battery potential during busy (tip ground)
- ground start, inverted M-lead operation: input battery potential during idle, ground during busy (tip ground)

M-lead current capacity

ground state: 100mA maximum sourcing capability

input battery state: 130mA maximum sinking capability

M-lead seizure delay

loop start: 200ms nominal

ground start: 150ms nominal

incoming signaling

E-lead signaling states

open during idle, ground during busy

idle termination removal delay

100ms nominal

dial pulse distortion

5% maximum, 8 to 14pps

ring-ground seizure delay (ground-start operation only)

40ms nominal

common specifications

power requirements

-22 to -56Vdc (ground referenced); 60mA maximum

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

4 ounces (113 grams)

mounting

mounts on printed circuit board of 6461 Common Signaling Module via two male connectors on 9961B 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 9961B Signaling Converter FXO 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 9961B subassembly. Unauthorized testing or repairs may void the 9961B 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 9961B 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 9961B 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 8X9961B 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 9961B 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 9961B 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 9961B 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:
circuit idle supervision loop start, normal or inverted M-lead operation	With circuit idle, determine M-lead condition via M-lead LED on host 6461.	M-lead LED lit (M lead at battery) in normal mode <input type="checkbox"/> . M-lead LED unlit (M lead at ground) in inverted mode <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> . Local office wiring <input type="checkbox"/> .
circuit idle supervision, ground start, normal or inverted M-lead operation	With circuit idle, determine M-lead condition via M-lead LED on host 6461.	M-lead LED unlit (M lead at ground) in normal mode <input type="checkbox"/> . M-lead LED lit (M lead at battery) in inverted mode <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> . Local office wiring <input type="checkbox"/> .
outgoing seizure, loop start, normal or inverted M-lead operation	Apply ringing to terminal-side loop. Observe M-lead LED on host 6461.	M-lead LED unlit (M lead at ground) when ringing applied in normal mode <input type="checkbox"/> . M-lead LED lit (M lead at battery) when ringing applied in inverted mode <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Circuit not seized from distant end <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
outgoing seizure, ground start, normal or inverted M-lead operation	Apply tip ground toward 9961B from office-side loop and observe M-lead LED on host 6461.	M-lead LED lit (M lead at battery when tip ground applied) in normal mode <input type="checkbox"/> . M-lead LED unlit (M lead at ground when tip ground applied) in inverted mode <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Circuit not seized from distant end <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
circuit idle, incoming signaling	With distant station on-hook, observe E-lead LED on host 6461 and loop status.	E-lead LED unlit (E lead open) <input type="checkbox"/> . Loop open <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
incoming seizure, loop start	Seize circuit from distant end. Observe E-lead LED on host 6461 and loop status.	E-lead lit (E lead at ground) <input type="checkbox"/> . Loop seized <input type="checkbox"/> . Continuity between tip and ring leads (pins 41 and 43 on host 6461) <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
incoming seizure, ground start	Seize circuit from distant end. Observe E-lead LED on host 6461. Also observe loop status when ground applied to tip lead (6461 pin 41) after detection of ring-lead (6461 pin 43) ground.	E-lead LED lit (E lead at ground) <input type="checkbox"/> . Ground applied to local ring conductor <input type="checkbox"/> . When local office places ground on tip lead, ring ground removed <input type="checkbox"/> . Continuity between tip and ring leads (pins 41 and 43 on host 6461) <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
dialing	Request distant end to send dial pulses at 50% break and 10pps. Observe local loop pulsing.	Loop dial pulses between 45% and 70% break, depending upon facility characteristics <input type="checkbox"/> .	Replace 9961B and retest <input type="checkbox"/> . Replace host 6461 and retest <input type="checkbox"/> .
idle circuit termination and busy-condition transmission	Determine that CC relay operates. This can be done as follows: Insert 1000Hz tone at 0dBm at 2wire port or 4wire xmt input port of host 6461 (pins 41 and 43). Using 600 ohm terminated transmission measuring set, measure level at 4wire transmit output port of host 6461 (pins 8 and 10).	With circuit seized, levels consistent with circuit alignment levels <input type="checkbox"/> . With circuit idle, levels 3 to 9dB below circuit alignment levels <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Power to host 6461 <input type="checkbox"/> . Replace 9961B and retest <input type="checkbox"/> .



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