Tellabs
technical manual
76-816103
rev E

practice section 816103

6103 FXS Signaling Converter

contents

1. general description

1.01 The 6103 FXS (foreign exchange, station end) Signaling Converter module (figure 1) provides conversion between facility-side E&M signaling and the loop signaling normally used at the station end of a foreign exchange (FX) or off-premises-station (OPS) circuit. Specifically, the 6103 converts incoming E-lead signals to station-end ringing and seizure states and also converts supervisory and dialing states from the station to outgoing M-lead signals.

1.02 This practice section is revised to correct the block diagram, to provide updated application information, and to make several minor corrections and improvements to the text, tables, and figures.

1.03 The 6103 can be used alone as a direct E&M-carrier interface device, or it can be paired with a Tellabs 6101 SF Transceiver module or with a Tellabs 6001 or 6002 DX Signaling Module. Such two-module combinations provide facility-side SF or DX signaling, terminal- (station-) side FXS-type loop signaling, and full-duplex conversion between the two signaling modes.

1.04 Features and options available in all three applications of the 6103 (direct E&M-to-loop interface, SF interface, and DX interface) include the following: switchable loop-start or ground-start operation, switchable normal or inverted E-lead signaling states (except in ground-start SF applications), ring-up and ring-trip circuitry compatible with any type of biased ringing arrangement, loop-sensing and ring-trip ranges of 3000 ohms (at −48Vdc operation), accommodation of either A&B-lead or A, B, T, and R-lead station-side signaling, M-lead current limiting, and minimum-break transmit pulse correction.

1.05 When used in combination with a 6101 SF Transceiver, the 6103 converts E-lead signals (derived by the 6101 from received SF tones) to ringing and tip-ground supervision toward the station. It also converts loop supervisory and dialing signals received from the station to M-lead input for the transmit section of the 6101. The 6103 controls (but does not perform) pre-cut, cut-and-terminate, and tone-generation functions. These functions are instead performed by the 6101, which contains an integral 2600Hz oscillator, transmit tone-control and path-cut circuitry, and receive tone-reception and output-level-control circuitry. In SF applications, the 6103 follows ringing from the switching equipment in either the loop-start or ground-start supervisory mode.

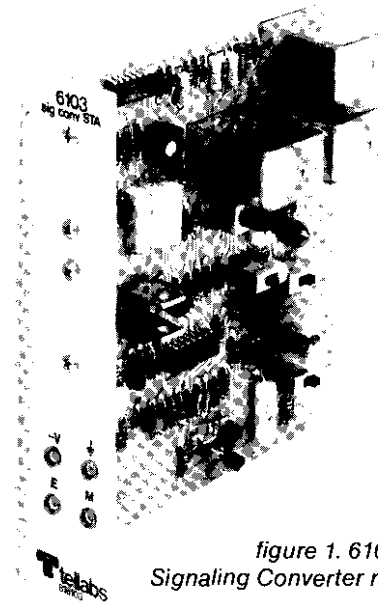


figure 1. 6103 FXS Signaling Converter module

1.06 When used in combination with a 6001 or 6002 DX Signaling module, the 6103 provides E&M-to-loop signaling conversion in essentially the same manner as in SF applications. In DX applications, the 6103 follows ringing from the switching equipment in the loop-start mode but provides only continuous ringing in the ground-start mode unless the local ringing generator is equipped with an interrupter. Features and options of the 6103 relating to DX (or other dc) applications and also to direct loop-to-E&M (carrier-interface) applications include transient suppression during both dialing and idle conditions, dial-pulse delay to ensure that transient-suppression circuitry is inserted before transmission of dial pulses, idle-circuit termination, and a lead for disabling an associated voice-frequency repeater during idle circuit conditions.

1.07 Circuit testing and maintenance are facilitated by four test points on the 6103's front panel. These provide access to battery, ground, E lead, and M lead.

1.08 An internally regulated power supply in the 6103 permits operation on filtered, ground-referenced −22 to −56Vdc input. For maximum current requirements in the 6103's various modes of operation, see section 6 of this practice. M-lead and B-lead potentials are derived from input power prior

to regulation; thus, conventional external M-lead and B-lead power can be used with the 6103.

1.09 A Type 10 module, the 6103 mounts in one position of a 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 6103 can also be mounted in the appropriate module position(s) in a Tellabs 260 or 261 Signaling and Terminating System Mounting Assembly.

2. application

2.01 The 6103 FXS Signaling Converter module serves three basic areas of application:

A. Interfacing a Tellabs 6101 SF Transceiver with a station-end FX or OPS loop. In such applications, the 6101-6103 combination meets all F-type specifications for an SF-to-FXS-type signaling system.
B. Interfacing a Tellabs 6001 or 6002 DX Signaling Module with a station-end FX or OPS loop.
C. Interfacing an E&M signaling facility (e.g., an E&M carrier channel) with a loop that uses FXS-type signaling. In this case, the 6103 is used on a stand-alone basis, i.e., **not** in conjunction with a companion SF or DX signaling module.

2.02 A common use of the 6103 is in Tellabs' 260 and 261 Signaling and Terminating Systems. Both systems are universally wired 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 (office-end foreign exchange [FXO], station-end foreign exchange [FXS], E&M, conventional ringdown, or data ringdown) can be changed simply by interchanging the appropriate modules. See the 260 and 261 System practices for a comprehensive description of the 6103's operation in these systems.

2.03 The 6103 can be switch-optioned for the loop-start or ground-start supervisory mode. Loop-start operation is common in FX and OPS applications in which a single station instrument is served. Ground-start operation is used in applications where "head-on" or "glare" can be a problem, such as when trunking into a PBX.

SF applications (with companion 6101)

2.04 The 6103 module, in combination with a Tellabs 6101 SF Transceiver module, provides a signaling circuit that meets all F-type inband SF signaling specifications for the station end of an FX or OPS circuit. Paragraph 1.05 describes how the 6103 and 6101 work together.

2.05 **Signaling Tone States.** Standard E&M-lead states for the 6103, as well as the corresponding SF tone states for the 6101 module and the corresponding conditions at the station, are listed in tables 1 and 2 for loop-start and ground-start operation, respectively. Please note that local station ringing is derived from the E-lead input state and that the 6103's M-lead output is derived from the station's on-hook/off-hook/dialing states. Also, please be aware that the normal/inverted E-lead signaling-state option is nonfunctional (i.e., its switch setting is immaterial) in **ground-start** SF applications.

Note: *With* **normal** *E-lead signaling states, the 6103's ring-up (RU) relay operates when the E lead is open. With* **inverted** *E-lead signaling states, the RU relay operates when the E lead is grounded. This applies not only to SF applications but also to DX (dc) and loop-to-E&M applications of the 6103.*

station condition	SF tone rcv	SF tone xmt	E lead	M lead
on-hook	off	on	gnd	gnd
ringing	on	on	open (−21V)	gnd
off-hook	off	off	gnd	battery
dialing	off	off-on-off	gnd	batt-gnd-batt

table 1. Signaling conditions, loop start

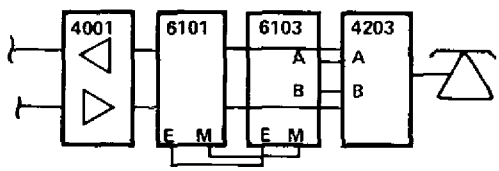
station condition	SF tone rcv	SF tone xmt	E lead	M lead
on-hook	on	on	open (−21V)	gnd
local ring gnd (service request)	on	off	open (−21V)	battery
tip gnd toward off-hook station	off	off	gnd	battery
dialing	off	off-on-off	gnd	batt-gnd-batt
off-hook (busy)	off	off	gnd	battery
ringing	on*	on	alternating gnd and open (−21V)	gnd
*Modulated at 20 to 60Hz.				

table 2. Signaling conditions, ground start

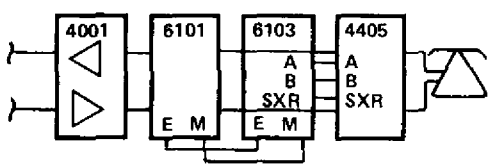
2.06 **Signaling Tone Levels.** When used with the 6103, the companion 6101 SF Transceiver interfaces the 4wire SF facility at standard +7 receive and −16 transmit TLP's (transmission level points) via an associated line-interface module (see paragraph 2.07). During loop-start ringing and ground-start idle conditions, SF tone is received at a nominal −20dBm0 (−13dBm) level. A higher level of −8dBm0 (−1dBm) is received for approximately 400ms each time tone is applied at the distant (office) end of the facility. During both loop-start and ground-start idle conditions, the 6101 transmits SF tone at −20dBm0 (−36dBm). During dial-pulse breaks (in both supervisory modes) and also for the first 400ms each time it applies tone to the facility, the 6101 transmits tone at a higher level of −8dBm0 (−24dBm). This momentarily increased tone level aids in office-end detection of supervisory-state changes and incoming dial pulsing.

2.07 **Facility and Terminal Interfaces.** As stated above, the 6101 SF Transceiver, when used with the 6103, interfaces the 4wire VF facility via a line-interface device. This device, generally a line amplifier (Tellabs 400X or equivalent), provides not only impedance matching but also the level control necessary to derive the +7 receive and −16

terminating set (Tellabs 420X or equivalent) provides the necessary level coordination, impedance matching, and 4wire-to-2wire conversion in applications where the station-end equipment (telephone or PBX is 2wire. If the station-end equipment is 4wire, a 4wire station termination module (Tellabs 4405 or equivalent) is normally used for impedance matching and level coordination. Figure 2 shows typical FXS SF signaling and terminating circuit arrangements. For detailed information on the modules other than the 6103 shown in figure 2, please refer to their individual Tellabs practices.



Foreign Exchange – 2wire Station – SF



Foreign Exchange – 4wire Station – SF

figure 2. Typical SF applications with 2wire and 4wire station terminations

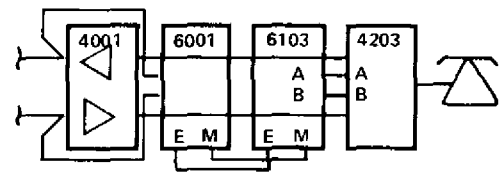
DX applications

2.08 The 6103 module can be paired with a DX signaling module in FX and OPS applications where conversion is required between facility-side DX signaling and FXS-type terminal-side signaling. For 4wire DX facilities, a Tellabs 6001 DX Signaling module is used; for 2wire DX facilities, a Tellabs 6002 DX Signaling Module (with integral repeat coil) is used.

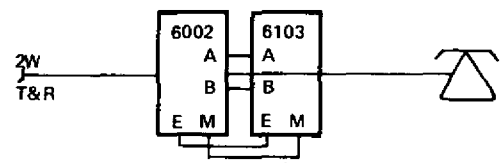
2.09 In 4wire DX applications, a facility-interface device (normally, a Tellabs 400X Line Amplifier or 4411A Pad/Transformer module) must be used to derive the simplex (SX) leads used as inputs from the facility to the 6001 DX module. In 2wire DX applications, a separate facility-interface device is not required because a repeat coil is integral to the 6002 DX module. Figure 3 shows typical FXS DX signaling and terminating circuit arrangements. For detailed information on the modules other than the 6103 shown in figure 3, please refer to their individual Tellabs practices.

2.10 The 6103 automatically provides dial-pulse transient suppression and idle-circuit termination in DX applications. Also, provision is made to disable an associated repeater during idle and dialing intervals. M-lead outputs from the 6103 are delayed approximately 16ms to ensure that the transient-suppression circuitry is connected before signaling takes place.

Note: *For proper operation of a 4wire DX circuit with identical intermodule wiring at both ends of the facility (as is the case with the universally wired Tellabs 260 and 261 Signaling and Terminating Systems), the 600X DX module at one end of the facility must be optioned for normal input leads, and the 600X at the opposite end must be optioned for reversed input leads.*



Foreign Exchange – 2wire Station – DX



Foreign Exchange – 2W/2W Station – DX

figure 3. Typical DX applications with 2wire and 4wire facility terminations

2.11 Ringing energy to an FX or OPS station must be provided from a local ringing source. In DX applications, CO ringing is followed by the 6103 in the loop-start mode, but only continuous ringing can be provided in the ground-start mode unless the local ringing source is equipped with an interrupter.

loop-to-E&M applications

2.12 The 6103 can be used without an associated SF or DX signaling module to convert E&M facility signaling (typically, from an associated carrier channel) to FXS-type signaling at the station end of a circuit. If the carrier channel uses inverted E-lead signaling states, the 6103's inverted-E-lead signaling option provides the necessary compatibility. Please note that if the carrier channel (or other facility-side signaling equipment) requires –48Vdc M-lead potential, the 6013 must likewise be powered from a nominal –48Vdc source. Also, please be aware that the information in paragraphs 2.10 and 2.11 applies equally to E&M applications of the 6103. Figure 4 shows a typical 4wire-E&M-to-2wire-FXS application. A terminating set (Tellabs 420X or equivalent) provides the required 4wire-to-2wire conversion.

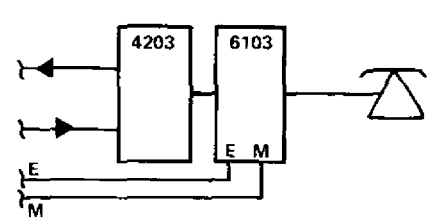


figure 4. Typical 4wire-E&M-to-2wire-FXS application

station interface

2.13 In both 4wire SF and 4wire DX applications of the 6103 (as mentioned above), a 4wire-to-2wire terminating set (e.g., a Tellabs 420X) must be used to interface the 6103 with a 2wire station or PBX, and a 4wire station termination module (e.g., a

Tellabs 4405) must be used to interface the 6103 with a 4wire station or PBX. In either case, signaling between the 6103 and the station-side terminating module can be accomplished either via the A&B leads alone or via the A&B and station transmission (T&R) leads.

2.14 In 2wire station and PBX applications, the use of a terminating set with an A&B-lead inductor and A&B-lead filter capacitors (e.g., the Tellabs 4203) is highly recommended, especially when A&B-lead signaling is used. With a terminating set of this type, the battery supply is isolated to improve hybrid balance and reduce the effects of battery noise. In some circumstances, however, an A&B-lead inductor can contribute to dial-pulse distortion. See the Tellabs 4201/4203 practice for details.

pulse correction

2.15 Within the 6103, transmitted dial pulses are delayed 14 to 20ms. In SF applications, this results in a pre-cut interval of sufficient duration to ensure that the transmit path cut is always inserted prior to any SF tone transmission. In DX and loop-to-E&M applications, this dial-pulse delay provides adequate time for insertion of the 6103's transient-suppression circuitry. Momentary loop-current "makes" and "breaks" less than 15ms in duration are not recognized by the 6103. All incoming breaks between 30 and 50ms are lengthened to 50 ± 2ms, regardless of pulsing speed, by the 6103's integral minimum-break pulse corrector. All incoming breaks longer than 50ms are transmitted with the same duration at which they were received ±2ms.

power and range

2.16 Although the 6103's internal circuitry receives power from the module's integral series regulator (which allows operation on −22 to −56Vdc input power), M-lead and B-lead potentials are derived directly from the **external** power source. Loop-sensing limits, therefore, depend upon the external source. The 6103's loop-sensing circuitry operates 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 B-lead potential and 650 ohms at 24Vdc B-lead potential. For applications involving a short loop between the 6103 and the local station, 24Vdc B-lead potential is recommended. With respect to the M lead, external powering from a 48Vdc source is necessary to provide any substantial facility-side range in DX or other dc applications. (The 8001 Power Supply used in Tellabs 261 Systems containing the 6103 can be switch-optioned to provide 24Vdc or 48Vdc power.) If, in a DX or other dc application, the station-side loop is short but the facility-side loop is long, the requirements of the facility side take precedence and 48Vdc power must be used.

ringing

2.17 In SF applications and also in loop-start DX applications, a local noninterrupted ringing source is required by the 6103. In these applications, the 6103 follows switching-equipment (CO or PBX) ringing. In ground-start DX applications, either an interrupted or a noninterrupted local ringing source can be used because, in these applications, the 6103 applies a continuous connection to the ringing source.

2.18 To enable local ring trip during the ringing interval, some type of dc bias during ringing must be provided. (This is sometimes referred to as *superimposed ringing*.) The required dc bias can be provided via either of two ringing arrangements: battery-connected ringing or grounded ringing. In battery-connected ringing, one side of the ringing generator's floating output is connected to the module's negative battery supply, and the other side of the ringing-generator output is connected to the 6103's ring-generator lead (pin 9). In grounded ringing, one side of the ringing generator's floating output is connected to the same ground as the 6103 module, and the other side of the ring-generator output is connected to the 6103's ring-generator lead (pin 9). **In ground-start applications, battery-connected ringing must be used.** A switch option on the 6103 conditions the module for operation with either of the ringing arrangements described above.

3. installation

3.01 The 6103 FXS 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 6103 mounts in one position of a Tellabs Type 10 Mounting Shelf, or in position 3 of a Tellabs 260 or 261-System Mounting Assembly. The module plugs physically and electrically into a 56-pin connector at the rear of the shelf or assembly.

installer connections

3.03 In applications where the 6103 module is to be installed in a 260 or 261 Assembly, no external connections to the module itself need be made because all internal connections in these assemblies are factory-prewired. For reference purposes, however, all required connections in a typical 260 or 261-System signaling and terminating circuit (in this illustration, an SF circuit) are shown in figure 5.

3.04 When a 6103 module is to be installed in a conventional Type 10 Shelf, external connections to the module must be made. Before making any connections to the shelf, ensure that power is **off** and modules are **removed**. Modules should be put into place only **after** they are properly optioned and **after** wiring is completed.

3.05 The following tables, 3 through 7, list external connections to the 6103 module. All connections are made (to non-prewired mounting shelves) via wire-wrapping to the 56-pin connector at the

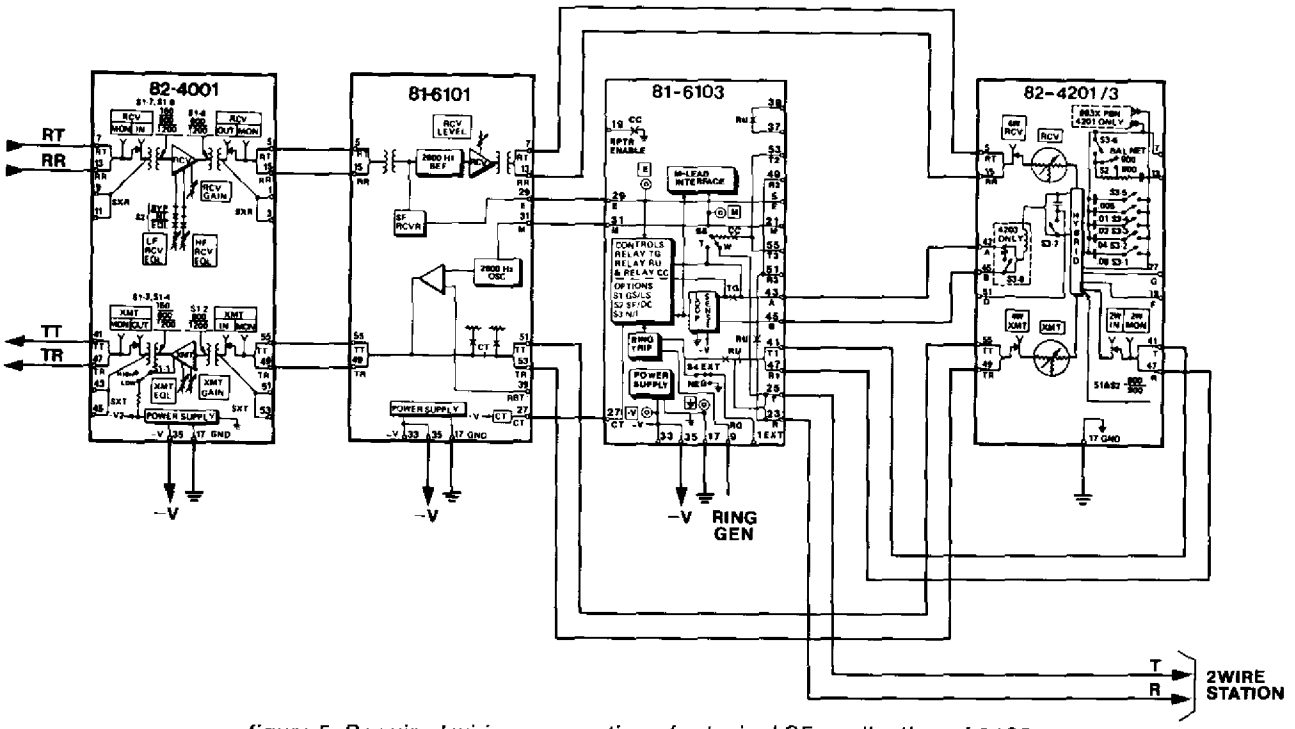


figure 5. Required wiring connections for typical SF application of 6103 (these connections are factory-prewired in Tellabs 260 and 261 Assemblies)

rear of the module's shelf position. Pin numbers are found on the body of the connector. Connections common to all applications of the 6103 are listed in table 3. Additional connections required for specific applications are listed in tables 4, 5, 6 and 7. **The installer should make all connections listed in table 3 and all connections listed in one (and only one) of the specific-application tables (4, 5, 6, and 7).** Again, please note that if

connect:	to pin:
E lead	5 or 29
M lead	21 or 31
CT RELAY CONTROL*	27
−BATT (−22 to −56Vdc filtered input)	33 or 35
GND (ground)	17
RING GENERATOR	9
EXT RG BIAS (external −24 or −48Vdc ring-generator bias)**	1
RPTR ENABLE (external repeater-enable or ground)***	19

* SF applications only.
** Required only if ringing source is referenced to ground potential.
*** DX or other dc applications only.

table 3. External connections to 6103

connect:	to:	function:
6103, pin 41	6103, pin 43	internal A lead
6103, pin 45	6103, pin 47	internal B lead
6103, pin 25	420X or 4405, pin 43	external A lead
6103, pin 23	420X or 4405, pin 45	external B lead

table 4. Additional 6103 connections required for SF applications where signaling is via **A&B leads only**

connect:	to:	function:
6103, pin 41	420X, pin 41*	tip lead to hybrid
6103, pin 47	420X, pin 47*	ring lead to hybrid
6103, pin 43	420X, pin 43*	A lead
6103, pin 45	420X, pin 45*	B lead
6103, pin 25	station tip lead	
6103, pin 23	station ring lead	

* If a 4405 4Wire Station Termination module is used in place of 420X Term Set module, only transmit-pair ringing can be used.

table 5. Additional 6103 connections required for SF applications where signaling is via A, B, and transmission (T&R) leads

connect:	to:	function:
6103, pin 41	6103, pin 43	internal A lead
6103, pin 45	6103, pin 47	internal B lead
6103, pin 25	420X or 4405, pin 43	external A lead
6103, pin 23	420X or 4405, pin 45	external B lead
6103, pin 53 or 55	420X or 4405, pin 41	tip-lead transient sup.
6103, pin 49 or 51	420X or 4405, pin 47	ring-lead transient sup.

table 6. Additional 6103 connections required for DX applications and for loop-to-E&M applicaitons

connect:	to:	function:
6103, pin 41	6103, pin 43	internal A lead
6103, pin 45	6103, pin 47	internal B lead
6103, pin 25	6002, pin 43	external A lead
6103, pin 23	6002, pin 45	external B lead
6103, pin 53 or 55	6002, pin 41	tip-lead transient sup.
6103, pin 49 or 51	6002, pin 47	ring-lead transient sup.

table 7. Additional 6103 connections required for 2wire DX applications

the 6103 is to be used in a Tellabs 260 or 261 Assembly, all connections to the 6103 (and its companion modules) are prewired.

switch options

3.06 Five option switches on the 6103 must be set before the module is placed into service. Locations of these switches on the module's printed circuit board are shown in figure 6. Instructions for setting the five switches follow in paragraphs 3.07 through 3.11.

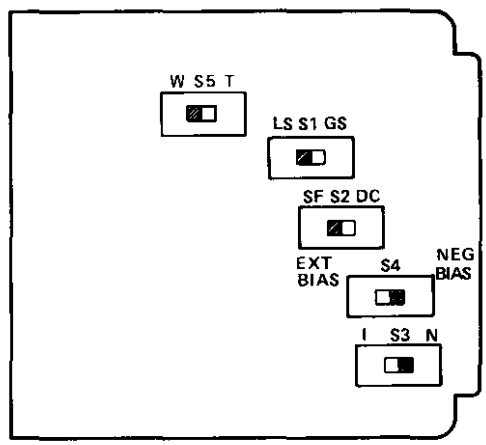


figure 6. 6103 option switch locations

3.07 **Supervisory Mode.** Switch *S1* conditions the 6103 to operate in either the loop-start or ground-start supervisory mode. For loop-start operation, set *S1* to the *LS* position. For ground-start operation, set *S1* to the *GS* position.

3.08 **SF or DX (dc) Operation.** Switch *S2* conditions the 6103 for proper operation in either SF or DX (dc) applications. In SF applications (6103 used with 6101), set *S2* to the *SF* position. In DX applications (6103 used with 6001 or 6002), in other dc applications, and in loop-to-E&M applications, set *S2* to the *DC* position.

3.09 **Normal or Inverted E-Lead States.** Switch *S3* selects normal or inverted E-lead signaling states. For normal E-lead states (RU relay operation when E lead is open), set *S3* to the *N* position. For inverted E-lead states (RU relay operation when E lead is grounded), set *S3* to the *I* position.
Note: *The inverted E-lead option can only be used on loop-start SF signaling circuits.*

3.10 **Ring Generator Bias.** Switch *S4* conditions the 6103 for use with either battery-connected or grounded ringing. For battery-connected ringing, set *S4* to the *NEG BIAS* position. For grounded ringing, set *S4* to the *EXT BIAS* position and connect a nominal −24 or −48Vdc source to connector pin 1.

3.11 **Station-Side Signaling-Lead Arrangement.** Switch *S5* selects either A&B-lead or A, B, and transmission-lead (T&R) station-side signaling. If A&B-lead signaling is to be used, set *S5* to the *T* position. If A, B, T, and R-lead signaling is to be used, set *S5* to the *W* position.

Note: *Whenever the 6103 is used in a Tellabs 260 or 261 Signaling and Terminating System or in an application where the Tellabs universal wiring scheme of these systems is used, switch* S5 **must** *be set to the* T *position.*

alignment

3.12 The 6103 requires no alignment. In SF applications, however, the receive amplifier of the associated 6101 SF Transceiver must be adjusted for zero gain through the module. Also, if a line amplifier is used as the associated facility-interface device, it should be adjusted (at 1004Hz) to provide a standard +7 receive TLP at the 6101's receive input port. Similarly, if a terminating set or 4wire station termination module is used as the associated station-side loop-interface device, it should be adjusted (at 1004Hz) to provide a standard −16 transmit TLP at the 6101's transmit output port. Refer to the Tellabs 260 or 261 System practice, if applicable, and to the individual Tellabs practices on the associated line amp, term set or station termination module, and signaling module for complete information on the optioning and alignment of these modules.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 6103 FXS Signaling Converter module for engineering and application purposes only. Attempts to troubleshoot the 6103 internally are not recommended and may void its warranty. Troubleshooting procedures should be limited to those prescribed in section 7 of this practice. Please refer to the 6103 block diagram, section 5 of this practice, as an aid in following the circuit description.

4.02 The 6103 provides ringing toward the station in response to an input E-lead signal and derives an M-lead output from detection of loop supervisory and dialing conditions from the station. The E-lead and M-lead circuits are independent except for a *ring inhibit* interconnection between the *loop-current sensor* and the *ring-up (RU) relay control* circuit to prevent sering.

4.03 The input E lead to the 6103 is connected to the *RU relay control* circuit through appropriate sensing and delay circuits. In loop-start operation, an E-lead input derives the *RU relay* through the *ring delay* and *RU-relay control* circuitry. In ground-start operation, not only does an E-lead input drive the *RU relay* through the aforementioned circuitry, the E-lead input also drives the *tip-ground (TG) relay* through the *tip-ground delay* circuit. The delay timing is such that the *TG relay* always operates before the *RU relay.*

4.04 Ringing current is supplied toward the station through a *ring-trip detector* circuit when the *RU relay* is operated. Option switch *S3* allows either normal or inverted E-lead operation to be selected. With normal E-lead operation, the *RU relay* operates when the E lead is open; with in-

verted E-lead operation, the *RU relay* operates when the E lead is grounded. The *RU relay* is de-energized (to prevent its operation) by inhibit logic associated with the *ring-trip detector* and by an off-hook indication from the *loop-current detector.*

4.05 Local ring trip is accomplished by a bidirectional opto-coupled *ring-trip detector* that responds to the dc component of the composite ac-dc ringing signal. The ac component is routed around the *ring-trip detector,* thereby preventing pre-trip even with large capacitive loads. An option switch conditions the module for operation with either battery-connected or grounded ringing.

4.06 Loop current is sensed by the 6103's precision balanced *loop-current detector.* The output of this *detector* provides input to a *make delay* timing circuit that delays recognition of each off-hook (make) transition by approximately 16ms and also to the *cut-and-terminate/cut-control (CT/CC) relay control* circuit. This circuit controls the CT relay (located on the associated 6101 SF Transceiver module) in SF applications and controls the CC relay (located on the 6103 itself) for transient suppression in DX (or other dc) and loop-to-E&M applications.

4.07 A *break delay* circuit similar to the *make delay* timer delays recognition of each on-hook (break) transition by approximately 16ms. The *minimum-break timer* ensures a minimum delay of 50ms between successive make-break/break-make transitions.

4.08 The *minimum-break timer,* which is a monopulser (or "one-shot"), provides input to the *M-lead driver.* The *M-lead driver* is a Schmitt-trigger level translator and pulse shaper that drives a transistorized M-lead circuit. A positive-temperature-coefficient varistor provides M-lead current limiting when the M lead is at negative battery potential (off-hook condition).

4.09 The *CT/CC relay control* circuit provides for operation of the associated 6101's CT relay (SF applications) or of the 6103's own *CC relay* (DX or other dc applications) within 2ms of detection of an off-hook-to-on-hook transition. The *CT/CC relay control* circuit also delays release of the 6101's *CT relay* or the 6103's *CC relay* for approximately 125ms after detection of an on-hook-to-off-hook transition, thus ensuring proper operation of the *CT* or *CC relay* during dial pulsing.

4.10 The 6103's integral *power supply* is a series voltage regulator that permits operation on −22 to −56Vdc input while limiting supply potentials to −21Vdc. An active divider derives a −10.5Vdc reference for the module's sensing and timing circuits. Unregulated input voltage is supplied to the B lead and M lead during off-hook intervals.

6. specifications

maximum E-lead resistance to ground
500 ohms

ringing frequency range
16 to 167Hz

ring-up delay
loop-start mode: 150 to 250ms
ground-start mode, SF applications: 120 to 180ms

tip-ground application delay (ground-start mode)
80 to 120ms

tip-ground removal delay (ground-start mode)
100 to 140ms

ring-trip range
0 to 3000-ohm loop

pre-trip margin
will not pre-trip with up to 4μF capacitance and 30 kilohms loop leakage

loop-sensing range
at 48Vdc: 3000 ohms loop resistance
at 24Vdc: 1200 ohms loop resistance

M-lead pulsing-rate range
7.5 to 14pps

M-lead delay
14 to 20ms

minimum-break pulse correction
- **input makes and breaks shorter than 15ms are ignored**
- **input breaks between 30 and 50ms are lengthened to and transmitted at 50±2ms**
- **input breaks longer than 50ms are transmitted at the same duration as received ±2ms**

maximum M-lead current
0.5 ampere

longitudinal balance
60dB minimum

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

transmit-path pre-cut interval (SF applications only)
11 to 18ms

CT-relay release delay (SF applications only)
100 to 150ms

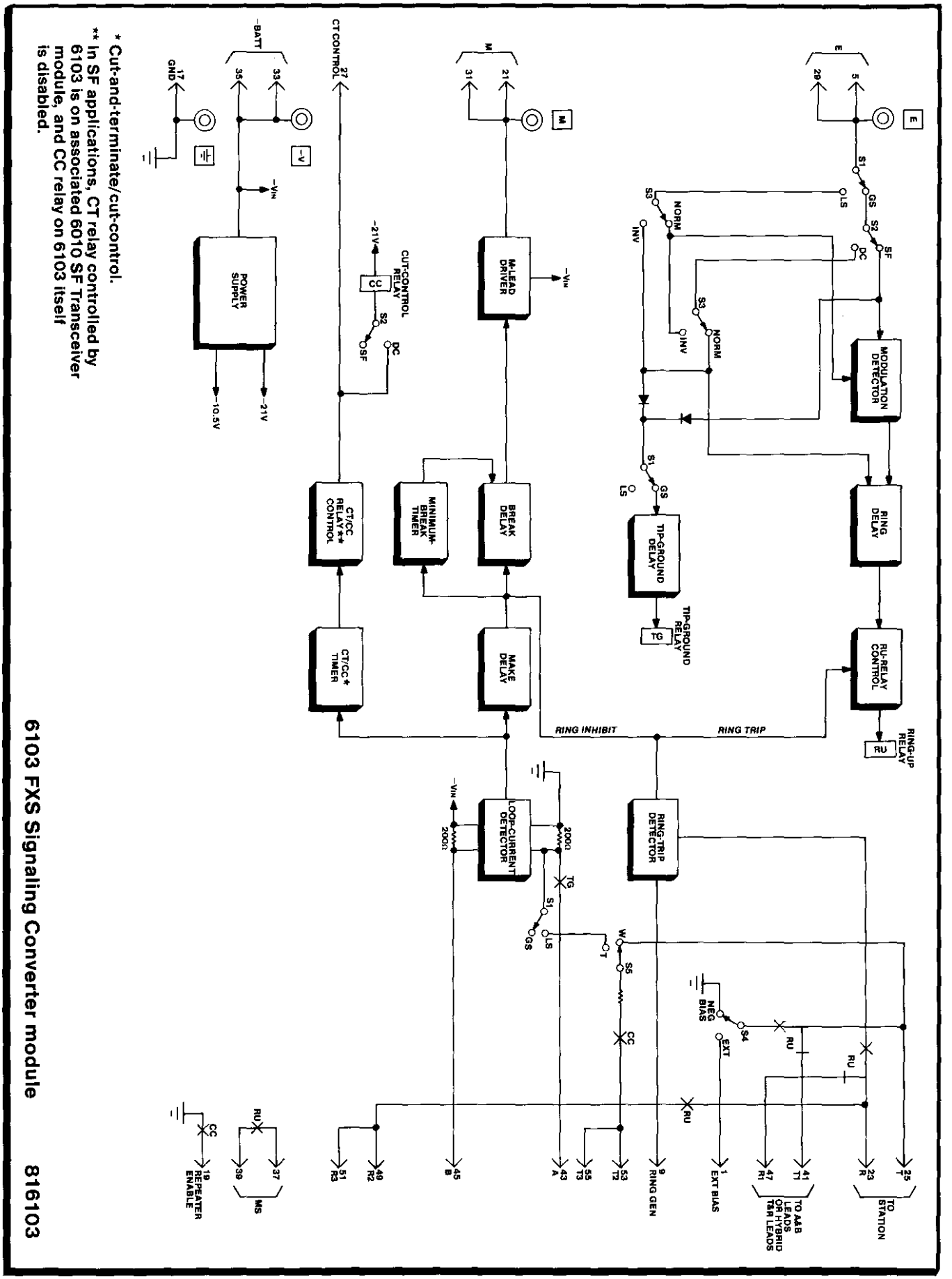
CC-relay operate delay (for idle-line termination and transient suppression in DX [dc] and loop-to-E&M applications only)
7ms maximum

CC-relay release delay (DX [dc] and loop-to-E&M applications)
100 to 150ms

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

maximum input current
idle, SF applications: 32mA
idle, DX (dc) applications: 55mA
busy, loop-start applications: 30mA plus A, B, and M-lead current
busy, ground-start applications: 50mA plus A, B, and M-lead current
ringing, ground-start applications: 80mA

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



* Cut-and-terminate/cut-control.

** In SF applications, CT relay controlled by 6103 is on associated 6010 SF Transceiver module, and CC relay on 6103 itself is disabled.

5. block diagram

6103 FXS Signaling Converter module 816103

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

weight
10 ounces (284 grams)

mounting
relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf; also mounts in appropriate module position(s) of a Tellabs 260 or 261 Signaling and Terminating 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 6103 FXS 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 6103 module. Unauthorized testing or repairs may void the module's warranty.

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 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: (702) 827-3400
Lisle Headquarters: (312) 969-8800
Mississauga Headquarters: (416) 624-0052

7.03 If a 6103 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 6103 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 8X6103 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 6103 in the replacement 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 6103 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 39
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: *It is assumed in this checklist that the signaling equipment at the distant (office) end of the circuit is arranged for normal (i.e., not inverted) M-lead signaling states: M lead at ground when idle and at battery when busy (distant E-lead states are open when idle and at ground when busy). If this is not the case, appropriate modifications to the checklist must be made to take into account the inverted distant-end M-lead states, which will result in inverted E-lead states (when switch* S3 *is set to* N *for normal E-lead states) at the local (station) end.*

test	test procedure	normal result	if normal conditions are not met, verify:
ring-up, loop-start, SF or DX (dc) operation	For applications with **normal** E-lead operation (*S3* set to *N*), initiate local ringing as follows: Request distant (office) end of ckt. to send SF tone, to place battery on distant M lead (DX1), or to ground distant E lead (DX2). As an alternative, open local E lead by unplugging associated signaling module. For applications with **inverted** E-lead operation (*S3* set to *I*), initiate local ringing as follows: Request distant end of ckt. to remove outgoing SF tone or to place battery on distant M lead, or ground local E lead at 6103's *E* test point.	For normal-E-lead applications, local ringing begins approx. 80ms after any of the following: receipt of SF tone, receipt of distant M-lead ground, or opening of local E lead ☐. For inverted-E-lead applications, local ringing begins approx. 80ms after any of the following: cessation of incoming SF tone, receipt of distant M-lead battery, or grounding of local E lead ☐.	Power ☐. Wiring ☐. Option switches *S1*, *S2*, and *S3* properly set ☐. Associated signaling module properly optioned ☐. In DX mode, normal/reversed DX-module input-lead option correct at both ends of ckt. ☐. Local station on-hook ☐. Station wiring correct ☐. No excessive station-loop leakage ☐. Ringing voltage present on pin 9 ☐. (If not, check ring-generator connections and opertion ☐.) Replace 6103 and retest ☐. Replace associated signaling module and retest ☐.
ring-up, ground-start, SF operation	Request distant (office) end of ckt. to send modulated SF tone or to ground and open the distant E lead at a 20 to 50Hz rate.	Local ringing occurs during receipt of modulated SF tone or of E-lead pulsing ☐.	Same as above ☐.
ring-up ground start, DX (dc) operation	For applications with **normal** E-lead operation (*S3* set to *N*), request distant (office) end of ckt. to apply ground to M lead. As an alternative, open local E lead. For applications with **inverted** E-lead operation (*S3* set to *I*), request distant end of ckt. to apply battery to M lead. As an alternative, ground local E lead at 6103's *E* test point.	For normal-E-lead applications, local ringing begins upon receipt of distant M-lead battery or upon grounding of local E lead ☐. For inverted-E-lead applications, local ringing begins upon receipt of distant M-lead ground or upon opening of local E lead ☐.	Same as above ☐.
ring trip	Initiate ringing in appropriate manner for your application (see preceding three tests). Go off-hook with local station telephone, or connect a resistor* across station T&R leads if station is inconveniently distant from 6103. (In 4wire station applications, connect resistor across station transmit pair.) *To simulate maximum range condition, use 300Ω resistor with 48Vdc loop powering and 1200Ω resistor with 24Vdc loop powering.	Ringing ceases ☐. No ringing is heard in station telephone receiver ☐.	Switch *S4* properly set ☐. Ring generator correctly biased ☐. Ringing voltage present on connector pin 9 ☐. Maximum station-side range not exceeded ☐.
seizure, loop-start, SF or DX (dc) operation	Go off-hook with local station telephone, or connect a resistor across station T&R leads as directed in preceding (ring trip) test. Monitor M-lead state at 6103's *M* test point.	With station on-hook, M lead is at ground ☐. With station off-hook, M lead is at battery ☐.	Station wiring correct ☐. No excessive station-loop leakage ☐. Maximum station-side range not exceeded ☐.

testing guide checklist continued on next page

test	test procedure	normal result	if normal conditions are not met, verify:
seizure, ground-start, SF or DX (dc) operation	With circuit idle, either ground the local ring lead or dial appropriate trunk-access code. Monitor M-lead state at 6103's *M* test point.	M lead changes from ground to battery potential upon seizure □.	Station or trunk wiring correct □. Station ring lead at battery during idle □. Ring ground during seizure does not exceed 200Ω at 48Vdc operation or 1000Ω at 24Vdc operation □.
CC-relay operation (tests idle-line termination in DX [dc] mode; tests cut-and-terminate function in SF mode)	Set switch *S2* to *DC* if it is not already set to that positon. Using VOM, measure resistance between pin 19 and ground during local-station on-hook, off-hook, and dialing conditions. In SF applications, reset *S2* to *SF* position at completion of this test.	Resistance is less than 5Ω during on-hook and dialing conditions □. VOM indicates open state during off-hook condition □.	Station wiring correct □. Option switches correctly set □. Maximum station-side range not exceeded □.
dial pulsing	Disconnect station T&R leads on station side of associated term set. (In 4wire station applications, disconnect station transmit T&R leads on station side of associated 4wire station termination module.) Connect transmit portion of pulsing test set (PTS) to term set's station T&R leads. (In 4wire station applications connect transmit portion of PTS to 4wire station termination module's station transmit pair.) Connect receive portion of PTS to 6103's M lead (use front-panel *M* test point if desired). Arrange xmt portion of PTS to transmit dial pulses at 10pps and at various percent breaks.	Pulses at less than 15% break result in no pulsing on M lead □. Pulses between 15 and 50% break are corrected to 50±2% break □. Pulses at greater than 50% break result in M-lead pulsing at same percent break as received from PTS ±2% □.	Same as above □.

Tellabs Incorporated
4951 Indiana Avenue, Lisle, Illinois 60532
telephone (312) 969-8800 twx 910-695-3530