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6131A 2Wire or 4Wire FXS to 4Wire E&M Terminal Interface Signaling Converter Module

CLEI code: NCC4CG02*

FCC Part 65 Registration Number: BPX826-15539-WP-E

Contents

1. General

1.1 The 6131A 2Wire or 4Wire FXS to 4Wire E&M Terminal Interface Signaling Converter Module provides transmission interface between a 2wire or 4wire metallic facility and a 4wire carrier channel or PBX. It also provides bidirectional signaling normally used at the station end of a foreign-exchange (FX) or off-premises-station (OPS) circuit, and Types I, II, and V E&M signaling used by a carrier channel or a PBX. Adjustable prescription-set loss in the receive and transmit channels and switch-selectable 2wire-to-4wire or 4wire-to-4wire operation are provided. For non-FCC-registered applications, straps on the mother board may be removed to independently allow each transmission path to be optioned to provide either loss or gain. As an alternative, the 6131A can be used at both ends of an E&M facility to provide automatic ringdown operation. In its primary application (FXS to E&M), the 6131A converts FXS signaling from the station end of the circuit to E-lead outputs (with A-side signaling) or M-lead outputs (with B-side signaling) toward the carrier channel or PBX, and converts M-lead inputs (with A-side signaling) or E-lead inputs (with B-side signaling) from the carrier channel or PBX to FXS-type supervisory and ringing signals toward the station end.

Reason for Revision / Reissue

1.2 This practice section has been revised to change the Ringback Tone Level to -12.5dBm±4.5dB.

Features

1.3 The 6131A offers the following features:

- CUL-1459 and UL-1459 compliant
- Switch-selectable A-side or B-side E&M signaling
- Switch-selectable Type I, II, or V E&M signaling arrangement

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- Independently switch-selectable normal or inverted input and output operation of the E&M leads
- Switch-selectable loop-start, ground-start, or reverse-battery supervision
- Switch-selectable minimum-break pulse correction for the loop-to-E&M path
- Switch-selectable integral precision ringback tone source
- Switch-selectable 2-second-on, 4-second-off ringing interruption or continuous ringing
- Active station-side loop-current limiting
- Transmission-path-cut control
- A busy-indicating LED
- From 0 to 24dB of prescription-set loss in 0.1dB increments in both the receive and transmit channels. (From 0 to 24dB of prescription-set gain in switch-selectable 0.1dB increments is also available in both channels, but only in non-FCC-registered applications.)
- Switch-selectable 2wire or 4wire facility-side interface, with an integral magnetic hybrid providing the 2wire-to-4wire conversion when 2wire facility interface is selected
- Transformer isolation at all ports in either the 2wire-to-4wire or 4wire-to-4wire mode
- Balanced, switch-selectable 900- or 600-ohm terminating impedance in series with 2.15μF of capacitance at the facility-side 2wire port in the 2wire-to-4wire mode
- Fixed, balanced, 600-ohm terminating impedances at the module's terminal-side 4wire ports and at both facility-side 4wire ports in the 4wire-to-4wire mode
- An integral Compromise Balance Network (CBN) that provides either 900 or 600 ohms (switch-selectable) or 0 to 2000 ohms (continuously adjustable) in series with 2.15μF at the hybrid's balance port
- From 0 to 0.062μF of Network Build-out (NBO) capacitance in switch-selectable 0.002μF increments, for use with either the module's integral CBN or an external Precision Balance Network (PBN) Module
- Lightning surge protection on the facility-side ports
- Over-voltage protection on the terminal-side ports
- Reverse-polarity 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
- Four front-panel bantam-type test jacks (one opening jack facing the module at each port) to facilitate alignment and maintenance
- Operation on filtered, ground-referenced, -22 to -56Vdc input power with current requirements of 50mA maximum, 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. Applications

2.1 The 6131A interfaces a loop signaling 2wire or 4wire FX or OPS facility with a 4wire E&M carrier or PBX channel unit. The FXS facility is normally terminated to a 2wire or 4wire telephone station instrument or PBX trunk. When the 6131A is optioned for 2wire facility interface, signaling is derived via the module's 2wire tip and ring leads. When the 6131A is optioned for 4wire facility interface, signaling is derived via the module's receive output SX and transmit input SX leads.

2.2 The 6131A is typically used with a Tellabs 6131B module at the office (switching equipment) end of the FX or OPS circuit. When used in this arrangement, they provide all the necessary signaling and transmission conversions required to provide a 2wire or 4wire OPS or FX circuit over a 4wire E&M carrier channel.

2.3 Use of the 6131A is not limited to station-end FX and OPS applications. A two-way automatic ringdown circuit can be provided simply by equipping both ends of an E&M carrier with a 6131A.

2.4 In any application, the 6131A can be switch-optioned for A-side or B-side Type I, II, or V E&M signaling (see Table 2-1 and Figures 2-1 through 2-6); loop-start, ground-start, or reverse-battery supervision; normal or inverted E&M-lead input and output states. In loop-start, ground-start, and reverse-battery modes, local ringing (continuous or interrupted, as selected via switch option) persists for the duration of the incoming seizure condition until the station is answered.

2.5 In all applications of the 6131A, ringing energy to the associated station must be provided from a local ringing source external to the 6131A. To accommodate local ring trip during the ringing interval, the ringing generator used must be of the battery-bias (ground-return) type. If no ringing is required (as in DID applications), -BATT (pin 35) should be tied to Ring Generator (pin 46).

2.6 In loop-start FX and OPS applications, the 6131A must be optioned for continuous ringing, in which case the 6131A follows the incoming E or M lead seizure. In ground-start FX and OPS applications and also in all ringdown applications, either continuous ringing or interrupted (2-second-on, 4-second-off) ringing may be selected.

2.7 While all internal circuitry of the 6131A receives power via internal regulators (which permit operation on -22 to -56Vdc filtered input), Type I M-lead and B-lead (A-lead in reverse-battery applications) potentials are derived directly from the external power source. This means that if the E&M-side carrier channel (or other signaling equipment) requires nominal -48Vdc M-lead potential (when set for Type I E&M), the 6131A must be powered from a nominal -48Vdc source. This also means that loop-sensing limits depend upon the external power source. The 6131A's loop-sensing circuitry operates at up to 3000 ohms of loop resistance at -48Vdc and at up to 1200 ohms of loop resistance at -24Vdc. Loop limits (cable plus station instrument) for 23mA loop current are 1700 ohms of loop resistance at -48Vdc B-lead (or A-lead) potential and 700 ohms of loop resistance at -24Vdc B-lead (or A-lead) potential.

2.8 Table 2-2 lists a variety of possible operating modes of the 6131A, along with the switch options required to implement these modes. When referring to Table 2-2, please note the following:

- The input and output switch settings (SIG for normal, INV for inverted) apply to the E&M-side inputs and outputs. See Table 2-1 for normal setting states.
- The A-side / B-side signaling optioning depends upon the E&M signaling equipment that interfaces the 6131A. The 6131A is optioned for A-side signaling when it needs to provide E-lead outputs and receives M-lead inputs. B-side signaling is selected when the 6131A needs to provide M-lead outputs and receives E-lead inputs.
- When the 6131A is optioned for 2wire facility-side (loop-signaling) interface, its loop signaling leads are derived via the 2wire tip and ring leads. When the 6131A is optioned for 4wire facility-side interface, its loop signaling leads are derived via the facility-side SX leads.

2.9 The 6131A provides switch-selectable 2wire or 4wire interface on the facility side and a 4wire interface on the terminal side. In FCC-registered applications, the transmit and receive paths can be individually prescription-set to introduce from 0 to 24dB of loss in switch-selectable 0.1dB increments. With the factory-installed straps removed, which is permissible in non-FCC-registered applications only, the module's transmit and receive paths can be individually optioned to provide from 0 to 24dB of prescription-set loss or gain in switch-selectable 0.1dB increments.

E&M Type	Output Lead	On-hook State	Off-hook State
Type I A-side	E-lead	Open	Ground
Type I B-side	M-lead	Ground	Negative Battery
Type II A-side	E-lead	Open	Ground
Type II B-side	M-lead	Open	Negative Battery
Type V A-side	E-lead	Open	Ground
Type V B-side	M-lead	Open	Ground
Note: These states are valid only when unit is optioned for normal outputs (S15A and S15B).			

Table 2-1 E&M-side Inputs and Outputs Normal Setting States

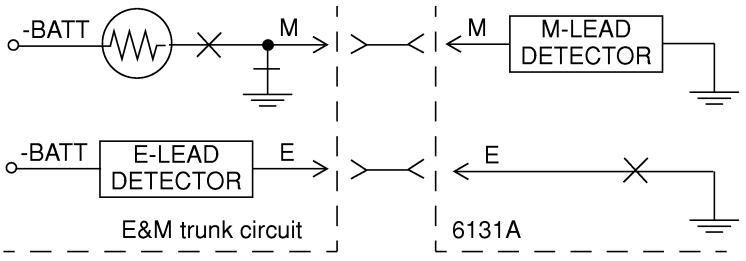


Figure 2-1 Type I E&M Interface, 6131A A-side Signaling

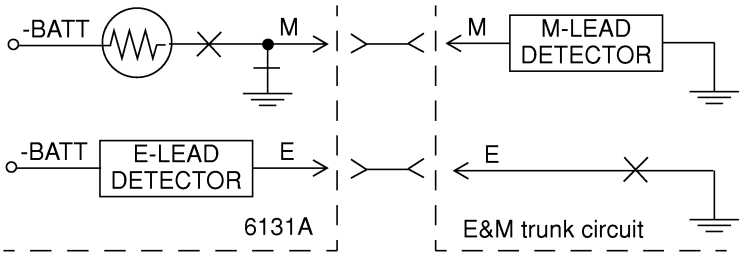


Figure 2-2 Type I E&M Interface, 6131A B-side Signaling

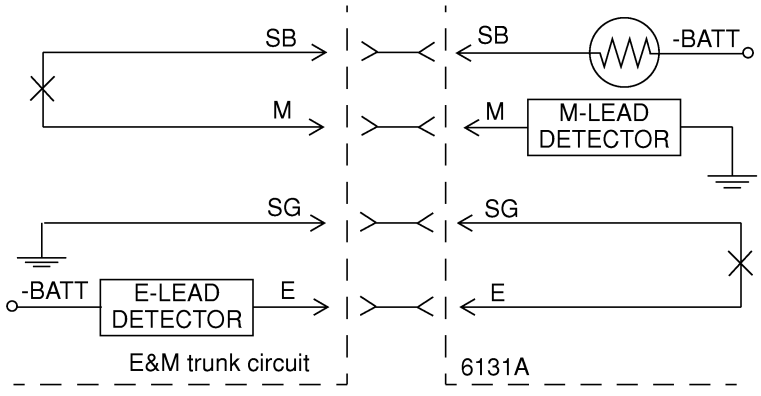


Figure 2-3 Type II E&M Interface, 6131A A-side Signaling

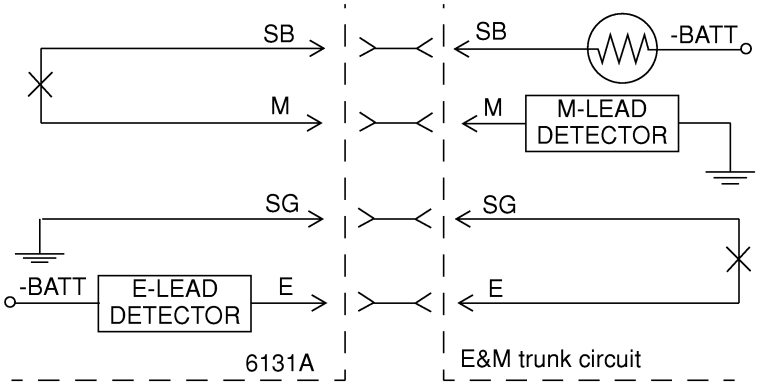


Figure 2-4 Type II E&M Interface, 6131A B-side Signaling

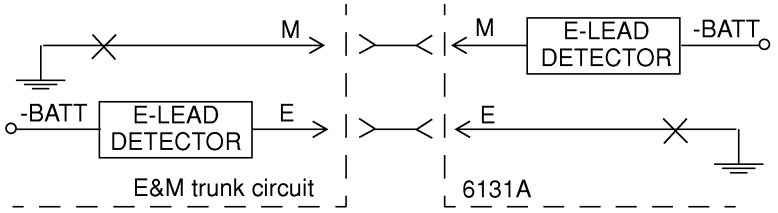


Figure 2-5 Type V E&M Interface, 6131A A-side Signaling

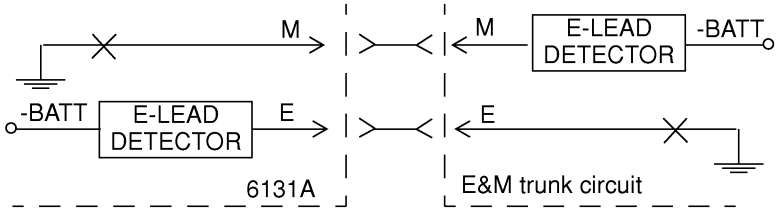


Figure 2-6 Type V E&M Interface, 6131A B-side Signaling

Facility Interface	Operating / Supervisory Mode	Required Switch Options*	
		Baby Board	Mother Board
2wire	automatic ringdown	S12 = LS (loop-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = ON***	S14 (sig. mode) = NORM S5 = 2WIRE
4wire	automatic ringdown	S12 = LS (loop-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = ON***	S14 (sig. mode) = NORM S5 = 4WIRE
2wire	ground-start	S12 = GS (ground-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 2WIRE
Continued on Next Page			

Table 2-2 Typical 6131A Operating Modes

Facility Interface	Operating / Supervisory Mode	Required Switch Options*	
		Baby Board	Mother Board
4wire	ground-start	S12 = GS (ground-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 4WIRE
2wire	loop-start	S12 = LS (loop-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 2WIRE
4wire	loop-start	S12 = LS (loop-start) S15-A (input) = SIG** S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 4WIRE
2wire	reverse-battery	S12 = RB (reverse-battery) S15-A (input) = SIG S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 2WIRE
4wire	reverse-battery	S12 = RB (reverse-battery) S15-A (input) = SIG S15-B (output) = SIG** S15-D (ringback tone) = OFF	S14 (sig. mode) = NORM S5 = 4WIRE

*For switch options not listed in this table, see Section 3.

** The SIG setting provides normal inputs (S15-A) and outputs (S15-B).

*** If ringback tone is not desired in ringdown applications, set switch S15-D on the baby board to OFF, i.e., away from its RT position.

Table 2-2 Typical 6131A Operating Modes

Note: These switch settings are valid for all E&M types determined by the setting of switch S10.

Terminating Impedances

2.10 When optioned for 2wire-to-4wire operation, the 6131A's facility-side 2wire port can be switch-optioned for 600- or 900-ohm terminating impedance in series with 2.15μF. In 4wire-to-4wire operation, the facility-side port impedances are restricted to 600 ohms only. The choice of two 2wire-port impedances permits interface with a variety of 2wire facilities and equipment. The 600-ohm option is selected when the 6131A interfaces nonloaded cable or station equipment, while the 900-ohm option is selected when the 6131A interfaces loaded cable, switched networks involving both loaded and nonloaded cable, or 900-ohm equipment. On the terminal side, the impedance at both 4wire ports (transmit output and receive input) is fixed at 600 ohms, as required for carrier and many nonloaded cable applications. Both terminal-side transformers are center-tapped to derive balanced SX leads.

Balance Network and NBO Capacitance

2.11 To ensure that adequate hybrid balance (i.e., enough transhybrid loss) is provided in any application, the 6131A's hybrid can be switch-optioned to function with the module's internal CBN or with an external 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, switched networks, or 900-ohm equipment, or 600 ohms (in series with 2.15μF) when the

2wire port interfaces nonloaded cable or 600-ohm station-end equipment. A third CBN option allows the module user to manually introduce from 0 to 2000 ohms of balancing impedance (in series with 2.15μF) via a continuously adjustable control on the 6131A's printed circuit board. This CBN option can be used as an economical alternative to a PBN in many applications. If, however, none of the three CBN options provides adequate hybrid balance, an external PBN can be used. See Table 3-1 for connections to an external PBN.

2.12 To further improve hybrid balance, especially in applications where a PBN for loaded cable is used with the 6131A, from 0 to 0.062μF of NBO capacitance can be introduced across the module's balance port. This NBO capacitance can also be used to compensate for the capacitance of station cables or other equipment or 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 telset, 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.

3. Installation

Inspection

3.1 The 6131A Module 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 module should be visually inspected again prior to installation.

Mounting

3.2 The 6131A plugs into one position of a Tellabs Type-10 Mounting Shelf (plugs physically and electrically into a 56-pin connector at the rear of the 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 required. Pre-wired versions of these cases are also available. Contact your local office for more information.

Installer Connections

3.3 Before making any connections to the mounting shelf, make sure 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.

3.4 Table 3-1 lists external connections to the 6131A Module. All connections are made via wire-wrapping to the 56-pin connector at the rear of the module's mounting-shelf position. Pin numbers are found on the body of the connector.

Connect	To Pin
4WIRE TRANSMIT IN TIP*	7
4WIRE TRANSMIT IN RING*	13
B LEAD / 4WIRE TRANSMIT IN SIMPLEX*	9
TRANSMIT OUT TIP**	5
TRANSMIT OUT RING**	15
TRANSMIT OUT SIMPLEX**	3
RECEIVE IN TIP**	55
Continued on Next Page	

Table 3-1 External Connections to 6131A

Connect	To Pin
RECEIVE IN RING**	49
RECEIVE IN SIMPLEX**	51
2WIRE TIP / 4WIRE RECEIVE OUT TIP*	41
2WIRE RING / 4WIRE RECEIVE OUT RING*	47
A LEAD / 4WIRE RECEIVE OUT SIMPLEX*	43
-BATT (-22 to -56Vdc filtered input)	35
GND (ground)	17
E LEAD**	23
M LEAD**	21
SG (signal ground) LEAD**	19
SB (signal battery) LEAD**	1
RG (ringing generator)	46
EXT BAL NET (external PBN)	2 and 4
* Facility side ** Terminal side	

Table 3-1 External Connections to 6131A

Option Selection on the Baby Board

3.5 Before the 6131A is placed into service, four option switches on the baby board must be set. One is a two-position slide switch, two are three-position slide switches, and the third is a five-position DIP switch. Figure 3-1 shows the locations of these switches on the printed circuit board.

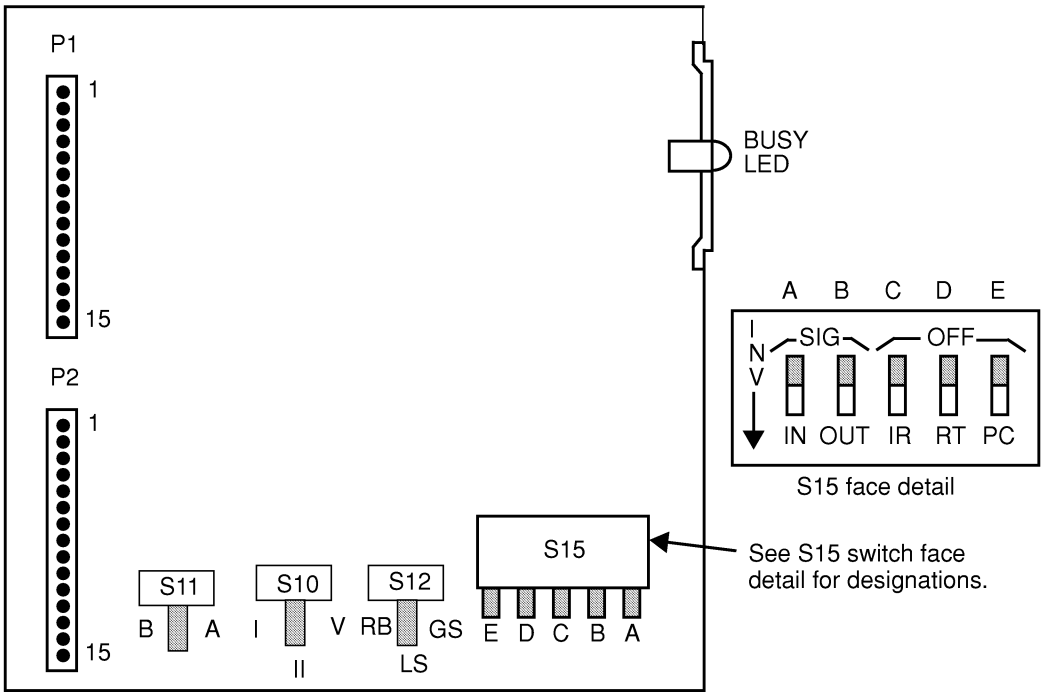


Figure 3-1 Baby Board Option Switch Locations

Option Switch Settings

3.6 Set the four option switches as directed below.

E&M Signaling Type

3.7 Three-position slide switch S10 selects a choice of three E&M signaling types.

- For Type I E&M, set S10 to the I position.
- For Type II E&M, set S10 to the II position.
- For Type V E&M, set S10 to the V position.

A-Side or B-Side E&M Signaling

3.8 Two-position slide switch S11 conditions the E&M leads of the 6131A to interface equipment that uses either A-side or B-side E&M signaling. Set S11 as follows:

- If the 6131A is to provide E-lead outputs and receive M-lead inputs, set S11 to the A position.
- If the 6131A is to provide M-lead outputs and receive E-lead inputs, set S11 to the B position.

Supervisory Mode

3.9 Three-position slide switch S12 selects either the loop-start, ground-start, or reverse-battery supervisory mode. Set S12 as follows:

- For loop-start supervision, set S12 to the LS position.
- For ground-start supervision, set S12 to the GS position.
- For reverse-battery supervision, set S12 to the RB position.

Normal or Inverted E&M Inputs

3.10 Position A (labeled IN) of five-position DIP switch S15 selects either normal or inverted E&M-lead inputs regardless of the setting of S11. Set S15-A as follows:

- For normal E&M-lead inputs, set S15-A to SIG (i.e., away from IN and the INV arrowhead).
- For inverted E&M-lead inputs, set S15-A to INV (i.e., toward IN).

Normal or Inverted E&M Outputs

3.11 Position B (labeled OUT) of five-position DIP switch S15 selects either normal or inverted E&M-lead outputs regardless of the setting of S11. Set S15-B as follows:

- For normal E&M-lead outputs, set S15-B to SIG (i.e., away from OUT and the INV arrowhead).
- For inverted E&M-lead outputs, set S15-B to INV (i.e., toward OUT).

Continuous or Interrupted Ringing

3.12 Position C (labeled IR) of five-position DIP switch S15 selects either continuous or interrupted (2-second-on, 4-second-off) ringing. Set S15-C as follows:

- For continuous ringing, set S15-C to OFF.
- For interrupted ringing, set S15-C to IR.

Ringback Tone

3.13 Position D (labeled RT) of five-position DIP switch S15 selects whether ringback tone is applied to the transmit-out port of the associated 6131A or not. Set S15-D as follows:

- To apply ringback tone, set S15-D to RT.
- To not apply ringback tone, set S15-D to OFF.

Pulse Correction

3.14 Position E (labeled PC) of five-position DIP switch S15 selects either minimum-break pulse correction or no pulse correction for the loop-to-E&M path. Set S15-E as follows:

- For minimum-break pulse correction, set S15-E to PC.
- For no pulse correction, set S15-E to OFF.

Switch Option	Switch	Selection	Setting	Checklist
E&M signaling type	S10	Type I	I	
		Type II	II	
		Type V	V	
A-side* / B-side** E&M signaling	S11	A-side signaling*	A	
		B-side signaling**	B	
Supervisory mode	S12	loop-start	LS	
		ground-start	GS	
		reverse-battery	RB	
Normal or inverted E&M inputs	S15-A (IN)	normal inputs	SIG (i.e., away from IN)	
		inverted inputs	INV (i.e., toward IN)	
Normal or inverted E&M outputs	S15-B (OUT)	normal outputs	SIG (i.e., away from OUT)	
		inverted outputs	INV (i.e., toward OUT)	
Continuous or interrupted (2-second-on, 4-second-off) ringing	S15-C (IR)	interrupted ringing	IR	
		continuous ringing	OFF	
Ringback tone	S15-D (RT)	ringback tone	RT	
		no ringback tone	OFF	
Minimum-break pulse correction for loop-to-E&M path	S15-E (PC)	pulse correction	PC	
		no pulse correction	OFF	

* If the 6131A is to provide E-lead outputs and receive M-lead inputs, set S11 to the A position.

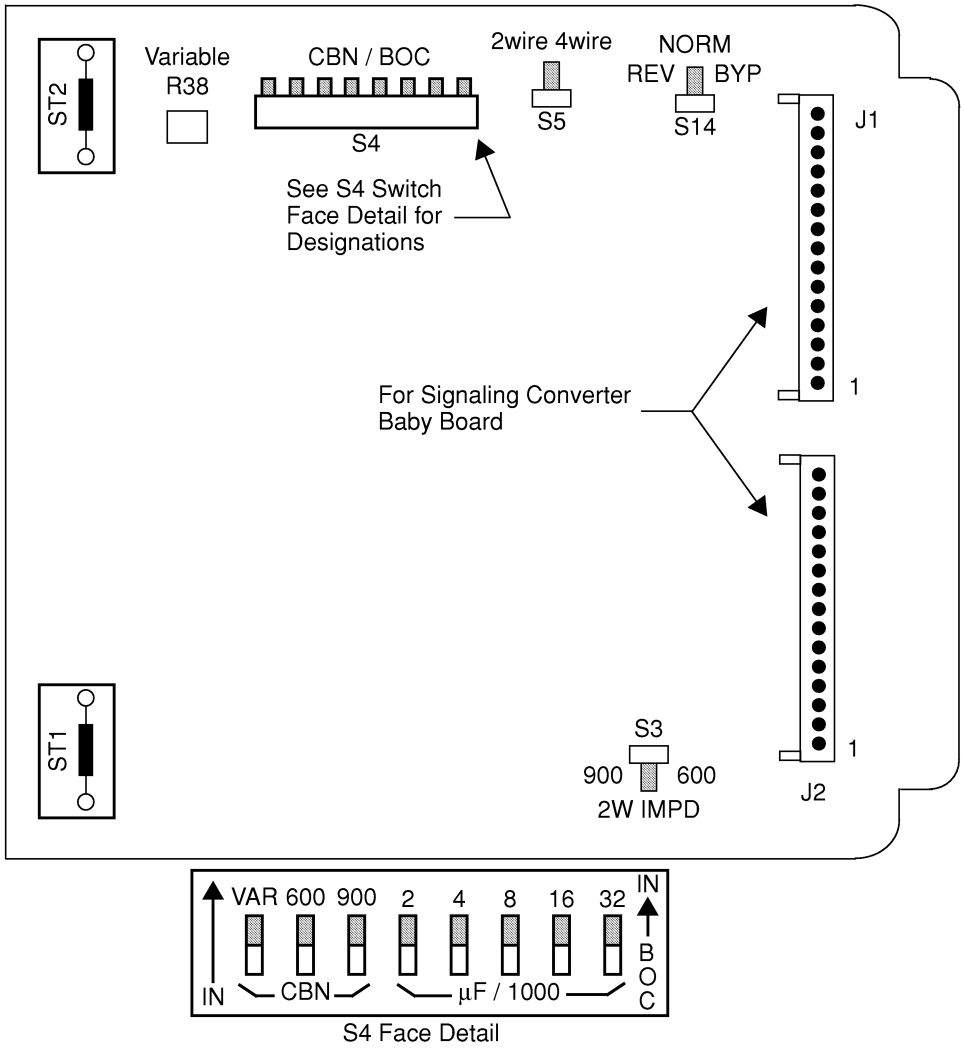
** If the 6131A is to provide M-lead outputs and receive E-lead inputs, set S11 to the B position.

Table 3-2 Summary and Checklist of Baby Board Switch Options

Mother Board Option Selection

3.15 With the exception of two factory-installed straps that allow for loss only or a choice of gain or loss in each channel (discussed under 'Alignment' later in this practice), all mother board options are selected via slide or DIP switches. Locations of these switches and straps on the module's printed circuit board are shown in Figure 3-2. Table 3-3 gives a brief explanation of the function and settings of each option switch and strap, along with a convenient optioning and alignment checklist. The checklist can be filled out (by checking the appropriate box for each switch and strap) either prior to installation, to allow for prescription optioning and alignment of the module, or as the module is being optioned and aligned, to provide a record for future reference. Detailed instructions for optioning the mother board are provided in paragraphs 3.16 through 3.19.

Note: Introduction of NBO capacitance is covered in paragraphs 3.29 and 3.30 of this practice.



S4 Face Detail

Figure 3-2 Mother Board Option Switch and Strap Locations

Switch / Strap Option	Switch / Strap	Selection	Setting	Checklist
2wire or 4wire facility-side transmission interface	S5	2wire interface	2wire	
		4wire interface	4wire	
2wire-port terminating impedance (with S5 set for 2wire facility interface) Note: With S5 set to 4wire, switch S3 must always be set to 600.	S3	600 ohms plus 2.15µF in 2wire mode, 600 ohms resistive in 4wire mode (required with 4wire facility interface)	600	
		900 ohms plus 2.15µF (not available with 4wire facility interface)	900	
Continued on Next Page				

Table 3-3 Summary and Checklist of Mother Board Switch and Strap Options

Switch / Strap Option	Switch / Strap	Selection	Setting	Checklist
Facility-side signaling-lead arrangement	S14	Bypass: **NEVER USED**	BYP **(NEVER USED)**	
		Normal: A&B leads derived via 2wire T&R leads, respectively, in 2wire mode; RCV OUT SX and XMT IN SX leads derived via RCV OUT and XMT IN pairs, respectively, in 4wire mode	NORM	
		Reverse: A&B leads derived via 2wire R&T leads, respectively, in 2wire mode; RCV OUT SX and XMT IN SX leads derived via XMT IN and RCV OUT pairs, respectively, in 4wire mode	REV	
Internal CBN options	S4, CBN positions only (VAR, 600, 900)	900 ohms with 2.15µF	VAR to OUT** 600 to OUT 900 to IN	
		600 ohms with 2.15µF	VAR to OUT 600 to IN 900 to OUT	
		User-adjustable 0 to 2000 ohms (via VARIABLE CBN RESISTANCE potentiometer R38) with 2.15µF	VAR to IN 600 to OUT 900 to OUT	
		Internal CBN excluded (for use of external PBN)	VAR to OUT 600 to OUT 900 to OUT	
Conditioning of transmit channel for loss only (FCC-registered applications) or for gain or loss in non-registered applications Note: In FCC-registered applications, both channels of the 6131A must be conditioned for loss only.	Strap ST2 and front-panel xmt level DIP switch, gn and ls positions	Loss only, as required in FCC-registered applications	ST2 present gn to OUT ls to IN	
		Loss (with gain available as an alternative; non-registered applications)	ST2 cut or removed gn to OUT ls to IN	
		Gain (with loss available as an alternative; non-registered applications)	ST2 cut or removed gn to IN ls to OUT	
Continued on Next Page				

Table 3-3 Summary and Checklist of Mother Board Switch and Strap Options

Switch / Strap Option	Switch / Strap	Selection	Setting	Checklist
Transmit-channel level (either gain or loss, as selected above)*	Front-panel xmt level DIP switch, dB-value positions*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
Conditioning of receive channel for loss only (FCC-registered applications) or for gain or loss in non-registered applications In FCC-registered applications, both channels of the 6131A must be conditioned for loss only.	Strap ST1 and front-panel rcv level DIP switch, gn and ls positions	Loss only, as required in FCC-registered applications	ST1 present gn to OUT ls to IN	
		Loss (with gain available as an alternative in non-registered applications)	ST1 cut or removed gn to out ls to IN	
		Gain (with loss available as an alternative in non-registered applications)	ST1 cut or removed gn to IN ls to OUT	
Receive-channel level (either gain or loss, as selected above)*	Front-panel rcv level DIP switch, dB-value positions*	0.1dB	0.1 to IN	
		0.2dB	0.2 to IN	
		0.4dB	0.4 to IN	
		0.8dB	0.8 to IN	
		1.5dB	1.5 to IN	
		3.0dB	3.0 to IN	
		6.0dB	6.0 to IN	
		12.0dB	12.0 to IN	
NBO capacitance***	S4, µF / 1000 positions only (2, 4, 8, 16 and 32)***	0.002µF	2 to IN	
		0.004µF	4 to IN	
		0.008µF	8 to IN	
		0.016µF	16 to IN	
		0.032µF	32 to IN	

* The dB-value positions of the mother board's front-panel rcv level and xmt level DIP switches are cumulative. Total gain or loss introduced into a channel is the sum of that channel's dB-value DIP-switch positions set to IN. For zero gain or loss in a channel, set all dB-value positions of that channel's front-panel level DIP switch to OUT.

** Setting a switch to the OUT position means moving the switch away from the IN position.

*** The mother board's network build-out capacitance (BOC) switch positions on DIP switch S4 are cumulative. Total NBO capacitance introduced is the sum of those NBOC DIP-switch positions set to IN. For zero NBO capacitance, set all five BOC DIP-switch positions on S4 to OUT.

Table 3-3 Summary and Checklist of Mother Board Switch and Strap Options

2Wire or 4Wire Facility-side Transmission Interface

3.16 Two-position slide switch S5 selects either a 2wire or 4wire transmission interface on the 6131A's facility side. Set S5 as follows:

- To the 2wire position for a 2wire facility interface
- To the 4wire position for a 4wire facility interface

2Wire-port Terminating Impedance

3.17 Two-position slide switch S3 (2W IMPD) selects either 900- or 600-ohm terminating impedance in series with 2.15μF at the 6131A's 2wire port when the module is optioned for 2wire facility interface (S5 set to 2WIRE). Switch S3 also conditions the 6131A to provide 600-ohm terminating impedance at both facility-side ports when the module is optioned for 4wire facility interface (S5 set to 4WIRE). Set S3 as follows:

- To the 900 position for 900 ohms in series with 2.15μF, normally required for interface with loaded cable, switched networks, or 900-ohm equipment
- To the 600 position for 600 ohms in series with 2.15μF, normally required for interface with nonloaded cable or 600-ohm equipment
- To the 600 position for 600-ohm impedance at both facility side ports in all applications where 4wire facility interface is selected (S5 set to 4WIRE)

Facility-side Signaling-lead Arrangement

3.18 Three-position slide switch S14 selects either a normal or reverse signaling-lead arrangement on the 6131A's facility side. Set S14 as follows:

- The **BYP** (bypass) position is **NEVER USED**.
- To the NORM (normal) position when it is desired that the 6131A's signaling leads be derived as follows:
  - In the 2wire mode, A lead derived from 2wire tip lead and B lead derived from 2wire ring lead
  - In the 4wire mode, RCV OUT SX lead derived from receive output pair and XMT IN SX lead derived from transmit input pair
- To the REV (reverse) position when it is desired that the 6131A's signaling leads be derived as follows:
  - In the 2wire mode, A lead derived from 2wire ring lead and B lead derived from 2wire tip lead
  - In the 4wire mode, RCV OUT SX lead derived from transmit input pair and XMT IN SX lead derived from receive output pair

Internal CBN Options

3.19 The first three positions of eight-position DIP switch S4 (CBN / BOC) select the 6131A's internal CBN options. These are the CBN positions labeled VAR, 600, and 900. Set the CBN positions of DIP switch S4 as follows:

- To select 900-ohm impedance in series with 2.15μF, set VAR to OUT, 600 to OUT, and 900 to IN
- To select 600-ohm impedance in series with 2.15μF, set VAR to OUT, 600 to IN, and 900 to OUT
- To select user-adjustable 0- to 2000-ohm impedance (via VARIABLE CBN RESISTANCE potentiometer R38) in series with 2.15μF, set VAR to IN, 600 to out, and 900 to OUT
- To exclude the 6131A's internal CBN from the circuit for use of an external PBN Module, set VAR to OUT, 600 to OUT, and 900 to OUT

Alignment

3.20 Transmission alignment of the 6131A consists of setting the receive and transmit transmission levels and, where required in 2wire facility-interface applications, introducing user-adjustable CBN resistance and / or NBO capacitance to achieve optimum hybrid balance. After all options on the 6131A are selected, two methods of alignment are available: prescription and direct measurement (non-prescription). With the prescription method, the 6131A's front-panel rcv level and xmt level switches and the printed-circuit-board BOC DIP switches are set in accordance with the specifications on the Circuit Layout Record (CLR). Procedures for prescription alignment of the 6131A are given in paragraphs 3.21 and 3.22. In applications where the information provided by the CLR is inadequate, it is necessary to perform the direct-measurement (non-prescription) alignment procedure. The non-prescription procedure consists of making measurements at the 6131A's ports to determine the required settings of the alignment switches. The non-prescription alignment procedures are given in paragraphs 3.23 through 3.30.

Note: It will be necessary to busy out the card before transmission will be allowed to pass through.

Prescription Level Adjustment, Transmit and Receive

3.21 To adjust the transmit and receive levels on the 6131A, proceed as follows: From the CLR, determine whether loss or gain is required in each channel. If loss is required in a channel, set the ls position of that channel's front-panel level DIP switch to IN and the adjacent gn position of the same DIP switch to OUT. If gain is required in a channel (non-registered applications only), ensure that the appropriate option strap on the 6131A's printed circuit board (see Figure 3-2) is cut or removed; then set the gn position of that channel's level DIP switch to IN and the adjacent ls position of the same switch to OUT. Next, determine (from the CLR) the amount of loss or gain required in each channel. Then, to achieve the required levels, set the appropriate combinations of rcv level and xmt level dB-value DIP switches to the IN position. The specific amount of loss or gain introduced by each dB-value DIP-switch position is indicated on the front panel adjacent to the switch position. These switch positions are cumulative; the total amount of loss or gain introduced into a channel is the sum of that channel's level DIP-switch positions set to IN.

Post-alignment Testing

3.22 After the transmission levels are set and, where applicable, NBO capacitance is introduced, it may be desirable to confirm the results via end-to-end tests. Where computer-controlled test equipment is used, a printout will verify the alignment results. Any deviation from the required levels can then be adjusted via the front-panel 'level' switches and printed-circuit-board BOC switches. If computer-controlled test equipment is not available, the alignment results can be confirmed by performing the measurements in the non-prescription alignment procedure below.

Prealignment Switch Settings for Non-prescription Alignment

3.23 Before beginning actual non-prescription alignment of the 6131A, do the following:

1. Ensure that all option switches (see Tables 3-2 and 3-3), especially those that select the module's facility-side terminating impedance(s), are properly set.
2. Ensure that the user-adjustable VARIABLE CBN RESISTANCE potentiometer (R38) is adjusted fully counterclockwise for zero CBN resistance.
3. Ensure that no NBO capacitance is introduced (all five BOC positions of the CBN / BOC DIP switch set to OUT).
4. Set all dB-value positions of the front-panel rcv level and xmt level DIP switches to the OUT position for zero gain or loss in each channel.

Non-prescription Transmit-level Adjustment

3.24 To adjust the transmit level of the 6131A when prescription level settings are not given in the CLR or when the given settings do not provide adequate results, proceed as follows:

1. In the 2wire mode only, insert an opening plug into the 6131A's RCV IN jack. Then, in either the 2wire or 4wire mode, arrange the receive portion of a Transmission Measuring Set (TMS) for 600-ohm terminated measurement and connect it to the 6131A's XMT OUT jack.
2. Request the distant facility-side location to send 1004Hz test tone at that location's CLR-specified output level.
3. If the measured transmit output level is the same as the local CLR-specified transmit output level, proceed to non-prescription receive level adjustment, paragraph 3.25. If the measured transmit output level is different from the specified transmit output level, proceed to step 4 or 5, as appropriate.
4. If the specified transmit output level is lower than the measured transmit output level, loss is required. Set the ls position of the front-panel xmt level DIP switch to IN and the gn position to OUT. Then set to IN that combination of xmt level dB-value DIP switches which equals the required amount of loss (see note below). This amount is the difference between the transmit output level measured in step 3 and the CLR-specified transmit output level. Proceed to paragraph 3.25.
5. If the specified transmit output level is higher than the measured transmit output level, gain is required. Ensure that option strap ST2 on the 6131A's printed circuit board (see Figure 3-2) is cut or removed (please note that this is permissible in non-FCC-registered applications only). Then set the ls position of the front-panel xmt level DIP switch to OUT and the gn position to IN. Finally, set to IN that combination of xmt level dB-value DIP switches which equals the required amount of gain (see note below). This amount is the difference between the transmit output level measured in step 3 and the CLR-specified transmit output level.
6. Remove the opening plug (if present) from the RCV IN jack, and disconnect the TMS. Proceed to paragraph 3.25.

Note: The dB-value positions of the front-panel xmt level DIP switch are cumulative. Total loss or gain introduced into the 6131A's transmit channel is the sum of those xmt level dB-value switches set to IN.

Non-prescription Receive-level Adjustment

3.25 To adjust the receive level of the 6131A when prescription level settings are not given in the CLR or when the given settings do not provide adequate results, proceed as follows:

1. Arrange the receive portion of a TMS for 900- or 600-ohm terminated measurement, as appropriate, and connect it to the 6131A's 2wire / 4wire RCV OUT jack.
2. Request the distant terminal-side location to send 1004Hz test tone at that location's CLR-specified output level.
3. If the measured receive output level (4wire mode) or 2wire output level is the same as the local CLR-specified receive / 2wire output level, level adjustment is complete, so disconnect the TMS. If the 6131A is optioned for 2wire facility-side interface, proceed to paragraph 3.26. If the 6131A is optioned for 4wire facility interface, alignment is complete. If, however, the measured receive / 2wire level is different from the specified receive / 2wire output level, proceed to step 4 or 5, as appropriate.
4. If the specified receive / 2wire output level is lower than the measured receive / 2wire output level, loss is required. Set the ls position of the front-panel rcv level DIP switch to IN and the gn position to OUT. Then set to IN that combination of rcv level dB-value DIP switches which equals the required amount of loss (see note following step 5). This

amount is the difference between the receive / 2wire output level measured in step 3 and the CLR-specified receive / 2wire output level. If the 6131A is optioned for 2wire facility-side interface, proceed to paragraph 3.26. If not, alignment is complete.

5. If the specified receive / 2wire output level is higher than the measured receive / 2wire output level, gain is required. Ensure that option strap ST1 on the 6131A's printed circuit board (see Figure 3-2) is cut or removed (please note that this is permissible in non-FCC-registered applications only). Then set the ls position of the front-panel rcv level DIP switch to OUT and the gn position to IN. Finally, set to IN that combination of rcv level dB-value DIP switches which equals the required amount of gain (see note below). This amount is the difference between the receive / 2wire output level measured in step 3 and the CLR-specified receive / 2wire output level. If the 6131A is optioned for 2wire facility-side interface, proceed to paragraph 3.26. If not, alignment is complete.

Note: The dB-value positions of the front-panel rcv level DIP switch are cumulative. Total loss or gain introduced into the 6131A's receive channel is the sum of those rcv level dB-value switches set to IN.

Non-prescription Balance-network Alignment and Introduction of NBO Capacitance (2Wire Mode Only)

Determining Transhybrid Loss and Adjusting Internal CBN When User-adjustable Option is Selected

3.26 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 (use of a Tellabs 9801 or 9802 Card Extender, or equivalent, is recommended for this procedure):

1. Terminate the 2wire side of the 6131A. Make sure the front panel LED shows busy and that the 2wire side of the unit is terminated properly.
2. Ensure that the CBN is inserted and properly optioned via the VAR, 600 and 900 positions of the CBN / BOC DIP switch S4 for either 600 ohms in series with 2.15μF, 900 ohms in series with 2.15μF, or a user-adjustable (via potentiometer R38) range of 0 to 2000 ohms in series with 2.15μF. See Table 3-3 or paragraph 3.19 for CBN optioning information.
3. Arrange the transmit portion of the TMS for 1004Hz tone output at the CLR-specified receive input level. (If the transmit portion of the TMS has a separate impedance setting, select 600 ohms.) Connect this signal to the RCV IN jack.
4. Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the XMT OUT jack.
5. If the user-adjustable CBN option is selected, adjust potentiometer R38 on the 6131A's mother board (see Figure 3-2) until the output-level reading on the TMS reaches its lowest point. If either the 600- or 900-ohm CBN option is selected, simply observe the output-level reading on the TMS. Regardless of which CBN option is in effect, 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 DBO capacitors on the 2wire loop. These situations are covered in paragraphs 3.27 through 3.30.

Using a PBN

3.27 If the module's internal CBN does not provide sufficient hybrid balance (transhybrid loss), which is most likely to occur when the module's 2wire port interfaces a long section of non-loaded cable, a PBN can be used to improve hybrid balance. When an external PBN is used, exclude the module's internal CBN from the circuit by setting the VAR, 600, and 900 positions of DIP switch S4 (CBN / BOC) to OUT. If an external PBN is to be used, ensure that it is connected to the 6131A's EXT BAL NET leads (pins 2 and 4). Then align the external PBN as directed in its separate practice.

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

1. Double check that the module's internal CBN is excluded from the circuit (VAR, 600, and 900 positions of DIP switch S4, set to OUT).
2. Refer to Table 3-3 and set to IN that combination of the μF / 1000 positions of DIP switch S4 that 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 3.29 or 3.30, as applicable. Otherwise, disconnect the TMS from the module. At this point, if NBO capacitance is already introduced, alignment of the 6131A is complete. If a card extender was used, unplug both it and the 6131A Module; then plug the module back into its shelf position.

Introducing NBO Capacitance by TMS Measurement When Required Amount is Unknown (CBN and PBN Applications)

3.29 To introduce NBO capacitance to compensate for office 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 (use of a Tellabs 9801 or 9802 Card Extender is recommended for this procedure):

1. 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 (VAR, 600 and 900 positions of the CBN / BOC DIP switch S4).
2. Arrange the transmit portion of the TMS for 2000Hz tone output at the CLR-specified receive input level. (If the transmit portion of the TMS has a separate impedance setting, select 600 ohms.) Connect this signal to the RCV IN jack.
3. Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the XMT OUT jack.
4. Using the five μF / 1000 positions of DIP switch S4 (CBN / BOC) 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 setting of the μF / 1000 positions of S4 that produce the minimum reading). Disconnect the TMS from the module. At this point, alignment of the 6131A is complete. If a card extender was used, unplug both it and the 6131A Module; then plug the module back into the shelf or assembly position.

Introducing NBO Capacitance by Formula When Required Amount is Unknown (Some CBN Applications)

3.30 If the module's internal CBN is being used and an easier method of introducing NBO capacitance (generally, to compensate for office cable capacitance) is desired than achieved in the procedure in paragraph 3.29, 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 3.29 must be performed.

1. From Table 3-4, calculate the required amount of NBO capacitance for the type and length of cable interfacing the module's 2wire port. (For example, if 1.2kft of high-capacitance cable interfaces the module's 2wire port, multiply 1.2kft by 0.016μF per kilofoot to obtain 0.0192μF.)
2. Set to IN that combination of the μF / 1000 positions of DIP switch S4 (CBN / BOC) that most closely approximates the calculated amount of NBO capacitance. (For example, in step 1, you would set positions 4 and 16 to IN to introduce 0.020μF, the closest possible amount to 0.0192μF.) At this point, alignment of the 6131A is complete. If a card extender was used, unplug both it and the 6131A Module; then plug the module back into the shelf or assembly position.

Type of Cable Interfacing 2wire Port	Amount of NBO Capacitance to be Introduced for Each Kilofoot of Cable Between Module and Local Facility-side Equipment
High Capacitance (0.083µF per mile)	0.016µF per kilofoot
Low Capacitance (0.066µF per mile)	0.012µF per kilofoot

Table 3-4 Guidelines for Introducing NBO Capacitance (in Conjunction with CBN) by Formula to Compensate for Facility-side Cable Capacitance

4. Circuit Description

4.1 This circuit description is intended to familiarize you with the 6131A Module for engineering and application purposes only. Attempts to troubleshoot the 6131A internally are not recommended. Troubleshooting procedures should be limited to those prescribed in this practice, Section 7. For help in understanding this circuit description, refer to the Block Diagram in this practice, Section 5.

Power Supply

4.2 The power supply in the 6131A is a series-regulated bipolar supply. A series diode in the negative input lead protects the circuit against reversed input power connections.

Lightning Protection

4.3 Lightning protection is provided at the facility-side transmission port(s) of the 6131A Module.

2Wire Facility Interface

4.4 When the 6131A is switch-optioned for 2wire-to-4wire (facility-to-terminal) operation, a magnetic 2wire-to-4wire (facility-to-terminal) hybrid with switch-selectable 900- or 600-ohm terminating impedance in series with 2.15µF provides the 2wire-side interface.

4.5 An internal CBN associated with the hybrid offers a switch-selectable choice of 900- or 600-ohm impedance in series with 2.15µF or user-adjustable 0 to 2000-ohm impedance (via potentiometer R38) in series with 2.15µF. This CBN can be excluded via switch option if use of an external PBN is preferred. Provision for connecting an external PBN is made at the 6131A's card-edge connector. From 0 to 0.062µF of NBO capacitance, in switch-selectable 0.002µF increments, is available for use either with the 6131A's internal CBN or with an external PBN.

Receive Channel

4.6 The receive-channel input uses a transformer to interface the transmission facility and to derive the receive input tip, ring, and simplex (SX) leads. The secondary winding of the transformer is coupled to the receive attenuator / amplifier. The output of this attenuator / amplifier is coupled to the magnetic hybrid in the 2wire mode or to the 4wire receive output transformer in the 4wire mode. The receive output transformer derives the receive output tip, ring, and SX leads in the 4wire mode.

Transmit Channel

4.7 In the 4wire mode, the transmit-channel input uses a transformer to derive the transmit input tip, ring, and SX leads. The secondary winding of the transmit input transformer is coupled to the transmit attenuator / amplifier. The transmit-channel input in the 2wire mode is from the magnetic 2wire-to-4wire hybrid, which is coupled to the transmit attenuator / amplifier. The output of this attenuator / amplifier is coupled to the transmit output transformer, which derives the transmit output tip, ring, and SX leads.

Signaling Interface

4.8 When the 6131A is in the 4wire facility-side mode (S5 in 4wire) the signaling on the loop-signaling side is available via the simplex (SX) leads. When the 6131A is in the 2wire facility-side mode (S5 in 2wire) the signaling on the loop-signaling side is available via the tip and ring leads.

4.9 The 6131A provides ringing and loop supervision toward a PBX trunk circuit or a local telephone instrument. Incoming E&M signaling (either A-side or B-side, Type I, II, or V, depending upon the associated equipment) is detected by the 6131A's E&M interface circuitry. Option switch S15-A (which selects either normal or inverted E&M inputs) conditions the 6131A to derive the appropriate logic states for control of local ringing, application of ground to the local tip lead, and application of reverse battery to the local loop. Selection of either the loop-start, ground-start, or reverse-battery supervisory mode is made via option switch S12. In the loop-start mode and with normal E&M inputs, an incoming E or M-lead activates the ring-up (RU) relay after a nominal 80ms delay. The RU relay, when activated, applies ringing to the local loop. See Table 2-1 for E&M-lead states for different E&M types.

4.10 When the 6131A is optioned for ground-start supervision, a sensing circuit activates the tip-ground (TG) and RU relays upon receipt of E or M-lead. The TG relay applies ground to the local tip lead. This same input also activates the RU relay, which applies ringing to the local loop. A nominal 80ms delay occurs between the input seizure and local application of tip-lead ground.

4.11 When the 6131A is optioned for reverse-battery supervision, a sensing circuit operating from the input activates the reverse-battery (RB) relay upon receipt of an E or M-lead. The RB relay reverses battery to the local loop. As in the loop-start and ground-start modes, this input also activates the RU relay. A nominal 80ms delay occurs between the input seizure and local application of reverse battery. (Please note that in the foregoing description, the 6131A's A&B loop-signaling leads are interchanged with respect to the tip and ring leads if switch S14 on the 6131A is optioned for the reverse [REV] signaling mode.)

4.12 An integral ringing interrupter can be optioned into the circuit via switch S15-C in the loop-start, reverse-battery, or ground-start mode. This interrupter provides nominal 2-second-on, 4-second-off ringing interruption in response to a continuous E or M-lead input. Continuous ringing is provided in response to a continuous E or M-lead input when the interrupter is optioned out of the circuit.

4.13 Local ring trip is provided via an opto-coupler and associated circuitry in the ring-trip circuit. If the station is answered during the ringing on cycle, the battery-biasing will drop the RU relay and stop ringing the station. If battery-biasing is not present, the station will hear a loud buzz in the phone for the duration of the ring cycle. A battery-biased ring generator must be used in all applications. If ringing is not used, negative battery must be connected to the ringing generator input lead (pin 46).

4.14 At the station or PBX interface port, the 6131A supplies local loop current through an active current limiter and a pair of matched 100-ohm battery-feed resistors. The current limiter limits loop current to a nominal 35mA. A balanced loop-current detector senses loop current and, after a nominal 15ms delay, provides the output signal level (busy state) indicated in Table 2-1, depending upon the settings of option switches S15-B and S11. Table 2-1 also includes the idle-state and busy-state signal levels for the various signaling output option-switch settings.

4.15 An integral minimum-break pulse corrector can be optioned into the loop-to-E&M path via switch S15-E. This pulse corrector outputs pulses with a nominal 50ms break for input breaks from 20 to 50ms.

4.16 Transmission through the 6131A is attenuated by 50dB unless loop current is being drawn and the front panel LED is on.

5. Block Diagrams

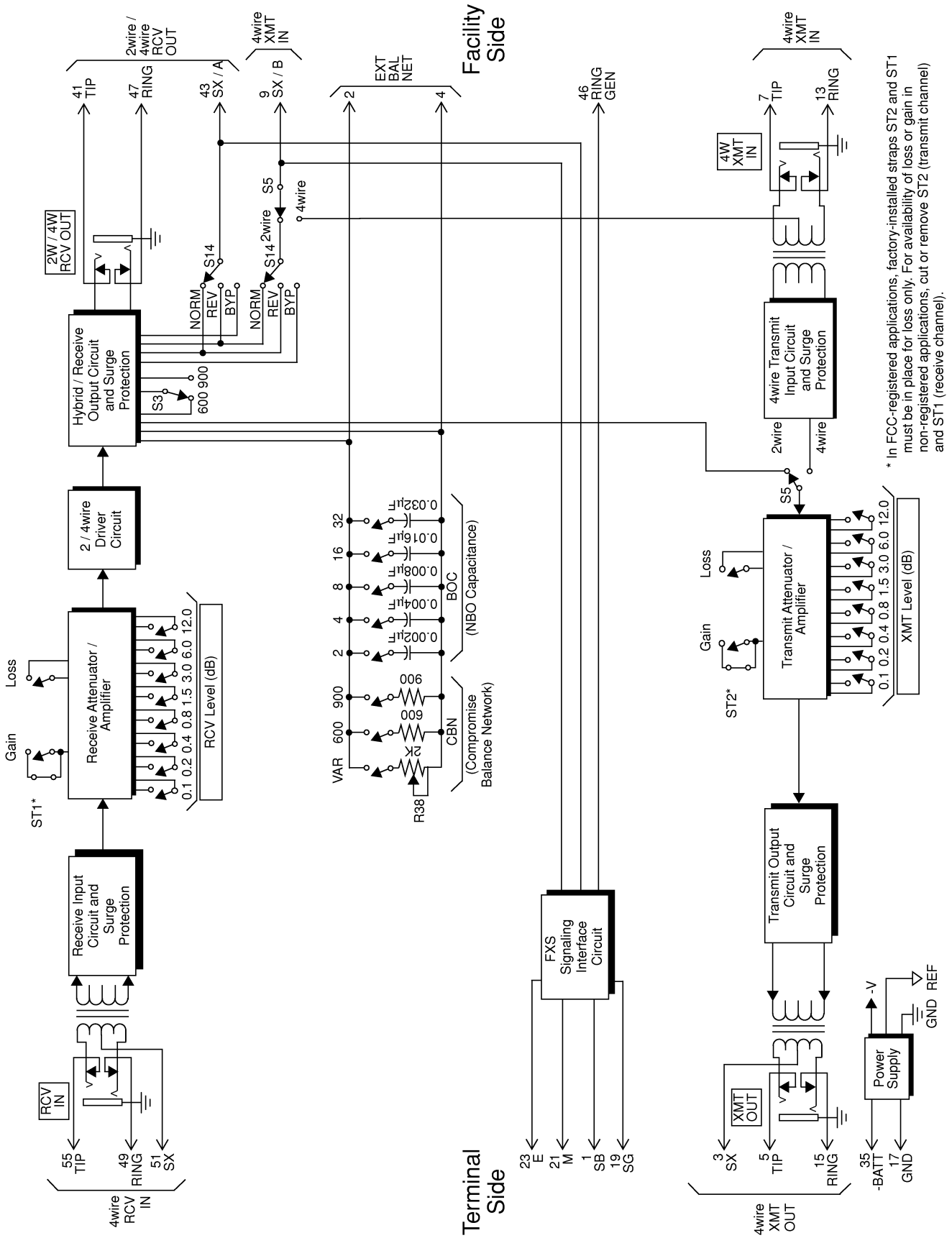


Figure 5-1 Mother Board (Transmission) Block Diagram

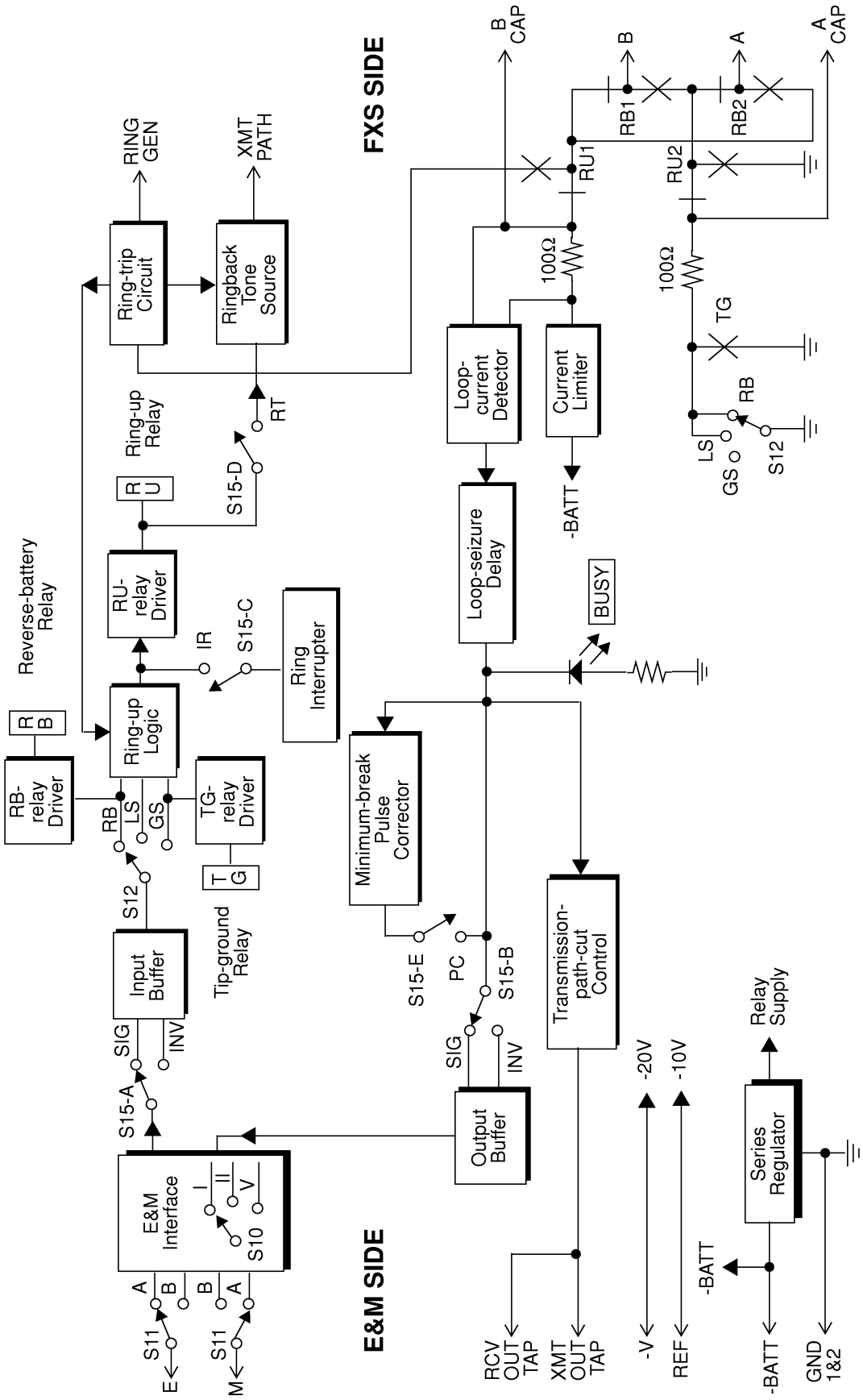


Figure 5-2 Baby Board (FXS Signaling Interface Circuit) Block Diagram

6. Specifications

Transmission

Attenuation Range (transmit and receive)	• 0 to 24dB of loss in switch-selectable 0.1dB increments (0 to 24dB of gain in switch-selectable 0.1dB increments also available via strap removal in non-FCC-registered applications only)
Maximum 2wire Input and Output Levels (2wire mode)	• +8dBm at 600 ohms / 900 ohms
Maximum 4wire Input and Output Levels (any 4wire port)	• +8dBm transmit channel • +5dBm receive channel
Frequency Response at 600 ohms (re 1000Hz)	• Receive path, 2wire facility interface: 300 to 1000Hz: -2.2, +0.2dB 1000 to 4000Hz: -1.0, +1.0dB • Receive path, 4wire facility interface: 300 to 1000Hz: -0.8, +0.1dB 1000 to 4000Hz: -0.8, +0.5dB • Transmit path, 2wire facility interface: 300 to 1000Hz: -2.2, +0.2dB 1000 to 4000Hz: -1.0, +1.0dB • Transmit path, 4wire facility interface: 300 to 1000Hz: -0.8, +0.1dB 1000 to 4000Hz: -0.5, +0.5dB
4wire-port Terminating Impedances (any 4wire port)	• 600 ohms, balanced
2wire-port Terminating Impedance	• Switch-selectable 900 or 600 ohms in series with 2.15µF, balanced
2wire DC Current Capability	• 40mA maximum with no significant performance degradation
2wire DC Resistance (with A&B leads shorted)	• 50 ohms nominal
Insertion Loss	• ±0.3dB at 600 ohms
Total Harmonic Distortion	• Less than 1% at maximum output level, 300 to 4000Hz
Crosstalk Loss Between Units in Adjacent Shelf Slots	• 80dB minimum, 200 to 3000Hz
Channel-to-channel Crosstalk Loss (4wire mode)	• 75dB minimum, 200 to 3000Hz
4wire-port Echo Return Loss (any 4wire port)	• 20dB minimum vs. 600 ohms
2wire Echo Return Loss (2wire mode)	• 22dB ERL minimum vs. 600 or 900 ohms in series with a 2.15µF
Noise	• 5dBrnC maximum at 0dB loss • 17dBrnC maximum at 24dB of gain (receive) • 22dBrnC maximum at 24dB of gain (transmit)
Peak-to-average Ratio (P / AR)	• Greater than 98
Transhybrid Loss	• 28dB ERL minimum
Compromise Balance Network	• Switch-selectable for 600 ohms, 900 ohms, or a user-adjustable range of 0 to 2000 ohms, all in series with 2.15µF; excludable via switch option for external PBN use
Network Build-out (NBO) Capacitance	• 0 to 0.062µF in switch-selectable 0.002µF increments
Longitudinal Balance	• 4wire: 60dB minimum, 200 to 1000Hz; 50dB minimum, 4000Hz • 2wire: 60dB minimum, 200 to 1000Hz; 50dB minimum, 4000Hz

Signaling

External E&M-lead Resistance	• 500 ohms maximum
Ringing Frequency and Voltage Ranges	• 16 to 67Hz, 80 to 130Vrms
Ring-trip Range	• 2500 ohms maximum with -48Vdc battery • 1200 ohms maximum with -24Vdc battery
Pre-trip Margin	• Will not pre-trip with up to 8µF load
Ring-up Delay	• 50 to 90ms
Ring-release Delay	• 50 to 90ms
Ringing Interrupter	• 2 seconds ringing, 4 seconds silent, nominal, excludable via switch option for continuous ringing
Tip-ground Seizure Delay	• 50 to 90ms
Tip-ground Release Delay	• 50 to 90ms
Reverse-battery Seizure Delay	• 50 to 90ms
Reverse-battery Release Delay	• 50 to 90ms
Loop-to-E&M Delay	• 25±5ms
Loop-sensing Range	• 2500 ohms maximum with -48Vdc battery • 1200 ohms maximum with -24Vdc battery
Dial-pulsing Rate	• 7.5 to 12.5pps
Dial-pulse Distortion	• Maximum 3.0% distortion for input breaks longer than 50ms
Loop-to-E&M Dial-pulse Correction	• Minimum-break, with minimum break duration of 50±2ms, excludable via switch option
Transmission-path-cut Control	• 50dB attenuation minimum
Ringback Tone Level	• -12.5dBm±4.5dB
Input Power Requirements	• Voltage: -22 to -56Vdc, filtered, earth-ground-referenced • Current: 70mA maximum, not including loop current

Environmental

Operating Environment	• 32° to 130°F (0° to 54°C), humidity to 95% (no condensation)

Physical

Dimensions	• 5.58 inches (14.17cm) high • 1.42 inches (3.16cm) wide • 5.96 inches (15.14cm) deep
Weight	• 14.5 ounces (410.35 grams)
Mounting	• Relay rack or apparatus case via one position of a Tellabs Type-10 Mounting Shelf

7. Troubleshooting, Technical Assistance, Repair and Return

7.1 This section will assist in the installation, testing, or troubleshooting of the 6131A and will aid in the localization of trouble to this specific equipment. If the equipment seems to be defective, substitute new equipment (if possible) and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement (see paragraph 7.3). We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment; unauthorized testing or repairs may void its warranty.

Trouble Condition	Possible Causes
Module completely inoperative	• No input power or improper supply voltage. • Improper wiring. • Card not fully seated in card edge connector. • Improperly set option switches (check S14, S12, and S5). • If ground-start mode is selected (S12 to GS) verify orientation of tip and ring.
Station not ringing	• Ringing generator not connected, not functioning properly, or not battery-biased. • Improperly set option switches (check S5, S11 and S10). • Station not connected properly. • Internal ringing interrupter enabled (S15-C set to ON).
Station ringing constantly	• Improperly set option switches (check S15-A, S15-B, S10, and S11). • E or M lead held busy by connecting E&M equipment. Disconnect E&M leads and retest.
Improper E&M signaling states	• Improperly set option switches (check S10, S11, S15-A, and S15-B). • Verify orientation of E&M leads (E connected to E and M connected to M). • No common ground between E&M device and 6131A.
No transmission through module	• Module must be busy (front panel LED on) to pass transmission. • 2wire / 4wire option selection switch set wrong (S5).
No ring trip at the station	• Ringing generator not battery biased.
Station will only ring momentarily	• The 6131A can only handle five high impedance ringers connected to its station port. Disconnect extra stations and retest. • Low on-hook resistance phone. Replace phone and retest.

Table 7-1 Troubleshooting Guide for Baby Board

Technical Assistance

7.2 Contact Tellabs Technical Assistance as follows:

Location	Telephone	FAX
Tellabs International, Inc., Sucursal Buenos Aires, **Argentina**	+541.393.0764, .0892, or .0835	+541.393.0732
Tellabs Pty Ltd., Milsons Point NSW, Sydney, **Australia**	+61.2.9966.1043	+61.2.9966.1038
Tellabs Comm. Canada Ltd., Mississauga, Ontario, **Canada**	905/858-2058	905/858-0418
Tellabs International, Inc., Beijing, **China**	+86.10.501.1873	+86.10.501.1871
Tellabs International, Santa Fe de Bogota, **Colombia**	+571.623.3162 or .3216	+571.623.3047
Tellabs International, Inc., **Dubai, U.A.E.**	+971.4.373250	+971.4.376526
Tellabs U.K. Ltd., Bucks, **England**	+44.1494.555800	+44.1494.555801
Martis Oy, Espoo, **Finland**	+358.0.502.771	+358.0.502.7815
Tellabs SAS, **France**	+33.1.345.20838	+33.1.309.60170
Tellabs GmbH, Munich, **Germany**	+49.89.54.90.05.+ext. or 0 (switchboard)	+49.89.54.90.05.44
Tellabs H.K. Ltd., **Hong Kong**	+852.2866.2983	+852.2866.2965
Tellabs GmbH Rep. Office, Budapest, **Hungary**	+36.1.2681220	+36.1.2681222
Tellabs International, Inc., Bangalore, **India**	+91.80.6610826	+91.80.6615908
Tellabs, Ltd., County Clare, **Ireland**	+353.61.471433	+353.61.471000/472004
Tellabs de **Mexico**	525.282.1107, .1432, .1050, or .0981	525.282.0218
Tellabs Singapore Pte, Ltd., **Singapore**	+65.736.2855	+65.736.1231
Tellabs South Africa, **Republic of South Africa**	+27.12.665.0034	+27.12.665.0084
Tellabs International, Inc., Seoul, **South Korea**	+82.2.589.0667 or .0668	+82.2.589.0669
Tellabs Southern Europe s.a., Barcelona, **Spain**	+34.3.414.70.16	+34.3.414.69.25
Tellabs AB, Stockholm, **Sweden**	+46.8.678.4040	+46.8.678.4041
Tellabs International, Inc., Bangkok, **Thailand**	+662.262.9065	+662.661.1141
USA and **Puerto Rico**	(800) 443-5555*	708/512-7097
*All other **Caribbean** and **South American** locations, or if the toll-free number is busy, telephone 708/969-8800		

Repair and Return

7.3 If equipment needs repair, contact Tellabs' Product Services Department with the equipment's model and issue numbers and warranty date code. You will be issued a Material Return Authorization (MRA) number and instructions on how and where to return the equipment.

Location	Telephone	FAX
Martis Oy, Espoo, **Finland**	+358.0.502.771	+358.0.502.7815
Tellabs Comm. Canada Ltd., Mississauga, Ontario, **Canada**	905/858-2058	905/858-0418
Tellabs, Ltd., County Clare, **Ireland**	+353.61.471433	+353.61.471000/472004
Tellabs Operations, Inc., **Lisle, IL USA**	(800) 443-5555 (USA and Puerto Rico only) 708/969-8800 (other International)	708/512-7097 (both)

7.4 Repair service includes an attempt to remove any permanent markings made by customers on Tellabs equipment. If equipment must be marked, it should be done with non-permanent materials and in a manner consistent with the correct handling of electrostatically sensitive devices.

8. FCC Registration Information

8.1 The Federal Communications Commission (FCC) has established through Part 68 of its Rules and Regulations that FCC-registered terminal equipment may be directly connected to the telephone network through standard plugs and jacks. This section documents the customer's responsibility to the telephone company when the Tellabs 6131A Module is connected to Central Office (CO) and Off-premises-station (OPS) lines.

Connection Arrangement

8.2 FCC-registered terminal equipment may not be connected to coin lines or party lines.

8.3 Customers directly connecting this equipment to the telephone network shall, before connection, give notice to the telephone company of the particular CO / OPS lines to which such connection is to be made. In off-premises applications, the OPS class for which the equipment is registered shall be observed. The customer shall give notice upon final disconnection. In addition, the telephone company shall be provided the following information:

- For each line, the FCC registration numbers for all equipment dedicated to that line, the largest ringer equivalence number (REN) to be presented to that line, and any information required for the compatible operation of this equipment with telephone company communications facilities
- The quantities and Universal Service Order Code (USOC) numbers of the required standard jacks
- For each jack, the sequence in which lines are to be connected, the technical description codes by position, and the service codes by position

FCC Requirement on CPCS

8.4 Customer-provided Communications Systems (CPCSs), such as private microwave systems and analog / digital cable facilities, may be connected to the telephone network to provide Wide Area Telephone Service (WATS), Long Distance Message Telecommunications Service (LDMTS), and private-line services by regulations established under Tariffs 259, 263, and 260, respectively. An alternative within these tariffs has been established to allow CPCSs to be connected to the network through registered protective circuitry that provides hardware protection for all requirements of Part 68 of the FCC Rules and Regulations except signal-power limitation. With this alternative, signal-power limitation is accomplished from a CPCS at the network interface by means of new institutional procedures. These procedures include supplying to the telephone company all of the information in paragraphs 8.3 and, in addition, filing an affidavit that attests to the customer's willingness and ability to comply with the signal-power levels set forth in the appropriate tariffs.

Note: The affidavit requirement noted in paragraph 8.4 applies only to CPCSs. Exhibit 1 is a sample affidavit. See paragraphs 8.5 through 8.11 for this affidavit procedure.

Affidavit Procedure

8.5 Part 68 of the FCC Rules and Regulations requires that a CPCS's overall gain be unity gain for live transmission. Signals other than live voice transmission and network control signaling must be less than -9dBm entering the switched network interface and less than -13dBm entering an OPS interface. The customer assures compliance with these restrictions with an affidavit.

8.6 A customer who wishes to connect a CPCS to the telecommunications network and who chooses to use the institutional procedures for control of signal power may do so by submitting an affidavit to the telephone company where the network connection is to be made. The customer attests in the affidavit, in accordance with the appropriate tariff, that the communi-

cations system will be operated only by trained individuals and that the signal power at the interface with telephone company services will not exceed signal-power limitations set forth in Part 68.

8.7 The affidavit is to be notarized and filed at least 10 days before the initial connection of the communications system to the telecommunications network. After the telephone company receives the affidavit and is satisfied that it meets all the tariff requirements, the affidavit is assigned an Affidavit Identification Number (AIN) valid for one year. The AIN covers all connections at the network access points for a period of one year. After an AIN is provided, additional affidavits are not required for additional network connections of communications system(s) at the location(s) covered by the original AIN. When requesting additions, the customer may provide the existing, valid AIN to the telephone company to comply with the tariffs. Reference to the existing AIN may be oral. If the customer requires a network connection of a communications system at a location not covered by the previous affidavit, the new information must be filed in the form of an amended affidavit that updates the information in the initial affidavit.

8.8 A copy of the affidavit is to be maintained at the customer's premises where the network connections are made. This requirement may be satisfied by posting a label on the premises within sight of the network interface rather than by posting a copy of the affidavit. Under either of these options, the telephone company can verify affidavit accuracy, if necessary.

8.9 The tariffs specifying the institutional procedures for signal-power control require the following specific information in filing the affidavit: full name, business address, business telephone number, and signature of customer or authorized representative.

8.10 The affidavit must be filed either by the customer who wishes to connect a CPCS to the telecommunications network or by the customer's authorized representative who has responsibility for the operation and maintenance of the CPCS.

8.11 A separate affidavit must be submitted to each telephone company in whose territory the CPCS will be connected to the telecommunications network. If telephone companies operate in more than one state, a complete affidavit must be filed with the company in each state where CPCSs will be connected to the telecommunications network. It is important to emphasize that the affidavit must be submitted only in those territories where CPCSs will be connected to the telecommunications network. A customer, therefore, with a communications system from New York City to Chicago who will connect to the telecommunications network only in New York City and Chicago will file only two affidavits, even though the system passes through several states.

Installation Requirements

8.12 The Tellabs 6131A Module is considered a wiring-protected (WP) system. As such, all premises wiring is considered fully protected. A 6131A Module is typically connected to the LDMTS / WATS or OPS interface by a cable less than 25 feet in length and terminated in a USOC RJ2DX or RJ21X plug. Cables do not require registration and may be purchased from Tellabs or another manufacturer. The only requirements for cables are that they meet the industry-standard 1000Vac dielectric rating and that those cables deriving the network interface be terminated in USOC RJ2DX or RJ21X plugs.

Incidence of Harm

8.13 If the registered equipment causes harm to the telephone network, the telephone company shall, where practicable, notify the customer that a temporary discontinuance of service may be required. Where prior notice is not practical, however, the telephone company may temporarily discontinue service if such action is reasonable under the circumstances. If the telephone company temporarily discontinues service, the customer must be promptly notified. The customer must also be provided with an opportunity to correct the problem that caused the discontinuance and be informed of the right to bring a complaint to the FCC.

8.14 When trouble is experienced, the customer shall disconnect the registered equipment from the telephone line to determine if the registered equipment is malfunctioning. If the equipment is malfunctioning, its use shall be discontinued until the problem is corrected. No repair work (other than those routine troubleshooting procedures prescribed in this practice) is authorized to be performed by the user. Part 68 of the FCC Rules and Regulations prescribes all repairs of registered equipment to be made by the manufacturer or an authorized agent of that manufacturer.

8.15 The telephone company may make changes to its communications facilities, equipment, operations, or procedures when reasonably required in the operation of its business and not inconsistent with the rules and regulations of Part 68. If such changes can be reasonably expected to render any customer's terminal equipment incompatible with telephone company communications facilities, to require modification or alteration of such terminal equipment, or to otherwise materially affect its use or performance, the customer shall be given adequate notice, in writing, so that the customer has an opportunity to maintain uninterrupted service.

MTS / WATS Interface	REN	Number of Leads	USOC	Required Baby Board Option Switch Settings					Required Mother Board Option Switch Settings	
				S12	S15-A*	S15-B*	S15-D	S11**	S5	S14
2wire DID	0.0B	2	RJ2GX or RJ2DX	RB	INV*	SIG* (normal)	OFF	A or B**	2WIRE	REV
4wire DID	0.0B	4	RJ2GX or RJ2DX	RB	INV*	SIG* (normal)	OFF	A or B**	4WIRE	REV

* Depending on the requirements of the specific application, S15-A and S15-B (which select normal or inverted E&M inputs and outputs, respectively) may be set differently than indicated in this table.

** Select A-side signaling when the 6131A needs to provide E-lead outputs and receive M-lead inputs. Select B-side signaling when the 6131A needs to provide M-lead outputs and receive E-lead inputs.

Table 8-1 FCC Registration Information

Private-line Registered Facility Interface Code	Service Code	Number of Leads	USOC	Required Baby Board Option Switch Settings					Required Mother Board Option Switch Settings	
				S12	S15-A	S15-B	S15-D	S11*	S5	S14
OL13A	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM
OL13A	9.0F or 7.0Z	2	RJ2GX or RJ2DX	GS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM
OL13B	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM
OL13B	9.0F or 7.0Z	2	RJ2GX or RJ2DX	GS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM
OL13C	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM

Continued on Next Page

Table 8-2 FCC Registration Information

Private-line Registered Facility Interface Code	Service Code	Number of Leads	USOC	Required Baby Board Option Switch Settings					Required Mother Board Option Switch Settings	
				S12	S15-A	S15-B	S15-D	S11*	S5	S14
OL13C	9.0F or 7.0Z	2	RJ2GX or RJ2DX	GS	SIG**	SIG**	OFF	A or B*	2WIRE	NORM
OL13A	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	RT	A or B*	2WIRE	NORM
OL13B	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	RT	A or B*	2WIRE	NORM
OL13C	9.0F or 7.0Z	2	RJ2GX or RJ2DX	LS	SIG**	SIG**	RT	A or B*	2WIRE	NORM

* See second footnote in FCC registration Table 8-1 for information on A-side and B-side optioning.

** The SIG settings provides normal inputs (S15-A) and outputs (S15-B).

Table 8-2 FCC Registration Information

AFFIDAVIT FOR THE CONNECTION OF CUSTOMER-PROVIDED COMMUNICATIONS SYSTEMS NOT SUBJECT TO PART 68 OF THE FCC RULES AND REGULATIONS

For work to be performed in the certified territory of _____
(Telco's Name and State)

State of _____ County of _____

I, _____, _____
(Name) (Business Address) (Telephone Number)

representing _____, a customer located at _____
(Name of Customer) (Address)

_____ being duly sworn, state:
(Telephone Number)

1. I have responsibility for the operation and maintenance of the customer-provided communications system(s) not subject to Part 68 of the FCC Rules and Regulations which is (are) to be connected to the telecommunications network as indicated in paragraph (3.) below.

2. The said communications system(s) will be connected through FCC registered or grandfathered terminal equipment, systems, or protective circuitry which assures that all of the requirements of part 68 of the FCC Rules and Regulations, with the sole exception of excessive signal power, are met at the telecommunications network interface.

3. The telephone line(s) to which the equipment in (2.) above will be connected to, or arranged for connection to, is (are):

_____ _____ _____ _____ _____
_____ _____ _____ _____ _____
_____ _____ _____ _____ _____
_____ _____ _____ _____ _____
_____ _____ _____ _____ _____

4. I attest that all operations associated with the establishment, maintenance and adjustment of the said communications system(s) will be made so that the signal power (within the frequency range of 200-4000 Hertz) at the telecommunications network interface continuously complies with Part 68 of the FCC Rules and Regulations.

5. I attest that the operator(s) / maintainer(s) of the said communications system(s) responsible for the establishment, maintenance, and adjustment of the voice frequency signal power present at the telecommunications network interface has (have) been trained to perform these functions by successfully completing one of the following: (Check appropriate one(s))

a. A training course provided by the manufacturer of the equipment used to control voice frequency signal power; or
b. A training course provided by the customer or authorized representative, who has responsibility for the entire communications system, using training materials and instructions provided by the manufacturer of the equipment used to control the voice frequency signal power; or
c. An independent training course (e.g., trade school or technical institution) recognized by the manufacturer of the equipment used to control the voice frequency signal power; or
d. In lieu of the preceding training requirements, the operator(s) / maintainer(s) is (are) under the control of a supervisor trained in accordance with a b c above.
(circle one)

6. I agree to provide _____ with proper documentation to demonstrate compliance with the information as provided in paragraph (5.) preceding, if so requested.

Subscribed and Sworn to before me
this_____day of _____, 19___.

_____
NOTARY PUBLIC
My commission expires:_____

_____
(Signature)

_____
(Title)

_____
(Date)