tellabs
technical manual
76-816171
rev A

practice section 816171

6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater

contents

1. general description

1.01 The 6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater module (figure 1) provides both active transmission interface and bidirectional signaling conversion between a 4wire facility that uses 2600Hz single-frequency (SF) signaling and a 4wire 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. The 6171 is designed in accordance with the specifications given in AT&T Technical Reference Pub 43001: Functional Criteria for Voice-Frequency Terminating Equipment/Metallic Facilities/Central Office.

1.02 In the event that this practice section is revised or reissued, the reason for revision or reissue will be stated in this paragraph.

1.03 The 6171 module offers the following features and options:

- 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.
- From 0 to 24dB of prescription-set loss, in switch-selectable 0.1dB increments, in both the transmit and receive channels at the terminal-side ports.
- Active prescription slope-type or bump-type amplitude equalization, equivalent to that provided by the Western Electric (WECo) 309B Prescription Equalizer, in both the transmit and receive channels.
- Independently switch-selectable post-equalization, pre-equalization, or equalizer bypass (exclusion) for both the transmit and receive equalizers.
- Isolation transformers that are center-tapped to derive balanced simplex (SX) leads at all four ports.
- Terminal-side SX-lead reversal switch.
- Independently switch-selectable 1200, 600, or 150-ohm terminating impedance at all four ports.
- Integral 2600Hz SF tone oscillator.
- Switch-selectable loop-start or ground-start operation.

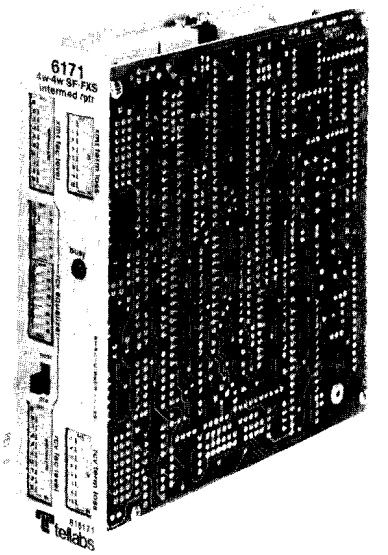


figure 1. 6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater module

- Switch-selectable automatic ringdown operation as an alternative to FXS operation.
- Minimum-break transmit pulse correction.
- Traffic-monitoring (sleeve) lead.
- Loop-current limiting.
- 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 −54Vdc input power with current requirements of 80mA typical at idle (at −48Vdc) and 136mA maximum (at −54Vdc), not including loop current.
- 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.

2. application

2.01 The 6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater module is designed primarily to interface a 4wire transmission facility that uses SF signaling with a 4wire metallic link that uses FXS signaling. This link can be either a station loop or a PBX trunk (loop-start or ground-start) that terminates at the station end of an FX or OPS circuit.

The 6171 module combines the functions of a 4wire line amplifier, an SF transceiver, an SF-to-FXS signaling converter, and a 4wire pad/transformer. No external transmission interface circuitry is required because the 6171 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, and amplitude equalization) between the SF facility and the FXS link. Figures 2 and 3 show typical applications.

terminal interface

2.02 The 6171 interfaces the terminal-side station loop or PBX trunk via prescription attenuators in the transmit and receive paths (see paragraph 2.04) and via transformers at the transmit input and receive output ports. Each terminal-side transformer provides 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-type amplitude equalization for nonloaded cable through the deliberate impedance mismatch. Both terminal-side transformers are center-tapped to derive balanced simplex (SX) leads; an option switch on the module selects either a normal or reversed arrangement for the terminal-side SX leads. In the normal arrangement, the transmit input simplex (XMT IN SX) lead is associated with the transmit input pair, and the receive output simplex (RCV OUT SX) lead is associated with the receive output pair. In the reversed arrangement, the XMT IN SX lead is associated with the receive output pair, and the RCV OUT SX lead is associated with the transmit input pair. The SX-lead reversal option is provided for use in applications involving polarity-sensitive dc signaling.

facility interface

2.03 The 6171 interfaces the facility-side SF signaling facility via prescription amplifiers in the transmit and receive paths (see paragraph 2.04) and via transformers at the transmit output and receive input ports. Like the terminal-side transformers, each facility-side transformer provides balanced, switch-selectable 1200, 600, or 150-ohm terminating impedance. Also, 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.

level control

2.04 Prescription-set transmit and receive amplifiers on the facility side of the 6171 allow the module to interface the SF signaling facility directly, i.e., without a separate facility-side line amplifier.

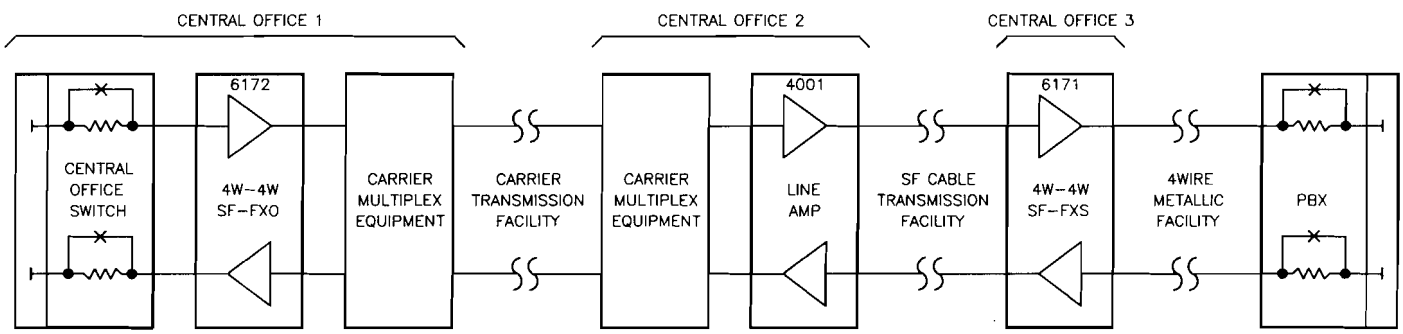


figure 2. Typical foreign-exchange (FX) application of 6171 module

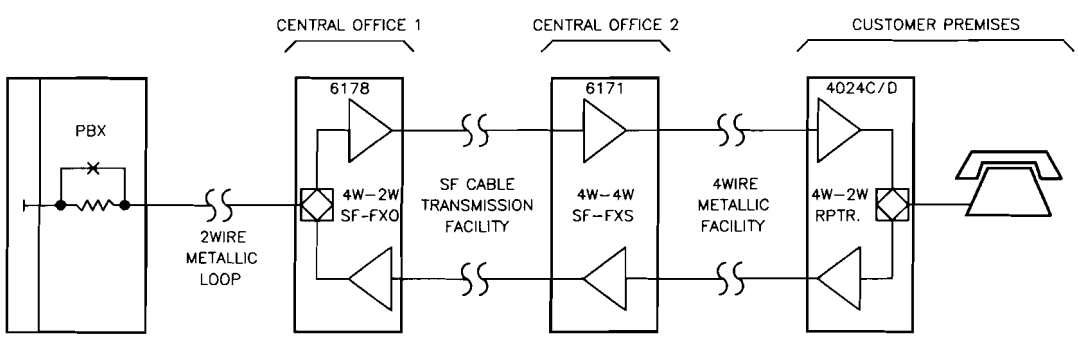


figure 3. Typical off-premises-station (OPS) application of 6171 module

These amplifiers, in conjunction with the prescription-set transmit and receive attenuators on the module's terminal side, provide for full coordination between facility-side and terminal-side 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 terminal-side receive 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 transmit output level. Both facility-side amplifiers in the 6171 provide from 0 to 24dB of gain or 0 to 24dB of loss in switch-selectable 0.1dB increments. Both terminal-side attenuators provide from 0 to 24dB of loss in switch-selectable 0.1dB increments. Thus, receive input TLP's from −17 to +7 can be accommodated and receive output TLP's from +7 to −17 can be derived. In a similar manner, transmit input TLP's from −16 to +8 can be accommodated and transmit output TLP's from +8 to −16 can be derived. Total facility-side gain or loss 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 receive input and receive output ports is 0dBm0. The overload point for the transmit input and transmit output ports is +3dBm0.

receive-channel amplitude equalization

2.05 Active prescription amplitude equalization functionally equivalent to that provided by the Western Electric 309B Prescription Equalizer is available in the receive channel of the 6171. This equalizer provides low-end slope equalization down to 404Hz and high-end bump equalization centered at 3250Hz for loaded or nonloaded cable, as selected via switch option. Degree of slope, height of bump, and affected bandwidth are also controlled by option switches on the module. An additional switch option conditions the equalizer to provide either post-equalization of the receive input pair or pre-equalization of the receive output pair, as required. For post-equalization, the equalizer is inserted before the receive-channel band-elimination filter (see paragraph 2.15). For pre-equalization, the equalizer is inserted after the band-elimination filter. If no equalization is required, the equalizer can be electrically bypassed by means of another switch option.

2.06 Figures 5 and 6 show typical response curves for the 309B-equivalent equalizer in the slope mode. Figure 5 shows the curves for non-loaded cable, while figure 6 shows the curves for loaded cable. For comparison purposes, all frequency-response curves in both figures are drawn with the same 0dB-gain reference point (1004Hz). Actually, all of these curves except those for a *SLOPE* switch setting of *0* are raised above the 0dB level at 1004Hz by as much as 11.4dB. The exact amount by which a particular curve is raised depends upon the *SLOPE* and *NL* (nonloaded/loaded) switch settings selected. These amounts are listed in table 1.

2.07 Figures 7 and 8 show typical response curves for the 309B-equivalent equalizer in the bump mode. Figure 7 shows the curves representing various height settings versus a wide bandwidth setting, while figure 8 shows the curves representing various height settings versus a narrow bandwidth setting. For comparison purposes, all frequency-response curves in both figures are

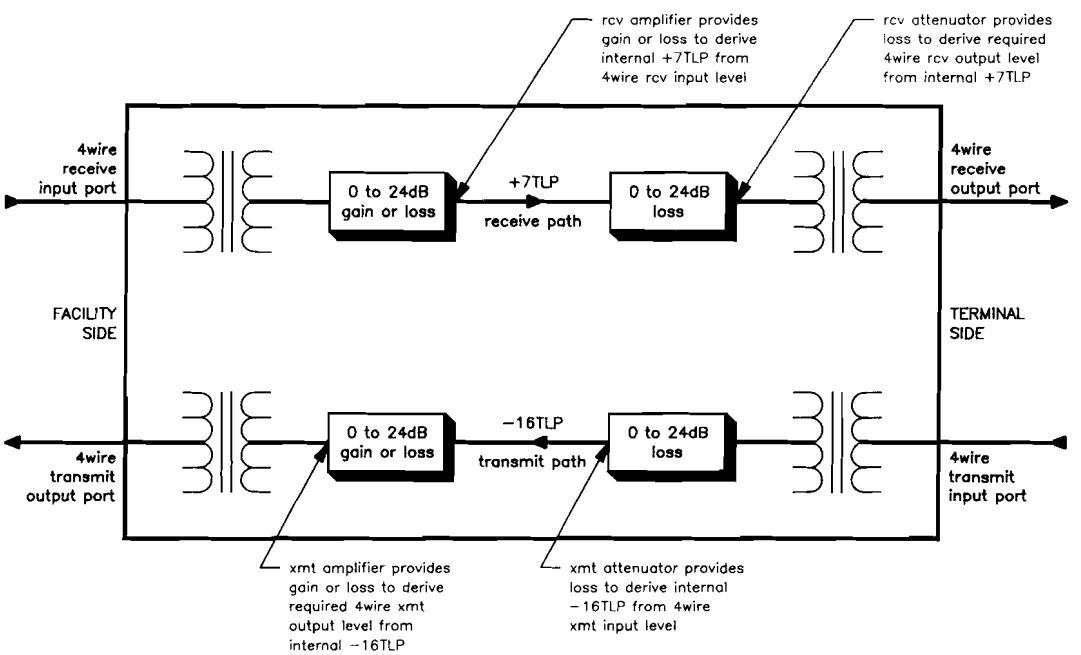


figure 4. Level coordination in 6171 module

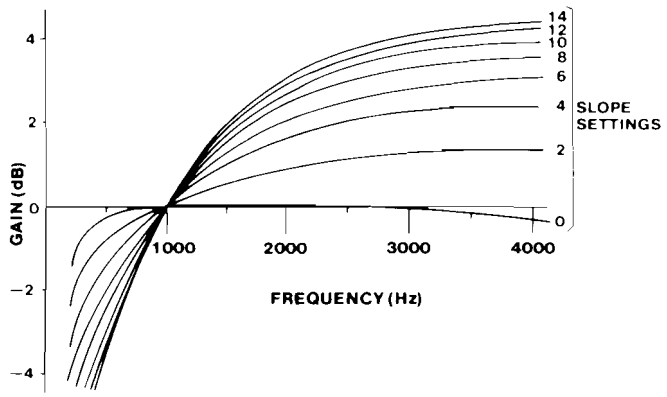


figure 5. Typical response curves for receive and transmit equalizers in slope mode, nonloaded cable

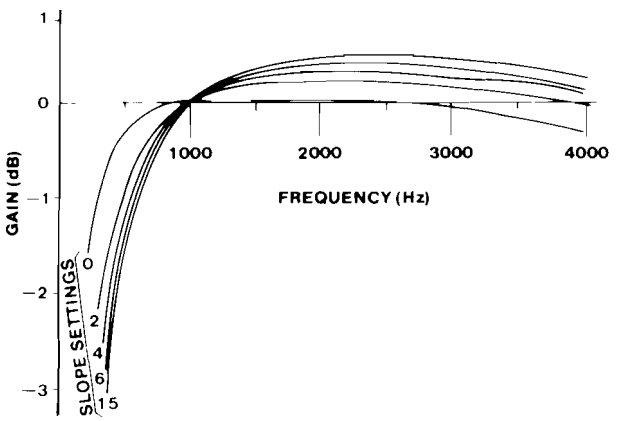


figure 6. Typical response curves for receive and transmit equalizers in slope mode, loaded cable

SLOPE switch setting	L/NL (loaded/nonloaded) switch setting	
	L	NL
0 (slope disabled)	0.0dB	0.0dB
1	1.4	0.4
2	2.6	0.9
3	3.7	1.4
4	4.7	1.8
5	5.5	2.3
6	6.3	2.8
7	7.2	3.4
8	7.8	3.7
9	8.4	4.2
10	9.0	4.6
11	9.5	5.0
12	10.0	5.4
13	10.5	5.8
14	11.0	6.2
15	11.4	6.6

table 1. Equalized gain (in dB) at 1004Hz in slope mode

drawn with the same 0dB-gain reference point (1004Hz). Actually, all of these curves except those for a height (*HT*) switch setting of 1 or 0 and/or for a bandwidth (*BW*) switch setting of 5 or less are raised above the 0dB level by as much as 3.9dB. The exact amount by which a particular curve is raised depends upon the *HT* and *BW* switch settings selected. These amounts are listed in table 2.

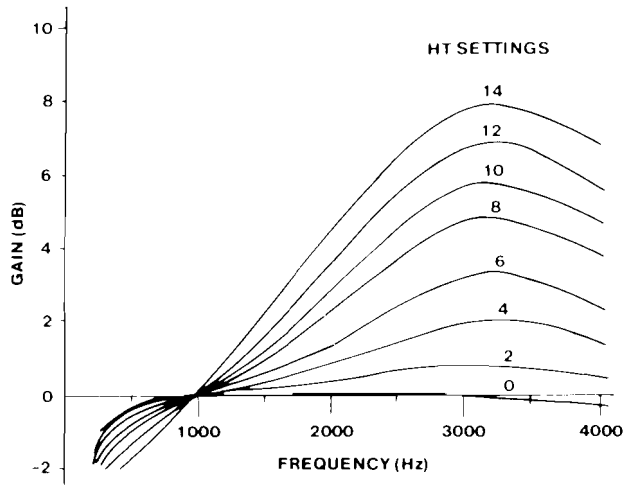


figure 7. Typical response curves for receive and transmit equalizers in bump mode, BW switch = 14

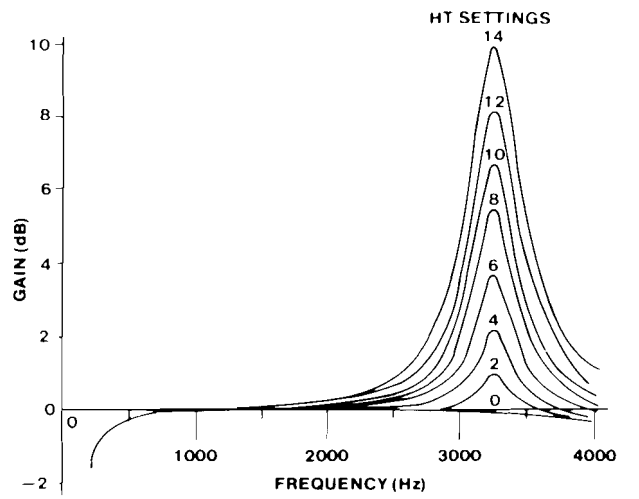


figure 8. Typical response curves for receive and transmit equalizers in bump mode, BW switch = 3

transmit-channel amplitude equalization

2.08 Active 309B-equivalent prescription amplitude equalization identical to that provided in the receive channel is available in the 6171's transmit channel as well. A switch option conditions the transmit equalizer to provide either post-equalization of the transmit input pair or pre-equalization of the transmit output pair. For post-equalization, the equalizer is inserted into the transmit path before the transmit path cut (see paragraph 2.18). For pre-equalization, the equalizer is inserted into the transmit path after the point at which SF tone is inserted (see the 6171 block diagram, section 5 of this practice). If no equalization is required, the equalizer can be electrically bypassed by means of another switch option.

supervisory states, loop start

2.09 The 6171 module accommodates a conventional loop-start supervisory format. In loop-start operation, detection of incoming SF tone activated 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 simplex leads.

HT switch setting*	BW switch setting**									
	6	7	8	9	10	11	12	13	14	15
2	0.0dB	0.0dB	0.0dB	0.0dB	0.0dB	0.0dB	0.0dB	0.1dB	0.1dB	0.2dB
3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3
4	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4
5	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.5
6	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.7
7	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.5	0.9
8	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.7	1.2
9	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.8	1.5
10	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.6	1.0	1.7
11	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.7	1.2	2.0
12	0.1	0.1	0.2	0.3	0.3	0.4	0.6	0.9	1.4	2.4
13	0.1	0.2	0.3	0.3	0.4	0.6	0.8	1.1	1.7	2.8
14	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.3	2.0	3.3
15	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.7	2.5	3.9

* An *HT* switch setting of *0* disables the bump function. An *HT* switch setting of *1* introduces 0.1dB of gain or less at 1004Hz.
** A *BW* switch setting of *0* through *5* introduces 0.1dB of gain or less for all *HT* switch settings.

table 2. Equalized gain (in dB) at 1004Hz in bump mode

supervisory states, ground start

2.10 In ground-start operation, just as in loop-start, the 6171 module accommodates a conventional supervisory format. Whenever incoming SF tone is detected, the transmit input pair is opened to ground, except during ringing. Presence of SF tone at the receive input port indicates that the associated office-end circuit is idle (transmit input pair 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 receive output pair, which causes transmission of SF tone to cease.

loop-current limiting and supervisory limits

2.11 An internal loop-current limiter on the 6171 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 receive output pair to initiate seizure toward the distant end. The ring-ground sensor in the 6171 can sense application of this ground through external resistance of up to 3000 ohms from the receive output pair to ground.

ring trip and ring-trip range

2.12 The 6171 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 −54Vdc. The 6171 can reliably detect ring trip at up to 2000 ohms of external loop resistance with −48Vdc biased ringing.

signaling-tone states

2.13 Signaling-tone states for the 6171 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

2.14 The 6171 is designed to interface the receive path on the facility 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 6171's SF tone detector 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 receive input 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.

2.15 The 6171'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 13ms 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 filter remains inserted during dial pulsing and during momentary losses of tone continuity.

outgoing SF tone transmission

2.16 The 6171 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

2.17 The 6171 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 18ms 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 upon pulsing breaks longer than 50ms.

transmit path cut

2.18 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 6171 is cut (opened) during dialing and whenever SF tone is transmitted or received.

automatic ringdown operation

2.19 As an alternative to FXS operation, the 6171 can be switch-optioned to operate in a loop-start or ground-start automatic-ringdown circuit. In such applications, two 6171'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 6171 until the station is answered. The ringing rate in the auto-ringdown mode is fixed at 2 seconds on and 4 seconds off. The 6171 can also be used in the auto-ringdown mode to interface a conventional E&M SF facility, i.e., one with tone on in both directions during idle.

SF tone source

2.20 The module is equipped with an integral 2600Hz SF tone oscillator and therefore does not require an associated master SF tone supply.

power

2.21 The 6171 is designed to operate on filtered, ground-referenced input potentials between −42 and −54Vdc. 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 136mA, not including loop current.

ringing

2.22 The ringing circuits in the 6171 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 −54Vdc 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

2.23 The 6171 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.

3. installation

inspection

3.01 The 6171 4Wire-to-4Wire SF-to-FXS Intermediate 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 6171 mounts in one position of a Tellabs Type 10 Mounting Shelf. The module plugs physically and electrically into a 56-pin connector at the rear of its shelf position.

installer connections

3.03 When a 6171 module is to be installed in a non-prewired 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.

3.04 Table 5 lists external connections to the 6171. All connections to non-prewired mountings are made via wire-wrapping to the 56-pin connector at the rear of the module's shelf position. Pin numbers are found on the body of the connector.

connect:	to pin:
RCV IN TIP	7
RCV IN RING	13
XMT OUT TIP	41
XMT OUT RING	47
RCV OUT TIP	5
RCV OUT RING	15
XMT IN TIP	55
XMT IN RING	49
RCV IN SX (simplex, facility side)	9
XMT OUT SX (simplex, facility side)	43
RCV OUT SX (simplex, terminal side)	3
XMT IN SX (simplex, terminal side)	51
SLEEVE (traffic-monitoring or sleeve lead)	1
MACHINE START (ringing machine start lead)	30
RING GEN (ringing generator)	46
−BATT (−42 to −54Vdc filtered input)	35
GND (ground)	17

table 5. External connections to 6171

option selection

3.05 Several option switches must be set before the 6171 is placed into service. Locations of these switches and of certain alignment switches on the module's printed circuit board are shown in figure 9. Table 6 summarizes all switch options and provides a convenient **checklist** 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 9 and table 6, and set each option switch on the 6171 as required.

Note: *Switch numbers on main printed circuit board may not be visible.*

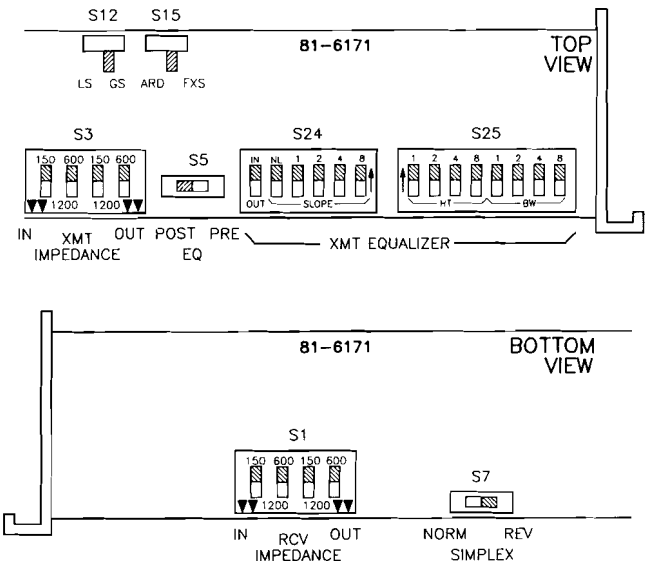
alignment overview

3.06 Alignment of the 6171 module 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.

prescription alignment

3.07 The 6171 module is primarily intended for **prescription alignment.** This involves setting all level-control and equalization DIP switches in accordance with specifications on the circuit layout



Note: *Switch numbers on main printed circuit board may not be visible.*

figure 9. 6171 option switch locations

record (CLR) before plugging the module into its shelf position. Table 7 in this practice summarizes all alignment switches on the 6171 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 6171 by setting each switch as indicated in the table (or on the CLR, if preferred).

4. circuit description

4.01 To provide the clearest possible understanding of the operation of the 6171 4Wire-to-4Wire SF-to-FXS Intermediate 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 verify normal operation by observing the module's response and comparing it to that shown in the flowcharts. Reference to the 6171 **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 6171 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.

option	switch	selection	setting	checklist
terminating impedance, receive input port (facility side)	*RCV IMPEDANCE (S1) IN* 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, receive output port (terminal side)	*RCV IMPEDANCE (S1) OUT* 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, transmit input port (terminal side)	*XMT IMPEDANCE (S3) IN* 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, transmit output port (facility side)	*XMT IMPEDANCE (S3) OUT* 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	
normal or reversed terminal-side SX leads	*SIMPLEX NORM/REV* switch (*S7*) on main board	normal (XMT IN SX associated with xmt input pair, RCV OUT SX associated with rcv output pair)	NORM	
		reversed (XMT IN SX associated with rcv output pair, RCV OUT SX associated with xmt input pair)	REV	
loop-start or ground-start operation	*LS/GS* switch (*S12*) on baby board	loop start	LS	
		ground start	GS	
automatic ringdown or FXS application	*ARD/FXS* switch (*S15*) on baby board	automatic ringdown	ARD	
		FXS	FXS	

table 6. Summary and checklist of 6171 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	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	
receive-channel terminal-side flat loss*	front-panel *rcv term loss* DIP switch*	0.1dB	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	
inclusion or bypass (exclusion) of receive-channel equalizer	*IN/OUT* position of front-panel *rcv equalizer SLOPE* DIP switch	equalizer included in circuit	IN	
		equalizer bypassed (excluded)	OUT	
post-equalization or pre-equalization operation for receive-channel equalizer	front-panel *rcv equalizer post/pre* switch	post-equalization	post	
		pre-equalization	pre	
introduction of receive-channel 309B-equivalent equalization	*SLOPE NL* position of front-panel *rcv equalizer SLOPE* DIP switch	nonloaded cable	toward NL	
		loaded cable	away from NL	
	SLOPE 1, 2, 4, 8 positions of front-panel *rcv equalizer SLOPE* DIP switch**	degree of slope	SLOPE 1 to 1	
			SLOPE 2 to 2	
			SLOPE 4 to 4	
			SLOPE 8 to 8	
	HT 1, 2, 4, 8 positions of front-panel *rcv equalizer HT/BW* DIP switch**	height of bump	HT 1 to 1	
			HT 2 to 2	
			HT 4 to 4	
			HT 8 to 8	
	BW 1, 2, 4, 8 positions of front-panel *rcv equalizer HT/BW* DIP switch**	affected bandwidth	BW 1 to 1	
			BW 2 to 2	
			BW 4 to 4	
			BW 8 to 8	
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	
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	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	

table 7 continued on next page

alignment function	switch	selection	setting	checklist
transmit-channel terminal-side flat loss*	front-panel *xmt term loss* DIP switch*	0.1dB	.1 to IN	
		0.2dB	.2 to IN	
		0.4dB	.4 to IN	
		0.8dB	.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3 to IN	
		6.0dB	6 to IN	
		12.0dB	12 to IN	
inclusion or bypass (exclusion) of transmit-channel equalizer	*IN/OUT* position of main-board *XMT EQUALIZER SLOPE* DIP switch (*S24*)	equalizer included in circuit	IN	
		equalizer bypassed (excluded)	OUT	
post-equalization or pre-equalization operation for transmit-channel equalizer	*POST/PRE EQ* switch (*S5*) on main board	post-equalization	POST	
		pre-equalization	PRE	
introduction of transmit-channel 309B-equivalent equalization	*SLOPE NL* position of main-board *XMT EQUALIZER SLOPE* DIP switch (*S24*)	nonloaded cable	toward NL	
		loaded cable	away from NL	
	SLOPE 1, 2, 4, 8 positions of main-board *XMT EQUALIZER SLOPE* DIP switch (*S24*)**	degree of slope	SLOPE 1 to 1	
			SLOPE 2 to 2	
			SLOPE 4 to 4	
			SLOPE 8 to 8	
	HT 1, 2, 4, 8 positions of main-board *XMT EQUALIZER HT/BW* DIP switch (*S25*)**	height of bump	HT 1 to 1	
			HT 2 to 2	
			HT 4 to 4	
			HT 8 to 8	
	BW 1, 2, 4, 8 positions of main-board *XMT EQUALIZER HT/BW* DIP switch (*S25*)**	affected bandwidth	BW 1 to 1	
			BW 2 to 2	
			BW 4 to 4	
			BW 8 to 8	

* The eight dB-value positions of the front-panel *rcv fac level* and *xmt fac level* DIP switches are cumulative, as are all eight positions 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* and *term loss* switch positions set to *IN*.

** The *1, 2, 4,* and *8* positions of the *SLOPE, HT,* and *BW* receive and transmit equalization DIP switches are cumulative. These switch positions may be set in any combination as required.

table 7. Summary and checklist of 6171 alignment switches

6. specifications

transmission

alignment level ranges, facility-side ports
receive input port: −17 to +7TLP
transmit output port: −16 to +8TLP

alignment level ranges, terminal-side ports
receive output port: +7 to −17TLP
transmit input port: +8 to −16TLP

overload points
receive input and output ports: 0dBm0
transmit input and output ports: +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

amplitude equalization, xmt and rcv channels
active prescription slope or bump-type equalization for nonloaded or loaded cable, functionally equivalent to that provided by the WECo 309B Prescription Equalizer. Each channel's equalizer can be conditioned for post- or pre-equalization operation or electrically bypassed (excluded) via switch option

terminating impedances, all four ports
1200, 600, or 150 ohms, balanced, individually switch-selectable at each port

frequency response, xmt and rcv channels, with no equalization and with receive-channel BEF removed
+0.0, −2.0dB at 200Hz, re 1004Hz
+0.3, −0.6dB, 300 to 3000Hz, re 1004Hz
+0.0, −1.3dB at 3400Hz, re 1004Hz

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

specifications continued on page 14

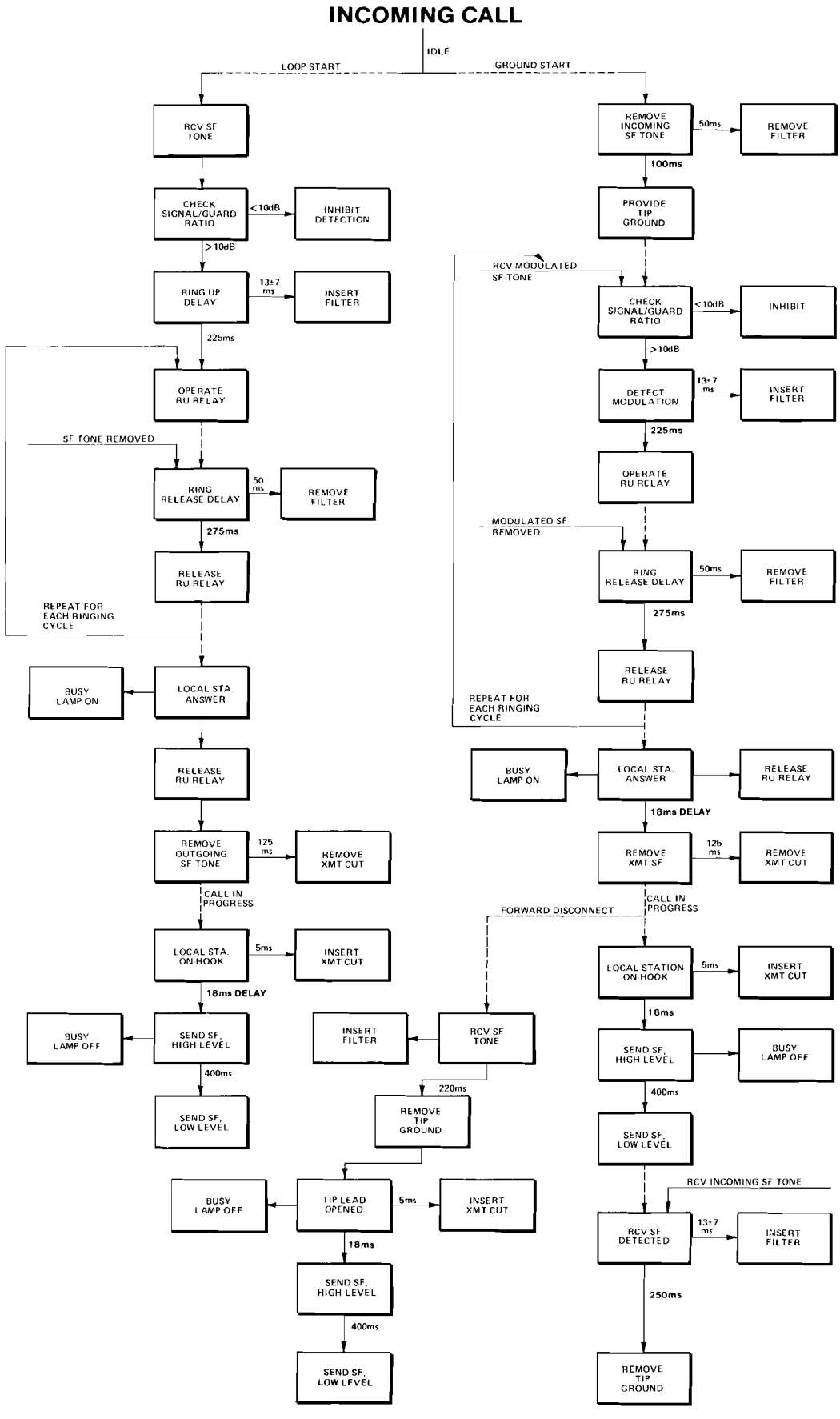


figure 10. Function sequence flowchart, incoming call

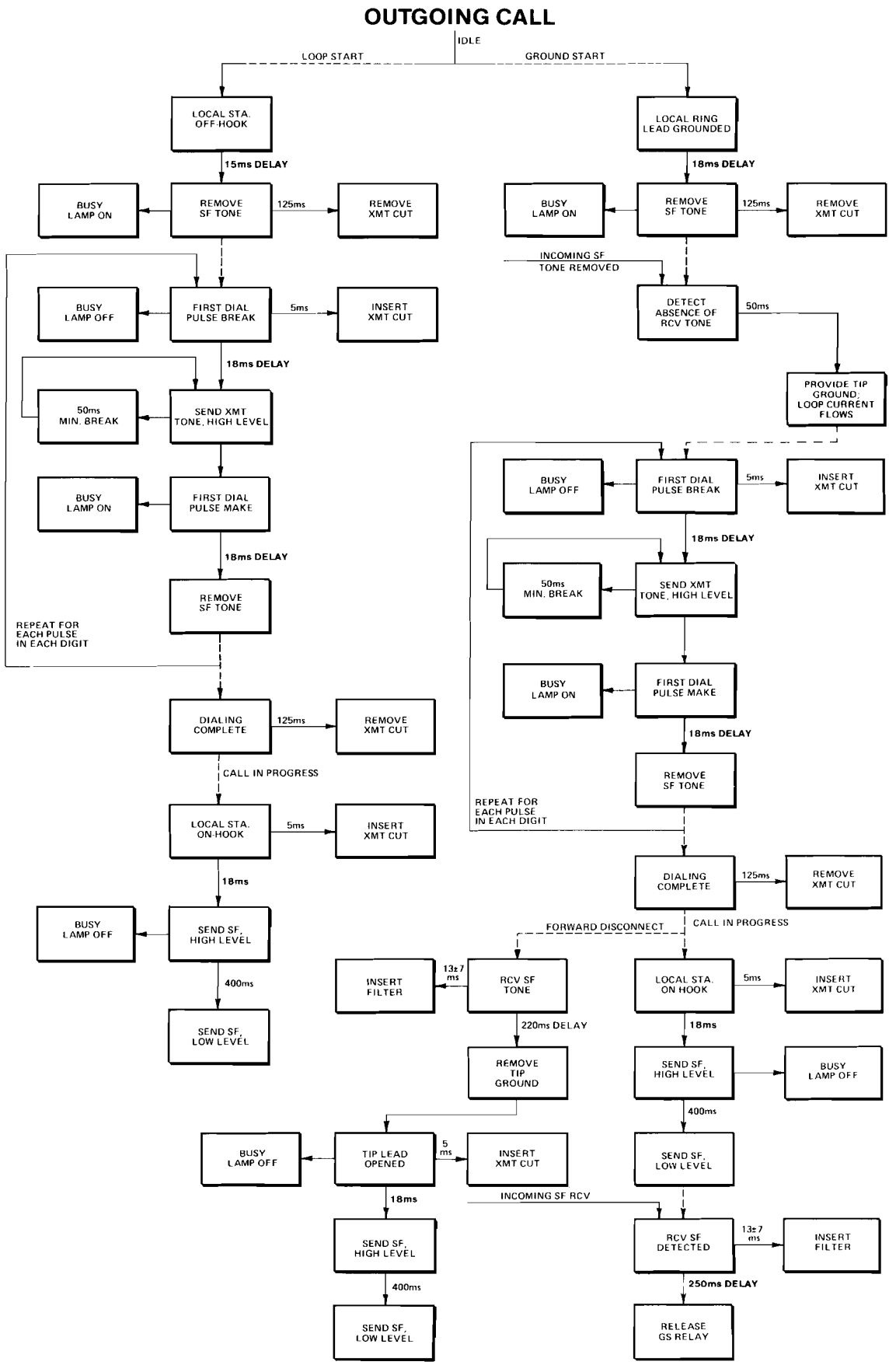
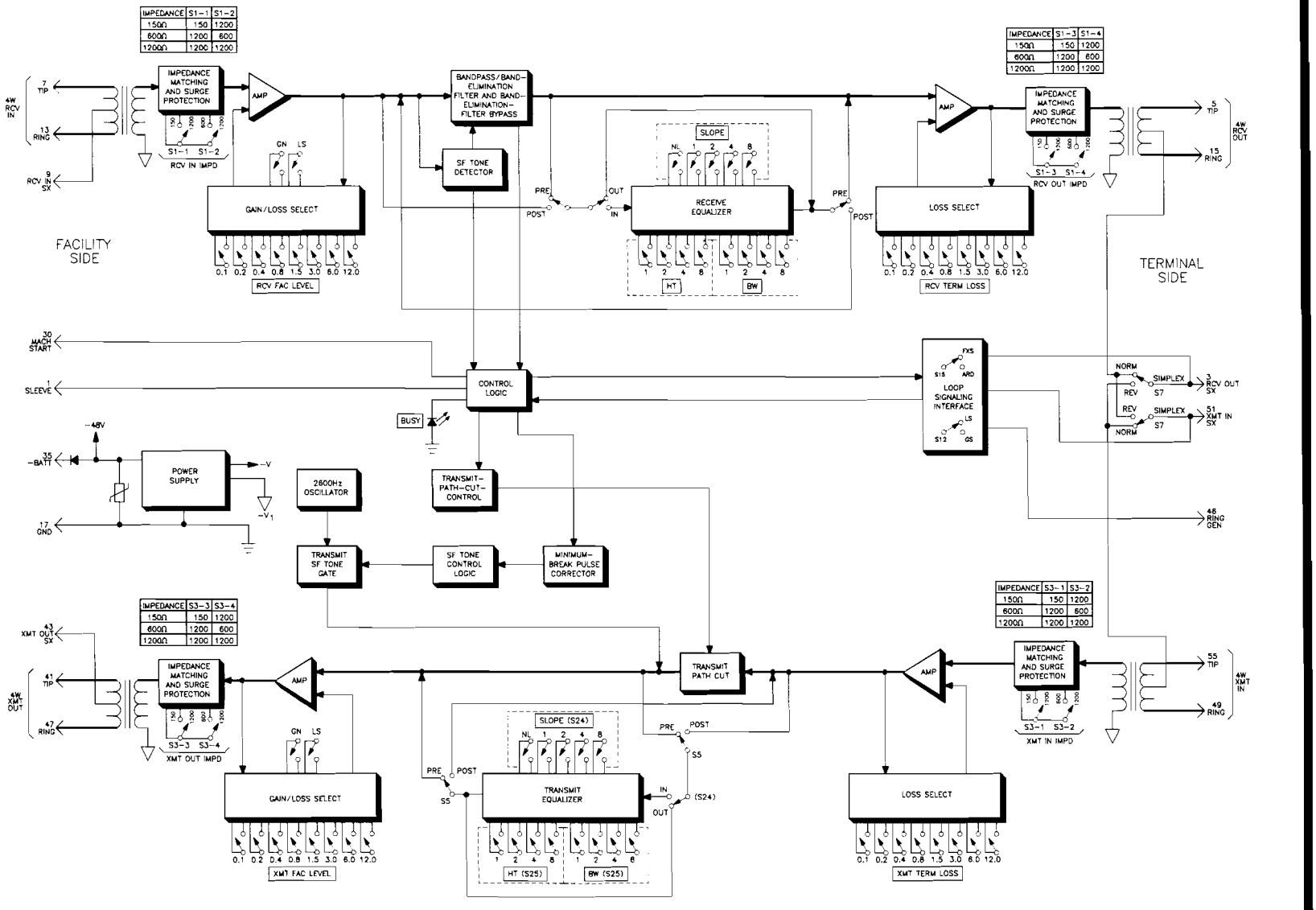


figure 11. Function sequence flowchart, outgoing call



6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater **816171**

5. block diagram

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

longitudinal balance, all four ports
greater than 60dB, 200 to 3000Hz

echo return loss, terminal and facility
greater than 23dB at all three impedance settings

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

crosstalk loss between xmt and rcv channels
75dB minimum, 200 to 3400Hz

crosstalk loss between adjacent modules in shelf
80dB minimum, 200 to 3400Hz

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**

transmit-path-cut insertion
transmit speech path is cut (opened) 13 ± 10ms 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 detection
frequency: 2600 ± 15Hz
level range: 0 to −27dBm0

SF tone rejection threshold
−37dBm0

signal-to-guard ratio for signal detection
6 to 12dB

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

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 (incoming)
loop-start mode: 225 ± 60ms
ground-start mode: 150 ± 50ms

release delay (incoming)
250 ± 50ms

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 (diode clamped to negative input potential)
busy condition: ground (100mA maximum source capacity)

common specifications

input power requirements
voltage: −42 to −54Vdc, filtered, positive-ground referenced
idle current: 80mA typical at −48Vdc
busy current: 136mA maximum at −54Vdc, not including loop current

operating environment
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
11.5 ounces (326 grams)

mounting
relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf

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 6171 4Wire-to-4Wire SF-to-FXS Intermediate Repeater module. The guide is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 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) 834-8311
US southwest region: (214) 869-4114
US western region: (714) 850-1300
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 8X6171 part number that indicates the issue of the module in question. Upon notification, we shall ship a replacement 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'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 carton prepaid to Tellabs.

repair and return

7.05 Return the defective 6171 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.

troubleshooting guide on page 16