tellabs
technical manual
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rev C

6123 and 6123A 2Wire FXS SF Signaling Sets with Gain

contents

1. general description

1.01 The 6123 2Wire FXS SF Signaling Set module with Gain and the 6123A 2Wire FXS SF Signaling Set module with Gain and Loopback (figure 1) each provide signaling and transmission interface between a 4wire facility that uses single-frequency (SF) signaling and a 2wire metallic station loop or PBX trunk that used the type of loop signaling normally associated with the station end of a foreign-exchange (FX) or off-premises-extension (OPS) circuit. Both modules provide active level control and amplitude equalization in the transmit and receive paths as well as full-duplex conversion between the SF signaling on the 4wire facility and the FXS (foreign-exchange, station-end) signaling on the 2wire station loop or PBX trunk. Conventional 2600Hz SF tone is supplied by an integral oscillator. The 6123 and 6123A differ from ordinary 2wire FXS SF signaling sets in that they each contain an integral line amplifier to accommodate a variety of facility interface levels. Unlike the 6123, the 6123A contains loopback circuitry to facilitate local or remote testing of the module and the facility. As members of Tellabs' 262U Universal Network Terminating 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 is revised to provide information on *signaling* loopback operation of the 6123A module, which was not covered in previous practice revisions. Also, the functional block diagram of the 6123 and 6123A (section 5 of this practice) is corrected as follows:

- The *XMT SF TONE GATE* output and the ringback tone input lead (RBT IN) meet the 4wire transmit path **before** rather than after the *TRANSMIT SLOPE EQUALIZER.*
- The *SIGNAL-TO-GUARD DETECTOR* provides input to the *BANDPASS/BAND-ELIMINATION FILTER* rather than vice versa.

1.03 Features and options of the 6123 and 6123A include the following: full prescription alignment capability; balanced, switchable 1200, 600, or 150-ohm terminating impedances on the 4wire

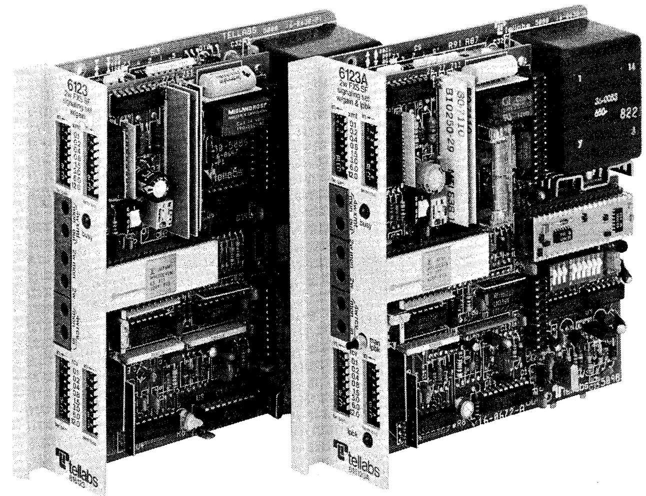


figure 1. 6123 and 6123A 2Wire FXS SF Signaling Sets with Gain

(facility) side; balanced, switchable 900 or 600-ohm terminating impedance (in series with 2.15μF) on the 2wire (terminal) side; facility-side amplifiers and terminal-side attenuators for interface at a variety of levels; active slope-type or compromise bump-type receive equalization; active slope-type transmit equalization; an integral compromise balance network; switch-selectable network build-out capacitance; minimum-break transmit pulse correction; switchable loop-start or ground-start operation; a switch option to accommodate normal or inverted incoming SF signaling states; and switchable 400 or 600-ohm battery-feed resistance for loop-current limiting. Both modules derive a circuit-status lead that can be used as a local sleeve lead or as a traffic-monitoring lead. The 6123A alone contains the aforementioned loopback circuitry, which offers both local (manual) and remote (tone- or ground-activated) loopback-state control. In place of this loopback circuitry, the 6123 makes provision for use of an optional precision balance network subassembly. Except for these differences, the two modules are identical.

1.04 Prescription-set transmit and receive amplifiers on the 4wire side of the 6123 and 6123A allow each module to interface the SF signaling facility directly, i.e., without a separate facility-side line amplifier. These integral amplifiers, in conjunction with prescription-set transmit and receive attenuators on the 2wire side (but located in the 4wire paths), provide for full coordination between facility-side and terminal-side levels. Both facility-side amplifiers on each module provide from 0 to 24dB of gain in switch-selectable 0.1dB increments, and both terminal-side attenuators provide from 0 to 24dB of loss in switch-selectable 0.1dB increments. In the receive channel, 4wire input TLP's (transmission level points) from −17 to +7 can be accommodated and 2wire output TLP's from +7 to −17 can be derived. In the transmit channel, 2wire input TLP's from −16 to +8 can be accommodated and 4wire output TLP's from +8 to −16 can be derived. Overload points at each module's ports are as follows: 4wire receive port, 4wire transmit port, and 2wire-port input, +5dBm0; 2wire-port output, +8dBm.

1.05 Two modes of amplitude equalization are available in the receive path of both the 6123 and the 6123A for post-equalization of the facility-side receive pair. For nonloaded cable, an active slope equalizer introduces from 0 to 7.5dB of equalized gain at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments. For loaded cable, a compromise bump equalizer inserts a 3dB bump at 3200Hz (re 1004Hz) and provides 1.5dB of roll-off at 404Hz (re 1004Hz). Because neither equalizer affects 1004Hz levels of the 6123 and 6123A, equalization can be introduced not only before but also **after** levels are set, with no interference between level and equalization adjustments.

1.06 In the transmit path of the 6123 and 6123A, active slope equalization is available for pre-equalization of a facility-side transmit pair consisting of nonloaded cable. This equalizer is essentially identical to the receive-path slope equalizer, introducing from 0 to 7.5dB of equalized gain at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments. Like the receive equalizers, the transmit equalizer has no effect on 1004Hz levels.

1.07 On the 4wire side, the 6123 and 6123A each provide transformer coupling at both ports (4wire receive and 4wire transmit). The transformers at these ports can be independently switch-optioned for balanced 1200, 600, or 150-ohm terminating impedance. The 150-ohm options provide approximately 2dB of slope equalization (in addition to any provided by the modules' active slope equalizers) when the 4wire ports interface long sections of nonloaded cable. Both facility-side transformers on the 6123 and 6123A are center-tapped to derive balanced simplex leads.

1.08 On the 2wire side, the 6123 and 6123A each contain a hybrid terminating set for 4wire-to-2wire conversion. This hybrid provides balanced, switchable 900 or 600-ohm terminating impedance in series with 2.15μF of capacitance at each module's 2wire port. At the hybrid's balance port (opposite the 2wire port), an integral compromise balance network (CBN) provides a switch-selectable choice of 900 or 600 ohms (in series with 2.15μF) or a balance setting for a short nonloaded loop terminated in a Type 500 (or equivalent) telephone set. On both modules, the CBN can be switch-optioned out of the circuit when use of a precision balance network (PBN) is preferred. For the 6123, this PBN can be supplied either as an external module (e.g., a Tellabs 423X) or, more conveniently, as a Tellabs 9930 (Issue 3 or later) or 9932 (Issue 2 or later) PBN subassembly, which plugs into a receptacle on the module's printed circuit board. For the 6123A, which lacks the PBN-subassembly receptacle of the 6123, the PBN must be supplied as an external module. (Please refer to the Tellabs 423X and 993X practices for details on these modules and subassemblies.) Both the 6123 and 6123A contain integral network build-out (NBO) capacitors that provide from 0 to 0.030μF of NBO capacitance in switch-selectable 0.002μF increments. These NBO capacitors can be used in conjunction with the modules' integral CBN or with an optional plug-on or external PBN.

1.09 The transmit portion of the 6123 and 6123A converts station-end supervisory and dialing and states to outgoing SF tone signals. Tone is transmitted during station idle and also during the break portions of dial pulses. A minimum-break transmit pulse corrector ensures transmission of recognizable tone pulses. A transmission-path-cut circuit with a nominal 15ms pre-cut delay interval prevents transient interference with outgoing SF signaling.

1.10 The receive portion of the 6123 and 6123A converts incoming SF tone signals to station-end ringing and seizure states. Recognition delays prevent response to spurious SF tone bursts and to momentary tone interruptions. In the loop-start supervisory mode, detection of incoming SF tone activates local ringing. In the ground-start supervisory mode, loss of incoming tone causes the loop to be completed toward the station, and detection of SF tone modulated by the incoming ringing frequency activates local ringing. In either supervisory mode, ring trip is provided during either ringing or silent intervals.

1.11 Unlike the 6123, the 6123A contains integral loopback circuitry that loops voice-frequency transmissions at the 4wire receive port back to the 4wire transmit port for remote testing of both the module and the facility. The SF tone detector and bank-elimination filter (BEF) in the 6123A's signaling section can also be tested remotely when the module is in loopback. Switch options allow a choice of manual, two-tone, or ground-controlled loopback. Specifically, activation methods include (1) local manual activation via front-panel pushbutton only and (2) remote activation by 2713Hz tone **or** local manual activation via front-panel pushbutton. Deactivation methods include (1) local manual deactivation via front-panel pushbutton only and (2) remote deactivation by 2713Hz tone **or** local manual deactivation via front-panel pushbutton. Automatic deactivation after a 2.6-minute or 20.8-minute timeout is also available for either of the activation modes (*manual only* and *tone or manual*). Regardless of which loopback switch options are in effect, loopback can also be activated by remote application of ground to an external-loopback lead and deactivated by removal of this ground. A prescription loopback-level-control circuit introduces from 0 to 23dB of loss or gain into the loopback path in switch-selectable increments (23dB loss; 0.5, 1.5, 3, 6, and 12dB gain) to provide true equal-level transmission loopback.

1.12 Both the 6123 and 6123A contain an integral 2600HzSF signaling tone oscillator and therefore do not require an external (master) SF tone source. Provision for use of a master oscillator, however, is available via factory modification.

1.13 In addition to precision facility-gain and terminal-loss DIP switches for both channels, the front panel of each module contains a busy-indicating LED and six bantam-type test jacks. An opening jack facing the module and a monitoring jack bridging the transmission pair are provided at both 4wire ports and at the 2wire port. The front panel of the 6123A also contains a manual-loopback pushbutton and an LED that lights when loopback is activated.

1.14 Both modules operate from filtered, ground-referenced −22 to −56Vdc input. Current requirements for the 6123 range from 65mA at idle to 90mA when busy, not including loop current. Current requirements for the 6123A range from 75mA at idle to 100mA when busy, not including loop current. When loopback is activated in the 6123A, an additional 20mA is required.

1.15 The 6123 and 6123A are Type 10 modules. As such, each module 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.

1.16 Both the 6123 and 6123A are members of Tellabs' 262U Universal Network Terminating System of modules and enclosures. Thus, each module can also be mounted in any of Tellabs' prewired 262U Mounting Assemblies, versions of which are available for relay-rack and apparatus-case installation. For details, please refer to Tellabs' 262U System brochure. In addition, the 6123 and 6123A can be used in the prewired mounting assemblies of Tellabs' 262 Network Terminating System and 260A SF Signaling and Terminating System. For details, please refer to the Tellabs brochures and practices on the 262 and 260A Systems.

2. application

2.01 The 6123 and 6123A 2Wire FXS SF Signaling Set modules are each designed to interface a 4wire SF transmission facility with a 2wire metallic station-end FX or OPS loop or PBX trunk (loop start or ground start). These modules combine the functions of a 4wire line amplifier, an SF transciever, an SF-to-FXS signaling converter, and a 4wire-to-2wire hybrid terminating set. Thus, the 6123 and 6123A are complete 2wire FXS SF signaling and terminating circuits, less power and ringing, on single Type 10 modules. As such, each module provides full-duplex signaling conversion and transmission interface between the 4wire SF facility and the 2wire station-end FXS or OPS loop or PBX trunk. The two modules differ as follows: the 6123A contains integral loopback circuitry that permits testing of both the module and the facility from a local or remote location. The 6123 lacks this loopback circuitry but, in the same location on the printed circuit board, makes provision for use of a Tellabs 993X Precision Balance Network plug-on subassembly.

2.02 Each 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, each 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 and 6123A. A special E&M-to-FXS (or E&M-to-station-end-OPS) application of these modules is covered in paragraph 2.21.

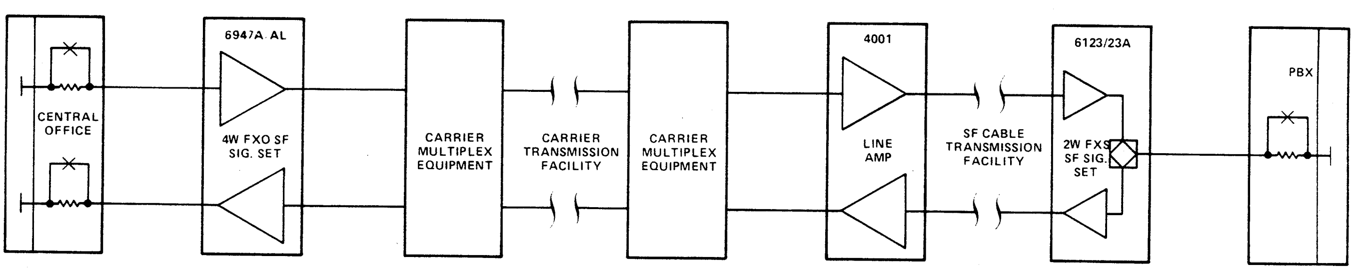


figure 2. Typical foreign-exchange (FX) application of 6123 or 6123A

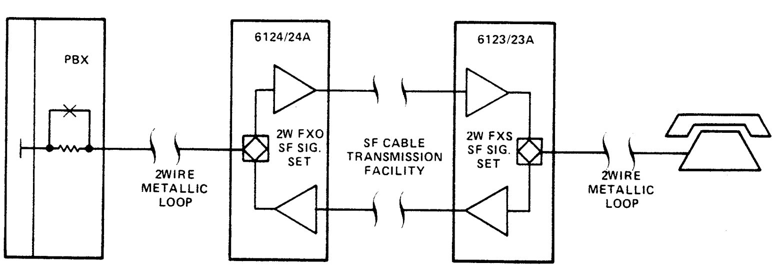


figure 3. Typical off-premises-extension (OPS) application of 6123 or 6123A

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

2.03 The 6123 or 6123A interfaces the 2wire station loop or PBX trunk via its integral hybrid terminating set. This magnetic 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 with a switched network involving both loaded and nonloaded cable). The 600-ohm option is selected for interface with nonloaded cable or station equipment. The hybrid derives A and B leads to accommodate loop current, if required.

2.04 To ensure that adequate hybrid balance (i.e., enough transhybrid loss) is provided in any application, the hybrid in the 6123 and 6123A can be switch-optioned to function with the module's internal compromise balance network (CBN) or with a separate precision balance network (PBN). 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 accommodates direct 2wire-port interface with a short (nonloaded) station loop terminated in a Type 500 (or equivalent) telephone set. If, in these applications, the CBN does not provide adequate hybrid balance (i.e., sufficient transhybrid loss), a separate PBN is required. Generally, a separate PBN is also necessary in applications where the module's 2wire port interfaces a long section of nonloaded cable.

2.05 The PBN used with the 6123 module can be provided either as a Tellabs 423X PBN module or, more conveniently, as a Tellabs 9930 (Issue 3 or later) or 9932 (Issue 2 or later) PBN subassembly. While the 423X PBN is a separate Type 10 module, the 993X is a subassembly that plugs physically and electrically into four-pin receptable *J2* on the 6123's printed circuit board. Because the 6123A module makes no provision for a plug-on PBN (due to the presence of loopback circuitry in place of the 6123's PBN subassembly receptacle), any PBN used with the 6123A must be a separate device, such as a Tellabs 423X PBN module. The 993X and 423X PBN's are available in several versions to approximate the impedances of specific transmission facilities and station equipment. For complete information on these PBN's, please refer to the Tellabs 993X and 423X practices.

2.06 To further improve hybrid balance, especially in applications where a **PBN for loaded cable** is used with the 6123 or 6123A, from 0 to 0.030μF 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. Please note that while NBO capacitance **can be used** with a CBN or with a PBN for nonloaded cable or a tel set, the NBO capacitance introduced in these cases may or may not result in significantly improved hybrid balance. The amount of additional transhybrid loss obtained in such applications depends upon individual circuit characteristics.

2.07 Located on the 4wire side of the hybrid are "terminal-side" prescription attenuators in the transmit and receive paths. These attenuators, in conjunction with transmit and receive prescription amplifiers on the 4wire side, provide full coordination between 4wire-side and 2wire-side levels, as described in paragraph 2.09.

facility (4wire) interface

2.08 The 6123 and 6123A interface 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 approximately 2dB of slope equalization (in addition to any provided by the integral slope equalizers) for long sections of nonloaded cable through the deliberate impedance mismatch. Both facility-side transformers are center-tapped to derive balanced simplex leads, which can be used to provide sealing current to the facility from a source *external* to the module if sealing current is desired.

level control

2.09 Prescription-set transmit and receive amplifiers on the facility side of the 6123 and 6123A allow each 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 necessary to derive a +7 transmision 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 necessary to derive the required facility-side transmit output level. Both facility-side amplifiers in the 6123 and 6123A provide from 0 to 24dB of gain in 0.1dB increments. Both terminal-side attenuators provide from 0 to 24dB of loss in 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 of −16 to +8 can be

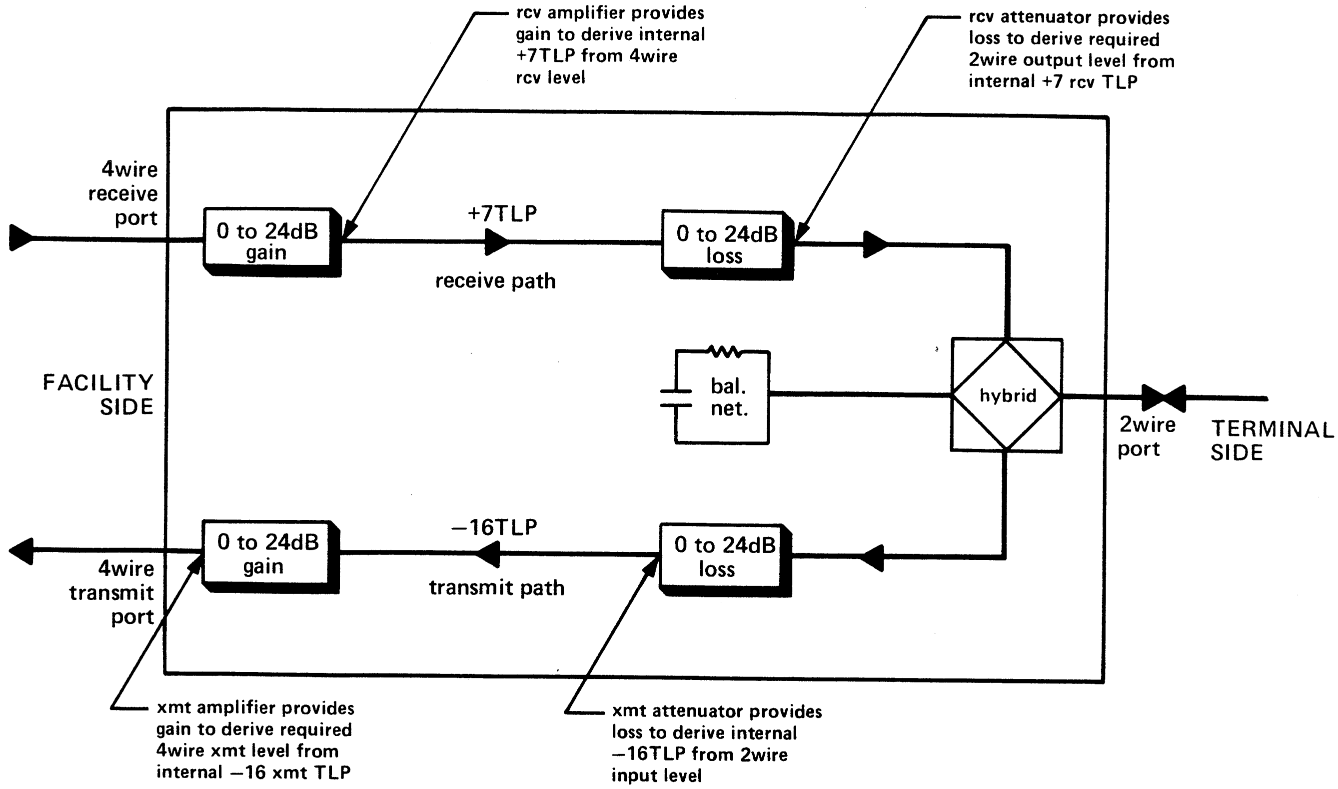


figure 4. level coordination in 6123 and 6123A

accommodated and 4wire transmit TLP's of +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 gain* and *term loss* switches set to the *IN* position.

receive-channel amplitude equalization

2.10 Two modes of amplitude equalization are available in the 6123 and 6123A 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 flatness achievable with the slope equalizer is ±0.3dB from 404 to 3200Hz (re 1004Hz). Typical frequency response of the slope equalizer is shown in tabular form in table 1.

2.11 The second mode of receive-channel equalization available in the 6123 and 6123A 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 tabular form in table 2.

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

transmit-channel amplitude equalization

2.13 Prescription active slope-type amplitude equalization is available in the 6123 and 6123A 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 equalized 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 2.10 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

2.14 The 6123 and 6123A modules accommodate conventional loop-start and ground-start supervisory formats. 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 modules' A and B leads. In **ground-start operation**, the tip-lead path is opened to ground whenever incoming SF signaling tone is detected, except during ringing. Presence of SF tone at the 4wire receive port

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	−0.18	−0.17	−0.15	−0.06	0.0	+0.17	+0.26	+0.42	+0.48	+0.54
1.0	−0.37	−0.33	−0.29	−0.13	0.0	+0.34	+0.52	+0.85	+0.96	+1.08
1.5	−0.56	−051	−0.44	−0.20	0.0	+0.50	+0.77	+1.28	+1.44	+1.62
2.0	−0.75	−0.68	−0.60	−0.26	0.0	+0.67	+1.03	+1.72	+1.94	+2.18
2.5	−0.95	−0.86	−0.75	−0.33	0.0	+0.83	+1.29	+2.15	+2.43	+2.74
3.0	−1.14	−1.03	−0.90	−0.40	0.0	+1.00	+1.54	+2.58	+2.93	+3.31
3.5	−1.32	−1.19	−1.04	−0.45	0.0	+1.17	+1.81	+3.03	+3.44	+3.89
4.0	−1.48	−1.33	−1.16	−0.50	0.0	+1.30	+2.01	+3.30	+3.86	+4.36
4.5	−1.67	−1.51	−1.31	−0.57	0.0	+1.45	+2.26	+3.82	+4.36	+4.98
5.0	−1.86	−1.68	−1.46	−0.64	0.0	+1.60	+2.49	+4.26	+4.88	+5.59
5.5	−2.04	−1.84	−1.60	−0.69	0.0	+1.75	+2.73	+4.70	+5.40	+6.21
6.0	−2.22	−2.00	−1.74	−0.75	0.0	+1.95	+3.72	+5.14	+5.93	+6.87
6.5	−2.40	−2.16	−1.87	−0.81	0.0	+2.03	+3.18	+5.56	+6.45	+7.52
7.0	−2.57	−2.31	−2.00	−0.86	0.0	+2.16	+3.39	+5.98	+6.97	+8.19
7.5	−2.66	−2.46	−2.13	−0.91	0.0	+2.28	+3.59	+6.38	+7.48	+8.86

table 1. Typical frequency response of transmit and receive slope equalizers

compromise bump equalizer setting	equalized gain (in dB) introduced at various frequencies									
	300Hz	404Hz	500Hz	800Hz	1004Hz	1500Hz	1800Hz	2500Hz	2804Hz	3200Hz
out	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
in	−2.51	−1.48	−0.91	−0.81	0.0	+0.22	+0.33	+0.58	+1.07	+3.08

table 2. Typical frequency response of receive compromise bump equalizer

indicates that the associated office-end circuit is idle (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.

supervisory limits and build-out resistors

2.15 The 6123 and 6123A contain internal build-out resistors (BOR's) in their loop-current supply circuits. These BOR's are used to limit current on short 2wire loops when the module is operating on nominal −48Vdc battery supply. With the BOR's optioned into the circuit, the battery-feed resistance is 600 ohms; with the BOR's optioned out of the circuit, the battery-feed resistance is 400 ohms. When nominal −48Vdc battery supply is used, the BOR's are normally optioned into the circuit in applications where external loop resistance (including that of the station instrument or PBX trunk circuit) is less than 500 ohms, and are normally optioned out of the circuit in applications where external loop resistance is 500 ohms or greater. When powered from nominal −48Vdc battery supply and with the BOR's optioned out, the 6123 and 6123A can accurately sense loop conditions at up to 3000 ohms of external loop resistance.

Note: *Although the 6123 and 6123A can operate with external loop resistance up to 3000 ohms when powered from −48Vdc battery and up to 1300 ohms when powered from −24Vdc battery, loop resistance exceeding 1687 ohms with −48Vdc battery and exceeding 643 ohms with −24Vdc battery will result in loop current less than 23mA.*

2.16 In ground-start operation, the 6123 or 6123A senses application of ground to the ring lead to initiate seizure toward the distant end. The ring-ground sensor in the 6123 or 6123A can sense application of this ground through external resistance of up to 2000 ohms on the ring lead.

ring trip and ring-trip range

2.17 The 6123 and 6123A provide 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 −22 to −56Vdc. The 6123 and 6123A can reliably detect ring trip at up to 2000 ohms of external loop resistance with −48Vdc biased ringing and at up to 800 ohms of external loop resistance with −24Vdc biased ringing. Both modules tolerate up to 4μF of capacitance in series with 5.1 kilohms bridged across tip and ring without pre-tripping. Furthermore, the 6123 and 6123A can tolerate a loop leakage resistance of 30 kilohms without falsely indicating off-hook or ring trip. An internal inhibit circuit prevents operation of the ring-up circuit when the local station or PBX trunk is off-hook.

signaling-tone states

2.18 Signaling-tone states for the 6123 and 6123A 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

2.19 The 6123 and 6123A are 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 400 milliseconds at the beginning of each tone interval. The SF tone detector in each module reliably detects tone levels as low as −31dBm0, provided that the SF tone energy is approximately 10dB above the level of all other signals simultaneously present at the 4wire receive port. The SF tonè 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.

2.20 Within approximately 13 milliseconds 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.

tone-detection-logic inversion for FXS and OPS applications where facility signaling is E&M

2.21 The 6123 and 6123A each contain a switch option that conditions (by inverting) their SF-tone-detection logic to correctly respond to conventional E&M SF facility signaling without the need for an E&M-to-FXS signaling converter between the facility and the 6123 or 6123A. This receive-path feature allows the 6123 or 6123A to be used without additional modules to provide station-end FX or OPS service when the 4wire facility uses E&M-type SF signaling instead of FX-type SF signaling. An application of this type is shown in figure 5.

Note: *The inverted-logic option can only be used when the module is optioned for loop-start operation.*

outgoing SF tone transmission

2.22 The 6123 and 6123A are designed to interface the transmit path on the facility side at any TLP from +8 to −16 and to transmit SF tone at either of two levels. During the idle state, the modules transmit SF tone at −20dBm0. During dial pulsing and also for the first 400ms each time they

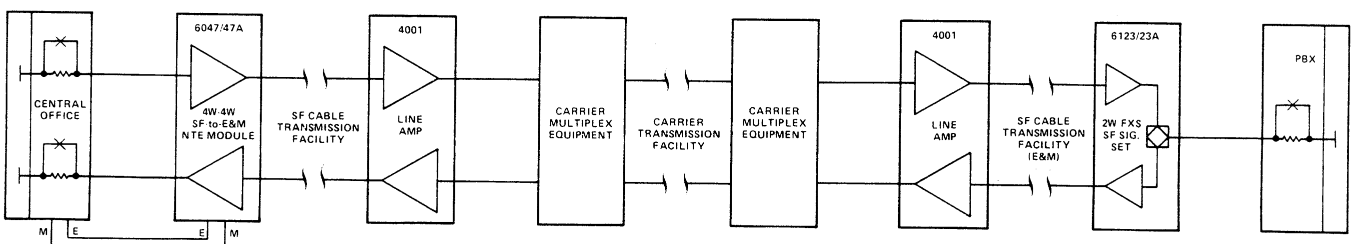


figure 5. Application where inverted-SF-receive-logic option of 6123 or 6123A is used to allow direct interface with an E&M SF facility

apply tone to the facility, the modules transmit 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

2.23 The 6123 and 6123A each contain 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 30 milliseconds to prevent false detection of short transients typically associated with station loops. A minimum-break pulse corrector in the transmit path ensures that the break portion of any transmitted dial pulse is no shorter than 50 milliseconds, regardless of input break or pulsing rate. The minimum-break pulse corrector has no effect on pulsing breaks longer than 50 milliseconds.

transmit path cut

2.24 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 and 6123A modules 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 approximatley 20 milliseconds before any transmission of SF tone. The path cut is removed approximately 125 milliseconds after transmission of SF tone ceases.

SF tone source

2.25 The 6123 and 6123A are each equipped with an integral SF tone oscillator and therefore do not require an associated master SF tone supply. If operation from a master SF tone supply is desired, however, provision is made (via factory modification) for connection of the external SF tone source, rather than the internally generated signal, to the tone control circuitry. The external signal should be 0.5±0.1Vrms, 2600±2Hz, unbalanced. Input to the 6123 and the 6123A is capacitively coupled and presents a load impedance of approximately 28 kilohms to the tone source.

power

2.26 The 6123 and 6123A each operate on filtered, ground-referenced input potentials between −22 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 is 90mA for the 6123 and 100mA for the 6123A unless the 6123A's loopback option is activated, in which case an additional 20mA is required.

ringing

2.27 The ringing circuits in each module operate with any ringing frequency between 16 and 67Hz, but the ringing generator must be referenced to (or superimposed upon) a potential of −22 to −56Vdc for reliable operation of the ring-trip detector. In the ground-start mode, each module responds to any modulated ringing frequency between 16 and 50Hz.

traffic monitoring

2.28 Both the 6123 and 6123A permit traffic monitoring of circuit seizure 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)

2.29 Integral facility- (4wire-) side loopback circuitry in the 6123A allows voice-frequency transmissions at the 4wire receive port to be looped back to the 4wire transmit port for remote testing of both the module and the facility. A prescription loopback-level-control circuit introduces from 0 to 23dB of gain or loss into the loopback path in switch-selectable increments (23dB loss; 0.5, 1.5, 3, 6, and 12dB gain) to provide true equal-level transmission loopback.

2.30 The SF tone detector and band-elimination filter (BEF) in the 6123A's signaling section can also be tested remotely when the module is in loopback. This is done by sending continuous SF tone at the proper level from the remote testing location. If the tone detector and BEF are operating properly, the SF tone will be removed by the BEF so that **no SF tone** is returned from the module's 4wire transmit port. Figure 6 shows the loopback path through the 6123A module.

2.31 **Loopback Summary.** For easy reference, table 5 summarizes the 6123A's loopback modes and the activation and deactivation methods for each. For a detailed description of these modes, see paragraphs 2.32 through 2.34. For information on optioning the 6123A for the various loopback modes, see section 3 of this practice.

2.32 **Manual Loopback.** Manual loopback, which is convenient for local testing, is activated by depressing the 6123A's front-panel *man lpbk* pushbutton for at least 1.4 seconds and then releasing it. (Loopback is activated only upon **release** of the pushbutton.) When the module is optioned for manual loopback, three different loopback-deactivation options are available. The first is **no timeout,** i.e., manual deactivation only. With this option, loopback can be deactivated only by depressing the *man lpbk* pushbutton again, this time for at least 0.7 second. (Releasing the pushbutton is not necessary for deactivation.) The second option is automatic deactivation after a **2.6-minute timeout**, and the third is automatic deactivation after a **20.8-minute timeout.** With either timeout option, loopback can be deactivated prior to timeout either by depressing the *man lpbk* pushbutton for at least 0.7 second or by applying nominal 2713Hz tone to the module's 4wire

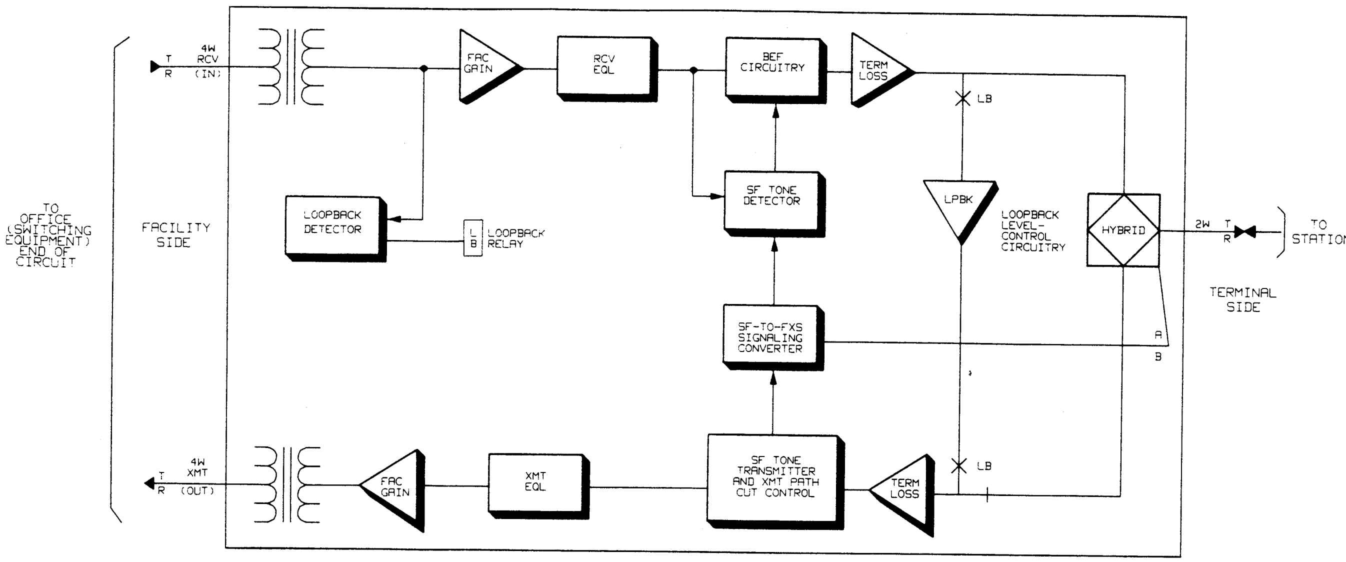


figure 6. Loopback route through 6123A

loopback mode	**method(s) of activation**	**method(s) of deactivation**
manual loopback with no timeout	1) Depress front-panel *man lpbk* pushbutton for at least 1.4 seconds.*	1) Depress front-panel *man lpbk* pushbutton for at least 0.7 second.**
manual loopback with 2.6-minute timeout	1) Depress *man lpbk* pushbutton for at least 1.4 seconds.*	1) Automatic deactivation after 2.6-minute timeout. 2) Prior to timeout, depress *man lpbk* pushbutton for at least 0.7 second.**
manual loopback with 20.8-minute timeout	1) Depress *man lpbk* pushbutton for at least 1.4 seconds.*	1) Automatic deactivation after 20.8-minute timeout. 2) Prior to timeout, depress *man lpbk* pushbutton for at least 0.7 second.**
two-tone (and manual) loopback with no timeout	1) Apply nominal 2713Hz tone to 4wire rcv pair for at least 1.4 seconds.* 2) Depress *man lpbk* pushbutton for at least 1.4 seconds.*	1) Apply nominal 2713Hz tone to 4wire rcv pair for at least 0.7 second.*** 2) Depress *man lpbk* pushbutton for at least 0.7 second.**
two-tone (and manual) loopback with 2.6-minute timeout	1) Apply nominal 2713Hz tone to 2wire rcv pair for at least 1.4 seconds.* 2) Depress *man lpbk* pushbutton for at least 1.4 seconds.*	1) Automatic deactivation after 2.6-minute timeout. 2) Prior to timeout, apply nominal 2713Hz tone to 4wire rcv pair for at least 0.7 second.** 3) Prior to timeout, depress *man lpbk* pushbutton for at least 0.7 second.**
two-tone (and manual) loopback with 20.8-minute timeout	1) Apply nominal 2713Hz tone to 4wire rcv pair for at least 1.4 seconds.* 2) Depress *man lpbk* pushbutton for at least 1.4 seconds.*	1) Automatic deactivation after 20.8-minute timeout. 2) Prior to timeout, apply nominal 2713Hz tone to 4wire rcv pair for at least 0.7 second.** 3) Prior to timeout, depress *man lpbk* pushbutton for at least 0.7 second.**
ground-controlled loopback***	1) Apply ground to module's external loopback lead.	1) Remove ground from module's external loopback lead.

* Loopback is activated only upon release of the *man lpbk* pushbutton or removal of 2713Hz tone.
** Loopback is released after 0.7 second regardless of whether or not the *man lpbk* pushbutton is released or, for two-tone loopback only, 2713Hz tone is removed.
*** Ground-controlled loopback operates independently of switch-selected loopback options. Thus, when activated, it cannot be deactivated by pushbutton, tone, or timeout.

table 5. Summary of loopback activation and deactivation methods for 6123A

receive pair (pins 7 and 13) for at least 0.7 second. (Removing the tone is not necessary for deactivation.) See paragraph 2.33 for details on two-tone loopback.

2.33 **Two-Tone Loopback.** Two-tone loopback, which is convenient for remote testing, is activated by applying nominal 2713Hz tone to the 6123A's 4wire receive pair (pins 7 and 13). This tone must fall within a 70Hz bandwidth centered at 2713Hz and must be at a level above −26dBm0. The duration of this activation tone must be at least 1.4 seconds, and loopback is activated only upon removal of the tone. Please note that when the module is optioned for two-tone loopback, loopback can also be activated manually via the front-panel *man lpbk* pushbutton because the pushbutton and the loopback-tone detector are logic-ORed together. Also, when the module is optioned for two-tone loopback, three different loopback-deactivation options are available. The first is **no timeout**, i.e., either deactivation by a second tone or manual deactivation. With this option, loopback can be deactivated only by applying nominal 2713Hz tone again, this time for a least 0.7 second, or by depressing the *man lpbk* pushbutton for at least 0.7 second. (Loopback is deactivated after 0.7 second regardless of whether tone is removed or the pushbutton is released.) The second loopback-deactivation option is automatic deactivation after a **2.6-minute timeout**, and the third is automatic deactivation after a **20.8-minute timeout**. With either timeout option, loopback can be deactivated prior to timeout either by applying nominal 2713Hz tone for at least 0.7 second or by depressing the *man lpbk* pushbutton for at least 0.7 second.

2.34 **Ground-Controlled Loopback.** Ground-controlled loopback, which (like two-tone loopback) is convenient for remote testing, is activated by applying ground to the 6123A's external loopback lead (pin 9). Loopback is maintained for as long as the ground is applied and is deactivated only upon removal of the ground, regardless of how the module is optioned with respect both to manual and tone loopback activation and to manual, tone, and timeout loopback deactivation. (This means that ground-activated loopback **cannot** be deactivated by the *man lpbk* pushbutton, by application of 2713Hz tone, or by timeout.)

3. installation

inspection

3.01 The 6123 and 6123A 2Wire FXS SF Signaling Set modules should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the modules should be visually inspected again prior to installation.

mounting

3.02 The 6123 and 6123A each mount in one position of a Tellabs Type 10 Mounting Shelf or in one position of a Tellabs 262, 262U, or 260A Mounting Assembly. The modules plug physically and electrically into 56-pin connectors at the rear of their shelf or assembly positions.

installer connections

3.03 In applications where the 6123 or 6123A module is to be installed in a 262, 262U, or 260A Assembly, no external connections to the module itself need be made. All internal connections in these assemblies are factory-prewired, and all external wiring is simplified through the use of female 25-pair micro-ribbon connector-ended cables arranged in accordance with Universal Service Order Code (USOC) RJ2HX. If the customer's terminal equipment is cabled in accordance with USCO RJ2HX, direct cable connection to the 262, 262U, or 260A Assembly and to 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.

3.04 When a 6123 or 6123A 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 Table 6 lists external connections to the 6123 and 6123A modules. All connections are made (to non-connectorized mounting shelves) via wire-wrapping to the 56-pin connectors at the rear of the module's shelf positions. Pin numbers are found on the body of each 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
RING GEN (biased ringing generator)	46
−BATT (−22 to −56Vdc filtered input)	35
GND (ground)	17
EXT BAL NET (external balance network)*	5 and 15
T1 (intermodule 2wire tip)*	25
R1 (intermodule 2wire ring)*	31
RBT IN (ringback tone input)*	37
SLEEVE (traffic-monitoring output or sleeve lead)*	1
4WIRE RCV SX (receive simplex, facility side)*	11
4WIRE XMT SX (transmit simplex, facility side)*	45
EXT LPBK (external ground-controlled loopback)**	9
XMT PATH CUT lead***	27
A lead†	43
B lead†	51
EXT OSC (external SF tone oscillator)††	39

* Optional.
** Optional, 6123A only.
*** Optional; a ground on this lead cuts (opens) transmit voice path.
† Not available for external connection to module.
†† Available only by factory modification.

table 6. External connections to 6123 and 6123A

option selection

3.06 All options on the 6123 and 6123A modules are selected via slide or DIP switches whose locations on the module's printed circuit boards are shown in figure 7. Table 7 summarizes these options and their switch settings, which are explained in detail below. Each module should be completely optioned and its optioning verified before alignment is attempted.

Note 1: *Included in table 7 is a checklist for* **prescription** *optioning of the 6123 or 6123A. Prior to installation, check marks can be placed in the appropriate boxes to indicate the required options. During installation, the module can then be quickly and easily optioned as indicated in the table without referring to the detailed optioning instructions in the text. A similar table and checklist are provided later in this section for the alignment switches on each module.*

Note 2: *Although the receive and transmit equalization switches and the network build-out (NBO) capacitance switches of the 6123 and 6123A are located on their printed circuit boards instead of on their front panels, introduction of equalization and introduction of NBO capacitance are more closely related to alignment than to switch-optioning. Thus, instructions for setting the equalization and NBO capacitance switches are provided under* **alignment** *later in this section.*

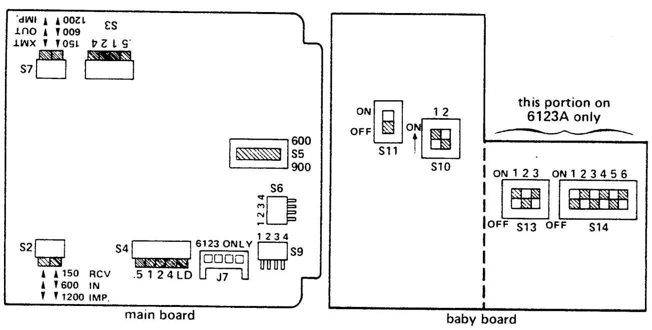


figure 7. 6123 and 6123A option switch locations

2wire port impedance

3.07 Terminating impedance at the 2wire port of the 6123 or 6123A is selected via switch *S5*, a ganged five-position DIP switch on the main printed circuit board. To select 600 ohms in series with 2.15μF (as is typically required for interface with nonloaded cable and/or a station instrument), set *S5* to *ON*. To select 900 ohms in series with 2.15μF (as is typically required for interface with loaded cable), set *S5* to *OFF*.

balance-network options

3.08 Balance-network options are selected via the first three positions of four-position DIP switch *S6* on the main board. (Please note that **position 4** of *S6* is **not used**.) To include the module's internal compromise balance network (CBN) in the circuit and to select 600 ohms in series with 2.15μF (as is typically used for interface with nonloaded cable), set *S6-1* and *S6-3* to *ON* (**up** position) and *S6-2* to *OFF* (**down** position). To include the CBN and to select 900 ohms in series with 2.15μF (as is typically used for interface with loaded cable), set *S6-1* to *ON* (up) and *S6-2* and *S6-3* to *OFF* (down). To include the CBN and to provide proper balance for a short nonloaded station loop and a Type 500 (or equivalent) telephone, set *S6-2* to *ON* (up) and *S6-1* and *S6-3* to *OFF* (down). To exclude the CBN from the circuit when a precision balance network (PBN) is to be used instead, set *S6-1, S6-2,* and *S6-3* to *OFF* (down).

4wire receive port impedance

3.09 Terminating impedance at the 4wire receive port is selected via two-position DIP switch *S2* on the main board. To select 1200 ohms (for loaded cable), set *S2-1* and *S2-2* to *OFF* (**down** position). To select 600 ohms (for nonloaded cable or carrier), set *S2-1* to *ON* (**up** position) and *S2-2* to *OFF* (down). To select 150 ohms (which provides approximately 2dB of extra slope equalization for nonloaded cable), set *S2-1* and *S2-2* to *ON* (up).

4wire transmit port impedance

3.10 Terminating impedance at the 4wire transmit port is selected via two-position DIP switch *S7* on the main board. To select 1200 ohms (for loaded cable), set *S7-1* and *S7-2* to *OFF* (**down** position). To select 600 ohms (for nonloaded cable or carrier), set *S7-1* to *ON* (**up** position) and *S7-2* to *OFF* (down). To select 150 ohms (which provides approximately 2dB of extra slope equalization for nonloaded cable), set *S7-1* and *S7-2* to *ON* (up).

loop-start or ground-start operation

3.11 Loop-start or ground-start operation is selected via position *2* of two-position DIP switch *S10* on the baby board. To select loop-start operation, set *S10-2* to *OFF*. To select ground-start operation, set *S10-2* to *ON*.

battery-feed build-out resistance

3.12 Battery-feed build-out resistors (BOR's), which limit current on the 2wire loop, are excluded from or inserted into the circuit via switch *S11* on the baby board. In applications where external loop resistance is 500 ohms or greater and/or the module is being powered from nominal −24Vdc battery, set *S11* to *ON* to exclude the BOR's and thus provide 400-ohm battery-feed resistance. In applications where external loop resistance is less than 500 ohms and the module is being powered from nominal −48Vdc battery, set *S11* to *OFF* to include the BOR's and thus provide 600-ohm battery-feed resistance for current limiting.

normal or inverted SF-tone-detection logic

3.13 Normal or inverted SF-tone-detection logic is selected via position *1* of two-position DIP switch *S10* on the baby board. In applications where incoming facility-side SF signaling is FXS-type, set *S10-1* to *ON* for normal logic. In applications where facility-side SF signaling is E&M-type, set *S10-1* to *OFF* for inverted logic.

Note: *The inverted-logic option can only be used when the module is optioned for loop-start operation.*

option	switch	selections	settings	checklist
2wire-port terminating impedance	S5 (main board)	600 ohms plus 2.15μF (for nonloaded cable or tel set)	ON	
		900 ohms plus 2.15μF (for loaded cable)	OFF	
internal compromise-balance-network options	S6-1 through S6-3 (main board) **Note:** *Position 4 of switch S6 is not used.*	CBN excluded from circuit (for use of PBN)	S6-1 OFF (down*) S6-2 OFF (down*) S6-3 OFF (down*)	
		CBN included in circuit; 600 ohms plus 2.15μF (for nonloaded cable)	S6-1 ON (up*) S6-2 OFF (down*) S6-3 ON (up*)	
		CBN included in circuit; 900 ohms plus 2.15μF (for loaded cable)	S6-1 ON (up*) S6-2 OFF (down*) S6-3 OFF (down*)	
		CBN included in circuit; balance for short nonloaded loop and Type 500 tel set	S6-1 OFF (down*) S6-2 ON (up*) S6-3 OFF (down*)	
4wire-receive-port terminating impedance	S2-1 and S2-2 (main board)	1200 ohms (loaded cable)	S2-1 OFF (down*) S2-2 OFF (down*)	
		600 ohms (nonloaded cable or carrier)	S2-1 ON (up*) S2-2 OFF (down*)	
		150 ohms (extra equalization for nonloaded cable)	S2-1 ON (up*) S2-2 ON (up*)	
4wire-transmit-port terminating	S7-1 and S7-2 (main board)	1200 ohms (loaded cable)	S7-1 OFF (down*) S7-2 OFF (down*)	
		600 ohms (nonloaded cable or carrier)	S7-1 ON (up*) S7-2 OFF (down*)	
		150 ohms (extra equalization for nonloaded cable)	S7-1 ON (up*) S7-2 ON (up*)	
loop-start or ground-start operation	S10-2 (baby board)	loop-start operation	OFF	
		ground-start operation	ON	
battery-feed build-out resistance	S11 (baby board)	BOR's out (400-ohm battery-feed resistance for external loops of 500 ohms or greater)	ON	
		BOR's in (600-ohm battery-feed resistance for external loops of less than 500 ohms)	OFF	
normal or inverted SF-tone-detection logic**	S10-1 (baby board)	normal logic (for FXS-type facility signaling)	ON	
		inverted logic (for E&M facility signaling)**	OFF**	
loopback activation and deactivation options (6123A only)	S13-1 through S13-3 (baby board)	manual loopback with no timeout	S13-1 OFF S13-2 OFF S13-3 OFF	
		manual loopback with 2.6-minute timeout	S13-1 OFF S13-2 ON S13-3 OFF	
		manual loopback with 20.8-minute timeout	S13-2 ON S13-1 ON S13-3 OFF	
		two-tone (and manual) loopback with no timeout	S13-1 OFF S13-2 OFF S13-3 ON	
		two-tone (and manual) loopback with 2.6-minute timeout	S13-1 OFF S13-2 ON S13-3 ON	
		two-tone (and manual) loopback with 20.8-minute timeout	S13-1 ON S13-2 ON S13-3 ON	

* For each individual switch on piano-style DIP switches *S2*, *S6*, and *S7*, "down" is toward the module's main printed circuit board and "up" is away from the main printed circuit board.
** Inverted-logic option can only be used when module is optioned for loop-start operation.

table 7. 6123 and 6123A switch-option summary and checklist

loopback activation and deactivation options (6123A only)

3.14 The desired mode of loopback activation and deactivation for the 6123A (except for ground-controlled loopback; see paragraph 2.34) is selected via three-position DIP switch *S13* on the baby board. Table 5 in section 2 of this practice summarizes the various modes. Select the desired mode from table 5; then refer to table 7 and set switches *S13-1, S13-2,* and *S13-3* as indicated for the desired mode.

alignment (general)

3.15 Alignment of the 6123 comprises five main parts, with one additional part required for the 6123A. These parts are as follows:

A. Introducing facility-side gain into the receive channel to derive an internal +7 transmission level point (TLP) from the 4wire receive level; then introducing terminal-side loss to derive the desired 2wire output level.

B. Introducing compromise bump-type or prescription active slope-type amplitude equalization, if required, to post-equalization the input to the receive channel.

C. Introducing terminal-side loss into the transmit channel to derive an internal −16TLP from the 2wire input level; then introducing facility-side gain to derive the desired 4wire transmit level.

D. Introducing prescription active slope-type amplitude equalization, if required, to pre-equalize the output from the transmit channel.

E. Adjusting the module's NBO capacitors to achieve optimum hybrid balance in many applications where the module's internal CBN or an external or plug-on PBN is used.

F. For the 6123A only, introducing the proper amount of gain or loss into the loopback path to provide true equal-level loopback (if desired).

prescription alignment

3.16 The 6123 and 6123A are primarily intended for **prescription alignment**. In prescription alignment, all gain, loss, equalization, NBO capacitance, and loopback-level switch settings are determined from circuit records prior to installation of the module. These settings are then noted in the **checklist** column of table 8, which is the alignment-switch summary table, or on the circuit layout record (CLR). During installation, the module can then be quickly and easily aligned without performing the detailed alignment procedures that follow in the text. Simply refer to the **checklist** column of table 8 (or to the CLR) and set all gain, loss, equalization, NBO-capacitance, and loopback level switches as indicated.

introduction to non-prescription alignment

3.17 In applications where prescription alignment settings are unavailable (and in applications where prescription alignment does not provide adequate results), non-prescription alignment of the 6123 or 6123A is necessary. Access to the appropriate ports of the module is conveniently

alignment function	switch	selections	settings	check-list
receive-channel facility-side flat gain	front-panel *rcv fac gain* DIP switch*	0.1dB gain	0.1 to IN	
		0.2dB gain	0.2 to IN	
		0.4dB gain	0.4 to IN	
		0.8dB gain	0.8 to IN	
		1.5dB gain	1.5 to IN	
		3.0dB gain	3.0 to IN	
		6.0dB gain	6.0 to IN	
		12.0dB gain	12.0 to IN	
receive-channel terminal-side flat loss	front-panel *rcv term loss* DIP switch*	0.1dB loss	0.1 to IN	
		0.2dB loss	0.2 to IN	
		0.4dB loss	0.4 to IN	
		0.8dB loss	0.8 to IN	
		1.5dB loss	1.5 to IN	
		3.0dB loss	3.0 to IN	
		6.0dB loss	6.0 to IN	
		12.0dB loss	12.0 to IN	
receive-channel equalizer selection	S4-5 (main board)	compromise bump-type equalizer (for loaded cable) inserted	down**	
		compromise bump equalizer excluded (for no equalization or use of slope equalizer)	up**	

table continued on next page

alignment function	switch	selections	settings	check-list
receive-channel slope equalization for nonloaded cable (2804Hz gain re 1004Hz)	S4-1 through S4-4*** (main board)	0.5dB	S4-1 down**	
		1dB	S4-2 down**	
		2dB	S4-3 down**	
		4dB	S4-4 down**	
transmit-channel terminal-side flat loss	front-panel *xmt term loss* DIP switch*	0.1dB loss	0.1 to IN	
		0.2dB loss	0.2 to IN	
		0.4dB loss	0.4 to IN	
		0.8dB loss	0.8 to IN	
		1.5dB loss	1.5 to IN	
		3.0dB loss	3.0 to IN	
		6.0dB loss	6.0 to IN	
		12.0dB loss	12.0 to IN	
transmit-channel facility-side flat gain	front-panel *xmt fac gain* DIP switch*	0.1dB gain	0.1 to IN	
		0.2dB gain	0.2 to IN	
		0.4dB gain	0.4 to IN	
		0.8dB gain	0.8 to IN	
		1.5dB gain	1.5 to IN	
		3.0dB gain	3.0 to IN	
		6.0dB gain	6.0 to IN	
		12.0dB gain	12.0 to IN	
transmit-channel slope equalization (2804Hz gain re 1004Hz)	S3-1 through S3-4*** (main board)	0.5dB	S3-1 down**	
		1dB	S3-2 down**	
		2dB	S3-3 down**	
		4dB	S3-4 down**	
NBO capacitance	S9-1 through S9-4† (main board)	0.002μF	S9-1 ON	
		0.004μF	S9-2 ON	
		0.008μF	S9-3 ON	
		0.016μF	S9-4 ON	
loopback gain/loss (6123A only)	S14-4 through S14-6†† (baby board)	23dB loss	S14-6 ON	
		0.5dB gain	S14-5 ON	
		1.5dB gain	S14-4 ON	
		3dB gain	S14-3 ON	
		6dB gain	S14-2 ON	
		12dB gain	S14-1 ON	

* All front-panel *fac gain* and *term loss* DIP-switch positions are cumulative. Total flat gain introduced at a channel's facility-side port or total flat loss introduced at a channel's terminal-side port is the sum of that channel's *fac gain* or *term loss* DIP-switch positions set to *in*. For zero gain or zero loss at a particular port, set all positions of the appropriate *fac gain* or *term loss* DIP switch to *out*.

** For DIP switches *S4-1* through *S4-5* and *S3-1* through *S3-4*, "down" is toward the module's main printed circuit board and "up" is away from the main printed circuit board.

*** The first four positions of receive-equalizer DIP switch *S4* (*S4-1* through *S4-4*) and all four positions of transmit-equalizer DIP switch *S3* are cumulative. Total equalized gain introduced at 2804Hz (re 1004Hz) is the sum of those *S4* or *S3* positions set to the "down" position. For no receive equalization, set all positions of *S4* (including *S4-5*) to the "up" position. For no transmit equalization, set all four positions of *S3* to the "up" position.

† The four positions of DIP switch *S9* are cumulative. Total NBO capacitance introduced is the sum of those *S9* positions set to *ON*. For no NBO capacitance, set *S9-1* through *S9-4* to *OFF*.

†† The six positions of loopback-level DIP switch *S14* (6123A only) are cumulative Total gain or loss introduced into the loop-back path is the sum of those *S14* positions set to *ON*. For zero gain or loss in the loopback path, set *S14-1* through *S14-6* to *OFF*.

table 8. 6123 and 6123A alignment-switch summary and checklist

provided via its six 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 and/or NBO capacitors are to be used, a Tellabs 9801 or 9802 Card Extender (or equivalent) will facilitate alignment by allowing access to the equalization and NBO capacitance switches on the module's printed circuit board while the module is in place and operating.

prealignment switch settings for non-prescription alignment

3.18 Before beginning actual non-prescription alignment of the 6123 or 6123A, do the following:

A. Ensure that all option switches (see table 7 for a listing), especially those that select the module's 4wire receive, 4wire transmit, and 2wire port impedances, are properly set.
B. Ensure that the module's receive and transmit equalizers are excluded from the circuit (all five positions of DIP switch *S4* and all four positions of DIP switch *S3* set to the *up* position, i.e., away from the main printed circuit board).
C. Ensure that no NBO capacitance is introduced (all four positions of DIP switch *S9* set to *OFF*).
D. For the 6123A only, ensure that the loopback level is set for zero loss or gain (all positions of DIP switch *S14* set to *OFF*).
E. Set all positions of both front-panel *fac gain* DIP switches (*xmt* and *rcv*) and all positions of both front-panel *term loss* DIP switches (*xmt* and *rcv*) to the *out* position for zero gain or loss in each channel.

Note: *In the alignment procedures that follow, you will be instructed to arrange the transmit and receive portions of the TMS to match certain terminating impedances selected on the 6123/23A module. Most TMS's provide 900, 600, and 135-ohm settings but not the 150 and 1200-ohm settings that are available at the module's 4wire facility-side ports. Therefore, please observe the following guidelines to obtain correct level measurements and settings when aligning the 6123/23A by means of a typical TMS:*

- *If the module is optioned for 150 ohms, use the 135-ohm setting on the TMS. The slight impedance mismatch will not affect level measurements appreciably.*
- *If the module is optioned for 1200 ohms,* **do not use** *the 900-ohm setting on the TMS. Instead, reoption the module for 600 ohms and use the 600-ohm setting on the TMS. Then, when alignment is completed, reoption the module for 1200 ohms as required.*
- *If the TMS* **does not have** *independent transmit and receive impedance settings, option both the TMS and all three ports of the module for 600 ohms during alignment; then reoption the module as required when alignment is completed.*

non-prescription receive-channel alignment

3.19 Alignment of the receive channel consists of the following: adjustment of the front-panel *rcv fac gain* switches to derive the receive channel's internal +7TLP, adjustment of the receive-channel slope equalizer to provide the required type and amount of equalization, and adjustment of the *rcv term loss* switches to provide the specified receive-channel output level. Align the receive channel as follows:

facility gain:

A. Arrange the receive portion of the TMS for 600 or 900-ohm terminated measurement, as appropriate, and connect it to the module's *2w* jack.
B. Request the distant facility-side location to send 1004Hz and 2804Hz tone at the level specified on the circuit layout record (CLR). Measure and record each level.
C. With 1004Hz tone being sent from the distant end, set the proper combination of front-panel *rcv fac gain* DIP switch positions to *in* so that a +7dBm level is achieved. If equalization for loaded cable is desired, proceed to step D. If equalization for nonloaded cable is desired, proceed to step E. If no receive-channel equalization is desired, proceed to step G.

loaded-cable equalization:

D. If the 4wire facility consists of loaded cable, set switch *S4-5* to the *down* position, i.e., toward the module's main printed circuit board, to provide compromise bump equalization. Proceed to step G.

nonloaded-cable equalization:

E. If the 4wire facility consists of nonloaded cable, subtract the 2804Hz level measured in step B from the 1004Hz level also measured in step B.
F. Set to the *down* position (i.e., *toward* the main printed circuit board) the proper combination of DIP-switch *S4* positions that approximates as closely as possible the difference determined in step E (the amount of equalized gain required), as directed in table 9.

terminal loss:

G. Refer to the CLR for the specified 2wire output level.
H. Calculate the difference between this specified output level and the internally derived +7dBm level.
I. Set to *in* the proper combination of front-panel *rcv term loss* DIP-switch positions that adds up to this difference, thus achieving the desired 2wire output level.
J. This completes alignment of the receive channel. Disconnect the TMS from the module.

non-prescription transmit-channel alignment

3.20 Alignment of the transmit channel consists of the following: adjustment of the front-panel *xmt term loss* switches to derive the transmit channel's internal −16TLP, adjustment of the transmit-channel slope equalizer to provide the required

1004Hz-2804Hz difference	amount of equalized gain required
0.0 to 0.2dB	0.0dB
0.3 to 0.7dB	0.5dB
0.8 to 1.2dB	1.0dB
1.3 to 1.7dB	1.5dB
1.8 to 2.2dB	2.0dB
2.3 to 2.7dB	2.5dB
2.8 to 3.2dB	3.0dB
3.3 to 3.7dB	3.5dB
3.8 to 4.2dB	4.0dB
4.3 to 4.7dB	4.5dB
4.8 to 5.2dB	5.0dB
5.3 to 5.7dB	5.5dB
5.8 to 6.2dB	6.0dB
6.3 to 6.7dB	6.5dB
6.8 to 7.2dB	7.0dB
7.3 to 7.7dB	7.5dB

table 9. Equalized gain settings for transmit and receive nonloaded-cable slope equalizers

amount of equalization, and adjustment of the front panel *xmt fac gain* switches to provide the specified transmit output level. Align the transmit channel as follows:

terminal loss:

A. Remove the transmit speech path cut by seizing the circuit from the 2wire side (thus causing loop current to flow). As an alternative, if the TMS being used for alignment is equipped with a holding coil, this can be used to seize the circuit.

Note: *If the TMS provides a dc path, option the BOR's (switch* S11*)* **IN** *during alignment (if they are not already optioned* **IN***) to limit loop current.*

B. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified 2wire input level. If the TMS has a separate transmit impedance setting, select the impedance for which the module's 2wire port is optioned (either 600 or 900 ohms). Connect this signal to the module's *2w* jack.

C. Arrange the receive portion of the TMS for terminated measurement at the impedance for which the module's 4wire transmit port is optioned (see the note preceding paragraph 3.19). Connect the receive portion of the TMS to the module's *4w xmt out* jack.

D. Set the proper combination of front-panel *xmt term loss* DIP-switch positions to *in* so that a −16dBm level is achieved. If equalization for nonloaded cable is desired, proceed to step E. If no transmit-channel equalization is desired, proceed to step L.

nonloaded-cable equalization:

Note: *Transmit-channel equalization (i.e., pre-equalization at the local end of the 4wire facility) is normally left flat (no equalized gain) in favor of receive-channel post-equalization at the distant end of the facility. To determine the need for transmit equalization (for nonloaded cable) when equalization is unavailable at the far end, and to adjust the module's transmit slope equalizer if equalization is required, proceed as directed below.*

E. Insert an opening plug into the module's *4w xmt out* jack.

F. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified 4wire transmit level. If the TMS has a separate transmit impedance setting, select the impedance for which the module's 4wire transmit port is optioned (see the note preceding paragraph 3.19). Connect this signal to the module's *4w xmt mon* jack.

G. Send test tone at 1004Hz toward the distant end and have personnel at that end measure and record the received level.

H. Change the test tone frequency to 2804Hz and have distant-end personnel measure and record the received level.

I. Have distant-end personnel subtract the 2804Hz level from the 1004Hz level and report the result.

J. Set to the *down* position (i.e., *toward* the main printed circuit board) the proper combination of DIP-switch *S3* positions that approximates as closely as possible the difference determined in step I (the amount of equalized gain required), as directed in table 9.

K. Remove the opening plug from the module's *4w xmt out* jack and disconnect the transmit portion of the TMS from the module.

facility gain:

L. Refer to the CLR for the specified 4wire transmit level.

M. Calculate the difference between this specified output level and the internally derived −16dBm level.

N. Set to *in* the proper combination of front-panel *xmt fac gain* DIP-switch positions that adds up to this difference, thus achieving the desired 4wire transmit level.

O. If any of the module's required impedance settings were changed during alignment, reset them correctly at this time.

P. If the BOR's (switch *S11*) were optioned *IN* during alignment but are otherwise not required, reset *S11* to *OUT*. This complete alignment of the transmit channel. Disconnect the TMS from the module.

non-prescription PBN alignment and introduction of NBO capacitance

3.21 **Determining Transhybrid Loss.** If it is not known whether the module's internal CBN will provide adequate hybrid balance (transhybrid loss) in a particular application, make this determination as follows:

A. Ensure that the CBN is inserted and properly optioned (DIP switch *S6*) as directed in table 7 or paragraph 3.08.

B. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified 4wire receive level. If the transmit portion of the TMS has a separate impedance setting, select the impedance for which the module's 4wire receive port is optioned (see the note preceding paragraph 3.19). Connect this signal to the module's *4w rcv in* jack.

C. Arrange the receive portion of the TMS for terminated measurement at the impedance selected for the 4wire transmit port (see the note preceding paragraph 3.19). Connect the receive portion of the TMS to the module's *4w xmt out* jack.

D. If the measured output level is too high (i.e., if transhybrid loss is insufficient) to meet the circuit requirements of the application, a PBN may be required or, occasionally, introduction of NBO capacitance in conjunction with the CBN may be necessary to compensate for terminal cable capacitance or for drop build-out (DBO) capacitors on the 2wire loop. These situations are covered in paragraphs 3.22 through 3.25.

3.22 **Using a PBN.** If the module's internal CBN does not provide sufficient hybrid balance (transhybrid loss), which will probably be the case if the 2wire port interfaces a long section of nonloaded cable and may be the case otherwise, a PBN can be used to improve hybrid balance. When an external PBN (for the 6123 or 6123A) or a plug-on PBN (for the 6123A only) is used, exclude the module's internal CBN from the circuit by setting switches *S6-1, S6-2,* and *S6-3* to *OFF*. Then adjust the PBN as directed in the PBN practice.

3.23 To further improve hybrid balance, especially when a **PBN for loaded cable** is used, proceed as follows:

A. Doublecheck that the module's internal CBN is excluded from the circuit (all three positions of DIP switch *S6* set to *OFF*).

B. Refer to table 8 and set to *ON* that combination of DIP-switch *S9* positions which introduces the appropriate amount of NBO capacitance. This amount should be determined from information in the PBN practice or on the CLR. **If this amount is not known, proceed to paragraph 3.24 or 3.25, as applicable.** Otherwise, disconnect the TMS from the module. At this point, **if NBO capacitance is already introduced,** alignment of the 6123 is complete. For the 6123A, however, one procedure remains; proceed to paragraph 3.26.

3.24 **Introducing NBO capacitance by TMS Measurement When Required Amount is Unknown (CBN and PBN Applications).** To introduce NBO capacitance to compensate for terminal cable capacitance or for DBO capacitors on the 2wire loop when the module's internal CBN is used, or to achieve optimum hybrid balance with a PBN (especially with one for loaded cable) when the required amount of NBO capacitance is unspecified, proceed as follows:

A. Ensure that the CBN is included in the circuit and properly optioned if it is being used or that it is excluded from the circuit if a PBN is being used (DIP switch *S6*).

B. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified 4wire receive level. If the transmit portion of the TMS has a separate impedance setting, select the impedance for which the module's 4wire receive port is optioned (see the note preceding paragraph 3.19). Connect this signal to the module's *4w rcv in* jack.

C. Arrange the receive portion of the TMS for terminated measurement at the impedance selected for the 4wire transmit port (see the note preceding paragraph 3.19). Connect the receive portion of the TMS to the module's *4w xmt out* jack.

D. Using the four positions of DIP switch *S9*, add NBO capacitance until the TMS level reading is at its lowest point (i.e., add NBO capacitance until the TMS reading reaches a minimum and then starts to rise; then return to the *S9* setting that produced the minimum reading). Disconnect the TMS from the module. At this point, alignment of the 6123 is complete. For the 6123A, however, one procedure remains; proceed to paragraph 3.26.

3.25 **Introducing NBO capacitance by Formula When Required Amount Is Unknown (Some CBN Applications).** If the module's internal CBN is being used and an easier method of introducing NBO capacitance (generally, to compensate for terminal cable capacitance) is desired than the procedure in paragraph 3.24, proceed as follows:

Note: *The amount of NBO capacitance introduced by this method should provide adequate results in most applications. If it does not, the procedure in paragraph 3.24 must be performed.*

A. From table 10, calculate the required amount of NBO capacitance for the type and length of cable interfacing the module's 2wire port. (For example, if 1.2 kilofeet of high-capacitance cable interfaces the module's 2wire port, multiply 1.2 kilofeet by 0.016μF per kilofoot to obtain 0.0192μF.)

B. Set to *ON* that combination of DIP-switch *S9* positions which most closely approximates the calculated amount of NBO capacitance. (For the example in step A, you would set *S9-4* and *S9-2* to *ON* to introduce 0.020μF, the closest possible amount to 0.0192μF.) At this point, alignment of the 6123 is complete. For the 6123A, however, one procedure remains; proceed to paragraph 3.26.

non-prescription loopback-level adjustment (6123A only)

3.26 To adjust the 6123A's loopback-level-control circuitry to provide true equal-level transmission loopback, proceed as follows:

type of cable interfacing 2wire port:	amount of NBO capacitance to be introduced for each kilofoot of cable between module and local terminal equipment:
high capacitance (0.083μF per mile)	0.016μF per kilofoot
low capacitance (0.066μF per mile)	0.012μF per kilofoot

table 10. Guidelines for introducing NBO capacitance (in conjunction with CBN) by formula to compensate for terminal cable capacitance

A. From the CLR, determine the specified 2wire input and output levels.
B. Subtract the 2wire input level from the 2wire output level. The result will be the amount of loss required in the loopback path, as indicated in the following equation (also see example below):

2wire output level	—	**2wire input level**	=	**amount of loss to be inserted in loopback path**

C. Set to *ON* that combination of DIP-switch *S14* positions which most closely approximates the amount of loss determined in step B. At this point, alignment of the 6123A is complete. Remove all test cords.

Example: In a hypothetical application, the CLR-specified 2wire input level is −2dBm and the CLR-specified 2wire output level is +2dBm. Thus we subtract −2dBm from +2dBm as follows:

$$+2\text{dBm} - (-2\text{dBm}) = +4\text{dB}$$

Thus, 4dB is the amount of **loss** to be introduced into the loopback path via DIP switch *S14.* (If the result of the subtraction were **negative**, this would be the amount of **gain** required in the loopback path.) To introduce the required amount of loss, we first set switch *S14-6* to *ON* to introduce 23dB of loss; we then set the remainder of the *S14* positions to provide the closest possible approximation to 19dB of gain without exceeding it (23dB of loss plus 19dB of gain equals 4dB of loss, the required amount). In this example, the closest we can get to 19dB of gain without exceeding it is 18.5dB (*S14-1, S14-2,* and *S14-5* set to *ON*; *S14-3* and *S14-4* set to *OFF*). Thus, we end up introducing 4.5dB of loss (23dB of loss plus 18.5dB of gain) into the loopback path, which puts us within 0.5dB of true equal-level transmission loopback, a tolerance that should suffice in nearly all applications.

4. circuit description

4.01 To provide the clearest possible understanding of the operation of the 6123 and 6123A 2Wire FXS SF Signaling Set modules, function sequence flowcharts (figures 8 and 9) that illustrate operation of the modules 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 whether a module is performing normally by observing the module's response and comparing it to that shown in the flowchart. Reference to the 6123 and 6123A functional block diagram, section 5 of this practice, may aid in understanding the flowcharts.

4.02 The flowcharts are intended to familiarize you with the operation of the 6123 and 6123A for engineering, application, and troubleshooting purposes only. Attempts to test or troubleshoot these modules internally are not recommended and may void your 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: *Except where noted, specifications apply to both the 6123 and the 6123A.*

transmission specifications

alignment level range, 4wire rcv port
+7 to −17TLP

alignment level range, 4wire xmt port
+8 to −16TLP

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

overload points
4wire rcv port: +5dBm0
4wire xmt port: +5dBm0
2wire-port input: +5dBm0
2wire-port output: +8dBm

facility-side gain (xmt and rcv)
0 to 24dB in switch-selectable 0.1dB increments

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

insertion loss
0±0.2dB at 1004Hz with gain and loss switches set to zero

receive-channel equalization
slope type: 0.0 to 7.5dB of gain (in switch-selectable 0.5dB increments) at 2804Hz re 1004Hz
compromise bump-type: 3.0dB bump at 3200Hz re 1004Hz and 1.5dB loss at 404Hz re 1004Hz

transmit-channel equalization (slope only)
0.0 to 7.5dB of gain (in switch-selectable 0.5dB increments) at 2804Hz re 1004Hz

2wire port impedance
900 or 600 ohms, balanced, switchable, in series with 2.15μF

4wire port impedances
1200, 600, or 150 ohms, balanced, 300 to 4000Hz, independently switchable at each port

specifications continued on page 22

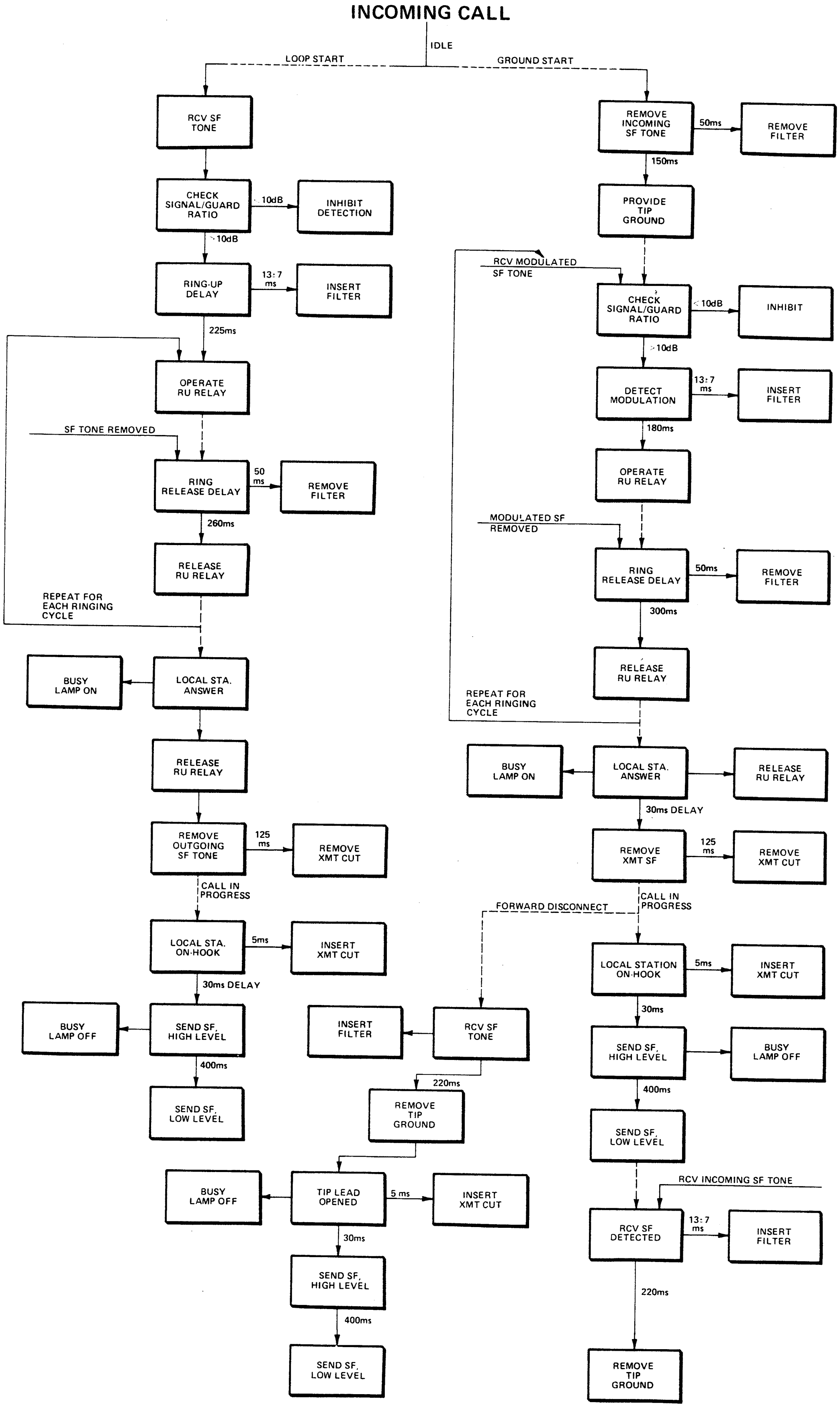


figure 8. Function sequence flowchart, incoming call

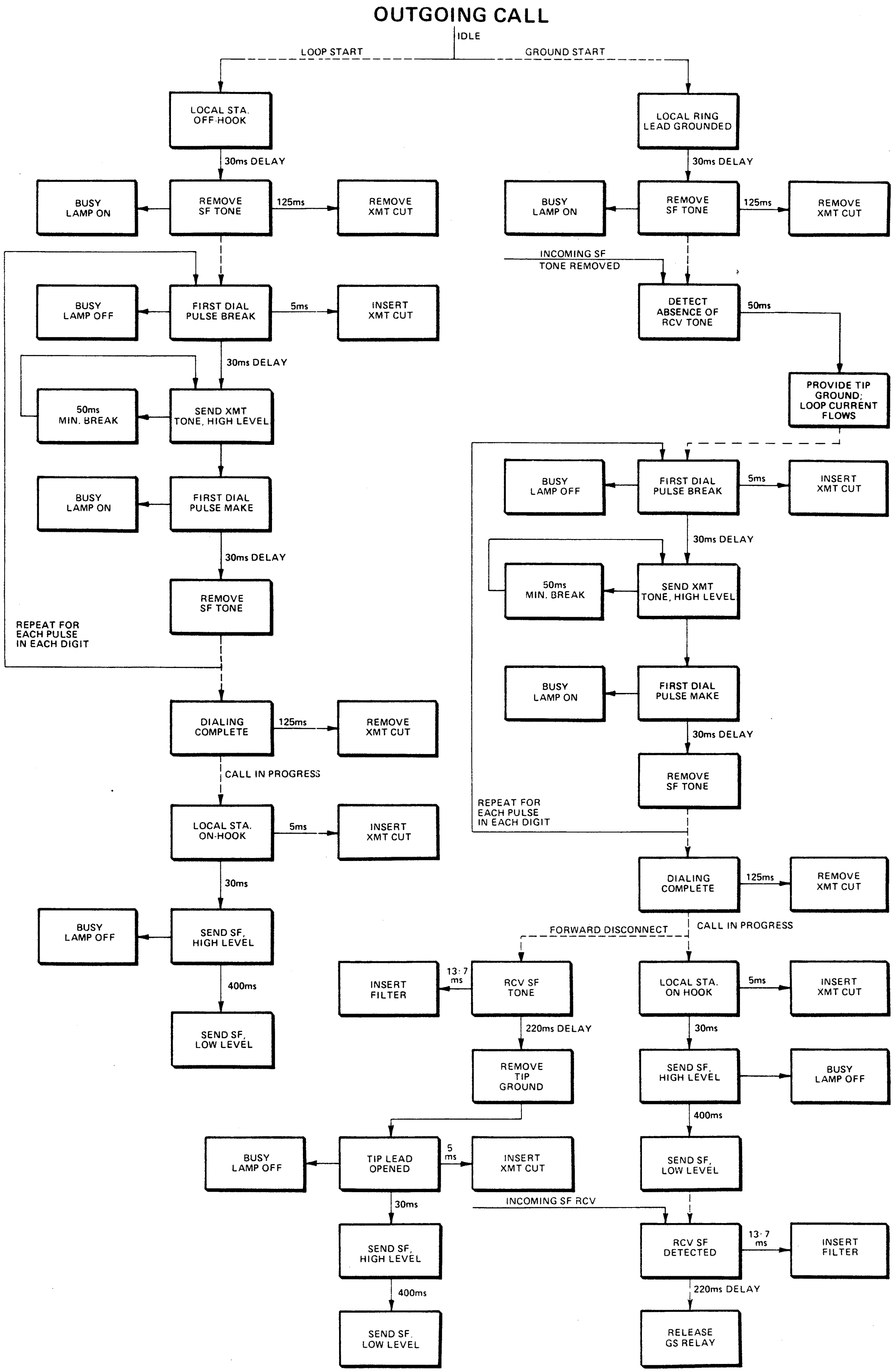
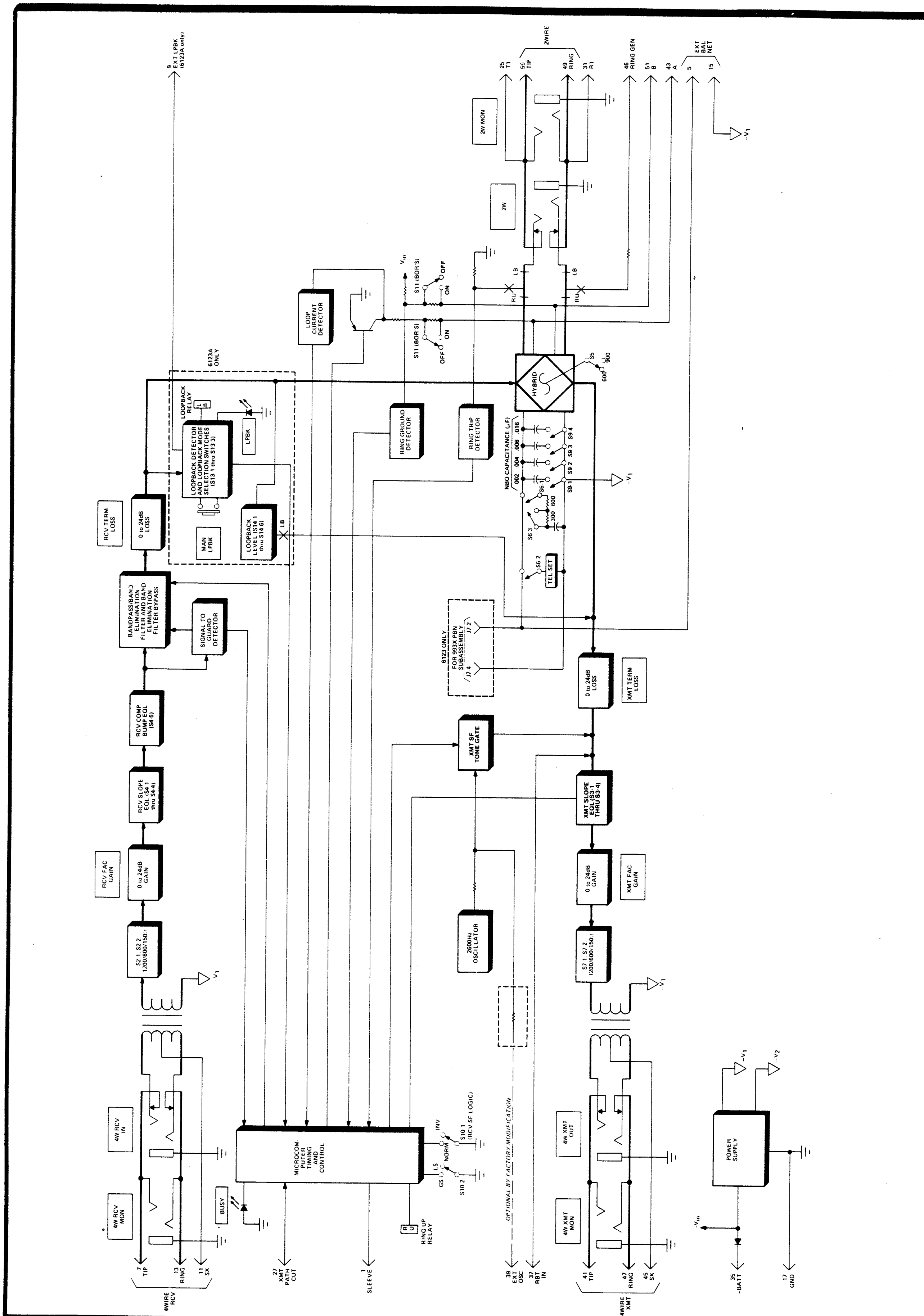


figure 9. Function sequence flowchart, outgoing call



6123 and 6123A 2Wire FXS SF Signaling Sets with Gain

816123/816123A

5. block diagram

terminal (2wire) return loss
ERL greater than 25dB

facility (4wire) return loss
ERL greater than 23dB for all three 4wire-port impedance settings

frequency response
±1dB re 1004Hz level, 300 to 4000Hz

transhybrid loss
greater than 35dB ERL, intrinsic

compromise balance network
switch-selectable for 600 ohms plus 2.15μF, 900 ohms plus 2.15μF, or short loop and Type 500 (or equivalent) telephone set

network build-out (NBO) capacitance
0 to 0.030μF in switch-selectable 0.002μF increments

noise
20dBrnC0 maximum at maximum gain (no equalization)

longitudinal balance (all ports)
greater than 60dB, 200 to 4000Hz

delay distortion
less than 300μs, 500 to 4000Hz, without equalization

total harmonic distortion
4wire ports: less than 1% at +5dBm0
2wire port: less than 1% at +8dBm

crosstalk loss between adjacent modules in shelf
greater than 85dB, 200 to 4000Hz

simplex current
100mA maximum with 2mA maximum unbalance

SF transmit section

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

SF tone levels
low (idle) level: −20dBm0 ± 1dB
high level: −8dBm0 ± 2dB

SF tone states, loop start
idle: tone transmitted
busy: no tone transmitted
ringing: tone transmitted during the break portions of dial pulses

high-level timing
high-level tone is transmitted for 400±100ms following each off-hook-to-on-hook transition

pulsing characteristics
input breaks shorter than 25ms do not cause transmission of SF tone
input breaks between 34 and 50ms are transmitted as 50±2ms tone bursts
input breaks longer than 50ms are transmitted as tone bursts with a duration equal to that of the input break ± 3ms

transmit path cut insertion
transmit speech path is cut (opened) 20±7ms before transmission of SF tone

transmit path cut removal
transmit speech path cut is removed 125±50ms after detection of an off-hook condition

SF receive section

SF tone frequency
2600±15Hz

SF tone detection threshold (at 2600Hz)
−33.5dBm0±2.5dB

SF tone rejection
50dB minimum, 2590 to 2610Hz

signaling bandwidth (high-guard state)
75Hz nominal

signal-to-guard ratio for signal detection
10dB nominal

maximum line noise
51dBrnC0

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

band-elimination-filter timing
insertion time: 13±7ms
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±10ms

seizure delay
loop-start mode: 225±50ms
ground-start mode: 150±50ms

incoming ringing frequency range (ground-start mode)
17 to 33Hz modulated onto incoming SF tone

2wire loop conditions

maximum loop resistance (with BOR's optioned out)
3000 ohms with −48Vdc input battery
1300 ohms with −24Vdc input battery

maximum loop resistance for 23mA loop current
1687 ohms with −48Vdc input battery
643 ohms with −24Vdc input battery

loop current, 0-ohm loop
120mA at −48Vdc input battery with BOR's optioned out
80mA at −48Vdc input battery with BOR's optioned in

external ringing supply requirements

frequency
17 to 67Hz

bias
must be referenced to negative battery supply

level
130Vac maximum

external oscillator requirements (optional by factory modification)

frequency
2600±2Hz

level
0.5Vrms

load impedance
75 kilohms minimum, unbalanced

traffic-monitoring (sleeve) lead

traffic-monitoring (sleeve) lead states
idle condition: open circuit (diode clamped to negative input potential)
busy condition: ground (100mA maximum source capacity)

loopback specifications (6123A only)

loopback control modes

loopback control mode	activation			deactivation			
	2713Hz tone	front-panel pushbutton	gnd on EXT LPBK lead	2713Hz tone	front-panel pushbutton	automatic timeout	removal of gnd on EXT LPBK lead
manual		X			X		
manual w/timeout		X			X	2.6-minute timeout	
manual w/timeout		X			X	20.8-minute timeout	
two-tone and manual w/no timeout	X	X		X	X		
two-tone and manual w/timeout	X	X		X	X	2.6-minute timeout	
two-tone and manual w/timeout	X	X		X	X	20.8-minute timeout	
ground			X				X

tone-loopback frequency
2713±35Hz

tone-loopback detection threshold (at 2713Hz)
−26.0dBm0

tone-loopback guard ratio
greater than 3.0dB

tone-loopback activation timing
loopback is activated upon ***removal*** **of 1.4±0.2-second or longer tone**

tone-loopback deactivation timing
loopback is deactivated after receipt of 0.7±0.15-second or longer tone (removal of tone not necessary for deactivation)

loopback level adjustment
0 to 23dB of loss or gain in switch-selectable increments (23dB loss; 0.5, 1.5, 3, 6, and 12dB gain)

power requirements

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

input current
6123: 65mA at idle, 90mA when busy (not including loop current)
6123A: 75mA at idle, 100mA maximum when busy not including loop current), with an additional 20mA required when loopback is activated

physical

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

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

weight
6123: 18 ounces (510 grams)
6123A: 20 ounces (567 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 262U, 262, or 260A Mounting Assembly

7. testing and troubleshooting

7.01 Due to the complexity of the 6123A 2Wire FXS SF Signaling Set modules, a detailed testing guide checklist is not included in this practice. Such a checklist would be so long and complicated as to be of dubious value for troubleshooting in the field. Proper operation of the module can be verified, however, by observing its actual operation while referring to the function sequence flowcharts (figures 8 and 9) that summarize the module's correct operation on incoming and outgoing calls. In addition, a *troubleshooting guide* in this section lists a variety of trouble conditions along with possible causes for each. If the module is not performing properly, look up the problem in the *troubleshooting guide* and check all the possible causes listed opposite the problem. If this does not correct the problem, substitute a new module (if possible) and observe its operation. If the substitute module operates correctly, the original module 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 6123 or 6123A module. Unauthorized testing or repairs may void the module's warranty. Also, if the module is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

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 *troubleshooting guide*, contact Tellabs Customer Service as follows (telephone numbers are given below):

USA customers: Contact Tellabs Customer Service at your Tellabs Regional Office.
Canadian customers: Contact Tellabs Customer Service at our Canadian headquarters in Mississauga, Ontario.
International customers: Contact your Tellabs distributor.

US Atlantic region: (203) 798-0506
US capital region: (703) 478-0468
US central region: (312) 357-7400
US southeast region: (305) 645-5888
US southwest region: (214) 869-4114
US western region: (702) 827-3400
Canada: (416) 624-0052

7.03 If a module is diagnosed as defective, follow the *replacement* procedure in paragraph 7.04 when a critical service outage exists (e.g., when a system or a critical circuit is down and no spares are available). If the situation is not critical, follow the *repair and return* procedure in paragraph 7.05.

replacement

7.04 To obtain a replacement module, notify Tellabs via letter or telephone (see addresses and numbers below) or via TWX (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X6123(A) 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 module 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 module, shipment prepaid, to Tellabs (attn: repair and return).

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

in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7
telephone (416) 624-0052

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.