Tellabs
technical manual
76-816106
rev B

practice section 816106

6106 Signaling Converter Data ARD module

contents

1. general description

1.01 The 6106 Signaling Converter Data ARD (ringdown) module (figure 1) provides conversion between E and M signaling derived from a companion SF or DX Signaling module and a special form of automatic ringdown signaling associated primarily with data ringdown terminations. The 6106 is commonly used in combination with a Tellabs 6101 SF Transceiver module to provide a two-module sf ringdown signaling system compatible with established criteria for F-type inband signaling. A Tellabs DX Signaling module (6001 or 6002) may also be paired with the 6106 to provide a ringdown arrangement with dx signaling over the facility. In addition, the 6106 may directly interface a carrier-derived E and M signaling facility.

1.02 When used in combination with a 6101 SF Transceiver, the 6106 provides conversion of E-lead signals (derived by the 6101 from incoming sf tone states) to ringing signals toward the local termination. The 6106 also converts local call origination signals from the local termination to M-lead inputs to the transmit section of the 6101 SF Transceiver. When used in dx applications, the 6106 interfaces the DX Signaling module (6001, 6002, or equivalent) in the same manner.

1.03 Within the framework of a universal wiring scheme, such as that employed in Tellabs' Type 261 Signaling and Terminating System, the 6106 is interchangeable with other Tellabs Signaling Converter modules. This permits the System to be adapted to other terminal modes (i.e., foreign exchange or E and M) by the substitution of Signaling Converter modules.

1.04 In sf applications, the 6106 controls (but does not perform) precut, cut-and-terminate, and sf signaling tone generation functions. These functions are performed by circuitry integral to the 6101 SF Transceiver module.

1.05 Unlike conventional Signaling Converter Ringdown modules (e.g., Tellabs' 6105), the 6106, in conjunction with a 6101 SF Transceiver, provides automatic ringdown with **tone on during idle** in both directions of transmission. Removal of tone causes station ringing to occur. An integral ringing interrupter in the 6106 provides conventional 2-second-on/4-second-off ringing from an external, noninterrupted ringing supply.

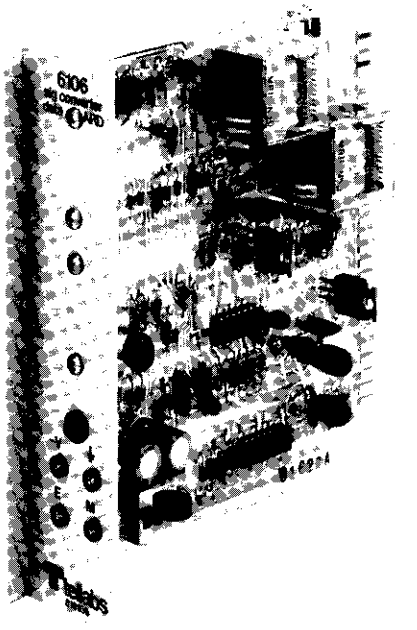


figure 1. 6106 Signaling Converter Data ARD (Ringdown) module

1.06 Because the 6106 uses the same tone-on-during-idle signaling format (when paired with a 6101) as conventional E and M sf signaling, traffic monitoring can be accommodated. Also, tone-on-during-idle operation provides station ringing at both ends of the circuit in response to a failure of the facility. Thus, the 6106 is ideal for use in high-security or high-priority circuits where immediate indication of such a failure is vital.

1.07 A data disable lead is provided in the 6106 for use when an associated Tellabs 4414 Alternate Voice/Data (AVD) Amplifier module is used in place of a conventional Line Amplifier. This disable lead prevents the 6106 from initiating ringing toward the station when the 4414 is conditioned for the data mode.

1.08 Other features of the 6106 Signaling Converter module include switchable loop start/ground start operation; switch selection of superimposed or grounded ringing generator biasing; ringback indication to the originating station during ringing intervals; leads to accommodate a visual indication of incoming seizure or to start a local ringing generator; either A-and-B-lead or tip, ring, A, and B-lead connection to associated station-side equipment; and a balanced loop-sensing circuit to allow operation in the presence of large longitudinal voltages.

1.09 Internal voltage regulation permits operation on −22 to −56Vdc input. B-lead (talk battery) power is derived prior to regulation to allow operation with conventional B-lead potentials.

1.10 The front panel provides battery, ground, E-lead and M-lead test points and a busy lamp.

1.11 The 6106 mounts in one position of the Tellabs Type 10 Shelf, variations of which provide for relay rack or KTU apparatus case installation. In relay rack applications, up to 12 modules mount across a 19 inch rack, and up to 14 modules mount across a 23 inch rack. In either case, 6 inches of vertical rack space is utilized.

2. application

2.01 The 6106 Signaling Converter Data ARD (Ringdown) module is normally used to interface a Tellabs 6101 SF Signaling Transceiver module with a special form of automatic ringdown signaling associated primarily with data ringdown terminations. The 6101 and 6106, in combination, meet all F-type SF signaling specifications. (Paragraph 1.02 briefly explains the interaction of these two modules.) In less common applications, the 6106 may also be used in the same capacity with a Tellabs 6001 or 6002 DX1/DX2 Signaling module or to provide a local ringdown termination through direct interface with the E and M signaling leads of a carrier-derived voice-frequency circuit.

sf applications

2.02 Non-standard sf states are utilized by the 6106 and 6101 to provide the "special ringdown" service. Low-level* tone is transmitted during idle in both the transmit and receive directions of sf signaling. Outgoing tone is removed to initiate ringing at the distant end. Cessation of incoming tone indicates a distant-end off-hook seizure, which causes local ringing to occur. When the local end is seized in response to ringing, outgoing sf tone ceases, allowing normal transmission to being. (In standard ringdown circuits, such as those employing Tellabs 6101 and 6105 modules, tone is off during idle and is transmitted only to initiate a call.)

***Note:** *The 6101 operates with standard sf tone levels. Input to the receive port of the 6101 is −13dBm during tone-on conditions. An augmented level of −1dBm is received for approximately 400ms each time tone is applied at the distant end of the facility. Transmit tone level is −36dBm, except for an augmented tone level of −24dBm during the first 400ms of any tone transmission interval. These levels are consistent with standard interface levels of +7dB receive and −16dB transmit.*

2.03 Tone-on-during-idle ringdown signaling has one unique advantage: station ringing at both ends of the circuit will occur in response to a failure of the facility. This makes the 6106 ideal for use in high-priority voice or data circuits where immediate indication of such failure is vital.

2.04 The tone-on-during-idle signaling format also allows the 6106 to be used in traffic monitoring applications, much as a conventional E and M SF signaling unit.

Note: *Although the sf tone states of the 6106 are nonstandard, the module operates from conventional E and M-lead states (see table 1).*

lead	lead state	circuit state	sf tone state
E lead	open (−21Vdc*)	idle	sf on
	ground (0Vdc)	signaling and talk	sf off
M lead	ground (0Vdc)	idle	sf on
	battery (power input Vdc)	signaling and talk	sf off
*Measured between **E** and **ground** front-panel test points.			

table 1. E and M-lead and sf tone states of 6106

2.05 When the 6106 is used with a companion 6101 SF Transceiver in sf applications, the transmit path is cut and terminated in both directions during idle and ringing intervals. The cut-and-terminate function is controlled by the 6106 but performed by circuitry integral to the 6101. The 6101/6106 combination provides transmission of audible ringback tone to the call-originating location during ringing intervals at the opposite end of the circuit. (In dx applications, station ringing energy coupled through the A and B leads provides ringback tone.)

dx applications

2.06 As mentioned earlier, the 6106 Signaling Converter module can also be used to interface dx signaling units with the ringdown mode of signaling at a termination. Both 4wire and 2wire dx facilities may be served. The 6106 may be paired with a Tellabs 6001 DX Signaling module for use on a 4wire facility, or with a 6002 DX Signaling module (with integral repeat coil) for use on a 2wire facility. In 4wire dx applications, a facility terminating module, such as a 4001 Line Amplifier or a 4414 AVD Amplifier module, must be used to derive transmit and receive simplex leads used as inputs from the facility to the 6001 DX Signaling module. In 2wire applications, a repeat coil is integral to the 6002 DX module, and no external facility interface module is required (see figure 2D). Refer to the 6001/6002 Practice for additional information on Tellabs dx units.

facility and terminal interfaces

2.07 On its "terminal side", the 6106 normally interfaces a station loop or PBX trunk through a terminating module. The "facility side" of the 6106 normally faces (through the sf or dx signaling module or carrier channel) another tone-on-during-idle ringdown signaling system at the distant end of a 2wire or 4wire voice-frequency transmission facility. (An exception to this, in which the "facility side" of the 6106 faces a switching system, is covered in paragraph 2.08.) With associated terminating modules, either 2wire or 4wire terminal-side loops or 2wire or 4wire facilities may be served by the 6106. In 2wire terminal-side applications involving a 4wire facility, a 4203 Terminating Set with A and B-lead inductor is required. In applications involving a 4wire facility and a 4wire terminal-side loop, a Tellabs 4405 4Wire Station Termination module is used in conjunction with the 6106 to provide transmitter current, sidetone amplification and transformer coupling to the 4wire instrument. The four circuits depicted in figure 2 illustrate common applications. Note that, in

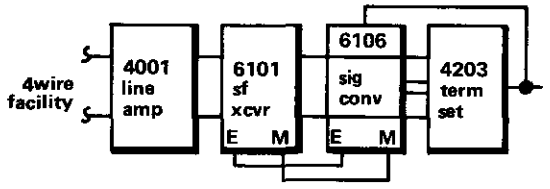


figure 2A. Typical sf application, 4wire-to-2wire

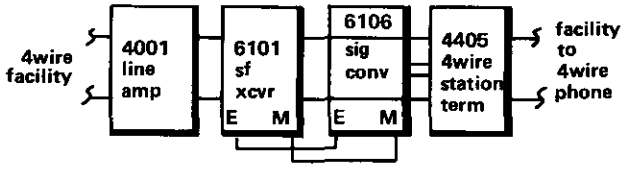


figure 2B. Typical sf application, 4wire-to-4wire

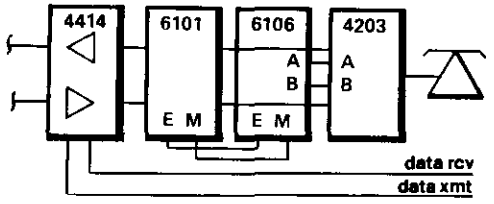


figure 2C. Special automatic ringdown application, 4wire-to-2wire, sf, AVD

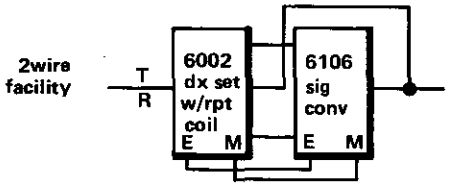


figure 2D. Typical dx application, 2wire-to-2wire

addition to associated signaling and terminating modules, a Line Amplifier or Alternate Voice/Data (AVD) Amplifier is normally used in conjunction with the 6106 to establish transmission levels when a 4wire facility is involved. When Tellabs' 4414 AVD Amplifier is used with the 6106, a data disable lead in the 6106 prevents the 6106 from initiating ringing toward the station when the 4414 is optioned for the data mode.

one-way ringdown

2.08 Although the 6106 is normally used in two-way automatic ringdown applications (in which a 6106 and an associated SF or DX Signaling module are used at both ends of the circuit), it may also be used in the special one-way ringdown applications depicted in figure 3. These applications require multifrequency (MF) or dual tone multifrequency (DTMF) pulsing in the outgoing (from the station end) direction and ringdown operation in the incoming (toward the station end) direction. Applications of this type are usually found in multipoint, dial-accessed data systems. The interface equipment at the switching end usually consists of conventional E and M signaling converters and sf signaling modules (such as Tellabs' 6102 and 6101, respectively).

loop start/ground start operation

2.09 The 6106 may be optioned, via slide switch, to operate in either loop start or ground start applications. When optioned for ground start operation, the 6106 opens the A-lead path to ground when the circuit is idle. Upon receipt of incoming seizure (E-lead open), the A-lead connection to ground is made and is maintained during ringing and when the local station is off-hook. Outgoing seizure in ground start applications is initiated by application of ground to the station ring conductor (2wire station termination) or to either lead of the station transmit pair (4wire station termination). Local A-lead ground will then persist as long as the local station remains off-hook.

power, ringing and range

2.10 While all internal 6106 circuitry receives power through a regulator that allows the module to operate on an input range of −22 to −56Vdc, B-lead and M-lead potentials are derived directly from the external power source. Loop sensing limits are, therefore, dependent upon the external source. Loop sensing circuitry in the 6106 will operate to 3000 ohms at 48Vdc and to 1200 ohms at 24Vdc. Loop limits (cable + station instrument) for 23mA loop current are 650 ohms at 24Vdc and 1600 ohms at 48Vdc B-lead potential. In applications involving a short loop between the 6106 and local station, 24Vdc operation is recommended. Facility-side range is determined by the capabilities of the associated signaling unit.

2.11 Talking current is provided to the local station through the 6106. To prevent excessive circuit noise, it is important that the power source for the 6106 be free from excessive ripple and transients.

2.12 To accommodate local ring trip during the ringing interval, some type of dc ringing bias must

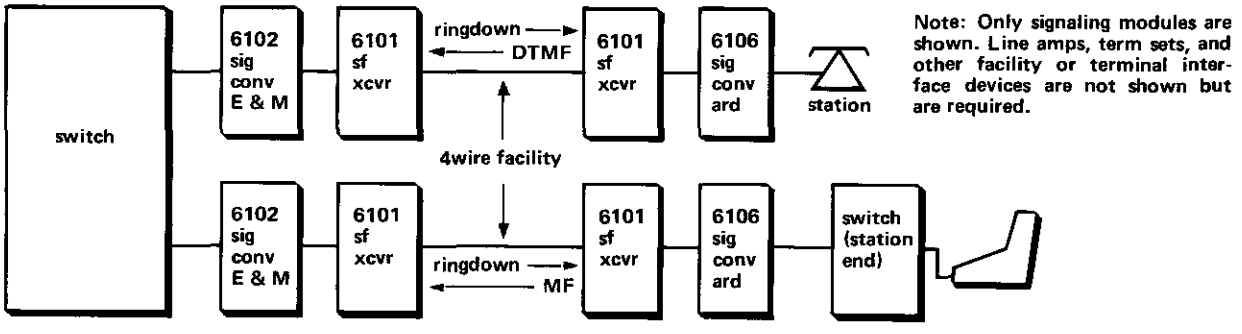


figure 3. Special one-way ringdown applications of 6106

be provided. Either negative or positive superimposed ringing or grounded ringing may be employed to this end. (In grounded ringing applications, an external dc bias must be provided between the dc ringing bias lead (pin 1) of the 6106 ring generator ground. In superimposed ringing applications, the ringing source is connected to an external dc potential.) Switch *S2* on the 6106 options the module for superimposed or grounded ringing applications (see paragraph 3.08).

2.13 A spare set of contacts on the ring-up (RU) relay is available on connector pins 11, 13 and 15. These contacts may be used to provide visual indication of incoming seizure or to start a local ringing generator.

3. installation

inspection

3.01 The 6106 Signaling Converter ARD (special ringdown) module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

mounting

3.02 The 6106 mounts in one position of the Tellabs Type 10 Shelf, which is available in configurations for both relay rack and apparatus case installation. Each module plugs physically and electrically into a 56-pin connector at the rear of the Type 10 Shelf.

installer connections

3.03 Before making any connections to the Mounting Shelf, make sure that power is **off** and modules are **removed**. The 6106 module should be plugged into place only **after** wiring has been completed and **after** the module is properly optioned.

3.04 Tables 2, 3, and 4 list specific connections to the 6106 Signaling Converter in each of its three basic modes of application: 4wire sf or dx with A and B-lead station interconnection; 4wire sf or dx with station tip and ring interconnection; and 2wire dx operation. Note that A and B-lead station interconnection is the preferred method. Note also that the wiring shown in tables 2, 3, and 4 is related only to each of those specific applications and is not the universal wiring that is provided, for example, in Tellabs 261 Signaling and Terminating System. All connections are made at the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the 56-pin connector.

3.05 One of the most common applications of the 6106 involves its use in an sf signaling and terminating system with a 4001 Line Amp at the facility interface and a 420X Term Set interfacing the station. Figure 4 shows the connections required in this application. Note that, if the 6106 is provided in combination with these modules in a Type 261 Signaling and Terminating System, all

connect 6106	to	function
pin 17	external ground	ground input
pin 35 or 33	external −22 to −56Vdc	battery input
pin 43	6106, pin 41	internal A-lead
pin 45	6106, pin 47	internal B-lead
pin 9	local ring generator	ringing source
pin 1	±24 or ±48Vdc (if req'd)	dc ringing bias
pin 39	6101, pin 39 (sf only)	ringback signal
pin 27	6101, pin 27 (sf only)	CT relay control
pin 5 or 29	6101, pin 29, or 6001, pin 23	E-lead input
pin 21 or 31	6101, pin 31, or 6001, pin 21	M-lead output
pin 25	420X or 4405, pin 43	external A-lead
pin 23	420X or 4405, pin 45	external B-lead

When used in AVD applications with a 4414 module, connect the 6106's Ring Disable lead (pin 4) to pin 39 of the 4414.

The following connections do not involve the 6106 module, but are required to complete system wiring:

420X, pin 41	station Tip-lead
420X, pin 47	station Ring-lead
420X, pins 5 and 15	6101 or 6001, pins 7 and 13. 4W rcv pair
420X, pins 49 and 55.	6101 or 6001, pins 51 and 53 4W xmt pair

Note: For 4wire station wiring, please consult the 4405 practice.

table 2. 4Wire sf or dx with A and B-lead station interconnection

connect 6106	to	function
pin 17	external ground	ground input
pin 35 or 33	external −22 to −56Vdc	battery input
pin 43	420X, pin 43	A-lead
pin 45	420X, pin 45	B-lead
pin 9	local ring generator	ringing source
pin 1	±24 or ±48Vdc (if req'd)	dc ringing bias
pin 39	6101, pin 39 (sf only)	ringback signal
pin 27	6101, pin 27 (sf only)	CT relay control
pin 5 or 29	6101, pin 29, or 6001, pin 23	E-lead input
pin 21 or 31	6101, pin 31, or 6001, pin 21	M-lead output
pin 41	420X, pin 41	Tip-lead to hybrid
pin 47	420X, pin 47	Ring-lead to hybrid
pin 25	station Tip-lead	xmission
pin 23	station Ring-lead	xmission

When used in AVD applications with a 4414 module, connect the 6106's Ring Disable lead (pin 4) to pin 39 of the 4414.

The following connections do not involve the 6106 module, but are required to complete system wiring:

420X, pins 5 and 15	6101 or 6001, pins 7 and 13. 4W rcv pair
420X, pins 49 and 55.	6101 or 6001, pins 51 and 53 4W xmt pair

Note: for 4wire station wiring, please consult the 4405 practice.

table 3. 4Wire sf or dx with Tip and Ring station interconnection

connect 6106	to	function
pin 17	external ground	ground input
pin 35 or 33	external −22 to −56Vdc	battery input
pin 43	6106, pin 41	internal A-lead
pin 45	6106, pin 47	internal B-lead
pin 9	local ringing generator	ringing source
pin 1	±24 or ±48Vdc (if req'd)	dc ringing bias
pin 5 or 29	6002, pin 23	E-lead
pin 21 or 31	6002, pin 21	M-lead
pin 25	6002, pin 43	external A-lead
pin 23	6002, pin 45	external B-lead

The following connections do not involve the 6106 module, but are required to complete system wiring:

6002, pin 41	station Tip-lead
6002, pin 47	station Ring-lead
6002, pin 1	facility Tip-lead
6002, pin 3	facility Ring-lead

table 4. 2Wire dx operation interconnections

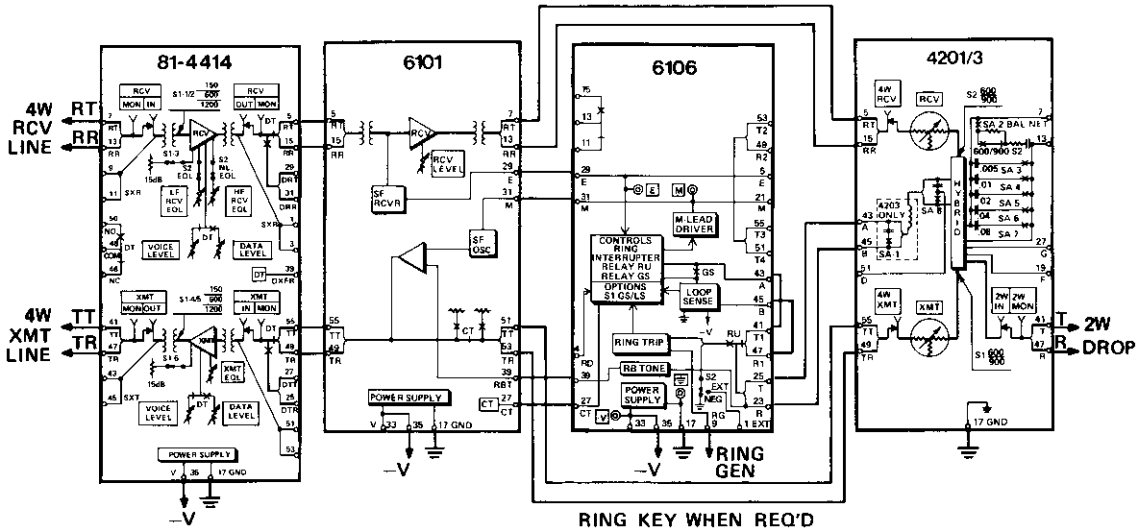


figure 4. Wiring diagram showing necessary connections when 6106 is used in a typical sf signaling application

necessary connections are prewired as part of the 261 System's universal wiring scheme.

options

3.06 Two option switches must be set before the 6106 is placed into service. Locations of these switches on the module are shown in figure 5.

Caution: When this module is used in conjunction with a Tellabs 4203 Terminating Set module, the 4203's A-and-B-lead filter capacitor **must** be optioned **out** of the circuit (switch **S3-8** set to **OFF**). Excessive ring generator loading, pretrip, and/or dial pulse distortion may otherwise result.

3.07 Option switch *S1* selects loop start or ground start operation. Set *S1* to the *LS* position for loop start applications and to the *GS* position for ground start applications.

3.08 Option switch *S2* (*BIAS*) conditions the 6106 for superimposed or grounded ringing. If the local ringing source is referenced to a dc potential (±24 or ±48Vdc), set *S2* to the *NEG* position (superimposed ringing). If the ringing source is grounded, set *S2* to the *EXT* position, and connect a source of dc potential (±24 or ±48 volts) to pin 1.

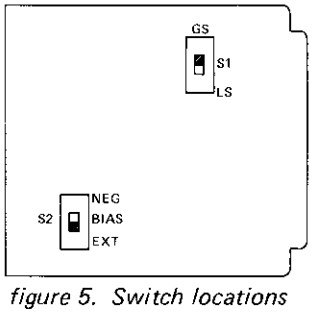


figure 5. Switch locations

alignment

3.09 No alignment of the 6106 is required. In sf applications, however, the receive amplifier of the associated 6101 SF Transceiver must be adjusted for zero gain through the unit. Additionally, if an associated Line Amplifier is used at the facility interface, it should be adjusted (at 1000Hz) to provide +7dB receive and −16dB transmit transmission level points to the 6101 module. Refer to either the Tellabs 261 System Practice or individual practices on the associated Line or AVD Amps, Signaling modules and Term Sets for detailed information on the alignment and optioning of these associated modules.

4. circuit description

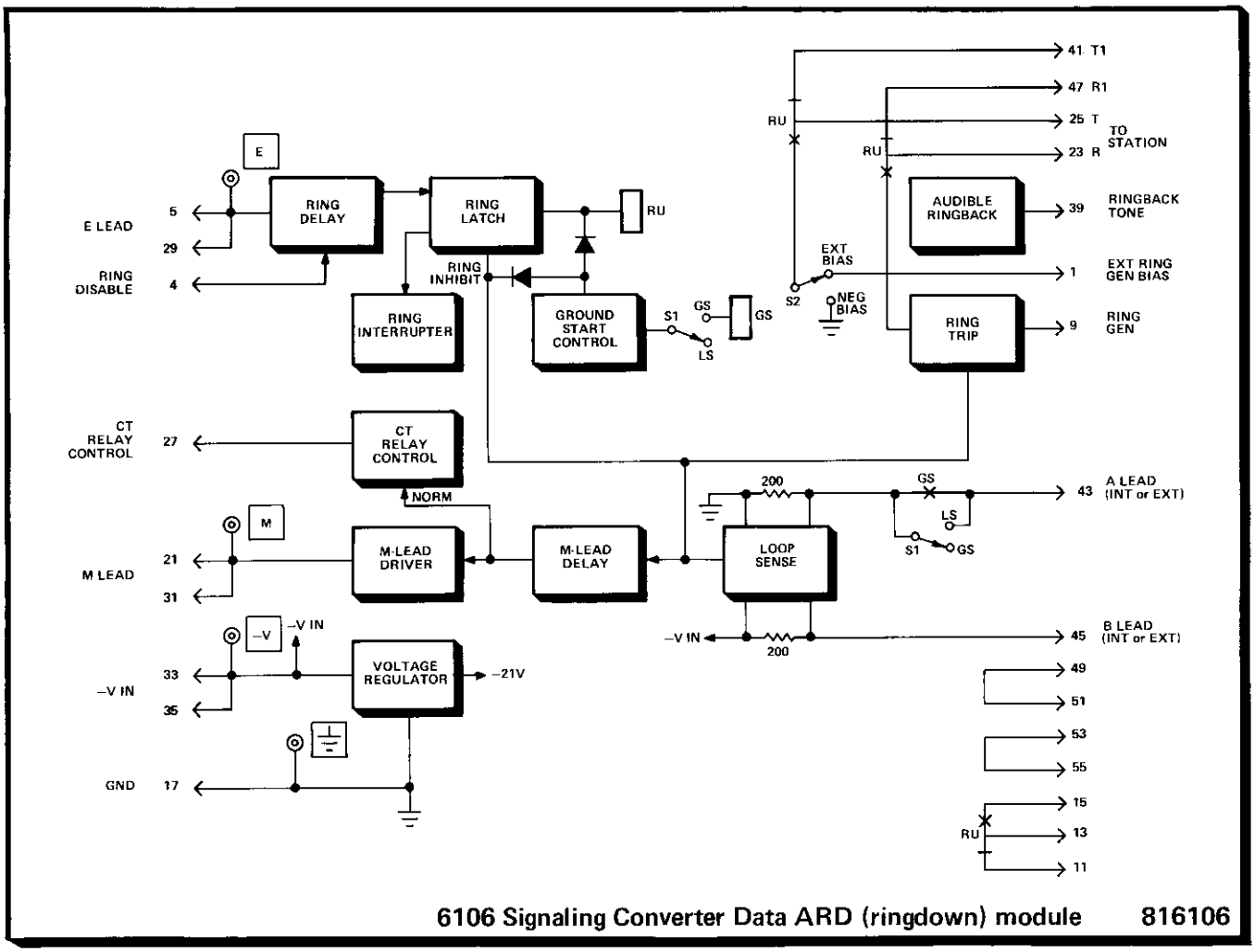
4.01 This brief circuit description is intended to familiarize you with the 6106 Signaling Converter ARD (Ringdown) module for engineering and application purposes only. Attempts to troubleshoot the 6106 internally are not recommended. Please refer to the associated functional Block Diagram (section 5 of this Practice) as an aid in understanding this circuit description.

4.02 The receive portion of the 6106 consists of a *RING DELAY* timer and sensing circuit, a *RING LATCH*, and a *RING INTERRUPTER*. The *RING DELAY* circuit and E-lead sensor set the *RING LATCH* approximately 100 milliseconds after the incoming E lead changes from ground to open. The *RING LATCH* is reset by the ring trip circuit. When the *RING LATCH* is set, relay *RU* is operated and ringing is supplied to the local station. After relay *RU* has been operated for 2 seconds, the *RING INTERRUPTER* releases relay *RU* for 4 seconds, and ringing to the local station ceases during this interval.

4.03 Local ring trip is provided by a bidirectional light-coupled sensor that operates on the dc component of the composite ac-dc ringing signal.

4.04 In ground start applications, the *GS* relay is operated when the incoming E lead is grounded, and is de-energized when the E lead is opened, unless the local station has gone off-hook while the E lead is grounded.

4.05 Outgoing seizure (toward a distant location) occurs when the local station goes off-hook and is effected through control of the M lead. A precision balanced detector, the *LOOP SENSE* circuit, senses the flow of loop current upon seizure and, after a 120-millisecond delay, enables the *M-LEAD DRIVER*. While the *M-LEAD DRIVER* is enabled, i.e., during busy states, the M lead is maintained at



6106 Signaling Converter Data ARD (ringdown) module 816106

5. block diagram

battery potential. When the local station goes back on-hook, the M lead changes to ground potential to indicate an idle condition.

4.06 The *CT* (cut-terminate) *RELAY CONTROL* circuit in the 6106 is controlled by the *LOOP SENSE* circuit. The CT-lead is at ground (CT relay operated) when the circuit is idle (no loop current) and when the M lead is at ground.

6. specifications

E-lead signaling states
idle: open
busy: ground
ringing initiation: ground

maximum external E-lead resistance to ground
500 ohms

ringing cycle
2 seconds on/4 seconds off ±10%

ringing frequency range
16 to 67Hz

ring-up delay
120 to 180ms

local ring trip range
48Vdc ringing generator bias: 0 to 3000 ohm station loop
24Vdc ringing generator bias: 0 to 1200 ohm station loop

pretrip margin
will not pre-trip with up to 3μF bridged capacitance and 30 kilohms loop leakage resistance

loop sensing range
48Vdc operation: 3000 ohms
24Vdc operation: 1200 ohms

ground start seizure delay
within 200ms of incoming seizure

M-lead signaling states
idle: ground
busy: resistance battery

transmit signaling time parameters (M-lead duration)
responds within 100ms to seizure or release

ac manual seizure
minimum 50Vac ringing on loop (A and B) leads

power requirements
–22 to –56Vdc
20mA idle
20mA + loop current: busy (loop start)
40mA + loop current: busy (ground start)
40mA: ringing (loop start)
50mA: ringing (ground start)

longitudinal
balance: 60dB minimum
environment: equivalent to 60Vac rms line induction (measured with unit removed, and tip and ring connected together to ground through a 500 ohm resistor)

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

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

weight
9 ounces (255 grams)

mounting
one position of Tellabs Type 10 Shelf or one position of Wescom Type 400 Shelf; may also be provided as part of Type 260 or Type 261 SF Signaling and Terminating System

7. testing and troubleshooting

7.01 The Testing Guide Checklist may be used to assist in the installation, testing or troubleshooting of the 6106 Signaling Converter Data ARD (Ringdown) module. The Testing Guide Checklist is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective, a new module 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. It is strongly recommended that no internal (component level) testing or repairs be attempted on the 6106 module. Unauthorized testing or repairs may void the module's warranty.

7.02 If a situation arises that is not covered in the Checklist, contact Tellabs Customer Service at (312) 969-8800 for further assistance.

7.03 If a 6106 is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is the more expedient method, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

7.04 If a defective 6106 is encountered, notify Tellabs via telephone [(312) 969-8800], letter [see below], or twx [910-695-3530]. Notification should include all relevant information, including the 8X6106 part number (from which we can determine the issue of the module in question). Upon notification, we shall ship a replacement module to you. If the warranty period of the defective module has not elapsed, the replacement module will be shipped at no charge. Package the defective module in the replacement module's carton; sign the packing list included with the replacement module 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 equipment prepaid to Tellabs.

repair and return

7.05 Return the defective 6106 module, shipment prepaid, to: Tellabs Inc.,
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: repair and return dept.

Enclose an explanation of the module's malfunction. Follow your company's standard procedure with respect to administrative paperwork. Tellabs will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

testing guide checklist on page 8

testing guide checklist

test	test procedure	normal result	if normal conditions are not met, verify:
power and ringing	Measure voltage across $-V$ and *ground* front-panel test points, and measure ringing potential at connector pin 9.	From −22 to −56Vdc (referenced to ground) present at $-V$ test point ☐. Ringing voltage of 50 to 120Vac measured from pin 9 to ground ☐.	External power ☐. External ringing source ☐. Wiring ☐.
circuit idle, E lead	During idle circuit conditions, measure E-lead voltage from E-lead test point to ground test point.	Voltage approximately −21Vdc, indicating E-lead open ☐. Ringing voltage does not appear across station Tip and Ring leads ☐.	No sf tone being received ☐, or distant-end DX set busy ☐. Replace associated signaling unit and retest ☐.
incoming seizure, loop start operation	Ground E lead to 6106 by removing sf tone or M-lead battery from distant location. Observe station ringing (or observe station T and R leads with ac meter).	Local ringing commences within 150ms of occurrence of E-lead ground ☐.	Switch S1 in LS position ☐. Station wiring correct and station on-hook ☐. Replace 6106 and retest ☐. Replace associated signaling unit and retest ☐.
incoming seizure, ground start operation	Same as loop start incoming seizure above.	Tip ground extended to station and ringing commences within 150ms of occurrence of E-lead ground ☐.	Switch S1 in GS position ☐. Remaining verifications same as "loop start seizure" test above ☐.
local ring trip	While local station ringing, place station in off-hook condition.	Ringing ceases as soon as station goes off-hook, with no audible ringing in station receiver ☐.	Ringing source referenced to dc potential and S2 in NEG BIAS position ☐; or ringing source grounded and dc bias potential connected to pin 1 with S2 in EXT BIAS position ☐. Station wiring correct ☐. Local loop limits not exceeded ☐. Replace 6106 and retest ☐.
circuit idle, M lead	During idle circuit conditions, measure M-lead voltage between M-lead and ground test points.	With circuit idle, M-lead test point at ground (i.e., no potential between M-lead and ground test points) ☐.	Local station on-hook ☐. Replace 6106 and retest ☐.
outgoing seizure, loop start	Place local station off-hook and measure M-lead voltage between M-lead and ground test points.	When station goes off-hook, M-lead voltage changes from ground to battery (power supply) potential ☐.	S1 in LS position. Local station wiring correct ☐. Local loop limits not exceeded ☐. Replace 6106 and retest ☐.
outgoing seizure, ground start	Place local station off-hook, momentarily ground associated Ring conductor, and measure M-lead voltage between M-lead and ground test points.	As station goes off-hook, no change in M-lead potential occurs ☐. When Ring conductor is grounded, M lead changes from ground potential to battery (power supply) potential ☐.	S1 in GS position ☐. Local station wiring ☐. Local loop limits not exceeded ☐. Replace 6106 and retest ☐.
cut-and-term. relay control (sf only)	Observe operation of CT relay in associated 6101 module.	CT relay operated during idle, released during seizure ☐.	Switch S1 set correctly ☐. Wiring between pin 27 of 6106 and pin 27 of 6101 ☐. Replace 6106 and retest ☐. Replace 6101 and retest ☐.
interrupted ringing	Ground E lead to initiate incoming seizure and observe local ringing.	Within 150ms of E-lead ground, ringing commences and follows nominal 2-second-on/4-second-off sequence ☐.	Local station on-hook ☐. Local station wiring ☐. Replace 6106 and retest ☐.