tellabs
technical manual
76-826104
rev A

practice section 826104

6104 FXO Signaling Converter ★

contents

1. general description

1.01 The 6104 FXO (foreign exchange, office-end) Signaling Converter module (figure 1) provides conversion between E&M-lead signaling and loop signaling conventionally used at the office end of a foreign-exchange (FX) or at the PBX end of an off-premises station (OPS) circuit. Specifically, the 6104 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. The 6104 may be used alone as a carrier interface device, or may be paired with either a Tellabs 6101 SF Transceiver module or a Tellabs 6001 or 6002 DX Signaling module. The resulting two-module signaling circuit provides facility signaling, loop signaling, and conversion between the two signaling modes at the office end of an FX or at the PBX end of an OPS circuit.

1.02 This Practice section is reissued to coordinate with the reissue of the 6104 module to include a traffic-monitoring lead and with Tellabs' Videotape Training Program on the 6104 module.

1.03 Features, options, and functions common to all three applications of the 6104 (SF interface, DX interface, and direct loop-to-E&M interface) include switch selection of loop-start or ground-start operation; single-switch optioning for interface with SF or dc signaling modes; provision for an optional Tellabs 9901 precision Pulse Corrector plug-on subassembly; accommodation of switching-side signaling via a combination of tip, ring, A, and B leads; switching-side loop-current limiting; and protective M-lead current limiting. In 6104 modules of Issue 2 or later, a metering lead has been added to provide ground output for activation of traffic-monitoring equipment.

1.04 The 6104 is commonly paired with a Tellabs 6101 SF Transceiver module to provide a two-module SF/loop signaling circuit compatible with established criteria for F-type inband signaling. A Tellabs 6001 or 6002 DX Signaling module can be paired with the 6104 to provide an FXO arrangement with DX signaling on the facility. The 6104 can also be used as a loop-to-E&M converter in applications where the module directly interfaces T-carrier, E&M carrier, or a DX E&M circuit.

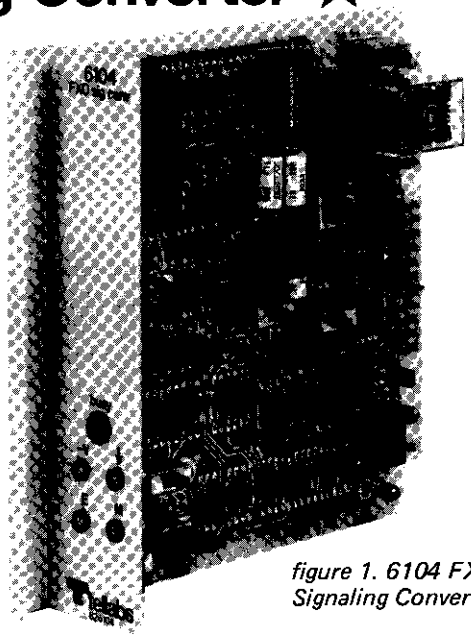


figure 1. 6104 FXO Signaling Converter

1.05 In SF applications, the 6104 converts E-lead signals (derived by the 6101 from received SF tone states) to loop signaling for operation of the switching equipment. It also converts loop supervisory and ringing signals from the switching equipment to M-lead input to the transmit section of the 6101 for transmission over the facility. The 6104 controls (but does not perform) transmit-path-cut and tone-generation functions in the associated 6101 SF Transceiver module. (The 6101 also contains an integral 2600Hz oscillator, transmit tone-control circuitry, a receive amplifier, and tone-receiver circuitry.) In the ground-start mode only, the 6104 provides 20Hz modulation of outgoing SF tone (via the M lead) regardless of the switching-equipment ringing frequency.

1.06 In dc applications (including use with Tellabs' 6001 and 6002 DX Signaling modules), the 6104 provides the following features (in addition to basic loop-to-E&M conversion): dial-pulse transient suppression, switch selection of normal or inverted M-lead signaling, switch selection of an M-lead wink option for ringing indication in the ground-start mode, and idle-circuit termination.

1.07 An internal voltage regulator permits operation on −22 to −56Vdc filtered input. M-lead and tip-ground sensing-circuitry (ground-start) power is derived from input power prior to regulation, thus permitting conventional external M-lead and tip-lead potentials to be used.

1.08 Solid-state control and timing circuitry is used throughout the 6104 to ensure reliable, precision-timed performance.

★A Tellabs Videotape Training Program is available for this product.

1.09 Front-panel test points provide access to battery, ground, E lead, and M lead. A front-panel LED lights to indicate a circuit-busy condition.

1.10 The 6104 mounts in one position of the Tellabs Type 10 Mounting Shelf, versions of which are available for relay-rack and apparatus-case installation. In relay-rack applications, up to 12 modules can be mounted across a 19-inch rack, while up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical rack space is used. The 6104 also mounts in one position of a Tellabs 260 or 261 Signaling and Terminating System Assembly.

2. application

2.01 The 6104 FXO Signaling Converter module is used at the switching-equipment end of either an FX or an OPS circuit to provide any of three types of signaling interface. As a stand-alone loop-to-E&M converter, the 6104 can be used to interface T-carrier, E&M carrier, or a DX E&M circuit. Paired with a Tellabs 6001 or 6002 DX Signaling module, the 6104 is part of a two-module signaling circuit that provides an FX arrangement with DX signaling on the facility. Paired with Tellabs 6101 SF Transceiver, the 6104 is part of an SF/loop signaling circuit compatible with established criteria for F-type inband signaling.

2.02 A common application of the 6104 is in Tellabs' 260 and 261 Signaling and Terminating Systems. Both Systems are universally prewired to accept a variety of Tellabs' signaling, terminating, and interface modules. As a result, the facility signaling mode (SF or DX) and the loop signaling mode (FXO, FXS [foreign exchange, station end], E&M, ringdown, or data ringdown) can be changed as desired by interchanging the appropriate modules. Please refer to Practice sections 8X260 and 8X261 for detailed descriptions of the 260 and 261 Systems, respectively.

2.03 The 6104 can be used in loop-start or ground-start applications. Loop-start signaling is common in FX and OPS applications in which a single station instrument is served. Ground-start signaling is used in applications where "head-on" or "glare" can be a problem, such as when trunking into a PBX.

2.04 The 6104 can be physically located in the circuit at any distance from the switching-equipment (CO 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.

SF applications

2.05 The 6104 Signaling Converter and 6101 SF Transceiver, in combination, provide a signaling circuit compatible with F-type SF inband signaling conventions at the station end of an FX or OPS circuit. Refer to paragraph 1.05 for a description of how the 6101 and 6104 work together.

2.06 Standard E&M signaling states for the 6104 and the corresponding SF tone states are listed in tables 1 and 2. Please note that when using SF signaling in the ground-start mode, the 6104 provides 20Hz modulation of outgoing SF tone during ringing, regardless of the ringing frequency of the switching equipment. This allows end-to-end compatibility with Western Electric signaling and terminating equipment, which recognizes only 20Hz ringing.

loop condition	SF tone		E&M-lead states	
	receive	transmit	E (receive)	M (transmit)
idle	on	off	open	batt
ringing	on	on	open	gnd
off-hook	off	off	gnd	batt
dialing	off-on-off	off	gnd-open-gnd	batt

table 1. Signaling states, loop-start

loop condition	SF tone		E&M-lead states	
	receive	transmit	E (receive)	M (transmit)
idle	on	on	open	gnd
incoming seizure (ground applied to ring lead at station)	off	on	gnd	gnd
seizure acknowledgement (switch grounds local tip lead)	off	off	gnd	batt
dialing	off-on-off	off	gnd-open-gnd	batt
busy	off	off	gnd	batt
station on-hook	on	off	open	batt
CO release	on	on	open	gnd
outgoing seizure (switch grounds local tip lead)	on	off	open	batt
ringing	on	on-off-on at 20Hz rate	open	gnd-batt-gnd at 20Hz rate
station answer	off	off	gnd	batt
CO release (forward disconnect)	off until FXS signaling unit opens tip lead, then on	on	gnd until FXS signaling unit opens tip lead, then open	gnd
idle	on	on	open	gnd

table 2. Signaling states, ground-start

signaling tone levels

2.07 Normal idle SF tone level is −20dBm0 in both directions of transmission. When used with the 6104, the 6101 SF Transceiver interfaces the 4wire transmission facility at −16 transmit and +7 receive TLP's; thus, the nominal received SF tone level is −13dBm (at the 4wire receive input port of an associated line-interface module) and the transmitted tone level is −36dBm. For the first 400 milliseconds of any SF tone transmission by the 6101 (or by the associated FXS signaling arrangement at the opposite end of the facility), however, SF tone is transmitted at an augmented level of −24dBm (−8dBm0). This momentarily increased tone level aids in detection of supervisory or signaling state changes. During ringing in the ground-start mode, the 6101 transmits high-level SF tone modulated by 20Hz.

2.08 To provide standard SF interface levels, a line amplifier (typically, Tellabs' 4001) is used to provide the necessary facility-side gain. On the terminal (switching-equipment) side, a terminating set (typically, Tellabs' 4201 or 4203) provides level control and 4wire-to-2wire termination. A 4wire station termination module (typically Tellabs' 4405) can be used in a 4wire-to-4wire termination. Figure 2 shows a typical FXO/SF signaling and terminating arrangement. (*For specific information*

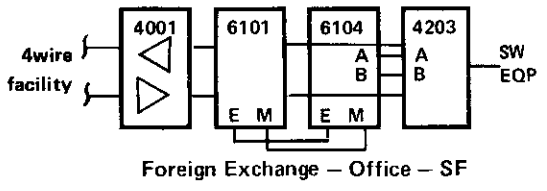


figure 2. Typical FXO/SF arrangement

on individual modules, please refer to the Tellabs Practice or videotape training program on that module.)

DX applications

2.09 In much the same manner as it is used in SF applications, the 6104 can be used to interface Tellabs' 6001 or 6002 DX signaling units with the mode of loop signaling used at the office end of an FX or OPX circuit. On 4wire facilities, the 6104 is used with the 6001; on 2wire facilities, the 6104 is used with the 6002.

2.10 While in 2wire applications no external facility-interface module is needed (the 6002 contains the necessary repeat coil), in 4wire applications a third and fourth module are required. On the facility side, a line amplifier (e.g., Tellabs' 4001) or a 4411 Pad/Transformer module must be used to derive transmit and receive simplex leads for inputs from the facility to the 6001. On the terminal (switching-equipment) side, a term set (Tellabs' 4201 or 4203) provides the 4wire-to-2wire termination and level control. Figure 3 shows two typical DX signaling arrangements.

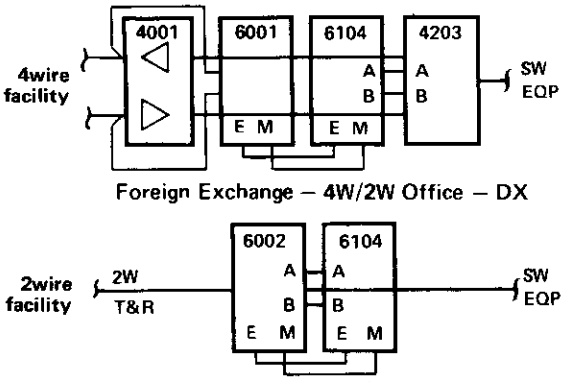


figure 3. Two typical DX signaling arrangements

2.11 The 6104 automatically provides dial pulse transient suppression and idle circuit termination in DX applications.

Caution: *For a 4W DX circuit to operate properly with identical intermodule wiring at either end of the facility (as in the universally wired Tellabs 260 and 261 Systems), one terminating 600X DX module must be optioned for reversed (REV) input leads and the one at the opposite end of the facility for normal (NORM) input leads.*

2.12 In ground-start DX applications requiring an M-lead wink as an indication that ringing is to follow (i.e., with a Western Electric 1C354 unit at the distant station end), the 6104 can be switch-optioned to provide this wink.

switching-side interface

2.13 In SF or DX applications involving a 4wire facility, a 4wire-to-2wire terminating set (e.g., Tellabs' 420X) must be used to interface the 6104 with the 2wire switching equipment. Signaling between the 6104 and the term set is accomplished via connection of the A and B and station transmission leads.

2.14 A high-impedance, regulated loop-current sink on the 6104 limits dc current to approximately 35mA, eliminating the need for line build-out resistors. Moreover, the loop-current regulator impedance is approximately 6000 ohms throughout the voice-frequency range, eliminating the requirement for A and B-lead balance inductors in an associated terminating set.

pulse correction

2.15 In those applications where dial pulse distortion presents a problem, the 6104 may optionally be equipped with a 9901 Pulse Corrector subassembly. The Pulse Corrector plugs physically and electrically into connectors on the 6104's printed circuit board. The 9901 corrects input (i.e., E-lead) pulses at 8 to 12pps and 30 to 70% break to 58 ±2% break. At 14pps, the 9901 corrects pulses with a 40 to 65% break to 57 ±3% break. When used without the optional Pulse Corrector subassembly, the 6104 contributes less than 5% distortion to dial pulses.

reverse/normal M-lead operation

2.16 In dc signaling applications where normal M-lead states are incompatible with circuit operation, a switch option on the 6104 is provided to "reverse" the M-lead states. **Do not** reverse M-lead operation in SF signaling applications. When the 6104 is used in the same circuit as a 6103 FXS Signaling Converter module, the M-lead should be arranged for normal operation. For information regarding applications requiring M-lead reversal, contact your Tellabs Regional Office or Tellabs Customer Service.

loop to E&M applications

2.17 The 6104 may be used alone (without any associated signaling module) to convert conventional E&M signaling to loop signaling at the office end of a circuit. This application is most commonly encountered in the conversion of E&M carrier channels to loop signaling. Note that if the associated carrier channel (or other facility-side signaling equipment) requires a –48Vdc M-lead potential, the 6104 must be powered from a nominal –48Vdc source. Paragraphs 2.12 and 2.13 also apply to E&M applications of the 6104.

power

2.18 All internal 6104 circuitry receives power through an integral regulator that allows the module to operate on –22 to –56Vdc filtered input. In ground-start applications, however, to ensure proper tip-conductor sensing, power supplied to the 6104 must be of the same dc voltage as that of the serving switching equipment. M-lead power is derived by the 6104 prior to regulation and, therefore, reflects the dc potential of the power source.

This allows a 6104 powered from −48Vdc to provide, for example, a −48Vdc M-lead potential in those applications where associated signaling equipment requires −48Vdc.

monitoring

2.19 A traffic-monitoring (TR MON) lead on the 6104 can be used for peg-count metering and time-used measurements. It provides ground output to external equipment when the module's E-lead is grounded. The TR MON lead does **not** follow E-lead dial pulses.

3. installation

3.01 The 6104 FXO Signaling Converter module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

mounting

3.02 The 6104 mounts in one position of the Tellabs Type 10 Mounting Shelf, or in position 3 of the 260 or 261 System Assembly. The module plugs physically and electrically into a 56-pin connector at the rear of the Type 10 Shelf.

installer connectors

3.03 Before making any connections to the Mounting Shelf, make sure that power is **off** and modules are **removed.** The 6104 module should be plugged into place only **after** it is properly optioned and **after** wiring is completed.

3.04 Table 3 lists external connections to the 6104. All connections are made via wire wrapping at the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector.

connect:	to pin:
T (to office tip lead)	25
R (to office ring lead)	23
T1 (to 420X)	41
R1 (to 420X)	47
T2 (if required)	53
T3 (if required)	55
R2 (if required)	49
R3 (if required)	51
E (intermodule E lead from 6101 or 600X)	29 or 5
M (intermodule M lead to 6101 or 600X)	31 or 21
CT (cut-and-terminate lead to 6101)	27
A (A lead to 420X)	43
B (B lead to 420X)	45
TR MON (traffic monitoring lead)	19
−BATT (−22 to −56Vdc input)	35 or 33
GND (ground)	17

table 3. External connections to 6104 module

3.05 One of the most common applications of the 6104 involves its use in an SF signaling and terminating system with a 4001 Line Amp on the facility interface and a 4201 or 4203 Term Set interfacing the station. Figure 4 shows the connections required in this application. Note that if the 6104 is used in combination with these modules in a Tellabs 260 or 261 Signaling and Terminating System, all intermodule connections are factory wired and external connections are simplified by the use of terminal strips or blocks. Refer to the 260 or 261 System Practice for further information.

options and alignment

3.06 No alignment of the 6104 module is required. However, six option switches must be set before the 6104 is placed into service. These switches and their functions are described in paragraphs 3.07 through 3.11. Locations of these switches on the module's printed circuit board are shown in figure 5.

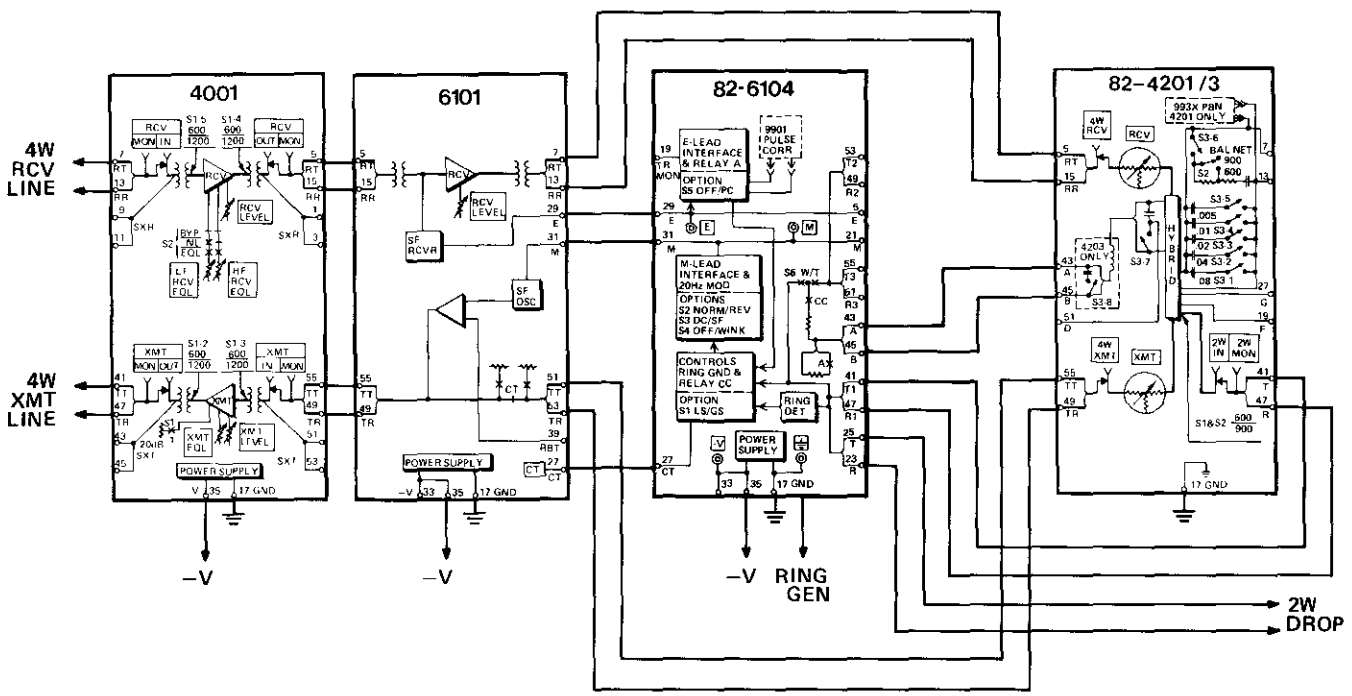


figure 4. Connections required for application in a Tellabs 260 or 261 System

3.07 Switch *S1* selects either the loop-start or ground-start supervisory mode. Set *S1* to the *LS* position for loop-start operation or to the *GS* position for ground-start operation.

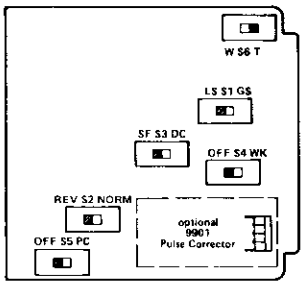


figure 5. Option switch locations

3.08 Switch *S2* selects normal or reversed M-lead operation. Set *S2* to the *NORM* position for **all** SF applications (i.e., when the 6104 is used with the 6101). In dc applications, set *S2* to the *NORM* position for M-lead ground = idle (M-lead battery = busy) in ground-start operation and M-lead battery = idle (M-lead ground = ringing) in loop-start operation. Set *S2* to the *REV* position for M-lead battery = idle (M-lead ground = busy) in ground-start operation, and M-lead ground = idle (M-lead battery = ringing) in loop-start operation.

3.09 Switch *S3* selects SF or dc as the facility signaling mode. Set *S3* to the *SF* position when using the 6104 with a 6101 SF Transceiver (or equivalent). Set *S3* to the *DC* position when interfacing a 6001 or 6002 DX Signaling module (or equivalent) or carrier (e.g., E&M carrier or T-carrier).

Note: S3 *must be in the* DC *position for M-lead reversal.*

3.10 Switch *S4* conditions the 6104 to provide an M-lead wink to signal a ground-start outgoing ringing condition. Set *S4* to the *WK* position to send an M-lead wink signal in the dc signaling mode. Set *S4* to the *OFF* position in all loop-start and/or SF applications and when no M-lead wink is required.

3.11 Switch *S5* options the 6104 for use with a Tellabs 9901 precision Pulse Corrector subassembly. Set *S5* to the *PC* position when a 9901 is plugged into its receptacle on the module's printed circuit board. Set *S5* to the *OFF* position if precision pulse correction is **not** required and the 9901 **is not used.**

3.12 Switch *S6* options the 6104 for the correct wiring scheme. Set *S6* to the *W* position for wiring schemes in which connector pins 41 or 25 and 47 or 23 are used for tip-ring connections to the switching equipment. Set *S6* to the *T* position when connector pins 53 or 55 and 51 or 49 are used for tip-ring connections.

3.13 The 6104 itself requires no alignment. In SF applications, the associated 6101 SF Transceiver must be adjusted for zero gain in the receive path. If a line amplifier is used to establish facility-side levels, it should be adjusted (at 1004Hz) to provide +7dBm receive and −16dBm transmit transmission levels on its terminal side. For detailed information on the alignment and optioning of line amps, signaling modules, term sets, and other modules used with the 6104 in Tellabs 260 and 261 Signaling and Terminating Systems, please consult the Practices or Videotape Training Programs on the appropriate modules or systems.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 6104 FXO Signaling Converter modules for engineering and application purposes only. Attempts to troubleshoot the 6104 internally are not recommended and may void your warranty. Troubleshooting procedures should be limited to those prescribed in section 7 of this Practice. Please refer to the 6104 block diagram, section 5 of this Practice, as an aid in following the circuit description.

4.02 When the 6104 is idle, the *A relay* is released and the *CC relay* is operated. Incoming call seizure is initiated by an E-lead ground, which causes a loop-current seizure of the switching equipment. In loop-start operation, ringing voltage initiates an outgoing call, while in ground-start operation, a switching equipment tip-lead ground initiates an outgoing call.

loop-start

4.03 When the E lead is at ground potential, the *A relay* operates through the optional Tellabs 9901 Pulse Corrector. The *A-relay* coil current flow causes the front-panel *busy* lamp to light. The grounded E lead also disables the *ringing detector* and forces the *M-lead driver* and *inverter* to a non-ringing condition. Additionally, the initial E-lead ground prepares the *CC relay* and *CT* (cut-and-terminate) *driver* for timed operation during subsequent E-lead-open conditions.

4.04 Operation of the *A relay* causes switching-equipment loop current to flow through the *current sink* and the external tip-ring and/or A and B leads of the associated transmission device (i.e., term set or 4wire station termination module). Ground-and-open E-lead dial pulsing causes the *A relay* to pulse. The *A-relay* contacts pulse switching-equipment loop current. The initial dial-pulse break of a dialed digit causes the *CT driver* and *CC relay* to operate. The *CC relay* serves to suppress transients caused by the inductance of the associated transmission device during dialing to reduce dial pulse distortion. When the 6104 and the Tellabs 6101 SF Transceiver are used together, the *CT driver* operates the transmit cut-and-terminate circuit in the 6101. The cut-and-terminate circuit prevents any loop current transients from interfering with the transmitted SF signals.

4.05 Outgoing-call ringing voltage operates the *ringing detector,* which causes an M-lead busy state.

ground start

4.06 An incoming request for service is initiated by an E-lead ground toward the 6104. The 6104 *time delay* and *logic* circuits cause the ring-ground circuit to place a ring-lead ground potential. The 6104's *tip-ground sense* circuitry senses this tip-lead ground and causes the *A relay* to operate. Additionally, the *ring-ground* circuit is disabled, which

removes the switching-equipment ring-lead ground. Dial-pulsing and loop-current operations are the same as in the loop-start mode.

4.07 The 6104 *tip-ground sense* circuitry also causes a busy M-lead condition when the switching-equipment-side tip lead is at ground potential.

4.08 M-lead states vary during ringing contingent on how the module is optioned. Ringing is sensed by the *ringing detector* circuit. With *S4* set to *OFF*, *S1* set to *GS*, and *S3* set to *DC*, the M lead remains busy during the tip-conductor ground condition (which indicates outgoing-call seizure. With *S4* set to *WK*, *S1* set to *GS*, and *S3* set to *DC*, the M lead remains in a busy condition except for a momentary (100ms) idle condition (the "wink") that occurs at the end of each burst of ringing applied by the switching equipment. With *S4* set to *OFF*, *S1* set to *GS*, and *S3* set to *SF*, ringing causes the *20Hz oscillator* to provide M-lead busy/idle modulation at a 20Hz rate, regardless of the switching-equipment modulation rate.

4.09 During ringing, the *logic* circuit causes the *CT relay* to operate, cutting and terminating the transmission path to prevent ringing from interfering with SF tone transmission.

6. specifications

E-lead resistance to ground
200 ohms maximum

ringing frequency range
16 to 67Hz

ringing voltage
50Vrms minimum

ringing-detection delay
50 to 150ms

M-lead modulation (ground-start, SF only)
20 ±3Hz

ring-ground delay (ground-start)
20ms maximum

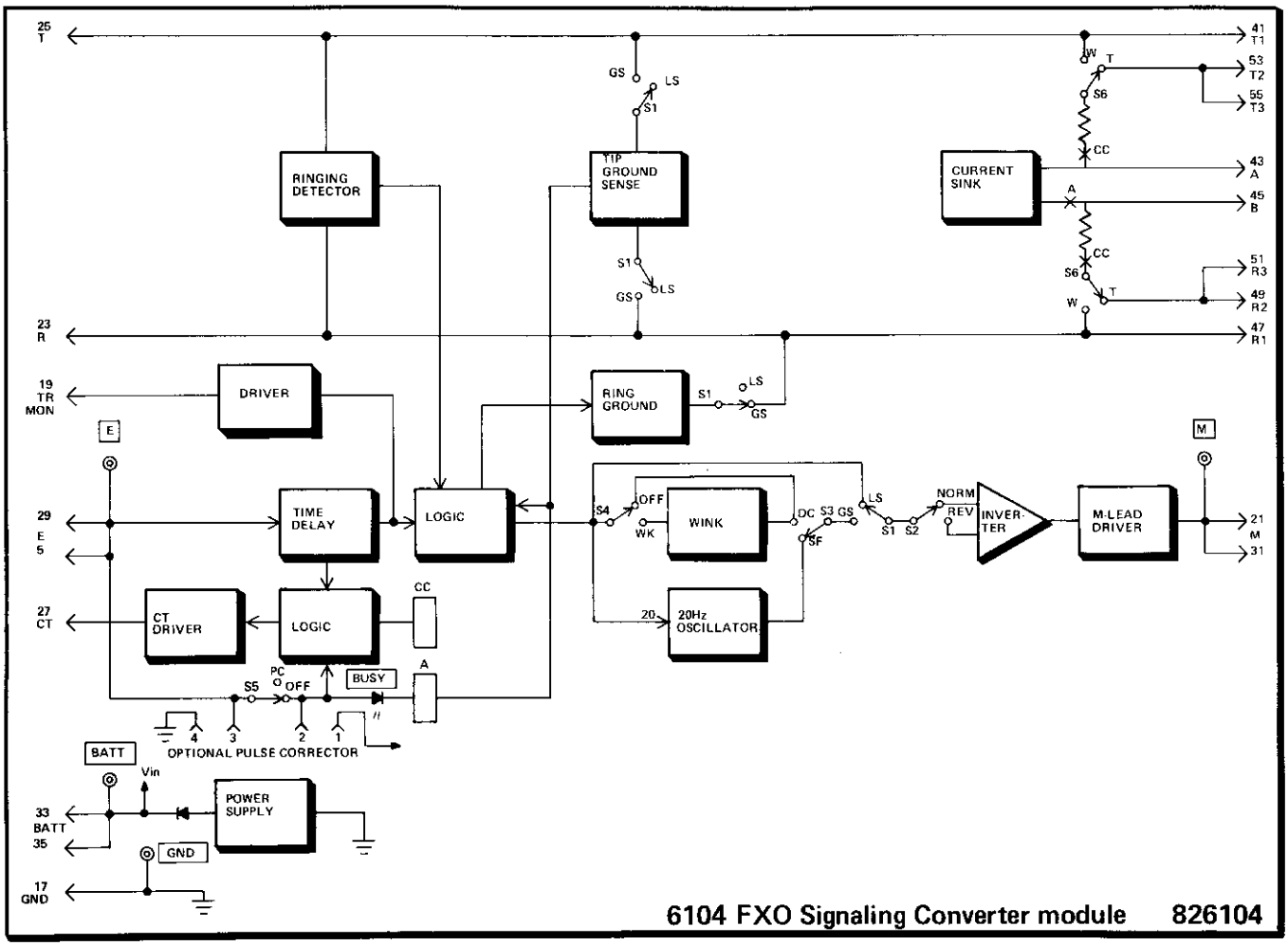
tip-ground sense delay (ground-start)
100ms maximum

loop-current limiting
60mA (dc) maximum for 0-ohm loop;
20mA (dc) minimum for 1200-ohm loop

M-lead current limiting
0.5 ampere sinking to battery (–48V)
0.1 ampere sourcing from ground

cut-and-terminate operate delay (SF only)
9ms maximum

cut-and-terminate release delay (SF only)
100ms minimum



5. Block Diagram

M-lead wink duration (dc only)
150 ±50ms

dial-transient-suppression operate delay
25ms maximum

dial-transient-suppression release delay
100ms minimum

receive (E-lead) pulse correction (via optional 9901 Pulse Corrector subassembly)
input 8 to 12pps, 30 to 70% break is corrected to 58 ±2% break;
input 14pps, 40 to 65% break is corrected to 57 ±3% break

dial-pulse distortion (without 9901 Pulse Corrector)
5% maximum

longitudinal balance
60dB minimum, 200 to 4000Hz

longitudinal environment
equivalent to 60Vac rms line induction (measured with unit removed, and tip and ring connected together to ground through a 500-ohm resistor)

input voltage
−22 to −56Vdc, filtered, earth-ground-referenced

input current
idle: 45mA maximum
busy: 80mA plus M-lead maximum

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

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

weight
8 ounces (227 grams)
9 ounces (255 grams) with 9901 Pulse Corrector

mounting
relay rack or apparatus case via one position of Tellabs Type 10 Mounting Shelf; also mounts in one position of a Tellabs 260 or 261 System Mounting Assembly

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 6104 FXO Signaling Converter module. The Checklist is intended as an aid in the 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. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 6104 module. Unauthorized testing or repairs may void the module's warranty.

7.02 If a situation arises that is not covered in the Checklist, contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle, Illinois, or Mississauga, Ontario, Headquarters. Telephone numbers are as follows:

US central region: (312) 969-8800
US northeast region: (412) 787-7860
US southeast region: (305) 645-5888
US western region: (213) 595-7071
Lisle Headquarters: (312) 969-8800
Mississauga Headquarters: (416) 624-0052

7.03 If a 6104 is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is more expedient, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

7.04 To obtain a replacement 6104 module, notify Tellabs via letter (see addresses below), telephone (see numbers above), or twx (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X6104 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 6104 in the replacement module's carton, sign the packing slip included with the replacement module, and enclose it with the defective module (this is your return authorization). Affix the preaddressed label provided with the replacement module to the carton being returned, and ship the module prepaid to Tellabs.

repair and return

7.05 Return the defective 6104 module, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532

in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 11
Mississauga, Ontario, Canada L4W 2S7

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: *This testing guide is based on the assumption that the 6104 is optioned for normal M-lead operation.*

test	test procedure	normal result	if normal conditions are not met, verify:
M-lead idle, loop-start	Verify *S2* set to *NORM.* With circuit idle, use a volt-ohm meter (VOM) to measure voltage (50Vdc scale) between ground and M-lead test points.	Meter shows approximately same voltage as battery (with no load on M lead) ☐.	Option switches correctly set ☐. Wiring ☐. Circuit idle ☐. Replace 6104 and retest ☐.
M-lead idle, ground-start	Verify *S2* set to *NORM.* With circuit idle, use VOM to measure voltage (50Vdc scale) between battery and M-lead test points.	Same as above ☐.	Same as above ☐.
outgoing ringing, loop-start	Apply ringing to terminal-side loop. Use VOM to measure voltage (50Vdc scale) between battery and M-lead test points.	Same as above ☐.	Option switches correctly set ☐. Circuit not seized from distant end ☐. Ringing voltage on 2wire tip and ring less than 50Vrms ☐. Replace 6104 and retest ☐.
outgoing ringing, ground-start, SF only	Same as above.	Meter shows battery voltage modulated by 20Hz (indicator will waver at somewhat less than battery voltage) ☐.	Same as above ☐.
outgoing ringing, ground-start, DC only	Same as above.	Meter shows approximately same voltage as battery ☐. If *S4* in *WK* position, 100ms pulse detected at the end of each ringing cycle (indicator will "dip" at regular intervals) ☐.	Same as above ☐.
E-lead idle	With circuit idle, use VOM to measure voltage across tip and ring.	Meter shows approximately same voltage as battery ☐.	Option switches correctly set ☐. Replace 6104 and retest ☐.
E-lead busy, loop-start	Same as above. Apply ground to E-lead test point.	Meter shows voltage drop proportional to loop length ☐.	Same as above ☐.
E-lead busy, ground-start	Same as above.	Same as above ☐. Voltage returns to higher level upon receipt of tip-ground ☐.	Same as above ☐.
dialing	Request distant location to send dial pulses at 50% break and 10pps. Use pulsing test set (PTS) connected to E lead and tip to measure % break.	Without 9901, output break within ±5% of input break ☐.	*S5* set correctly ☐. Replace 6104 and retest ☐.
	Connect PTS in monitor position to terminated receive tip and ring and measure pulses.	With 9901, dial pulses 58 ±2% break ☐.	Same as above ☐.