tellabs
technical manual
76.826123
rev C 10/88

practice section 826123/826123A

6123 and 6123A 4Wire-to-2Wire SF-to-FXS Terminal Repeaters

1. general description

1.01 The 6123 and 6123A 4Wire-to-2Wire SF-to-FXS Terminal Repeater modules (figure 1) each provide active transmission interface and bidirectional signaling conversion between a 4wire facility that uses 2600Hz single-frequency (SF) signaling and a 2wire metallic link (station loop or PBX trunk) that uses foreign-exchange station-end (FXS) loop signaling. This type of loop signaling is normally associated with the station end of both foreign-exchange (FX) and off-premises-station (OPS) circuits. Unlike the 6123, the 6123A contains transmission and signaling loopback circuitry to facilitate local or remote testing of the module and the facility. As members of Tellabs' 262 Network Channel Terminating Equipment/Data Station Termination (NCTE/DST) System of modules and enclosures, the 6123 and 6123A each fulfill Registered Facility Interface Codes OC13A, OC13B, OC13C, OL13A, OL13B, and OL13C for applications where the serving telephone company uses facility-side SF signaling.

1.02 This practice section covers the Issue 2 versions of the 6123 and 6123A modules (Tellabs part numbers **826123** and **826123A**, respectively). The practice is revised to update the SF and E&M signaling specifications throughout the practice. The Issue 2 modules differ from their Issue 1 counterparts as follows:

- The facility-side (4wire-side) level-control circuitry offers a choice of gain or loss, instead of gain only, in both the transmit and receive channels.
- All printed-circuit-board option and alignment switches are moved to card-edge locations for improved visibility and accessibility.
- The integral compromise balance network (CBN) now offers a user-adjustable resistance control (0 to 2000 ohms in series with 2.15μF) in addition to switch-selectable choices of 900 or 600 ohms in series with 2.15μF.
- The receive-channel amplitude equalizer now offers a choice of compromise bump-type or active prescription slope-type equalization instead of slope equalization only.
- The transmit channel now offers active prescription slope-type amplitude equalization identical to the slope equalization available in the receive channel.

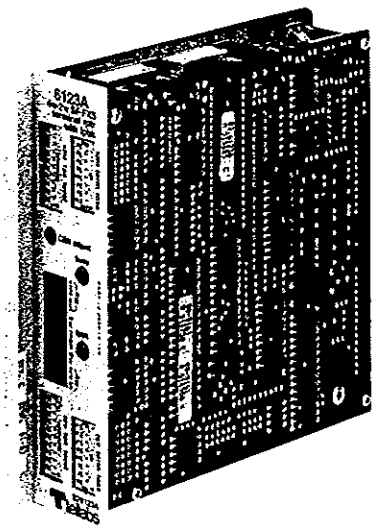


figure 1. 6123A 4Wire-to-2Wire SF-to-FXS Terminal Repeater module

- Both modules now operate on −42 to −56Vdc input power only.
- The transmit output simplex (XMT OUT SX) lead now appears on pin 43 instead of pin 45.
- The external transmit path cut lead (formerly on pin 27) is eliminated.
- External access to the module's A and B leads (formerly on pins 27 and 43, respectively) is no longer available.
- The external manual loopback (EXT MNLB) lead now appears on pin 18 instead of pin 9. Pin 9 (along with pin 11) is now the receive input simplex (RCV IN SX) lead.
- The 6123A's switch-selectable tone-loopback timeout intervals are changed to 4 minutes and 20 minutes instead of the previous 2.6 and 20.8 minutes.
- The 6123A's loopback-level-control circuitry is changed to provide 1.0dB gain/loss increments.

1.03 Features and options common to both the 6123 and 6123A modules include the following:

- 4wire-to-2wire conversion via an integral magnetic hybrid.
- From 0 to 24dB of prescription-set gain or loss, in switch-selectable 0.1dB increments, in both the transmit and receive channels at the facility-side ports (4wire transmit and 4wire receive).
- From 0 to 24dB of prescription-set loss, in switch-selectable 0.1dB increments, in both the transmit and receive channels on the module's terminal (2wire) side. This loss is actually introduced on the 4wire side of the hybrid.

- Integral receive-channel amplitude equalizer with a choice of two switch-selectable equalization modes:
  - ★ Compromise bump-type equalization for loaded cable. The bump equalizer introduces a 3dB bump at 3200Hz (re 1004Hz) and provides 1.5dB of roll-off at 404Hz (1004Hz).
  - ★ Active prescription slope-type equalization for nonloaded cable. The slope equalizer introduces from 0 to 7.5dB of gain at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments.
- Integral transmit-channel amplitude equalizer that is functionally identical to the receive-channel active prescription slope equalizer described above.
- Isolation transformers that are center-tapped to derive balanced simplex (SX) leads at both facility-side 4wire ports.
- Independently switch-selectable 1200, 600, or 150-ohm terminating impedance at each facility-side 4wire port.
- Switch-selectable 900 or 600-ohm terminating impedance in series with 2.15μF at the terminal-side 2wire port.
- Integral 2600Hz SF tone oscillator.
- Switch-selectable loop-start or ground-start operation.
- Switch-selectable automatic ringdown (ARD) operation as an alterative to FXS operation.
- Minimum-break transmit pulse correction.
- Integral compromise balance network (CBN) with switch-selectable 900 or 600-ohm impedance or front-panel-adjustable 0 to 2000-ohm impedance, all in series with 2.15μF of capacitance.
- From 0 to 0.062μF of network build-out (NBO) capacitance in switch-selectable 0.002μF increments.
- Traffic-monitoring (sleeve) lead.
- Loop-current limiting.
- Four front-panel bantam-type test jacks: an opening jack facing the module at each 4wire port, and both an opening jack facing the the module and a monitoring jack at the 2wire port.
- Front-panel LED that lights to indicate busy.
- Lightning surge protection at all transmission ports.
- Reverse-battery protection, transient-limiting circuitry, and RC (resistance-capacitance) filtering and decoupling networks to minimize crosstalk coupling and the effects of noise on the input power leads.
- Operation on filtered, ground-referenced −42 to −56Vdc input power with current requirements of 60mA typical at idle (at −48Vdc) and 101mA maximum (at −54Vdc), not including loop current. An additional 10mA is required for the 6123A when the module is in loopback.
- Type 10 module for mounting in a variety of Tellabs Type 10 Mounting Shelves, which are available in versions for relay-rack (occupying 6 inches of vertical rack space) and apparatus-case installation. The module can also be mounted in one position of a Tellabs 262-series NCTE/DST Mounting Assembly.

1.04 Loopback features and functions of the 6123A module include the following:

- Ability to perform transmission testing on the module and facility from a local or remote location.
- Ability to test the module's SF tone detector, SF tone oscillator and associated circuitry, transmit-path-cut circuitry, and SF signaling logic from a local or remote location.
- Manual (local) loopback activation via either of two methods: switch option or a connection between the manual loopback lead and the input power ground lead.
- Two-tone (remote) loopback with 2713Hz tone activation and a choice of deactivation methods: a second 2713Hz tone or automatic deactivation after a switch-selectable 4-minute or 20-minute interval.
- From 0 to 23dB of loopback-path loss or from 0 to 24dB of loopback-path gain, in switch-selectable 1dB increments, for true equal-level loopback.
- Front-panel LED that lights when loopback is in effect.

Note: *In those parts of this practice that apply equally to the 6123 and 6123A, both modules are, for convenience, referred to collectively as the* **6123/A.**

2. application

2.01 The 6123/A 4Wire-to-2Wire SF-to-FXS Terminal Repeater module is designed primarily to interface a 4wire transmission facility that uses SF signaling with a 2wire metallic link that uses FXS signaling. This link can be either a station loop or a PBX trunk (loop-start or ground-start) associated with the station end of an FX or OPS circuit. The 6123/A module combines the functions of a 4wire line amplifier, an SF transceiver, an SF-to-FXS signaling converter, and a 4wire-to-2wire hybrid terminating set. No external interface circuitry is required because the 6123/A is a complete SF signaling and terminating circuit, less power and ringing, on a single Type 10 card. Thus, the module provides not only bidirectional signaling conversion but also active transmission interface (impedance matching, level control, amplitude equalization, and 4wire-to-2wire conversion) between the SF facility and the FXS link. Unlike the 6123,the 6123/A contains integral transmission and signaling loopback circuitry that permits testing of both the module and the facility from a local or remote location.

2.02 The 6123/A module is well suited to a variety of 4wire-to-2wire SF-to-FXS and SF-to-station-end-OPS applications, both network-terminating and otherwise. In applications where the serving telephone company uses facility-side SF signaling, the module fulfills Registered Facility Interface Codes OC13A, OC13B, OC13C, OL13A,

OL13B, and OL13C. Figures 2 and 3 show typical FXS and OPS applications of the 6123/A. A special automatic ringdown (ARD) application of the module is covered in paragraph 2.24.

terminal (2wire) interface, balance network, and NBO capicatance

2.03 The 6123/A interfaces the 2wire station loop or PBX trunk via prescription attenuators in the tramsit and receive paths on the 4wire side of the integral magnetic hybrid (see paragraph 2.07) and via the hybrid itself. This hybrid provides switch-selectable 900 or 600-ohm terminating impedance (in series with 2.15μF) at the 2wire port. The 900-ohm option is selected for interface with loaded cable (or for interface with a switched network involving both loaded and nonloaded cable). The 600-ohm option is selected for interface with nonloaded cable or station equipment.

2.04 To ensure that adequate hybrid balance (i.e., enough transhybrid loss) is provided in any application, the 6123/A's hybrid can be switch-optioned to function with the module's internal compromise balance network (CBN). The CBN can be optioned for the same impedances as the 2wire port: 900 ohms (in series with 2.15μF) when the 2wire port interfaces loaded cable or a switched network, or 600 ohms (in series with 2.15μF) when the 2wire port interfaces nonloaded cable. A third CBN option allows from 0 to 2000 ohms of user-adjustable balance-network resistance (in series with 2.15μF) to be introduced via a front-panel control.

2.05 To further improve hybrid balance, from 0 to 0.062μF of network build-out (NBO) capacitance can be introduced across the module's balance port. This NBO capacitance can also be used to compensate for drop build-out (DBO) capacitors on the 2wire loop.

facility (4wire) interface

2.06 The 6123/A interfaces the 4wire-side (SF) transmission facility via prescription amplifiers in the transmit and receive paths and via transformers at the 4wire transmit and 4wire receive ports. Both facility-side transformers provide balanced, switch-selectable 1200, 600, or 150-ohm terminating impedance. The 1200-ohm option is used for interface with loaded cable; the 600-ohm option, for interface with nonloaded cable or carrier; and the 150-ohm option, to provide a small amount of slope equalization for long sections of nonloaded cable through the deliberate impedance mismatch. Both facility-side transformers are center-tapped to derive balanced simplex (SX) leads, which can be used to provide sealing current to a metallic facility from a local source external to the module, or which can be strapped together to establish a return path for sealing current applied at the distant end of the facility.

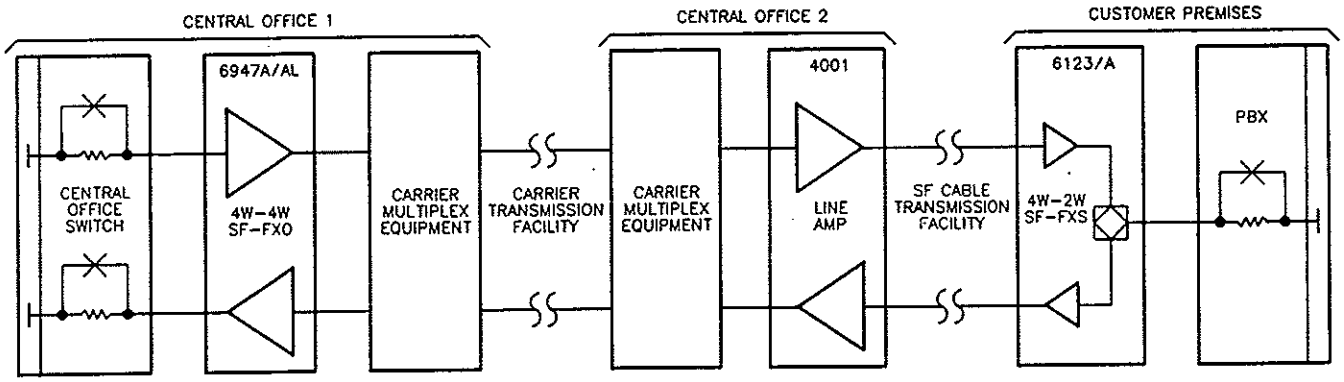


figure 2. Typical foreign-exchange (FX) application of 6123/A

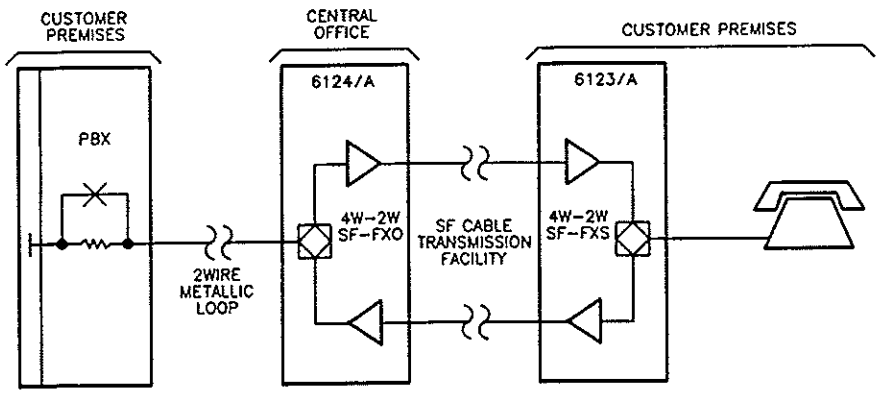


figure 3. Typical off-premises-station (OPS) application of 6123/A

level control

2.07 Prescription-set transmit and receive amplifiers on the facility side of the 6123/A allow the module to interface the 4wire SF signaling facility directly, i.e., without a separate facility-side line amplifier. The module's amplifiers, in conjunction with the prescription-set transmit and receive attenuators on the module's terminal side, provide for full coordination between facility-side (4wire) and terminal-side (2wire) levels (see figure 4). In the receive channel, the facility-side amplifier is set to provide the gain or loss necessary to derive a +7 transmission level point (TLP) within the module. This internal TLP is then used as a reference as the module's terminal-side receive attenuator is set to provide the loss necessary to derive the required 2wire output level. In the transmit channel, the terminal-side attenuator is set to provide the loss necessary to derive a −16TLP within the module. This internal TLP is then used as a reference as the module's facility-side transmit amplifier is set to provide the gain or loss necessary to derive the required facility-side 4wire transmit output level. Both facility-side amplifiers in the 6123/A provide from 0 to 24dB of gain or from 0 to 24dB of loss in switch-selectable 0.1dB increments. Both terminal-side attenuators provide form 0 to 24dB of loss in switch-selectable 0.1dB increments. Thus, 4wire receive TLP's from −17 to +7 can be accommodated and 2wire output TLP's from +7 to −17 can be derived. In a similar manner, 2wire input TLP's from −16 to +8 can be accommodated and 4wire transmit TLP's from +8 to −16 can be derived. Total facility-side gain and total terminal-side loss introduced into a channel are the respective sums of that channel's front-panel *fac level* and *term loss* switches set to *IN*. The overload point for the 4wire receive port and the 2wire port output is 0dBm0. The overload point for the 2wire port input and the 4wire transmit port is +3dBm0.

receive-channel amplitude equalization

2.08 Two modes of amplitude equalization are available on the 6123/A for post-equalization of the facility-side (4wire) receive pair. The first is prescription active slope equalization for nonloaded cable. When this mode is selected, from 0 to 7.5dB of gain at 2804Hz (re 1004Hz) can be introduced into the receive path in switch-selectable 0.5dB increments. Typical frequency response of the slope equalizer is shown in graphic form in figure 5 and in tabular form in table 1.

2.09 The second mode of receive-channel equalization available on the 6123/A is compromise bump-type equalization for loaded cable. The bump equalizer inserts a 3dB bump at 3200Hz (re 1004Hz) and provides 1.5dB of roll-off at 404Hz (re 1004Hz). Typical frequency response of the compromise bump equalizer is shown in graphic form in figure 6 and in tabular form in table 2.

2.10 The response curves of both the slope equalizer and the bump equalizer "pivot" at 1004Hz, as shown in figures 5 and 6. Thus, neither equalizer has any effect on 1004Hz levels. As a result, equalization can be introduced into the receive channel of the 6123/A not only before but also **after** receive levels are set, with no interference between level and equalization adjustments.

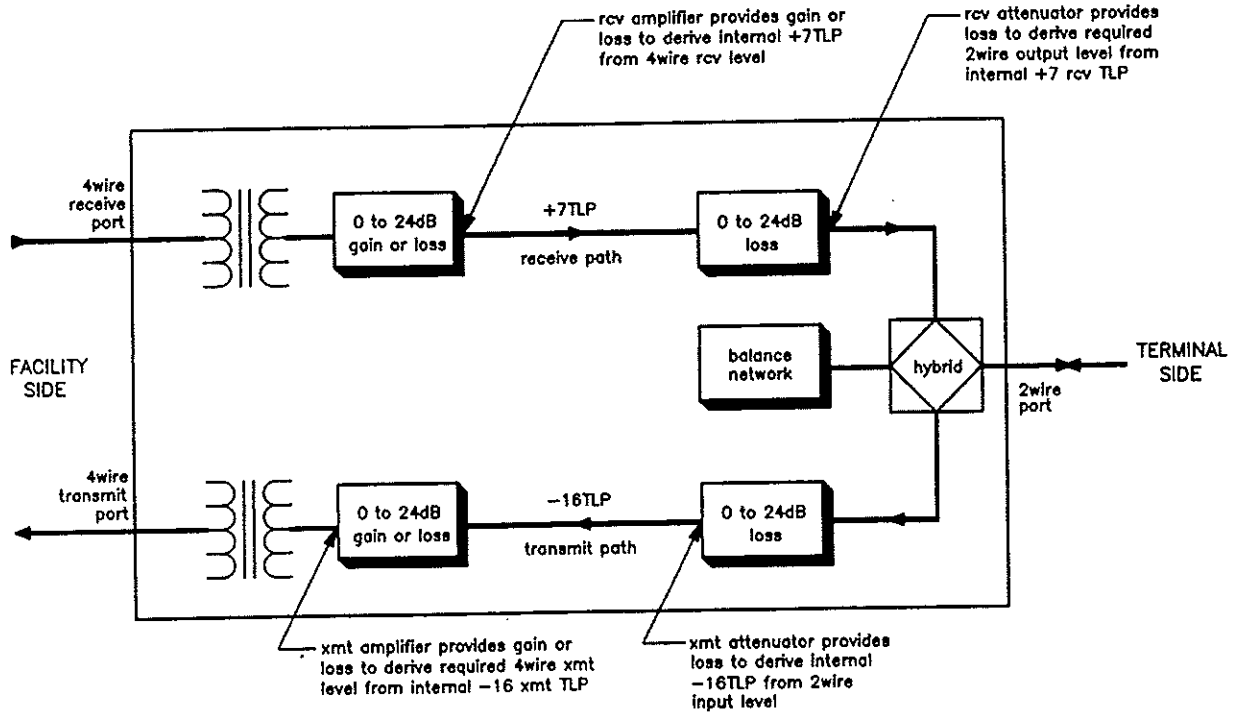


figure 4. Level coordination in 6123/A

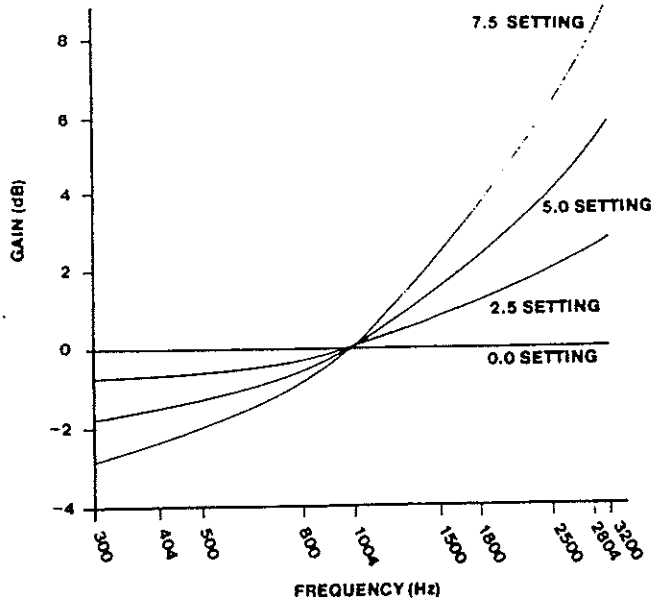


figure 5. Typical slope equalization response curves

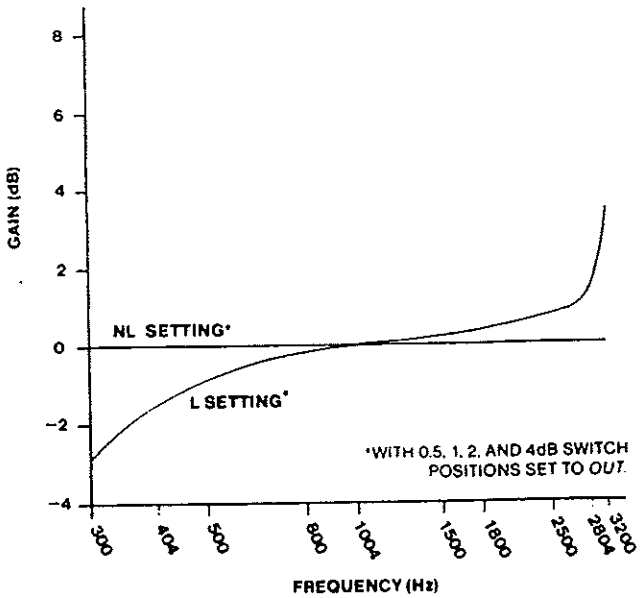


figure 6. Typical compromise bump equalization response curves

slope equalizer switch setting (dB)	equalized gain (in dB) introduced at various frequencies									
	300Hz	404Hz	500Hz	800Hz	1004Hz	1500Hz	1800Hz	2500Hz	2804Hz	3200Hz
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	−0.2	−0.2	−0.1	−0.1	0.0	+0.2	+0.3	+0.4	+0.5	+0.5
1.0	−0.3	−0.3	−0.3	−0.1	0.0	+0.4	+0.5	+0.9	+1.0	+1.1
1.5	−0.5	−0.5	−0.4	−0.2	0.0	+0.5	+0.8	+1.3	+1.5	+1.6
2.0	−0.7	−0.6	−0.5	−0.2	0.0	+0.7	+1.1	+1.8	+2.0	+2.2
2.5	−0.9	−0.8	−0.7	−0.3	0.0	+0.9	+1.4	+2.2	+2.5	+2.7
3.0	−1.1	−0.9	−0.8	−0.3	0.0	+1.1	+1.6	+2.7	+3.0	+3.3
3.5	−1.2	−1.1	−0.9	−0.4	0.0	+1.3	+1.9	+3.1	+3.5	+3.9
4.0	−1.5	−1.3	−1.2	−0.5	0.0	+1.3	+2.0	+3.4	+3.9	+4.4
4.5	−1.6	−1.5	−1.3	−0.5	0.0	+1.5	+2.3	+3.9	+4.4	+5.0
5.0	−1.8	−1.6	−1.4	−0.6	0.0	+1.6	+2.5	+4.3	+4.9	+5.6
5.5	−2.0	−1.8	−1.5	−0.6	0.0	+1.8	+2.8	+4.8	+5.5	+6.2
6.0	−2.2	−2.0	−1.7	−0.7	0.0	+1.9	+3.0	+5.2	+6.0	+6.9
6.5	−2.4	−2.1	−1.8	−0.8	0.0	+2.1	+3.2	+5.6	+6.5	+7.5
7.0	−2.6	−2.3	−2.0	−0.8	0.0	+2.2	+3.4	+6.0	+7.0	+8.2
7.5	−2.7	−2.5	−2.1	−0.9	0.0	+2.3	+3.6	+6.4	+7.5	+8.9

table 1. Typical slope equalization frequency response

L/NL switch setting	equalized gain (in dB) introduced at various frequencies (with 0.5, 1, 2, and 4dB switch positions set to OUT)									
	300Hz	404Hz	500Hz	800Hz	1004Hz	1500Hz	1800Hz	2500Hz	2804Hz	3200Hz
NL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L	−2.5	−1.5	−0.9	−0.2	0.0	+0.2	+0.3	+0.6	+1.1	+3.1

table 2. Typical compromise bump equalization frequency response

2.11 It is possible to introduce both modes of equalization into the receive channel simultaneously. If this is done, the resulting equalized gain at any frequency is the sum of the gain introduced by each equalizer at that frequency, as listed in tables 1 and 2. For example, if both equalizers are used and the slope equalizer is set for 3.5dB of gain at 2804Hz (re 1004Hz), the total amount of equalized gain at 800Hz is −0.6dB, which is the sum of −0.4dB (from table 1) and −0.2dB (from table 2). As a second example, with the same slope equalizer setting, the amount of gain introduced by both equalizers at 1800Hz is +2.2dB, which is the sum of +1.9dB (from table 1) and +0.3dB (from table 2). Please note that even if both equalizers are used, there is no effect upon 1004Hz levels, as explained in paragraph 2.10.

transmit-channel amplitude equalization

2.12 Prescription active slope-type amplitude equalization is available on the 6123/A for pre

equalization of a facility-side (4wire) transmit pair consisting of nonloaded cable. The transmit equalizer is essentially identical to the receive-channel slope equalizer, providing from 0 to 7.5dB of gain at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments. Typical achievable flatness and typical frequency response of the transmit equalizer are the same as those of the receive-channel slope equalizer (see paragraph 2.08, figure 5, and table 1). Like the receive equalizers, the transmit equalizer does not affect 1004Hz levels. Thus, transmit equalization can be introduced not only before but also **after** transmit levels are set.

supervisory states, loop start

2.13 The 6123/A module accommodates a conventional loop-start supervisory format. In loop-start operation, detection of incoming SF tone activates ringing toward the station or PBX trunk circuit. Loop current is supplied to the station-side loop or trunk through matched resistances in the module's internal A and B leads.

supervisory states, ground start

2.14 In ground-start operation, just as in loop-start, the 6123/A module accommodates a conventional supervisory format. Whenever incoming SF tone is detected, the 2wire tip-lead path is opened to ground, except during ringing. Presence of SF tone at the 4wire receive port indicates that the associated office-end circuit is idle (2wire tip lead open), and local ringing is initiated by receipt of SF tone amplitude-modulated by a ringing frequency of 18 to 33Hz. Outgoing seizure is initiated in ground-start operation by application of ground to the 2wire ring lead, which causes transmission of SF tone to cease.

loop-current limiting and supervisory limits

2.15 An internal loop-current limiter on the 6123/A limits current to less than approximately 35mA on short loops. With long loops, at least 16mA of current must be drawn from the battery feed to guarantee proper operation. In ground-start operation, the module senses application of ground to the 2wire ring lead to initiate seizure toward the distant end. The ring-ground sensor in the 6123/A can sense application of this ground through external resistance of up to 1500 ohms on the 2wire ring lead.

ring trip and ring-trip range

2.16 The 6123/A provides for removal of local ringing when the station or PBX trunk responds to incoming seizure. For proper operation of the ring-trip circuit, the external ringing source must be referenced to a potential of −42 to −56Vdc. The 6123/A can reliably detect ring trip at up to 2000 ohms of external loop resistance with −48Vdc biased ringing.

signaling-tone states

2.17 Signaling-tone states for the 6123/A are consistent with the conventional F-signaling formats of FXS and station-end OPS service. These states are listed in tables 3 and 4 for loop-start and ground-start operation, respectively.

local loop condition	SF tone	
	receive	transmit
idle	off	on
ringing	on	on
off-hook	off	off
dialing	off	off-on-off

table 3. Loop-start signaling-tone states

local loop condition	SF tone	
	receive	transmit
idle	on	on
seizure from CO	off	on
ringing	off-on-off	on
busy	off	off
CO release	on	off until detection of incoming SF tone, then on
idle	on	on
local seizure	on	off
CO seizure acknowledgement	off	off
dialing	off	off-on-off
busy	off	off
local station disconnect first	off	on
CO release	on	on
idle	on	on

table 4. Ground-start signaling-tone states

incoming SF tone detection

2.18 The 6123/A is designed to interface the receive path on the facility (4wire) side at any TLP from −17 to +7. Idle-state SF tone is received at a level of −20dBm0. A higher level of −8dBm0 is received during break portions of dial pulses and for about 400ms at the beginning of each tone interval. The SF tone detector in the module reliably detects tone levels as low as −27dBm0, provided that the SF tone energy is approximately 12dB above the level of all other signals simultaneously present at the 4wire receive port. The SF tone detector is actually a signal-to-guard ratio comparator that compares energy in a narrow band of frequencies centered at the SF tone frequency with energy in the entire voice band. This detection arrangement aids significantly in prevention of talk-off, but it places an upper bound on allowable circuit noise. In general, received noise in excess of 51dBrnC0 may interfere with detection of low-level signaling tones.

2.19 The 6123/A's SF tone detector is designed to ignore momentary losses of SF tone during periods of otherwise continuous receipt of tone and to ignore momentary tone bursts to prevent false signaling. Within approximately 17ms of detection of incoming SF tone, a band-elimination filter (BEF) is inserted into the receive transmission path to prevent propagation of SF tone beyond the module. An internal timing circuit ensures that the BEF remains inserted during dial pulsing and during momentary losses of tone continuity.

outgoing SF tone transmission

2.20 The 6123/A is designed to interface the transmit path on the facility side at any TLP from +8 to −16. During the idle state, the module transmits SF tone at −20dBm0. During dial pulsing and also for the first 400ms each time it applies tone to the facility, the module transmits SF tone at a higher level of −8dBm0. This momentarily increased tone level aids in office-end detection of supervisory-state changes and incoming dial pulsing.

delay circuit and transmit pulse correction

2.21 The 6123/A contains a delay circuit in the loop-current sensor that delays detection of on-hook-to-off-hook and off-hook-to-on-hook transitions by about 20ms to prevent false detection of short transients typically associated with station loops. A minimum-break pulse corrector in the transmit path ensures a 50ms minimum break duration and a 25ms minimum make duration during dialing, regardless of input break or pulsing rate. The minimum-break pulse corrector has no effect on pulsing breaks longer than 50ms.

transmit path cut

2.22 To prevent speech and transient energy from interfering with detection of SF signaling tone at the distant end of the circuit, the voice path through the transmit portion of the 6123/A module is cut (opened) during dialing and whenever SF tone is transmitted. The path cut is inserted within a few milliseconds of any interruption of local loop current and approximately 20ms before any transmission of SF tone. The path cut is removed approximately 125ms after transmission of SF tone ceases.

SF tone source

2.23 The 6123/A is equipped with an integral 2600Hz SF tone oscillator and therefore does not require an associated master SF tone supply.

automatic ringdown operation

2.24 As an alternative to FXS operation, the 6123/A can be switch-optioned to operate in a loop-start or ground-start automatic ringdown circuit. In such applications, two 6123/A's connected to telephone sets are used at each end of a circuit. In the idle (on-hook) condition, SF tone is sent, while off-hook conditions are indicated by no tone. If either telephone goes off-hook, the distant-end telephone rings, and ringback tone is sent to the calling 6123/A until the station is answered. The ringing rate in the auto-ringdown mode is fixed at 2 seconds on and 4 seconds off, as controlled by ringing-interruption circuitry integral to the module. The 6123/A can also be used in the auto-ringdown mode to interface a conventional E&M SF facility without the need for an E&M-to-FXS converter.

power

2.25 The 6123/A operates on filtered, ground-referenced input potentials between −42 and −56Vdc. The positive side of the dc power supply must be connected to earth ground. Ground-start operation of the station-end equipment (e.g., PBX or telephone set) requires a low-resistance ground that is common with the ground of the module. Maximum current required (at −54Vdc) is 101mA, not including loop current, unless the 6123A's loopback option is activated, in which case an additional 10mA is required.

ringing

2.26 The ringing circuits in the 6123/A operate with any ringing frequency between 16 and 67Hz, but the ringing generator must be referenced to (or superimposed upon) a potential of −42 to −56Vdc for reliable operation of the ring-trip detector. In the ground-start mode, the module responds to any ringing frequency (modulated SF tone) between 18 and 33Hz.

traffic monitoring

2.27 The 6123/A permits traffic monitoring of circuit seizures via a traffic-monitoring output lead (pin 1) that functions much like a local sleeve lead. This lead provides a ground output when the local station is off-hook and also during the break portion of dial pulses. When the circuit is idle, the lead is open.

loopback (6123A only)

2.28 **Overview.** Integral facility-side transmission and signaling loopback circuitry in the 6123A allows local or remote testing of both the module and the facility. This loopback circuitry can be activated either manually (locally) or via 2713Hz tone (remote two-tone loopback). A prescription loopback-level-control circuit introduces from 0 to 23dB of loss or from 0 to 24dB of gain into the loopback path in switch-selectable 1dB increments to provide true equal-level transmission loopback. Figure 7 shows, in simplified form, the transmission and signaling loopback paths through the module.

2.29 Transmission loopback in the 6123A module establishes a transmission path from the 4wire receive port to a point on the receive path after the terminal-side attenuator stage (*LOSS SELECT* block in the receive path on the block diagram later in this practice), thence through the loopback-level-control stage to a point on the 4wire transmit path before the terminal-side attenuator stage (*LOSS SELECT* block in the transmit path on the block diagram), and finally to the 4wire transmit port. The loopback level control stage (*LOOPBACK LEVEL* block on the block diagram) provides for true equal-level loopback, if desired.

2.30 Signaling loopback allows the 6123A's SF tone detector, band-elimination filter (BEF), SF tone oscillator, and transmit-path-cut circuitry to be tested remotely. Normally, a 6123A in loopback repeats all SF signaling states that it receives (tone in results in tone out, no tone in results in no tone out). Thus, the aforementioned signaling circuitry can be tested simply by placing the module into loopback and sending continuous 2600Hz SF tone at −10dBm0 from the remote testing location. If its signaling circuitry is operating properly, the module returns 2600Hz SF tone at −8dBm0 (high level) for approximately 400ms and at −20dBm0 thereafter.

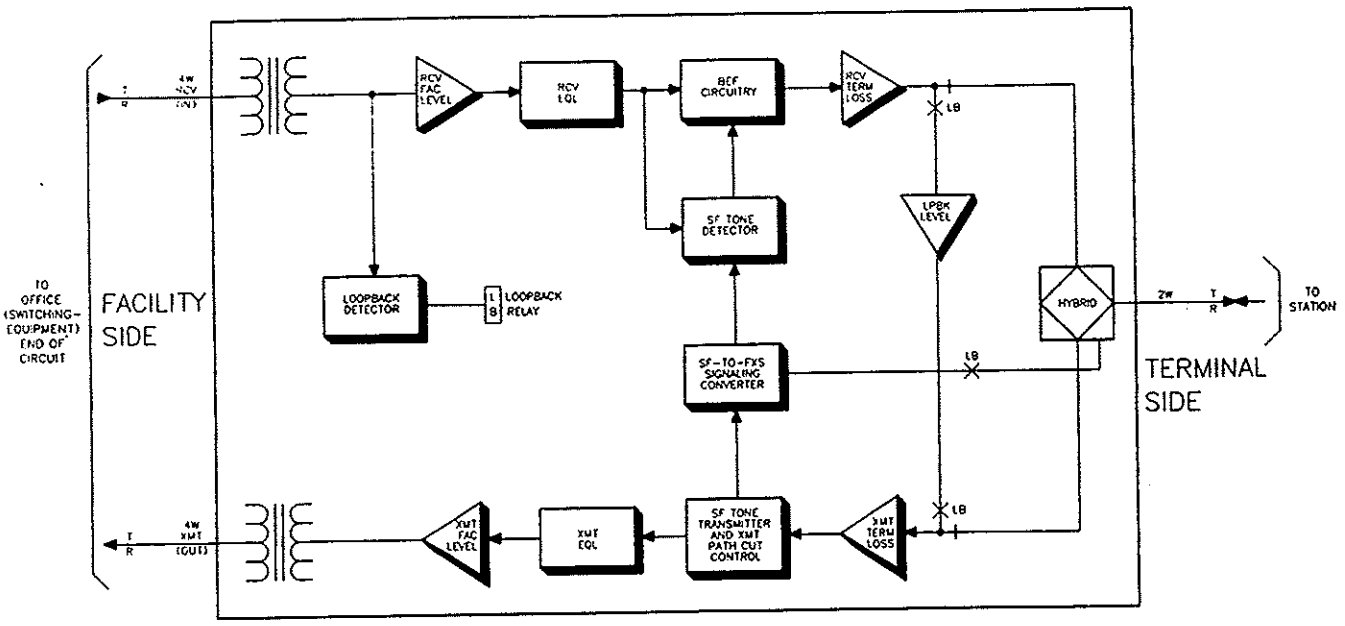


figure 7. Loopback route through 6123A

If not, the module either returns 2600Hz SF tone at −10dBm0 or returns no tone, depending upon the location of the problem in the module.

2.31 **Local (Manual) Loopback Activation and Deactivation.** Two methods of local loopback activation are available:

- Setting the *ML* position of the module's *LPBK* (loopback) DIP switch toward *ML*.
- Connecting the module's EXT MNLB (external manual loopback) lead (pin 18) to input power ground (pin 17).

With either of these methods of activation, loopback is maintained until the *ML* switch is set away from *ML* or until the EXT MNLB-ground connection is removed.

2.32 **Remote (Two-Tone) Loopback Activation and Deactivation.** Remote (two-tone) loopback is enabled via switch option and activated by placing a 2713Hz tone on the 4wire receive pair (pins 7 and 13) of the 6123A for longer than 2.5 seconds and then removing the tone. Because loopback is activated only upon removal of the tone, the accidental looping of other than the intended module on a multipoint circuit is prevented. The threshold of the loopback-tone-detection circuit is −30dBm as measured at the module's 4wire receive port. The loopback tone detector's center frequency is 2713Hz, and its maximum bandwidth is ±37Hz. A 12dB signal-to-guard ratio prevents either raw data signals or harmonics of those signals from initiating loopback, thus allowing the 6123A to operate in circuits where similar units might be prone to false loopback. Remote loopback is deactivated when the unit detects a second 2713Hz tone of 1.2-second duration or longer; removal of this tone is not necessary to deactivate loopback. With remote (two-tone) loopback enabled, another switch option either enables automatic loopback deactivation after a selected timeout interval or disables automatic deactivation for second-tone deactivation only. With automatic deactivation enabled, an additional switch option selects the desired timeout interval: 4 minutes or 20 minutes. With either timeout interval selected, tone-activated loopback can be deactivated prior to expiration of the interval by transmitting a second 2713Hz tone.

3. installation

inspection

3.01 The 6123/A 4Wire-to-2Wire SF-to-FXS Terminal Repeater module should be visually inspected upon arrival to find any 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 6123/A mounts in one position of a Tellabs Type 10 Mounting Shelf or in one position of a Tellabs 262-series NCTE/DST Mounting Assembly. Type 10 Shelves are available in versions for relay-rack and apparatus-case installation, while 262 Assemblies are available in versions for relay-rack, wall or desktop, and floor mounting. The 6123/A module plugs physically and electrically into a 56-pin connector at the rear of its shelf or assembly position.

3.03 In applications where a 6123/A module is to be installed in a 262 Assembly, no external connections to the module need be made. This is because all of the assembly's internal connections are factory-prewired and because external wiring is simplified through the use of 25-pair connector-ended cables arrange in accordance with Universal Service Order Code (USOC) RJ2HX. If the customer's terminal equipment is cabled in accordance with USOC RJ2HX, direct connection between the

assembly and the customer's equipment is possible. If not, cross-connections between the assembly and the local terminal equipment must be made at an intermediate connectorized terminal block or by means of a special adapter cable available as a list number for selected assemblies.

installer connections

3.04 When a 6123/A module is to be installed in a conventional Type 10 Shelf or in an unwired apparatus case or mounting assembly, external connections to the module must be made. Before making any connections to the shelf, case, or assembly, ensure that power is **off** and modules are **removed.** Modules should be put into place only **after** they are properly optioned and **after** wiring wiring is completed.

3.05 Table 5 lists external connections to the 6123/A module. All connections to non-prewired mountings are made via wire-wrapping to the 56-pin connector at the rear of the module's shelf, case, or assembly position. Pin numbers are found on the body of the connector.

connect:	to pin:
4WIRE RCV TIP	7
4WIRE RCV RING	13
4WIRE XMT TIP	41
4WIRE XMT RING	47
2WIRE TIP	55
2WIRE RING	49
4WIRE RCV SX (simplex, facility side)	9 and 11
4WIRE XMT SX (simplex, facility side)	43
SLEEVE (traffic-monitoring or sleeve lead)	1
RING GEN (ringing generator)	45 and 46
MACH ST (ringing machine start lead)	30
EXT MNLB (external manual loopback, 6123A only)	18
−BATT (−42 to −56Vdc filtered input)	35
GND (ground)	17

table 5. External connections to 6123/A

option selection

3.06 Several option switches much be set before the 6123/A is placed into service. Locations of these switches and of certain alignment switches on the module's printed circuit board are shown in figure 8. Table 6 summarizes all switch options and provides a convenient **checklist** column that can be filled out either prior to installation for prescription optioning or during installation to serve as a record for later reference. Refer to figure 8 and table 6, and set each option switch on the 6123/A as required.

alignment overview

3.07 Alignment of the 6123/A comprises the following procedures (all option switches should already be properly set as described above):

A. Setting the receive-channel facility-side and terminal-side levels.
B. Introducing receive-channel equalization, if necessary.
C. Setting the transmit-channel terminal-side and facility-side levels.
D. Introducing transmit-channel equalization, if necessary.
E. Introducing NBO capacitance, if necessary, to optimize hybrid balance (maximize transhybrid loss).
F. For the 6123A only, adjusting the loopback-path level.

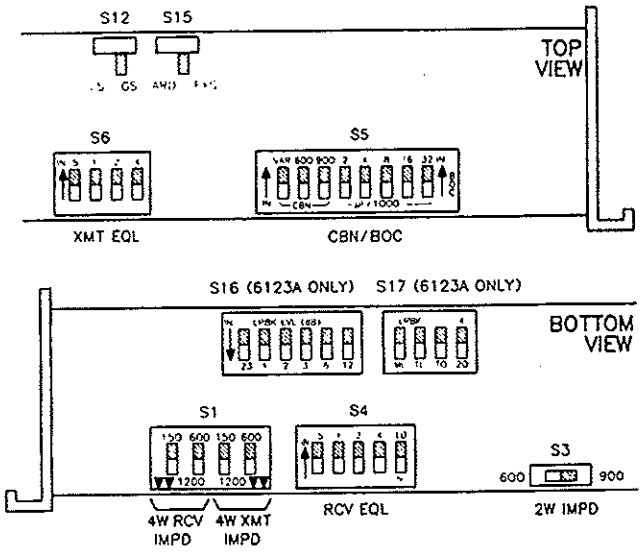


figure 8. 6123/A option switch locations

prescription alignment

3.08 Except in applications where the 6123/A's user-adjustable CBN option is selected, full prescription alignment of the module is possible. This involves setting all level-control, equalization, NBO capacitance, and loopback-level (6123A only) switches in accordance with specifications on the circuit layout record (CLR) before plugging the module into its shelf or assembly position. Table 7 in this practice summarizes all alignment switches on the 6123/A and provides a convenient **checklist** for prescription alignment. To use this table, simply indicate all required alignment-switch settings in the **checklist** column. Then, at installation time, align the 6123/A by setting each switch as indicated in the table (or on the CLR, if preferred).

equipment required for non-prescription alignment

3.09 In applications where prescription alignment settings are unavailable, non-prescription alignment of the 6123/A is necessary. Access to the appropriate ports of the module is conveniently provided via four front-panel bantam jacks. Equipment required for non-prescription alignment consists of a transmission measuring set (TMS), preferably one with independent transmit and receive impedance settings. If the module's equalizers, NBO capacitors, and/or loopback-level circuitry (6123A only) are to be used, a Tellabs 9801 or 9802 Card Extender (or equivalent) will facilitate alignment by allowing access to the switches on the module's printed circuit board while the module is in place and operating.

option	switch	selection	setting	checklist
terminating impedance, 4wire receive port (facility side)	*RCV IMPD* (*S1*) switches (lefthand *150* and *600* switches) on main board	1200 ohms (for loaded cable)	150 switch toward 1200, 600 switch toward 1200	
		600 ohms (for nonloaded cable or carrier)	150 switch toward 1200, 600 switch toward 600	
		150 ohms (extra equalization for nonloaded cable)	150 switch toward 150, 600 switch toward 1200	
terminating impedance, 4wire transmit port (facility side)	*XMT IMPD* (*S1*) switches (righthand *150* and *600* switches) on main board	1200 ohms (for loaded cable)	150 switch toward 1200, 600 switch toward 1200	
		600 ohms (for nonloaded cable or carrier)	150 switch toward 1200, 600 switch toward 600	
		150 ohms (extra equalization for nonloaded cable)	150 switch toward 150, 600 switch toward 1200	
terminating impedance, 2wire port (terminal side)	*2W IMPD* switch (*S3*) on main board	900 ohms plus 2.15μF	900	
		600 ohms plus 2.15μF	600	
loop-start or ground-start operation	*LS/GS* switch (*S12*) on baby board	loop start	LS	
		ground start	GS	
automatic ringdown (ARD) or FXS operation	*ARD/FXS* switch (*S15*) on baby board	ARD operation (or direct E&M-SF interface)	ARD	
		FXS operation	FXS	
internal compromise balance network (CBN) options	*CBN* positions (*VAR*, *600*, and *900*) of *CBN/BOC* DIP switch (*S5*) on main board	900 ohms with 2.15μF	VAR to OUT 600 to OUT 900 to IN	
		600 ohms with 2.15μF	VAR to OUT 600 to IN 900 to OUT	
		user-adjustable 0 to 2000 ohms (via front-panel *CBN adjust* control) with 2.15μF	VAR to IN 600 to OUT 900 to OUT	
		internal CBN excluded	VAR to OUT 600 to OUT 900 to OUT	
Note: *The following loopback options are available on the 6123A only.*				
manual loopback activate/deactivate	*ML* position of *S17* (*LPBK* DIP switch) on baby board	manual loopback activated	toward ML	
		manual loopback deactivated	away from ML	
2713Hz tone-loopback enable/disable*	*TL* position of *S17* (*LPBK* DIP switch) on baby board	tone loopback enabled	toward TL	
		tone loopback disabled (for manual loopback only)	away from TL	

table 6 continued on page 11

option	switch	selection	settings	checklist
tone-loopback timeout enable/disable (with tone loopback enabled)*	*TO* position of *S17* (*LPBK* DIP switch) on baby board	tone-loopback timeout enabled (see below for duration selection)	toward TO	
		tone-loopback timeout disabled (for second-tone deactivation only)	away from TO	
tone-loopback timeout duration (with tone-loopback timeout enabled)*	*4/20* position of *S17* (*LPBK* DIP switch) on baby board	4 minutes	toward 4	
		20 minutes	toward 20	

* With tone loopback disabled, both the *TO* and *4/20* positions of *S17* are nonfunctional. With tone loopback enabled but tone-loopback timeout disabled, the *4/20* position of *S17* is nonfunctional.

table 6. Summary and checklist of 6123/A switch options

alignment function	switch	selection	setting	checklist
selection of receive-channel facility-side flat gain or loss	*GN* and *LS* positions of front-panel *rcv fac level* DIP switch	gain	GN to IN LS to OUT	
		loss	GN to OUT, LS to IN	
amount of receive-channel facility-side gain or loss, as selected above*	dB-value positions of front-panel *rcv fac level* DIP switch*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
receive-channel terminal-side flat loss*	front-panel *rcv term loss* DIP switch*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
receive-channel equalizer selection	*LD/NL* position of DIP switch *S4* on main board	compromise bump equalizer (for loaded cable) inserted	LD	
		compromise bump equalizer excluded (for no equalization or use of slope equalizer)	NL	
receive-channel slope equalization for nonloaded cable (gain at 2804Hz re 1004Hz)**	dB-value positions of DIP switch *S4* on main board**	0.5dB	.5 to IN	
		1dB	1 to IN	
		2dB	2 to IN	
		4dB	4 to IN	
transmit-channel terminal-side flat loss*	front-panel *xmt term loss* DIP switch*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
selection of transmit-channel facility-side flat gain or loss	*GN* and *LS* positions of front-panel *xmt fac level* DIP switch	gain	GN to IN LS to OUT	
		loss	GN to OUT, LS to IN	

Important: During alignment, set these switches to achieve a +7dBm level (see figure 9) before setting *rcv term loss* switches to obtain final rcv output level.

Important: During alignment, set these switches to achieve a −16dBm level (see figure 9) before setting *xmt fac level* switches to obtain final xmt output level.

table 7 continued on page 12

alignment function	switch	selection	setting	checklist
amount of transmit-channel facility-side gain or loss, as selected above*	dB-value positions of front-panel *xmt fac level* DIP switch*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
transmit-channel slope-equalization for nonloaded cable (gain at 2804Hz re 1004Hz)**	DIP switch *S6* on main board**	0.5dB	.5 to IN	
		1dB	1 to IN	
		2dB	2 to IN	
		4dB	4 to IN	
NBO capacitance †	*μF/1000* positions of *CBN/BOC* DIP switch (*S5*) on main board †	0.002μF	2 to IN	
		0.004μF	4 to IN	
		0.008μF	8 to IN	
		0.016μF	16 to IN	
		0.032μF	32 to IN	
loopback-path loss (or gain) (6123A only) † †	*LPBK LVL* DIP switch (*S16*) on baby board † †	23dB loss	−23 to IN	
		1dB gain	1 to IN	
		2dB gain	2 to IN	
		3dB gain	3 to IN	
		6dB gain	6 to IN	
		12dB gain	12 to IN	

* The eight dB-value positions of the front-panel *rcv fac level* and *xmt fac level* DIP switches are cumulative, as are all eight posiitons of the *rcv term loss* and *xmt term loss* DIP switches. Total facility-side gain or loss and total terminal-side loss introduced into a channel are the sums of that channel's *fac level* dB-value and *term loss* switch positions set to *IN*.

** The dB-value positions (*.5, 1, 2,* and *4*) of receive-equalizer DIP switch *S4* and all four positions of transmit-equalizer DIP switch *S6* are cumulative. Total gain introduced at 2804Hz (re 1004Hz) is the sum of those dB-value positions set to *IN*. For no receive equalization, set the *LD/NL* position of *S4* to *NL* and the four dB-value positions of *S4* to *OUT*. For no transmit equalization, set all four positions of *S6* to *OUT*.

† The five *μF/1000* positions of the *CBN/BOC* DIP switch (*S5*) are cumulative. Total NBO capacitance introduced is the sum of those *μF/1000* positions set to *IN*.

† † The six positions of the *LPBK LVL* DIP switch (*S16*) on the 6123A are cumulative. Total loss or gain, in dB, introduced into the module's loopback path is the sum of those *LPBK LVL* switch positions set to *IN*.

table 7. Summary and checklist of 6123/A alignment switches

mandatory pre-alignment procedure for non-prescription alignment

3.10 Before beginning non-prescription alignment, do the following:

A. Ensure that all option switches are properly set. For the 6123A, also ensure that the module is not in loopback.
B. Set all front-panel receive and transmit level-control switches for no gain or loss.
C. Set all receive and transmit equalization switches (*S4* and *S6*) for no equalization.

Note: *On the receive equalizer DIP switch* (**S4**), *the* **LD/NL** *position must be set to* **NL**. *Otherwise, bump equalization will be introduced even though no dB-value positions are set to* **IN**.

D. Ensure that no NBO capacitance is introduced (*S5, μF/1000* positions).
E. For the 6123A, set the loopback-level DIP switch (*S16*) for no loopback-path loss or gain.

non-prescription alignment

3.11 Align the 6123/A as directed in the **non-prescription alignment procedure,** figure 9 of this practice.

Note: *The procedure in figure 9 is based on the assumption that certain required local input and output levels are available from circuit records. If this is not the case, some steps may have to be modified to include end-to-end measurements.*

Note: *During alignment, always ensure that the receive portion of the TMS is arranged for properly terminated measurement where appropriate. If the TMS has independent transmit and receive impedance settings, also ensure that the proper TMS transmit impedance is selected when inserting test tone.*

4. circuit description

4.01 To provide the clearest possible understanding of the operation of the 6123/A 4Wire-to-2Wire SF-to-FXS Terminal Repeater module, function sequence flowcharts (figures 10 and 11) that illustrate operation of the module on incoming and outgoing calls are presented in lieu of a more conventional circuit description. Horizontal paths identify events occurring simultaneously, and vertical paths denote sequential events. Dotted lines indicate elapsed time. These flowcharts can be used to determine normal module operation by observing

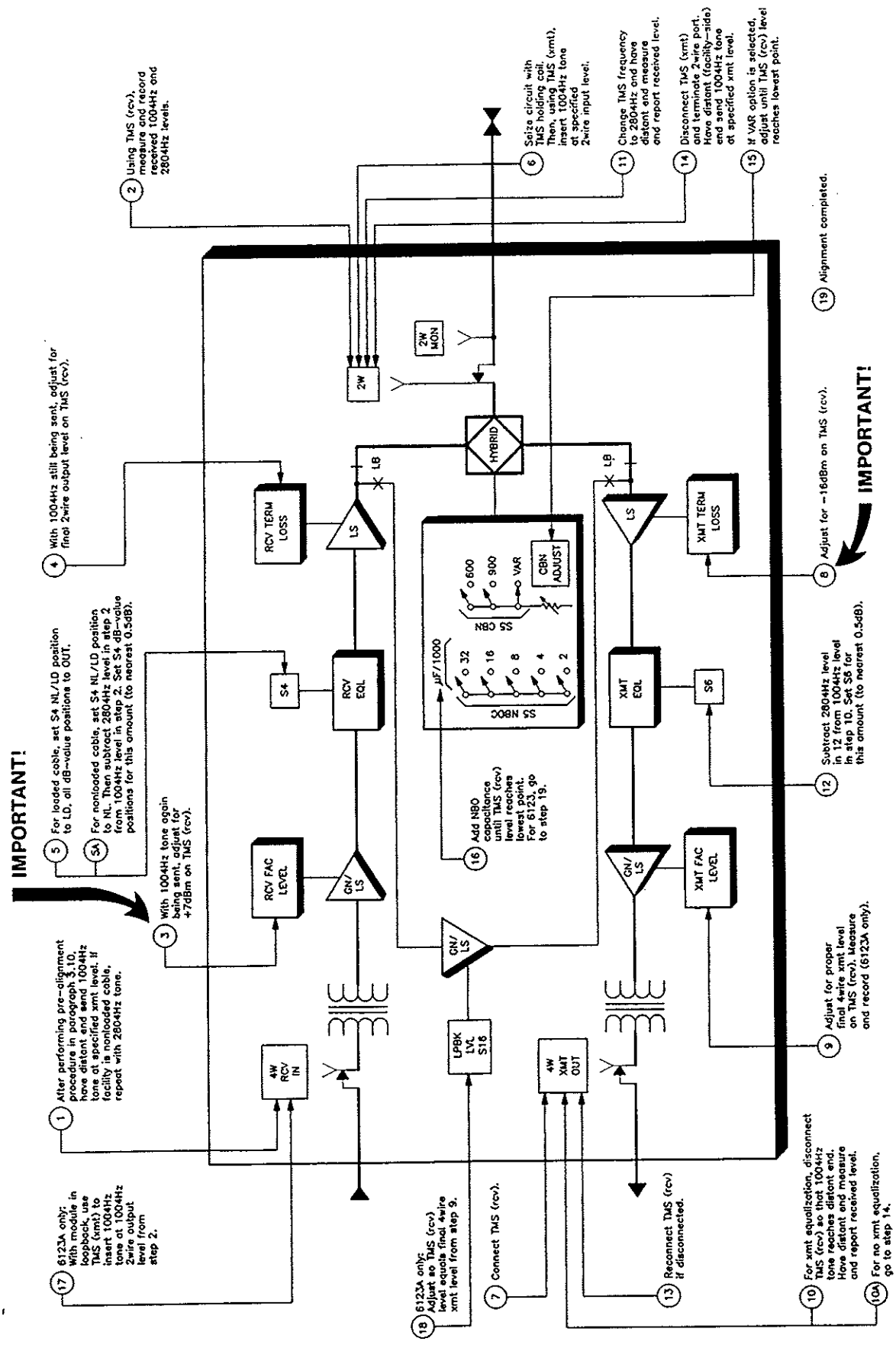


figure 9. Non-prescription alignment procedure for 6123/A

the module's response and comparing it to that shown in the flowcharts. Reference to the 6123/A functional block diagram, section 5 of this practice, will aid in understanding the flowcharts.

4.02 The flowcharts are intended to familiarize you with the operation of the 6123/A for engineering, application, and troubleshooting purposes only. Attempts to test or troubleshoot this module internally are not recommended and may void its Tellabs warranty. Procedures for recommended testing and troubleshooting in the field should be limited to those prescribed in section 7 of this practice.

6. specifications

Note: *Timing specifications marked with a ▲ symbol are nominal because they can vary with SF tone frequency and level.*

transmission

alignment level ranges, facility-side ports
4wire rcv port: −17 to +7TLP
4wire xmt port: −16 to +8TLP

alignment level ranges, 2wire port
2wire-port output: +7 to −17TLP
2wire-port input: +8 to −16TLP

overload points
4wire rcv port: 0dBm0
4wire xmt port: +3dBm0
2wire-port output: 0dBm0
2wire-port input: +3dBm0

facility-side gain or loss (xmt and rcv)
0 to 24dB of gain or 0 to 24dB of loss in switch-selectable 0.1dB increments, with gain or loss selected via switch option

terminal-side loss (xmt and rcv)
0 to 24dB of loss in switch-selectable 0.1dB increments

insertion loss, xmt and rcv channels (600-ohm termination at all ports)
0 ±0.2dB at 1004Hz with all level-control switches set for no gain or loss

receive-channel amplitude equalization
active prescription slope-type: 0 to 7.5dB of gain at 2804Hz, re 1004Hz, in switch-selectable 0.5dB increments
compromise bump-type: 3.0dB bump at 3200Hz, re 1004Hz, and 1.5dB loss at 404Hz, re 1004Hz
additive mode: if both equalizers are used simultaneously, the results are additive

transmit-channel amplitude equalization
active prescription slope-type: 0 to 7.5dB of gain at 2804Hz, re 1004Hz, in switch-selectable 0.5dB increments

terminating impedances, 4wire ports (rcv in, xmt out)
1200, 600, or 150 ohms, balanced, individually switch-selectable at each 4wire port

terminating impedance, 2wire port
900 or 600 ohms, balanced, switch-selectable, in series with 2.15μF

frequency response, 4wire rcv in to 2wire, with no equalization and with receive-channel BEF removed
+0.3, −2.0dB, 200 to 3000Hz, re 1004Hz
+0.3, −1.3dB, 3000 to 3400Hz, re 1004Hz

frequency response, 2wire to 4wire xmt out
+0.3, −2.0dB, 200 to 3000Hz, re 1004Hz
+0.3, −1.3dB, 3000 to 3400Hz, re 1004Hz

compromise balance network
switch-selectable for 900 ohms, 600 ohms, or a user-adjustable range of 0 to 2000 ohms, all in series with 2.15μF

network build-out (NBO) capacitance
0 to 0.062μF in switch-selectable 0.002μF increments

total harmonic distortion, all ports
less than 1% at overload points

internal noise, xmt and rcv channels
17dBrnC0 maximum at maximum gain

4wire longitudinal balance
greater than 58dB, 200 to 3000Hz

2wire longitudinal balance
greater than 55dB, 200 to 3000Hz

4wire echo return loss
23dB minimum vs. 600 or 1200 ohms

2wire echo return loss
22dB minimum vs. 600 or 900 ohms in series with 2.15μF

intrinsic transhybrid loss
greater than 35dB ERL

peak-to-average ratio (P/AR), receive-channel BEF removed
98 minimum, without equalization

crosstalk loss between adjacent modules in shelf
75dB minimum, 200 to 3400Hz

dc current capability of hybrid
40mA maximum

SF transmit section

internal SF tone oscillator frequency and stability
2600 ±5Hz for life of unit

SF tone levels
low level: −20dBm0 ±1dB
high level: −8dBm0 ±1dB

high-level timing
high-level tone is transmitted for 400 ±100ms when tone switches from off to on

outgoing SF tone states
see table 3 (loop start) and table 4 (ground start) in section 2 of this practice

pulsing characteristics
- **input breaks and makes shorter than 18ms are not recognized**
- **input breaks between 34ms and 50ms are transmitted as 50 ±2ms tone bursts**
- **input makes between 18ms and 25ms are repeated as 25 ±2ms silent (no tone) intervals**
- **input breaks longer than 50ms are transmitted as tone bursts equal in duration to the input break duration ±2ms**
- **input makes longer than 25ms are repeated as silent (no tone) intervals equal in duration to the input make duration ±2ms**

specifications continued on page 18

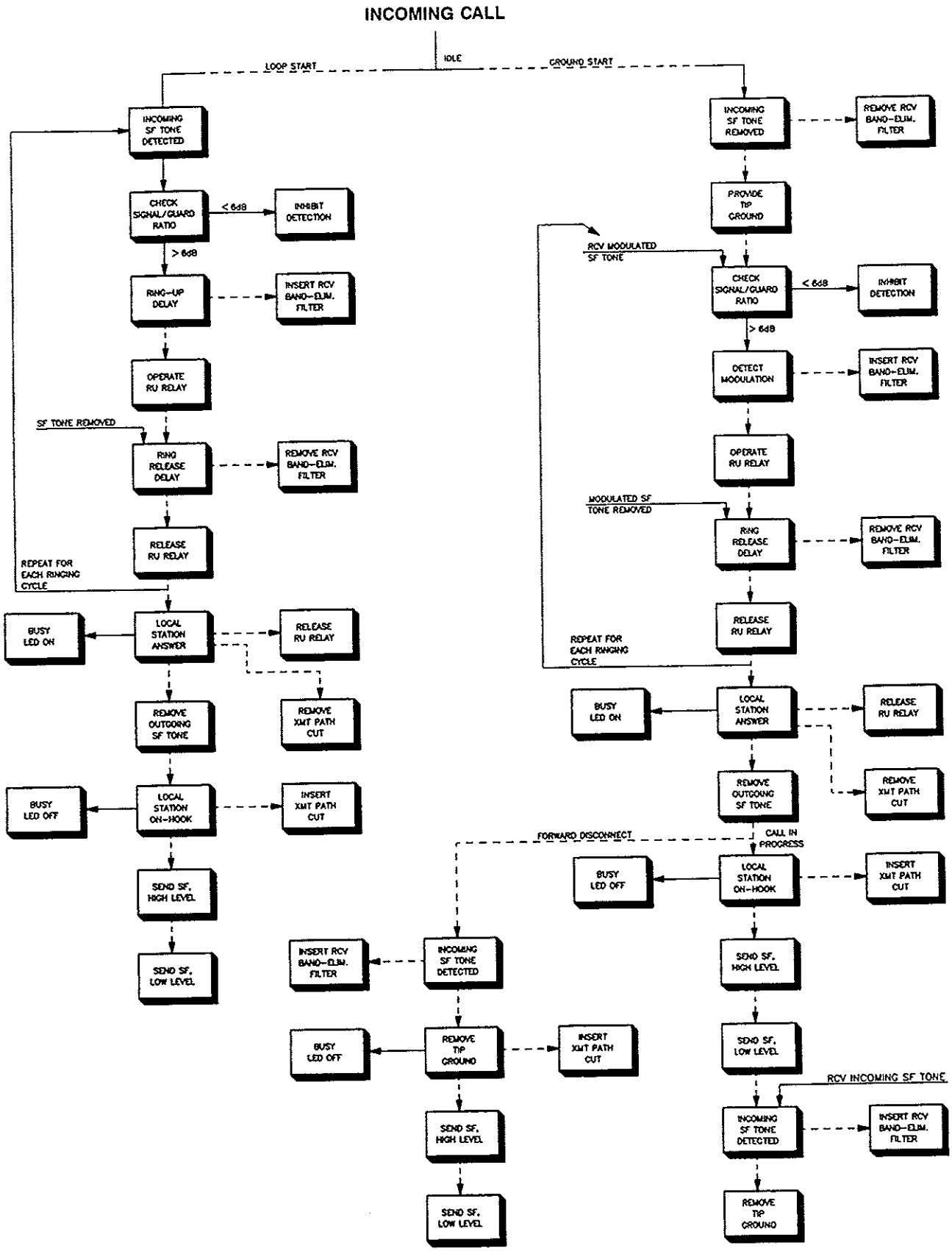


figure 10. Function sequence flowchart, incoming call

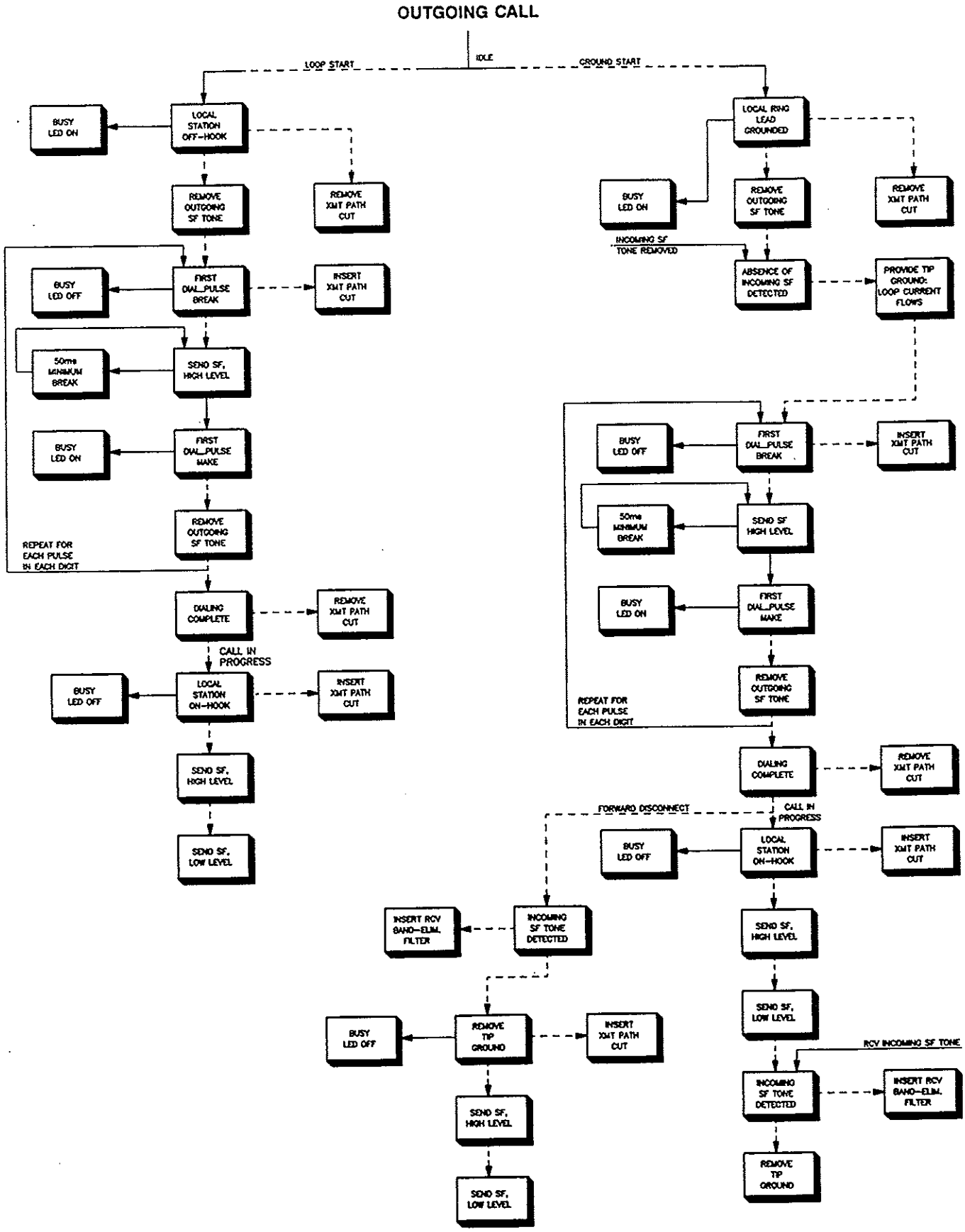
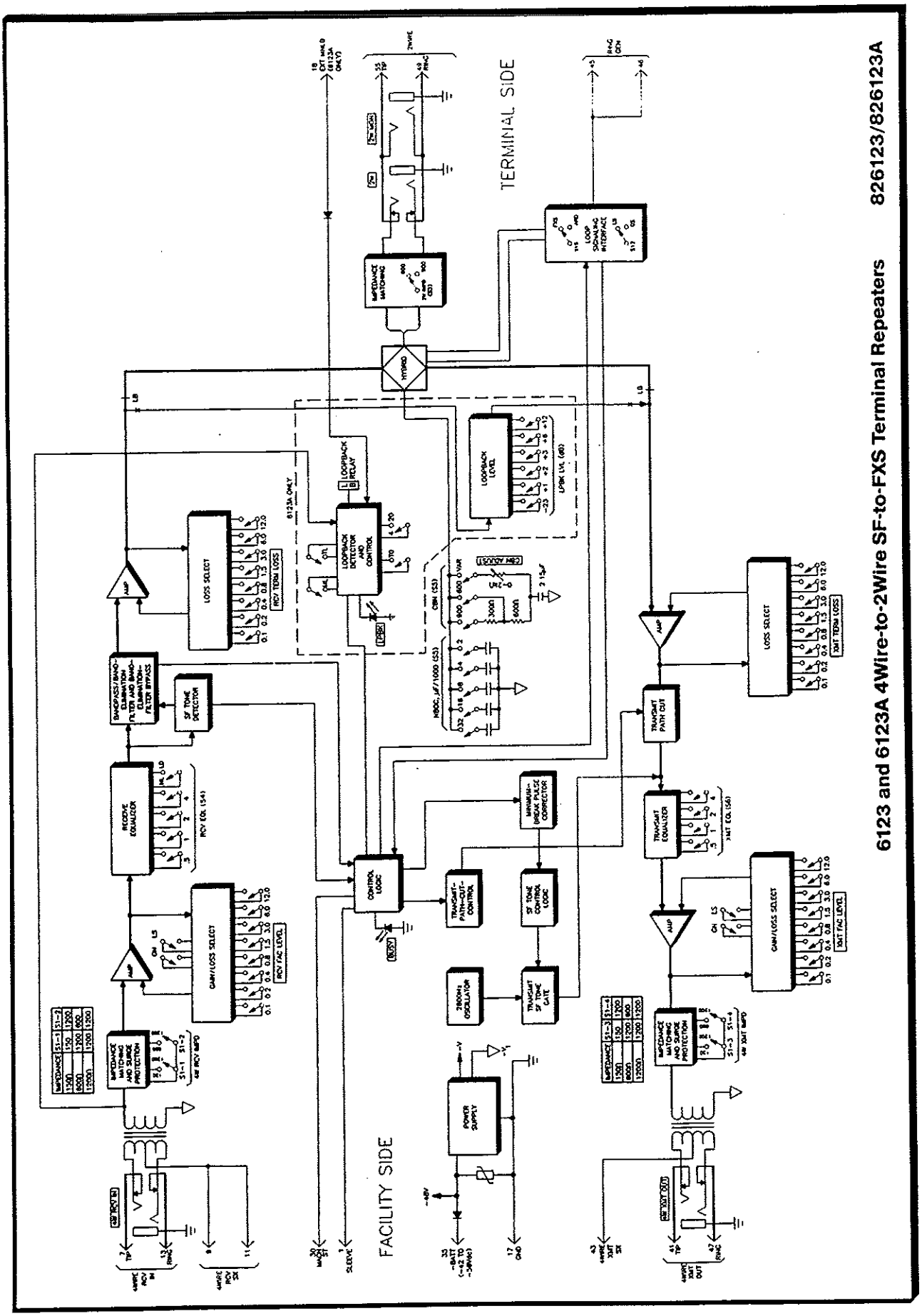


figure 11. Function sequence flowchart, outgoing call



6123 and 6123A 4Wire-to-2Wire SF-to-FXS Terminal Repeaters 826123/826123A

5. block diagram

SF receive section

SF tone detection
frequency: 2600 ±15Hz
level range: 0 to −27dBm0

SF tone rejection threshold
−37dBm0

signal-to-guard ratio for signal detection
6dB minimum

incoming SF tone states
see table 3 (loop start) and table 4 (ground start) in section 2 of this practice

maximum line noise
51dBrnC0 with incoming SF tone at nominal −20dBm0 level

guard circuit transition timing ▲
high-to-low: 225 ±60ms
low-to-high: 50 ±10ms

band-elimination-filter timing ▲
- **insertion time: 15 ±10ms**
- **insertion duration for SF tones shorter than 175 ±60ms: 225 ±50ms (with BEF insertion duration longer than tone duration in all cases)**
- **insertion duration for SF tones longer than 175 ±60ms: duration of SF tone plus 50 ±20ms**

2wire loop conditions

maximum loop resistance
3000 ohms with −48Vdc input battery

loop current, 0-ohm loop
35 ±5mA with −48Vdc input battery

external ringing supply requirements

frequency
16 to 67Hz

bias
must be referenced to negative battery supply

level
130Vac maximum

traffic-monitoring (sleeve) lead

traffic-monitoring (sleeve) lead states
idle condition: open circuit
busy condition: ground (100mA maximum source capacity)

loopback specifications (6123A only)

tone-loopback frequency
module will loop back at 2713 ±7Hz; module will not loop back outside of 2713 ±37Hz

tone-loopback level range
−30 to −3dBm at receive input port (factory-preset)

tone-loopback signal-to-guard ratio
12 ±6dB

tone-loopback operating times
initiate: 2.5 seconds minimum, loopback after removal of tone
release: second 2713Hz tone of 1.2-second minimum duration with release during tone, or automatic release after 20 minutes ±60 seconds or 4 minutes ±15 seconds, as selected via switch option

local (manual) loopback
activation: option switch on module or connection between EXT MNLB lead (pin 18) and input power ground (pin 17)
deactivation: option switch on module or removal of EXT MNLB-ground connection

loopback-path gain or loss
0 to 24dB of gain or 0 to 23dB of loss in switch-selectable 1dB increments

common specifications

input power requirements
voltage: −42 to −56Vdc, filtered, positive-ground-referenced
current: 60mA typical at idle (at −48Vdc), 101mA maximum when busy (at −54Vdc), not including loop current, with an additional 10mA required for the 6123A when in loopback

operating enviroment
32° to 122°F (0° to 50°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
6123: 12.5 ounces (354 grams)
6123A: 13 ounces (369 grams)

mounting
relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf. Can also be mounted in one position of a Tellabs 262-series NCTE/DST Mounting Assembly.

7. testing and troubleshooting

7.01 The **troubleshooting guide** in this section may be used in conjunction with the function sequence flowcharts (figures 10 and 11) in section 4 of this practice to assist in the installation, testing, or troubleshooting of the 6123/A 4Wire-to-2Wire SF-to-FXS Terminal Repeater module. The guide is intended as an aid in the localization of trouble to this specific equipment. If the equipment is suspected of being defective, substitute new equipment (if possible) and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment. Unauthorized testing or repairs may void its warranty. Also, if the equipment is part of a registered system, unauthorized repairs will result in

noncompliance with Parts 15 and/or 68 of the FCC Rules and Regulations.

Note: *Although repair service always includes an attempt to remove any permanent markings made by customers on Tellabs equipment, the success of such attempts cannot be guaranteed. Therefore, if equipment must be marked* **defective** *or* **bad**, *we recommend that it be done on a piece of tape or on a removable stick-on label.*

technical assistance via telephone

7.02 If a situation arises that is not covered in the **troubleshooting guide**, contact Tellabs Customer Service as follows:

USA customers: Contact your Tellabs Regional Office listed below.

region	telephone	office location
US Northeast	(203) 798-0506	Danbury, CT
US Capital	(703) 359-9166	Washington, DC
US Central	(312) 357-7400	Chicago, IL
US Southeast	(407) 834-8311	Orlando, FL
US Southwest	(214) 869-4114	Dallas, TX
US Western	(714) 850-1300	Orange County, CA

Canadian customers: Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)858-2058.

International customers: Contact your Tellabs distributor.

selecting correct product service procedure

7.03 If equipment is diagnosed as defective or if in-service equipment needs repair, follow the **product return procedure** in paragraph 7.04 in all cases except those where a critical service outage exists (e.g., where a system or a critical circuit is down and no spares are available). In critical situations, or if you wish to return equipment for reasons other than repair, follow the **product replacement procedure** in paragraph 7.05.

product return procedure (for repair)

7.04 To return equipment for repair, first contact Tellabs Product Services (see addresses and numbers below) to obtain a Material Return Authorization (MRA). A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the repair transaction). The service representative will then give you an MRA number that identifies your particular transaction. After you obtain the MRA number, send the equipment prepaid to Tellabs (attn: Product Services).

in the USA:
Tellabs, Inc.
4951 Indiana Avenue
Lisle, Illinois 60532-1698
telephone (312)969-8800

in Canada:
Tellabs Communications Canada, Ltd.
2433 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 5S2
telephone (416)858-2058

Enclose an explanation of the malfunction, your company's name and address, the name of a person to contact for further information, and the purchase order number for the transaction. Be sure to write the MRA number clearly on the outside of the carton being returned. Tellabs will inspect, repair, and retest the equipment so that it meets its original performance specifications and then ship the equipment back to you. If the equipment is in warranty, no invoice will be issued. Should you need to contact Tellabs regarding the status of a repair, call or write the Product Services department at our Lisle or Mississauga headquarters as directed above.

product replacement procedure

7.05 For critical service outages, Tellabs offers a choice of two replacement services (if the product is in replacement stock) in lieu of the 15-day repair and return service described above. These are **overnight express service** (at extra cost) anywhere in the USA and **five-day expedited delivery** (at no extra cost) anywhere in the USA and Canada. To obtain replacement equipment via either of these services, contact your Tellabs Regional Office in the USA or our Canadian headquarters in Mississauga, Ontario, for details, costs (if applicable), and instructions. Telephone numbers are given in paragraph 7.02. A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the replacement transaction). Tellabs will then ship the replacement to you in accordance with the replacement service you request. An invoice in the amount of the replacement's current price plus any applicable service charges will be issued after the replacement is shipped. When you receive the replacement, pack the equipment to be returned in the replacement's carton, sign and enclose the packing list, affix to the carton the preaddressed label provided, and ship the carton prepaid to Tellabs at our USA or Canadian headquarters. The defective equipment must be received within 30 days of the replacement's ship date. When we receive the defective equipment, a credit will be issued, leaving a balance due on the replacement's invoice that reflects only the express service and/or out-of-warranty charges, if any. Returns received more than 30 days after the replacement's ship date **will not be accepted for credit** but instead will be returned to you, thereby rendering the replacement's invoice due and payable. Please note that OEM, modified, and manufacture-discontinued equipment is not available via overnight express service.

troubleshooting guide on next page

troubleshooting guide

trouble condition	possible causes (check before assuming module is defective)
module completely inoperative	1) No input power. 2) Improper wiring.
cannot derive proper 4wire-to-2wire transmission levels	1) Front-panel *rcv fac level* and/or *rcv term loss* DIP switches improperly set. 2) Main-board 4wire receive and 2wire impedance switches (*S1* and *S3*, respectively) improperly set. 3) Receive equalization DIP switch (*S4*) improperly set. 4) Circuit not seized. 5) Test-equipment impedance improperly set or test equipment not terminated.
cannot derive proper 2wire-to-4wire transmission levels	1) Front-panel *xmt term loss* and/or *xmt fac level* DIP switches improperly set. 2) Main-board 2wire and 4wire transmit impedance switches (*S3* and *S1*, respectively) improperly set. 3) Transmit equalization DIP switch (*S6*) improperly set. 4) Circuit not seized. 5) Test-equipment impedance improperly set or test equipment not terminated.
objectionable echo or "hollow" sound at distant end of 4wire facility	1) Compromise balance network (*CBN* positions of DIP switch *S5*) improperly optioned. 2) Front-panel *CBN adjust* control improperly adjusted (with user-adjustable CBN resistance selected). 3) NBO capacitance switches (*μF/1000* positions of DIP switch *S5*) improperly set. 4) Level switches improperly set. 5) Equalization DIP switches improperly set. 6) Impedance switches improperly set.
no local-station ringing	1) Switch *S12* improperly set. 2) Local ring generator improperly wired or defective. 3) Level switches improperly set (too high or too low). 4) Main-board 4wire receive impedance switches improperly set. 5) No incoming SF tone (check facility and distant-end equipment). 6) Excessive ringing load on 2wire loop.
no local ring trip	1) Ring generator not superimposed on module's negative input battery. 2) Excessive loop resistance.
false local ring trip	1) Excessive capacitive loading on 2wire loop (e.g., too many telephone sets). 2) Excessive resistive leakage on 2wire loop.
no off-hook detection (i.e., cannot draw dial tone)	1) Excessive 2wire loop resistance (in which case outgoing SF tone may not be removed when local station goes off-hook). 2) Switch *S12* improperly set.
cannot dial	1) Excessive 2wire loop resistance (see preceding problem, cause 1). 2) Switch *S12* improperly set.
incorrect signaling states	1) Switches *S12* and/or *S15* improperly set. 2) Improper incoming SF signaling tones at 4wire receive port.
cannot activate or deactivate manual loopback via option switch (6123A only)	1) Ground on EXT MNLB (external manual loopback) lead (pin 18).
cannot activate or deactivate manual loopback via EXT MNLB-lead ground (6123A only)	1) EXT MNLB (external manual loopback) lead (pin 18) improperly wired. 2) Source of ground defective.
cannot activate or deactivate 2713Hz tone loopback (6123A only)	1) Loopback options improperly set; check *LPBK* DIP switch (*S17*). 2) Tone not applied for proper duration and, for activation only, then removed. 3) Tone at improper frequency or below −30dBm detection threshold. 4) Ground on EXT MNLB (external manual loopback) lead (pin 18).
cannot derive transmission loopback (6123A only)	1) Module not in loopback (*lpbk* LED unlit).
cannot derive proper loopback transmission level (6123A only)	1) Loopback-level (*LPBK LVL*) DIP switch (*S16*) improperly set. 2) Module not in loopback (*lpbk* LED unlit).