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practice section 83260

p/o

260 Signaling and Terminating System

contents

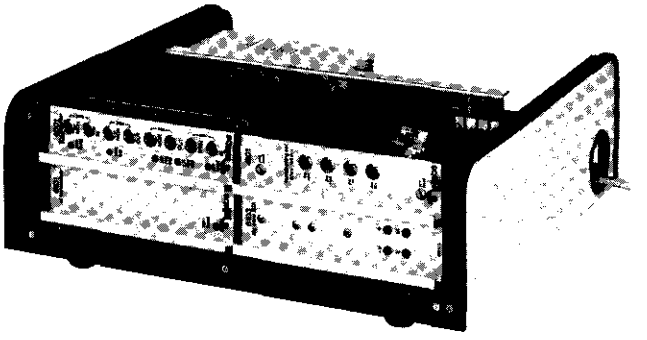


figure 1. 260 Signaling and Terminating System

1. general description

system overview

1.01 The Tellabs 260 Signaling and Terminating System (figure 1) is a self-contained modular System that provides SF or DX signaling over a 4wire transmission facility, termination of the facility, alternate voice/data (AVD) capability, and E&M, foreign exchange (FX), or ringdown signaling toward a 2wire or 4wire termination. The 260 System is housed in the 260 Mounting Assembly, which is a specially prewired 1914XX Apparatus Case optionally equipped with its own power supply and ringing generator. Modules used in the 260 Assembly may also be used in other types of apparatus cases, or the 260-System modules may be supplied alone for relay-rack installation and on-site wiring.

1.02 This Practice section is reissued to cover the Issue 3 version of the 260 Signaling and Terminating System (Tellabs part number 83260). The Issue 3 version differs from previous issues in that power and ringing circuitry are integral to the 260 Mounting Assembly. Previously, the power supply and ringing generator were supplied as separate plug-on devices. In addition, the 260 Mounting Assembly now is provided with quick-connect terminal blocks for all external connections as opposed to the screw terminal barrier strip supplied with previous 260 Systems. Other changes to this practice include updated information on the various modules that can be used with the 260 Signaling and Terminating System.

1.03 The 260 Assembly is universally wired, allowing the selection of various Tellabs modules to determine the system's operational modes and interfaces. Therefore, any subsequent changes to the 260 System require no internal rewiring. All changes are made by substitution of modules and by option selection on the individual modules.

1.04 The most commonly provided 260-System assembly, exclusive of modules, includes:
*one Tellabs 1914XX Apparatus Case.
*all internal wiring, with external connections brought out to two 30-position quick-connect terminal blocks.

1.05 The 260 System assembly that houses the two, three or four modules necessary for a complete circuit may be either wall-mounted or used as a desktop enclosure. Each of the four mounting positions in the 260 Assembly has a designated function:

position 1: facility interface
position 2: SF or DX signaling
position 3: signaling converter
position 4: terminal interface

1.06 Specific modes of operation are determined by the module selected for each position. Each position in the assembly accommodates a choice of two or more modules. See figure 2 and table 1.

1.07 Choice of the position-1 amplifier or pad/transformer module provides the facility interface to a 4wire metallic or carrier transmission facility.

1.08 Choice of the position-2 signaling module provides the 260 System with either SF or DX facility signaling. No wiring or alignment changes are necessary when changing signaling modes.

1.09 Choice of the position-3 signaling converter module provides the 260 System with one of its five modes of terminal signaling interface: E&M, station-end foreign exchange, office-end foreign exchange, ringdown, or data ringdown. Any of these five terminal interface modes may be changed, without internal wiring or alignment changes, by the exchange of one signaling converter module for another.

1.10 Choice of the position-4 terminal interface module permits use with either 2wire or 4wire terminal equipment.

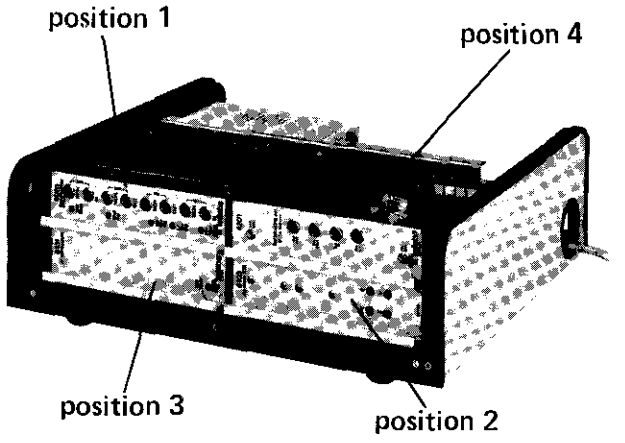


figure 2. 260 System with position numbers

Position One (facility interface):
4001/4002 Line Amplifier module
4001A Line Amplifier module
4001C/4002C Prescription Line Amplifier module
4003A Line Amplifier module with Loopback
4414 AVD Amplifier module
Position Two (signaling):
6101 SF Transceiver module
6001 DX signaling module*
6002 DX signaling module (with repeat coil)*
Position Three (facility/terminal signaling converters):
6102 E&M Signaling Converter module*
6103 FXS Signaling Converter module
6104 FXO Signaling Converter module
6105 Ringdown Signaling Converter module
6106 Data Ringdown Signaling Converter module
Position Four (terminal interface)
4201 Terminating Set module (2wire/4wire)
4203 Terminating Set module (2wire/4wire)
4405 4Wire Station Termination module
Note: *The above modules are those commonly used in the 260 System. In less common applications, other modules may be used in their place.*
**Refer to special applications section, paragraphs 2.32 through 2.34, for descriptions of these modules.*

table 1. Mounting-position functions and module choices

1.11 Options on all modules are selected by means of DIP switches or slide switches. No strapping or wiring is required.

1.12 Power and ringing may be provided to the 260 System by ordering the appropriately-equipped Tellabs 260 Mounting Assembly. Three versions of the 260 Assembly are available: 260DOO, 260DPO and 260DPR. The 260DOO has no power supply or ringing generator, the 260DPO comes equipped with a regulated −48Vdc power supply; the 260DPR Assembly is supplied with both a regulated −48Vdc power supply and a 20Hz ringing generator. The 260DOO Assembly should be used in applications requiring voltages other than −48Vdc. For these applications, the appropriate Tellabs 80XX Power Supply must be ordered separately.

individual modules

Following is a brief functional description of each of the printed circuit modules normally associated with the 260 Signaling and Terminating System. More detailed descriptions and specifications may be found in the Tellabs Practice or Catalog Sheet published on each device.

4001 and 4002 Line Amplifiers

1.13 The 4001 and 4002 Line Amplifier modules (position 1) provide two independent amplifier/equalizer circuits, each with 150, 600 or 1200-ohm input and output impedance-matching transformers. Gain range in the transmit channel is −15 to +36dB, while the receive channel has a −3 to +36dB range. Both amplifiers provide bump or slope-type amplitude equalization in the receive channel and slope equalization in the transmit channel. The two amplifiers are identical except that the 4001 provides front-panel access jacks while the 4002 does not.

4001A Line Amplifier

1.14 The 4001A (position 1) is similar to the 4001 except that both channels of the 4001A have bump or slope equalization and a −15 to +36dB gain range.

4001C and 4002C Prescription Line Amplifiers

1.15 The 4001C and 4002C Prescription Line Amplifiers (position 1) provide prescription-set bidirectional level control of −24 to +24dB in both the transmit and receive channels of a 4wire VF transmission facility. Either module can be optioned to provide 20mA of sealing current from a source internal to the module, to accept externally-generated sealing current, or to derive normal simplex leads at the facility-side ports. Impedance matching transformers at all four ports of each module can be independently switch-optioned for balanced 1200, 600 or 150-ohm terminating impedance. The 4001C and 4002C are identical except the 4001C contains front panel bantam-type test jacks while the 4002C does not.

4003A Line Amplifier

1.16 The 4003A Line Amplifier (position 1) provides bidirectional level control of −10 to +35dB in the receive channel and −15 to +30dB in the transmit channel of a 4wire VF facility. Bump or slope equalization is provided in the receive channel and slope equalization is provided in the transmit channel. The 4003A module provides impedance options of 150, 600 and 1200 ohms toward the facility (terminal side impedance is fixed at 600 ohms), and dc or 2713Hz tone-activated loopback. The 4003A contains a timeout circuit to release loopback (60 to 120 seconds).

4414 Alternate Voice/Data Amplifier

1.17 The 4414 AVD Amplifier (position 1) provides adjustable gain and amplitude equalization for a 4wire VF facility used to transmit, at separate times, voice and data signals. The 4414 derives two sets of ports and two independent gain adjustments on its terminal side, one for voice signaling and the other for data transmission. Overall gain ranges are

−15 to +36dB in the voice mode and −35 to +16dB in the data mode. The 4414 features bump or slope equalization in the receive channel and slope equalization in the transmit channel. Other features of the 4414 include optional 150, 600 or 1200-ohm facility-side impedance; fixed 600-ohm terminal-side impedance and derived simplex leads for dc signaling compatibility.

6101 SF Transceiver module

1.18 The 6101 SF Transceiver module (position 2) provides an integral SF tone supply and tone gates for the transmission of SF signals over the facility, and contains SF receive circuitry for the detection of incoming SF signals from the facility. The 6101 SF Transceiver must be used in conjunction with a position-3 signaling converter module, which interfaces the "internal" E&M signals of the 6101 with the signaling mode at the termination (i.e. E&M, FXS, FXO, ringdown, or data ringdown). The 6101 SF Transceiver module and associated Signaling Converter module together meet all F-type SF signaling specifications.

Note: *Refer to special applications section, paragraphs 2.32 and 2.33, for descriptions of the position-2 6001 and 6002 DX signaling modules. Also, for a description of the position-3 6102 E&M Signaling Converter module, see paragraph 2.34 of the special applications section.*

6103 FXS Signaling Converter module

1.19 The 6103 FXS Signaling Converter module (position 3) provides signaling conversion between the internal E&M leads of a position-2 SF Transceiver module and the station end of a foreign exchange circuit. Switch options allow the 6103 to operate in either the loop-start or ground-start mode, and with either normal or inverted E-lead control of ringing in the dc mode. Minimum-break pulse correction (50ms) is provided in the transmit direction. Ring-up and ring-trip circuitry accommodate any type of biased ringing arrangement, with a 3000-ohm range limit on station-side loop supervision and ring-trip functions. Either A&B leads only or tip, ring, and A&B leads may be used for station-side signaling.

6104 FXO Signaling Converter module

1.20 The 6104 FXO Signaling Converter module (position 3) is the office-end counterpart of the 6103 FXS Signaling Converter. As such, the 6104 provides conversion between the internal E&M lead signals of the position-2 SF transceiver or DX signaling module and the office end of a foreign exchange circuit. The 6104 may be switch-optioned for loop-start or ground-start operation, and for normal or inverted M-lead signaling states. In ground start (GS) applications, the 6104 also provides 20Hz modulation of outgoing tone, regardless of input ringing frequency. Either A&B-lead only or tip, ring, and A&B-lead connection to the 2wire switching side loop may be accommodated.

6105 (ARD) Signaling Converter module

1.21 The 6105 (ARD) Signaling Converter module (position 3) provides interface between the E&M lead signals of the position-2 SF transceiver or DX signaling module and a terminal utilizing ringdown signaling. While this "terminal" is usually a loop-start 2wire or 4wire telephone instrument, the 6105 may be optioned for ground-start operation to provide ringdown interface with a PBX trunk. When used with a 6101 SF transceiver, the 6105 provides tone off during idle in both the transmit and receive directions of SF signaling. The 6105 accommodates a variety of automatic and manual ringdown modes of operation. In the automatic ringdown mode, the 6105 provides either 30-second timed ringing with automatic timeout, 2-second burst ringing, or calling party controlled (CPC) ringing. An optional 9903 Ringing Interrupter subassembly plugs onto the main 6105 board to provide nominal 2-second-on/4-second-off interrupted ringing. In the manual ringdown mode, either ac (switchboard) or dc operation may be selected. In SF multistation applications, the unit can accommodate coded ringing. Additionally, the 6105 provides either superimposed or grounded ringing generator biasing; ringback indication toward the originating station during ringing intervals; either A&B-lead or tip, ring, and A&B-lead connection to the terminal-side equipment; transmit cut-and-terminate control during idle in SF applications; leads to accommodate a visual indication of incoming seizure or to start a local ringing generator; and a balanced loop sensing circuit to allow operation in the presence of high longitudinal voltages.

6106 Data Ringdown Converter module

1.22 The 6106 Data Ringdown Signaling Converter module, (position 3), in combination with the position-2 SF transceiver or DX signaling module, provides a special form of automatic two-point ringdown used primarily in data ringdown applications. Unlike the 6105 module, the 6106 provides tone on during idle in both the transmit and receive directions in the SF signaling mode. The 6106 accommodates automatic ringdown operation only; manual and switchboard ac ringdown are not provided. An integral ringing interrupter provides nominal 2-second-on/4-second-off interrupted ringing. Conventional ring-trip circuitry is also provided. The 6106 may be optioned for either loop-start or ground-start operation. A disable lead is provided on the 6106 for use with the 4414 AVD Amplifier module. This disable lead prevents the 6106 from initiating ringing toward the station when the 4414 is in the data mode. Additionally, the 6106 provides either superimposed or grounded ringing generator biasing; ringback indication toward the originating station during ringing intervals; either A&B-lead or tip, ring, and A&B-lead connection to the terminal-side equipment; transmit cut-and-terminate control during idle; leads to accommodate a visual indication of incoming seizure or to start a local ringing generator; and a balanced loop sensing circuit to allow operation in the presence of high longitudinal voltages.

4201 and 4203 Terminating Sets

1.23 A 4201 or 4203 Terminating Set may be

used in position 4 of the 260 Assembly to convert 4wire facility-side operation to 2wire terminal-side operation. Both modules feature switchable 600 or 900-ohm 2wire port impedance (in series with 2.15μF) and fixed 600-ohm 4wire port impedance. The 4203, in addition, is equipped with an A&B-lead isolation inductor. Both the 4201 and 4203 provide 0 to +30dB adjustable pads in the transmit and receive paths, a full complement of front-panel jacks, network build-out capacitors, and an integral compromise balance network. Issue 2 or later 4201's accommodate an optional 993X plug-on Precision Balance Network (PBN) subassembly for use when an external PBN is required.

Note: *To prevent low-impedance battery supply from degrading transhybrid loss performance, it is strongly recommended that the 4203 Term Set (with an A&B-lead isolation inductor) be used in station-end applications involving foreign exchange or ringdown modes of operation.*

4405 4Wire Termination module

1.24 The 4405 4Wire Station Termination module occupies position 4 in place of a 420X Term Set whenever a 4wire telephone instrument must be interfaced. The 4405 provides transmit and receive attenuation (via 0 to +30dB variable pads), transformer coupling in the transmit and receive paths for dc isolation and impedance matching, a sidetone amplifier to provide sidetone to the 4wire instrument, and A&B leads on the station side of the transmit path transformer to supply talk battery to the 4wire instrument. Impedance toward the facility is fixed at 600 ohms, while station-side impedances of 150, 600 or 1200 ohms in the receive channel and 600 or 900 ohms in the transmit channel may be selected. Sidetone amplification may be optioned out to allow use of the 4405 in data or other applications requiring isolated transmit and receive paths. Locally derived ringing may be applied to the telephone instrument via the transmit A&B leads or via the receive simplex lead to ground.

1.25 All test points, jacks and adjustments required to install, align and test the 260 System are provided on the front panels of the various modules (except 4002 and 4002C modules). The System may therefore be aligned and maintained with all equipment mounted in place.

2. application

2.01 In this description, the term "facility side" refers to the side of the 260 System (or module within that system) facing the facility over which SF or DX signaling is transmitted to the distant end of a communication channel. Conversely, "terminal side" refers to the side of the 260 System (or module within that system) facing the near-end equipment or station apparatus and toward which loop signaling is extended by the 260 System. See figure 3 for the application of this nomenclature.

general application

2.02 The 260 Signaling and Terminating System may be configured to accommodate a wide range of

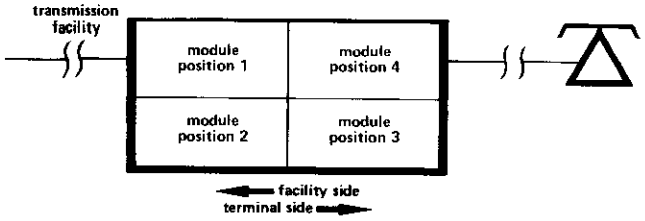


figure 3. "Facility side" and "terminal side" nomenclature

voice frequency signaling and terminating applications. Basically, these applications include 2wire or 4wire facility interface; 2wire or 4wire terminal interface; use of ac (inband SF) or DX signaling over the facility; and E&M, foreign exchange, alternate voice/data (AVD) capability, or ringdown signaling interface toward the terminal.

2.03 The basic applications delineated in the preceding paragraph, and variations thereof, are implemented by the selective use of Tellabs' Type 10 printed circuit modules in a universally wired equipment enclosure. Please note in figure 3 that the position-1 module interfaces the facility and the position-4 module interfaces the terminal. Between these interfaces, the position-2 module provides signaling for the facility, and the position-3 module converts the facility-side signaling to the mode of signaling required by the terminal. In certain applications, one or more of these four modules may not be required. However, if a particular module position is used, it always serves the same basic purpose (as described above). Module positions 1, 2, 3, and 4 are always defined, respectively; as the upper left, lower left, lower right and upper right positions as you look at the front of the module enclosure. The *general application* subsection of this Practice will discuss 260 System usage in terms of these module positions, their functions, their common applications, and their attendant modules.

facility-side interface (position 1)

2.04 The 260 System provides SF signaling over 2wire metallic or 4wire metallic or carrier transmission facilities. If SF signaling is to be used, a 4wire facility (metallic or carrier) is necessary. Facility interface is provided by the position-1 module in the 260 System.

2.05 In 4wire applications, position 1 is normally occupied by a 4001 Line Amplifier module. The Line Amplifier provides the facility with balanced termination, level adjustment and amplitude equalization. In rare cases where neither amplification nor equalization is required, a 4401 Pad/Transformer module may be used in position 1 to provide balanced termination and 0 to 30dB attenuation. When a 4wire carrier facility local to the 260 System assembly (e.g., in the same central office) is interfaced, position 1 may be left open, as the carrier channel provides coordinated levels and balanced termination. Bypass strapping on the 56-pin conector is required if position 1 is left open in 4wire applications. If amplitude equalization of the carrier facility is desired, however, a Line Amplifier will then be required in position 1.

2.06 As the majority of 260 Signaling/Terminating System applications involve 4wire metallic facilities, position 1 will normally be equipped with a 4001 Line Amplifier module (see paragraph 1.13). (The 4002 line Amplifier may also be used, but since it requires a 9801 or 9802 Card Extender for alignment access, it is not commonly used.) Gain provided in the transmit channel of the 4001 is continuously adjustable from −15 to +36dB, while receive-channel gain may be continuously adjusted from −3 to +36dB. Receive and transmit gain ranges will thus accommodate the levels required by the position-2 signaling module (usually standard +7 and −16 TLP's), with facility-side levels meeting all voice frequency circuit requirements within the limits of good transmission practice. Impedance-matching options of 150, 600, or 1200 ohms on the facility side of the 4001 provide for interface with loaded cable (1200 ohms), with nonloaded cable or carrier (600 ohms), or with long sections of nonloaded cable (150 ohms). Amplitude equalization is provided in both transmit and receive channels of the 4001. The receive channel is provided with a choice of bump or slope equalization; the transmit channel offers slope equalization only. Equalization in either channel may be optionally switched out to provide nominal flat response. Transformers at all ports of the 4001 contribute to longitudinal isolation of the 260 package. The 4001 also protects the 260 System from facility-side surges.

2.07 If a given application requires more extensive transmit-channel equalization capabilities than the single (nonloaded cable) mode provided by the 4001 Line Amp, the 4001A Line Amp may be used instead in position 1 of a 260 System. The 4001A provides either bump or slope equalization in both the receive and transmit channels.

2.08 Switch-selectable level control, equalization, and impedance matching in both the transmit and receive channels of the 4wire facility are provided by the 4001C and 4002C Prescription Line Amplifiers. These amplifiers provide prescription-set bidirectional level control of −24 to +24dB, up to 7.75dB of slope equalization at 2804Hz re 1000Hz, and switch-selectable terminating impedances of 150, 600, or 1200 ohms. The 4001C and 4002C are identical except that the 4001C contains front panel bantam-type test jacks while the 4002C does not.

2.09 A 4003C Line Amplifier with equal-level loopback may also be used in position 1 in applications where loopback circuitry is required for remote testing of the 4wire facility. Although this module offers either tone or dc-activated loopback, only the tone mode may be used in standard 260 System applications. While equalization characteristics of the 4003A are the same as those of the 4001, gain ranges are different, being −10 to +35dB in the receive channel and −15 to +30dB in the transmit channel.

2.10 If a 4wire transmission facility is to be used to transmit, at separate times, both voice and data signals, the 4414 Alternate Voice/Data (AVD) Amplifier may be used in position 1 to provide the required AVD capability. Selection of voice or data mode is made manually via a local key located within 150 ohms of the 4414. A ground on the 4414's data transfer lead selects the data mode; an open on the same lead selects the voice mode. Voice-mode gain in both transmit and receive channels is continuously adjustable from −3 to +36dB or, via switch option, from −15 to +6dB. Data-mode gain in both channels is continuously adjustable from −23 to +16dB or, via switch option, from −35 to −15dB. Maximum output level in both modes is +18dBm. If a facility is used for voice transmission only, the 4414 may be used as a conventional line amplifier.

facility-side signaling modes (position 2)

2.11 The position-2 6101 SF Transceiver module provides an integral SF tone supply and tone gates for transmission of SF signals over the facility, and contains SF receive circuitry for the detection of incoming SF signals from the facility. The 6101 SF Transceiver must be used in conjunction with a (position 3) signaling converter module, which interfaces the "internal" E&M signals (see note 1) of the 6101 with the signaling mode at the termination (i.e., foreign exchange or ringdown). A cut-and-terminate relay provided by the 6101 SF Transceiver is under control of the associated signaling converter module. The 6101 SF Transceiver Module and associated Signal Converter module together meet all F-type SF signaling specifications. A 10dB signal-to-guard ratio ensures extremely low talk-off probability.

Note 1: *The 6101 converts SF signaling on the facility side to "internal" logic-level E&M-state signals on the terminal side.*

Note 2: *Refer to special applications section, paragraphs 2.32 and 2.33, for descriptions of the position 2 6001 and 6002 DX signaling modules.*

signaling conversion (position 3)

2.12 The position 3 signaling converter module adapts the facility-side signaling of the position-2 SF Transceiver or DX signaling module to the mode of signaling required on the terminal side of the 260 System. The position-2 module may be combined with any of the position-3 Signaling Converter modules to convert the SF or DX facility-side signaling to E&M, foreign exchange (office), foreign exchange (station), ringdown, special data ringdown, or other (nonstandard) terminal-side signaling schemes.

2.13 Most 260 Systems employ a two-module (positions 2 and 3) combination to provide signaling and signaling conversion. The various two-module SF combinations meet all E and F-Type SF specifications. They are, therefore, end-to-end compatible with other manufacturers' equipment meeting the same criteria in the respective (E&M, foreign exchange or ringdown) mode (see table 2).

terminal. . . . (is compatible with) . . . terminal mode(s)
E&M . . . . . E&M
Foriegn Exchange (office) . . . . . .Foreign Exchange (station)
Foreign Exchange (station) . . . . . .Foreign Exchange (office)
Ringdown (any mode*) . . . . . .Ringdown (any mode*)

*This relates only to Systems using the modes of ringdown operation provided by the 6105 module. The 6106's mode of operation is somewhat less standard. It is end-to-end compatible only with another 6101/6106 combination or with a Wescom 455 Data Access Inband Signaling System. A 260 System employing a 6105 in the CPC ringdown mode is end-to-end compatible with a Wescom Signaling/Terminating System in the "ARD" ringdown mode.

table 2. End-to-end compatibilities in SF mode

2.14 In the SF mode, various Tellabs two-module (signaling/converting) and three-module (signaling/converting/terminating) combinations provide close functional equivalents to the Western Electric F-type counterparts listed in table 3, with which they are end-to-end compatible.

Tellabs modules	WECo counterpart
E&M 6101 + 6102	FWA
6101 + 6102 + 420X	FAA + FUA
6101 + 6102 + 4402	FBA + FUA
FXS 6101+6103+420X	FSA (or FSB)+FUA
6101+6103+4405	FRA+FUA
FXO 6101+6104+420X	FLA (or FLB)+FUA
6101+6104+4405	FPA+FUA
Ringdown*	
6101+6105+420X	FGM+FUA
6101+6105+4405	FHM+FUA

*Exact Western Electric counterparts to Tellabs module complements that include the 6106 Signaling Converter (ARD) do not exist.

table 3. Western Electric counterparts in SF mode

2.15 The position 3 signaling converter modules of the 260 System control transmit precut and cut-and-terminate functions. This isolates the drop (terminal-side circuit) from the facility just prior to and during tone transmission to prevent noise on the drop from interfering with signaling on the facility. Additionally, tone is prevented from reaching the terminal, which prevents transmission of SF tones outside of the facility signaling link.

2.16 The position-3 signaling converter modules also provide minimum-break pulse correction (50ms) in all transmit dial pulsing circuits, and either minimum-break or precision pulse correction in all receive pulsing circuits.

2.17 A variety of automatic and manual ringdown applications may be served by the 260 System. A 6105 Ringdown Signaling Converter module in position 3 of the 260 module enclosure provides automatic ringdown service with either 30 second timed ringing, 2 second burst ringing, or CPC ringing. Manual ringdown operation in either the dc or ac (switch-board) mode may also be effected. The CPC option of the 6105 allows end-to-end operation with a Wescom Signaling/Terminating package optioned for "WESARD" automatic ringdown. An optional 9903 subassembly may be mounted on the 6105 module to provide nominal 2-second-on/4-second-off ringing interruption.

2.18 A unique form of automatic ringdown signaling usually associated with data ringdown terminals may be provided through use of the 6106 Data Ringdown Signaling Converter ARD module in position 3. Like the 6105, the 6106 interfaces the terminal-side equipment via A&B leads alone, or via tip, ring, and A&B leads, and converts signaling on these leads to E&M signaling. Unlike the 6105, however, the 6106 provides tone on during idle in both directions (send and receive) when used with a 6101 SF Transceiver. Tone-on-during-idle operation provides station ringing at both ends of the circuit in response to a failure of the facility. This makes the 6106 ideal for use in high-security or high-priority circuits where immediate indication of facility failure is vital. An integral 2-second-on/ 4-second-off ringing interrupter is provided, as is a disable lead for use with a 4414 AVD Amplifier to prevent ringing toward the station in the data mode.

2.19 When a 260 package configured for office-end foreign exchange operation (i.e., equipped with a 6104 Signaling Converter module in position 3) is used in the ground-start mode, all input ringing from 16 to 67Hz is converted to 20Hz modulated SF tone for transmission over the facility. This allows end-to-end compatibility with Western Electric signaling/terminating equipment, which recognizes only 20Hz ringing, as well as with equipment that recognizes a range of ringing frequencies.

2.20 Individual features and options provided by the position-2 signaling modules or position-3 signaling converter modules allow adaptation of the 260 System to the more specific requirements of each application. The scope of this Practice does not allow pursuit of such detail. Relevant information may be found in the Catalog Sheet or Practice available from Tellabs on each individual module used within the 260 System.

terminal-side interface (position 4)

2.21 The 260 System may be configured to serve a 2wire or 4wire metallic terminal-side circuit ("drop"). The terminal-side circuit must be metallic. Various modules can be used in position 4 to fulfill individual applications. Most commonly, position 4 is occupied by a 420X Terminating Set module. The 420X Term Set is used when the 260 System interfaces a 4wire facility with a 2wire terminal-side drop. (See paragraph 1.23 for a description of Term Sets in the 420X Series.) If a 260 System interfaces a 4wire facility with a 4wire terminal-side drop terminating into a 4wire telephone set, a 4405 4Wire Station Termination module is required in position 4. (See paragraph 1.24 for a description of the 4405.) In some rare applications where the 4wire

terminal-side drop does not terminate into a 4wire tel set, a 4402 Pad/Transformer module may be required in position 4. If a 2wire facility is interfaced through the 260 System with a 2wire terminal-side drop, position 4 is left vacant. (No bypass strapping is required.)

2.22 The module used in position 4 provides impedance matching for a balanced termination with the terminal-side drop. The 4201 and 4203 Term Sets are equipped with switchable 600/900-ohm impedance matching in the transmit channel and optional 150, 600, or 1200-ohm impedance matching in the receive channel. A 600-ohm impedance match is generally preferable when interfacing nonloaded cable or station apparatus. The 900 or 1200-ohm option is chosen to interface loaded cable or switched networks accessing both loaded and nonloaded cable. The 150-ohm option in the receive channel of the 4405 is used when the 260 Package directly interfaces a 4wire tel set (over a very short drop).

2.23 Series 420X Term Sets are available with or without A&B-lead inductors. For 260 Systems in station-located applications, it is recommended that only 4203 Term Sets, which are equipped with A&B-lead inductors, be used. Filtering provided by the 4203's inductor and associated filter capacitor reduces the effect of battery noise. The inductor also isolates the battery supply, improving hybrid balance and, consequently, transhybrid loss within the Term Set. The filter capacitor may, when sensitive circuitry is involved, contribute adversely to dial pulse distortion or premature ring trip. A switch is therefore provided on the 4203 Term Set to remove the filter capacitor from the circuit when dial pulse distortion or excessive ringing current drain take priority over battery filtering.

2.24 Standard interface levels of +7 receive output and −16 transmit input are usually required at the terminal side of the position-2 Signaling module. Transmit and receive alignment levels on the terminal side of the position 4-module are such that attenuation is required in both transmit and receive directions to interface the +7 and −16 levels at the position-2 signaling module. Therefore, all modules that may be used in position 4 provide 0-to-30dB variable attenuation in both transmit and receive channels.

2.25 Maximum terminal-side signaling range of 260 Systems equipped for station-end foreign exchange or ringdown modes of operation is 3000 ohms of external loop resistance with 48Vdc power, and 1200 ohms of external loop resistance with 24Vdc power. Terminal-side cable loop range for 23mA at the tel set is, therefore, 1480 ohms at 48Vdc and 440 ohms at 24Vdc. Range of these Systems is determined by the loop sensing range and ring trip limits of the position 3 module (6103, 6105, and 6106). Terminal-side range in applications involving a 6104 Signaling Converter in position 3 is determined by the supervisory and sensing capabilities of the switching system interfaced by the 260 System.

2.26 The scope of this Practice does not allow presentation of detailed information about the features and options of modules available for use in position 4 of the 260 System. Relevant information may be found in the Catalog Sheet or Practice available from Tellabs on each individual module.

power and ringing

2.27 Power and ringing may be provided to the 260 System by ordering the appropriately-equipped 260 Mounting Assembly. Three versions of the 260 Assembly are available: 260DOO, 260DPO, and 260DPR. The 260DOO contains no power supply or ringing generator, and is intended for applications requiring voltages other than −48Vdc (see paragraph 2.28). For these applications, the appropriate Tellabs 80XX power supply must be ordered separately. Both the 260DPO and 260DPR Assemblies come equipped with Tellabs' 8016 Power Supply which provides a regulated −48Vdc input to the 260 System's associated modules. In addition, the 260DPR Assembly derives 20Hz ringing voltage from the same (8016) input and supplies it to the appropriate 260 System modules. The 8016 Power Supply plugs directly into any commercial 105 to 125Vac, 60 Hz outlet.

Note: *Current requirements for equipment housed within the 260 System vary according to application. Generally, 100 to 120mA plus external loop current is required by a four-module circuit.*

2.28 Certain applications have some restrictions concerning power. For example, when the 260 System is arranged for station-end foreign exchange or ringdown operation and is in close proximity to station equipment (within 440 ohms), operation at 24Vdc is strongly recommended. This conserves power and prevents excessive current flow through the associated station instrument(s). When a 260 System is operated in the ground start mode, the 260 package must be provided with the same battery voltage (24 or 48Vdc) as the terminal-side switching equipment. Also, there must be a connection between the PBX or central office ground and the 260 System ground.

2.29 All modules used within the 260 System incorporate internal voltage regulation that permits operation on −22 to −56Vdc input. External M-lead potentials and loop current feeds are derived prior to regulation, allowing these potentials to be limited only by the external supply potentials.

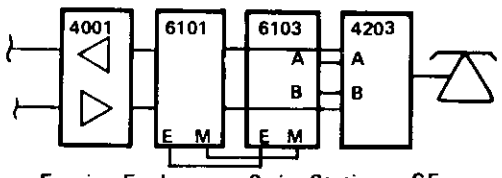
standard applications

2.30 While other module combinations may be used to satisfy specific applications, the following module combinations, figures 4-A through 4-G, provide the most common circuit configurations in which the 260 System is employed.

special applications

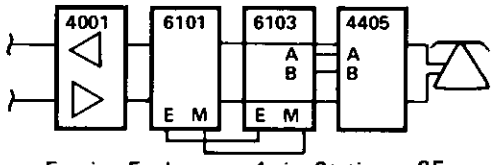
Note: *The 3 modules (6001/6002 and 6102) discussed below all contain mercury-wetted relays and*

figure



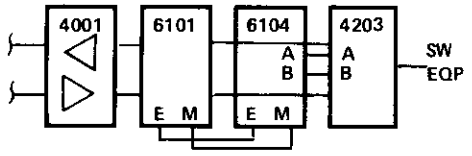
4-A

Foreign Exchange – 2wire Station – SF



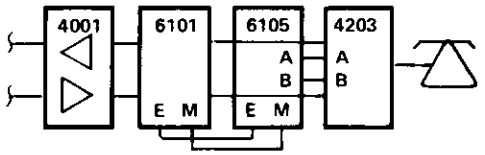
4-B

Foreign Exchange – 4wire Station – SF



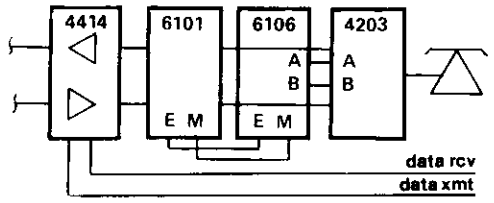
4-C

Foreign Exchange – Office – SF



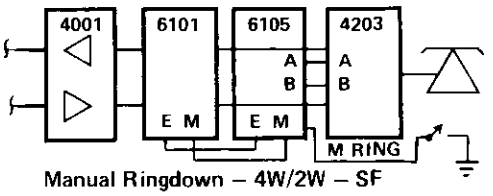
4-D

Automatic Ringdown – 4W/2W – SF



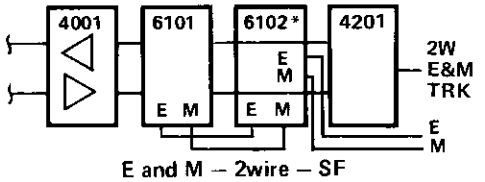
4-E

Special Auto Ringdown–4W/2W –SF– AVD



4-F

Manual Ringdown – 4W/2W – SF



4-G

E and M – 2wire – SF

* *Refer to special applications section, paragraph 2.34, for a description of the 6102 module.*

figure 4. Typical 260 System applications

must *therefore be mounted in a vertical, upright position. Since the 260 System is primarily designed for desktop use, their use in the 260 System is limited to* special applications.

2.31 While the basic 260 System will satisfy most conventional applications for SF Signaling/Terminating Assemblies, its inherent flexibility allows reconfiguration with additional Tellabs' modules to provide for both DX and E&M signaling. For DX applications, the position-2 6101 SF Transceiver module is replaced with either a 6001 DX Signaling module (4wire applications) or a 6002 DX Signaling module (2wire applications). A 260 System so equipped will provide switch-selectable DX1 or DX2 signaling over a 2wire or 4wire metallic facility. E&M signaling is provided by the 6102 Signaling Converter module (E&M) in position 3 of the 260 System. The 6102 provides E&M lead conditioning between "external" E&M leads of the terminal equipment and those "internal" (logic-level) E&M states derived in the position-2 6101 module. Following is a brief functional description of the 6001, 6002 and 6102 modules. More detailed descriptions and specifications may be found in the Tellabs Practice or Catalog Sheet on each.

6001 DX Signaling module

2.32 The 6001 DX Signaling module provides switch-selectable DX1 or DX2 signaling over a 4wire metallic facility. In the 260 System, the position-2 6001 DX Signaling module converts E&M lead signals derived from an associated position-3 Signaling Converter module to DX signaling over the facility. Signaling may be extended over the facility to a maximum of 5000 ohms loop resistance. M-lead current limiting prevents damage to the module while in the DX2 mode. A mercury-wetted pulsing relay ensures reliable operation. Capacitive and resistive balance network values are switch-selected.

6002 DX Signaling module

2.33 The 6002 DX Signaling module provides optional DX1 or DX2 Signaling as does the 6001 DX module. The 6002, however, has an integral repeat coil that allows its application to 2wire transmission facilities. The repeat coil may be switch-optioned out of the 6002 circuitry, allowing application of the 6002 to 4wire circuits.

6102 E&M Signaling Converter module

2.34 The position-3 6102 and position-2 6101 modules in combination provide a two-module SF signaling system (FWA) compatible with all F-type specifications. Minimum-break pulse correction (50ms) is applied to both E&M leads by the 6102. Provision is also made on the 6102 module for the connection of a 9901 Pulse Corrector subassembly for precision dial pulse correction in the E lead (receive side), if required. A switch option allows inversion of the M-lead signaling states. Transmit precut and cut-and-terminate control are derived by the 6102 in SF applications from E&M signals of the terminal equipment. Front-panel LED's indicate both E-lead and M-lead busy conditions. In the 260 System, the 6102 Signaling Converter may be used with DX as well as SF facility signaling. In DX applications, the 6102 provides E&M-lead conditioning in the form of pulse correction. On its terminal side, the 6102 module accommodates Type I, II, or III E&M signaling interface.

2.35 With additional modules in place of standard modules in the 260 System, other special ap-

plications can be satisfied. Therefore, new modules developed by Tellabs that may be used in the 260 System are provided, if possible, with pinouts compatible for use with the 260 universal wiring scheme. The 6251 SSN Trunk module, for example, may be used in position 3 of a standard 260 System. This results in a prewired package providing trunk service between the Common Control Switching Arrangement (CCSA) equipment of a Switched Service Network (SSN) and a Central Office line circuit (see figure 5). Refer to the Catalog Sheet or Practice describing the 6251 SSN Trunk module for specific operational details.

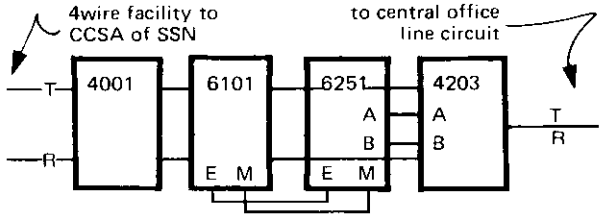


figure 5. Typical 4wire application using 6251

3. installation

inspection

3.01 The 260 Signaling System and its component modules should be 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 equipment should be inspected again prior to installation.

cover removal

3.02 In order to install the 260 Assembly, the protective metal cover enclosing the modules must be removed. The cover is held in place by two slotted spring latches located in either side of the cover. With a screwdriver, turn each latch counterclockwise approximately ¾ turn to allow the latch to clear the lip of the chassis. The cover can then be removed by lifting it straight upward and is replaced by an opposite motion. Store the wraparound cover in a location where it will not be bent or otherwise damaged.

mounting

3.03 The 260 Assembly is supplied with four rubber legs for desktop use. If wall mounting is required, the rubber legs should be removed to allow the Case to be mounted flush against the wall. The legs are easily removed by turning them, by hand, in a counterclockwise direction. Four mounting screws (not supplied) of a type suitable for the material of the wall on which the Assembly will be mounted are required. Mount the Assembly so that the Type 10 modules slide into place in an upright position. (When the modules are in an upright position, the access hole is at the bottom right of the Assembly.) The 260 Assembly must be located within eight-feet of a nominal 117Vac, 60Hz, single-phase, grounded receptacle.

Caution: *The 6001, 6002, and 6102 modules make use of a mercury-wetted relay for E-lead output. The 6001, 6002 and 6102 modules* must *be installed in a vertical, upright position (i.e., with the front handle perpendicular to the ground and nomenclature right-side-up) to operate properly. Therefore, when the 260 System contains any one of these three modules, the 260 System must be wall mounted to ensure proper relay operation. Before installation, the module should always be held in an upright position and tapped gently on a hard surface. This procedure ensures that the mercury is properly positioned within the relay – not shorting the contacts, etc. Once tapped, the module should be kept in an upright position until installation.*

Warning. *When making the following connections, be sure the 260 System is* not *plugged into a power outlet, or in any other way supplied with power. External power should only be applied after wiring is completed and modules (properly optioned) are in place.*

wiring

3.04 External connections to the 260 System are made via two 30-position punch-down terminal blocks, *TB1* and *TB2*, located in the 260 Assembly (see figure 6). Each position of *TB1* and *TB2* is connected to the corresponding pin on the terminal strips *P1, P2* and *P3* via printed circuit traces. All external wiring should be run through the access hole in the side of the case and through the cable ties located nearby. Make the installer connections in accordance with table 4 and the 260 wiring diagram (figure 8).

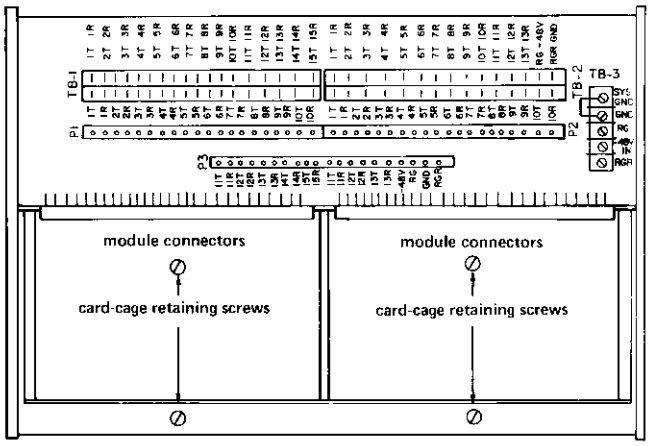


figure 6. 260DXX terminal block locations

3.05 Power connections to the 260 DPO and 260DPR case and associated 260 System modules are made to five-position barrier-type terminal strip *TB3*. The + terminal of the 8016 power supply is connected to the *SYS GND* terminal of *TB3*, the – terminal of the 8016 is connected to the *–48V* terminal of *TB3*, and the *GND* terminal of the 8016 is connected to the *EARTH GND* terminal of *TB3*. Power and ringing are extended to the modules by

COLOR	CABLE	TB NO.		WIRE-WRAP		DESIGNATIONS	
W/BL			1T		1T	RT	RCV IN
BL/W			1R		1R	RR	
W/O			2T		2T	TT	XMT OUT
O/W			2R		2R	TR	
W/G			3T		3T	SXT	SIMPLEX LEADS
G/W			3R		3R	SXR	
W/BR			4T		4T	T	RCV/BAL OUT/NET
BR/W			4R		4R	R	
W/S			5T		5T	T	XMT/2W IN
S/W			5R	P1	5R	R	
R/BL			6T		6T	E	SIGNAL LEADS
BL/R			6R		6R	EG	
R/O			7T		7T	M	
O/R			7R		7R	MB	
R/G	1	TB-1	8T		8T	A	CONTROL LEADS
G/R			8R		8R	B	
R/BR			9T		9T	D	
BR/R			9R		9R	F	
R/S			10T		10T	G	
S/R			10R		10R	SPARE	SPARE
BK/BL			11T		11T	RK	MANUAL RINGDOWN
BL/BK			11R		11R	GND	
BK/O			12T		12T	LL	MANUAL LOOPBACK
O/BK			12R		12R	GND	
BK/G			13T	P3	13T	DRT	RCV DATA
G/BK			13R		13R	DRR	
BK/BR			14T		14T	DTT	XMT DATA
BR/BK			14R		14R	DTR	
BK/S			15T		15T	DT/XF	DATA XFER
S/BK			15R		15R	SPARE	SPARE
GREEN			1T		1T	COM.	DATA RELAY LEADS
GREEN			1R		1R	N.C.	
GREEN			2T		2T	N.O.	
–			2R		2R	SPARE	SPARE
–			3T		3T		
–			3R		3R		
–			4T		4T		
–			4R		4R		
–			5T		5T		
–			5R	P2	5R		
–			6T		6T		
–			6R		6R		
–			7T		7T		
–			7R		7R		
–		TB-2	8T		8T		
–			8R		8R		
–			9T		9T		
–			9R		9R		
–			10T		10T		
–			10R		10R		
–			11T		11T		
–			11R		11R		
–			12T		12T		
–			12R		12R		
–			13T	P3	13T		
–			13R		13R		
RED			-48V		-48V	-48V	POWER AND RINGING SUPPLY
WHT			RG		RG	RG	
BLK			GND		GND	GND	
WHT			RGR		RGR	RGR	

table 4. Terminal block assignments

connecting the *48V, GND, RG,* and *RGR* pins on *P3* to the appropriate module connector pins (refer to the appropriate module practices for the power input pins of the modules).

option selection

3.06 Before inserting the appropriate complement of modules, ensure that each module is properly optioned. Each module used in the 260 System must be conditioned for the intended application. All options are implemented through use of slide switches or DIP switches located on the printed circuit board portion of each module. A brief explanation of options and functions is presented in paragraphs 1.13 through 1.24. More detailed explanation of options is available in the individual Practice for each module.

3.07 The position-1 module used for facility interface must be optioned for terminating impedance, level, and possibly, for amplitude equalization.

3.08 No option selection is necessary on the 6101 SF Transceiver module used in position 2 in SF applications. The 6001 and 6002 DX signaling modules used in DX signaling applications do, however, require option selection as outlined in the 6001/6002 practice.

3.09 Each of the position-3 Signaling Converter modules must be conditioned for its various options as detailed in its individual Practice.

3.10 Optioning of both 2wire and 4wire terminating modules involves impedance selection. In addition, 2/4wire Term Sets require network build-out capacitor and balance network selection. Again, refer to the individual module Practices to properly option these modules.

alignment

Note: *Before aligning the 260 System, disconnect (unplug) the position 3 Signaling Converter module. Disconnection of the position-3 module during alignment will expedite the procedure by removing talk battery from the 2wire loop in station-end applications and by preventing the SF cut-and-terminate relay from interfering with the transmit path.*

3.11 To align the 260 System, an oscillator and voltmeter, or Transmission Measuring Set (TMS) are required. A photograph of the 260 System (figure 7) is number-keyed to the text to supplement the alignment procedure. The procedure references only the 4001 Line Amplifier in position 1 of the Assembly. Other Tellabs' modules, when used in position 1, will follow this same procedure.

3.12 Alignment of the 260 System involves adjustment of gain in the position-1 4001 Line Amplifier, and adjustment of attenuation and network build-out capacitance in the position-4 2wire or 4wire Terminating Module. Gain must be adjusted to accommodate receive and transmit transmission level points of +7 and −16dB, respectively, at the interface between the Line Amplifier and the position-2 SF Transceiver Module. Terminating

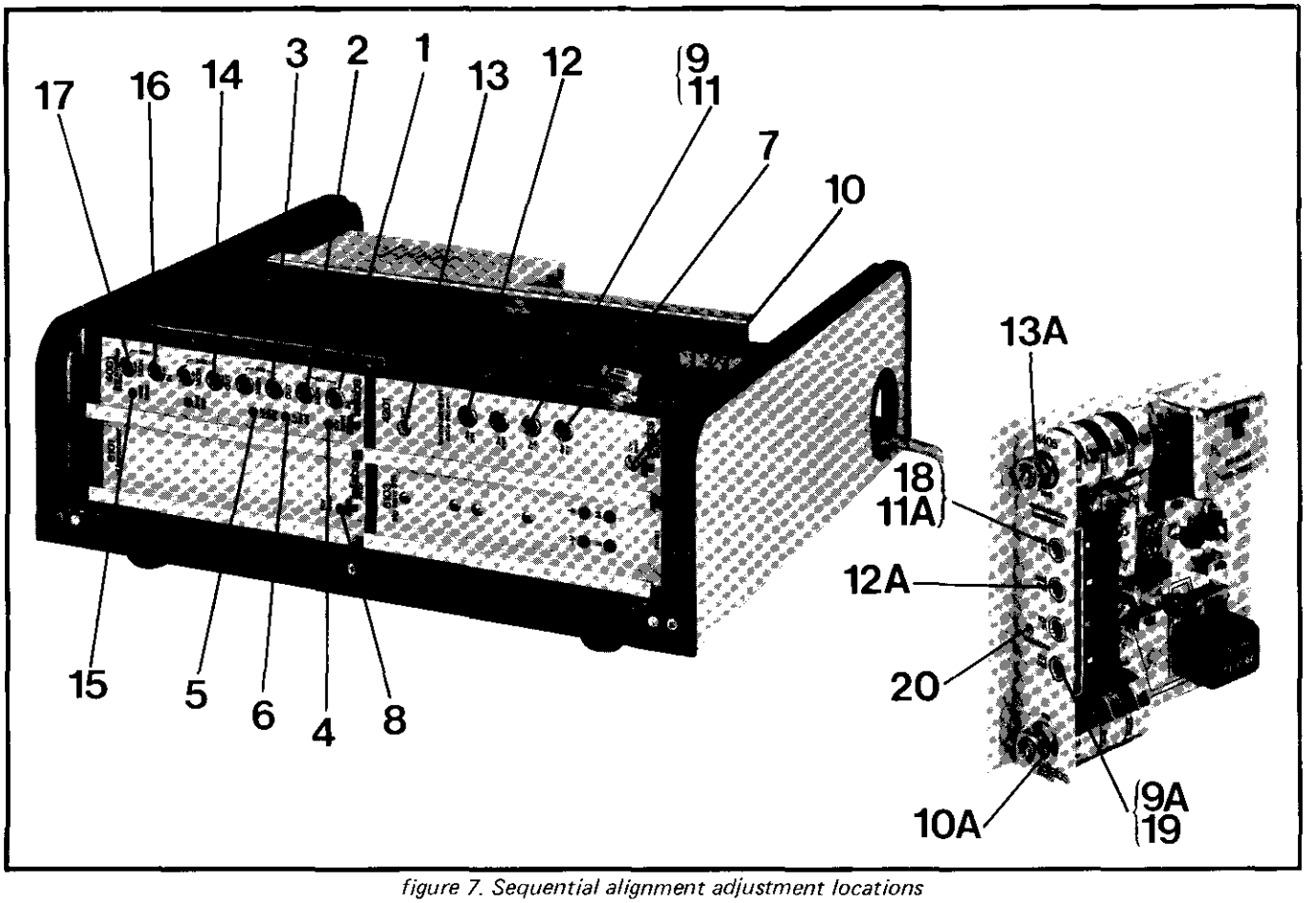


figure 7. Sequential alignment adjustment locations

Module attenuation is adjusted to derive the required 2wire (or 4wire) transmission level.

3.13 **Receive section.** After all modules have been properly optioned, proceed as follows:

A. Adjust all front-panel potentiometers fully counterclockwise.

B. Insert an opening plug into the *RCV IN* jack *1* of the 4001 Line Amplifier. Connect a Transmission Test Set (TTS), adjusted for 600 ohm terminated measurement, to the *RCV IN MON* jack *2* and request that the distant end send 1000Hz test tone at test level (0dBm0). Verify that the receive level is within limits for the circuit.

C. Remove the opening plug and the TTS, and connect the TTS to the 4001's *RCV OUT* jack *3*. Adjust the *RCV LEVEL* potentiometer *4* for +7dBm reading on the TTS (terminated 600 ohm measurement).

D. If receive equalization is desired, set the Line Amplifier's mode switch to the *EQL* or *NL* position, as appropriate, and adjust the *HF* and *LF RCV EQL* potentiometers *5* and *6* to derive a "flat" transmission response as a range of frequencies from 400 through 3200Hz is received from the distant location. For details concerning equalizer alignment, see the 400X Line Amplifier Practice.

E1. If the 420X Term Set is used, remove the TTS from the Line Amplifier *RCV OUT* jack and connect it to the *4W RCV* jack *7* on the 420X Term Set. With the TTS set for terminated measurement, and with 1000Hz tone at test level transmitted from the distant location, adjust the *RCV LEVEL* potentiometer *8*, accessible through the front panel of the 6101 SF Transceiver 8 until a level of +7dBm is measured. Remove the TTS connection to the *4W RCV* jack. Proceed to step **F1**.

E2. If the 4405 4W Station Termination module is used, remove the TTS from the Line Amplifier *RCV OUT* jack and connect it to the *RCV OUT* jack *9A* on the 4405. With the 4405 *RCV* attenuator set to zero, the TTS set for terminated measurement, and 1000Hz test tone transmitted from the distant location, adjust the 6101 *RCV LEVEL* control *8* until a level of +6.5dBm is measured. Proceed to alignment step F2.

F1. If a 420X 4wire Terminating Set is used, set the TTS terminating impedance to 600 or 900 ohms, as appropriate. Insert the TTS plug into the *2W IN* jack *9* on the 420X Term Set and adjust the *RCV* attenuator *10* until the level specified for 2wire receive is realized.

F2. If the 4405 4wire Station Termination module is used, insert the TTS plug into the *RCV OUT* jack *9A* of the 4405 and adjust the 4405 *RCV* attenuator *10A* for the level specified for the 4wire receive port of the associated station. This concludes the receive alignment procedure.

3.14 **Transmit Section.** After all modules have been properly optioned, proceed as follows:

A. Using the oscillator portion of the Transmission Test Set (TTS) or a suitable equivalent, set for either 600 or 900 ohm source impedance, as appropriate, inject 1000Hz tone at the level specified for the circuit at the *2W IN* jack *11* (420X) or *XMT IN* jack *12* (420X) or *XMT OUT* jack (4405) 12A, and adjust the *XMT* attenuator *13* or *13A* to achieve a level of −16dBm at 1000Hz (600-ohm measurement).
B. Connect the TTS to the *XMT OUT* jack *14* of the 4001 and adjust the *XMT LEVEL* potentiometer *15* to achieve the test level specified for the circuit at the 4wire facility transmit channel interface (600 ohm terminated measurement).
C. Although transmit equalization (pre-equalization) is not normally required, the *XMT EQL* control may be adjusted in a clockwise direction to provide (nonloaded cable) equalization. This control is normally left in the full counterclockwise position, providing flat gain in the transmit channel. See the 4001 Line Amplifier Practice for details.

3.15 **SF Tone.** To verify transmission of the SF tone, condition the terminating equipment to cause the 260 System to transmit tone as indicated in table 5 (in all applications, regardless of terminal equipment status, tone transmission may be effected by grounding the M-lead output from the position-3 Signaling Converter module), insert an opening plug into the *XMT IN 16* jack of the 4001, and connect the TTS (set for 600 ohm terminated measurement) into the *XMT IN MON* jack *17* of the 4001. For approximately 500 milliseconds after transition of the M-lead from negative potential to ground, the tone level should be −24 ±2dBm. The level should then drop to −36 ±1dBm. The level should then drop to −36 ± 1dBm for the duration of tone transmission. This completes alignment of the transmit channel.

module	mode	tone is transmitted when:
6102	All	Circuit is idle
6103	Loop Start	Location station is on-hook
6103	Ground Start	Circuit is idle
6104	Loop Start	Ringing is applied to 2W port
6104	Ground Start	Circuit is idle
6105	Automatic RD.	Circuit is seized locally
6105	Manual RD, dc	Ring key is depressed
6105	Manual RD, ac.	Ringing is applied to 2W port
6106	All	Circuit is idle

table 5. Conditions under which SF tone is transmitted

3.16 **Sidetone** In 4wire station applications, the 4405 4wire Station Termination module must be adjusted to provide sidetone level. To adjust the sidetone level:

A. Inject 1000Hz tone, at the test level and impedance specified for the station transmit port, at the *XMT IN* jack *18* of the 4405.
B. Connect the TTS, set for the proper terminating impedance, to the *RCV OUT* jack *19* of the 4405, and adjust the *SIDETONE* control *20* until a level 10dB lower than the station *4W RCV* level is realized.
C. Remove all test cords.

4. specifications

Note: *For individual Power Supply, Ring Generator, and module specifications refer to the respective Tellabs practices or catalog sheets.*

power requirements
(when ordered with 260 DPO or DPR Mounting Assembly equipped with 8016 Power Supply.)
input to 8016: 105 to 129Vac
input to 260 DPO and 260 DPR (from 8016):
nominal −48Vdc
voltage output to modules:
filtered, regulated −48Vdc
current output to modules:
0.55 Amperes

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

dimensions
4.50 inches (11.43cm) high (including 0.5 inch rubber feet)
13.30 inches (33.8cm) wide
17.50 inches (44.5cm) deep

weight
6 pounds 12 ounces (3.06Kg) without modules

mounting
provided with rubber feet for desktop placement; also may be wall-mounted via four screws (not supplied)

5. testing and troubleshooting

5.01 The Testing Guide Checklist in this section may be used to assist in the installation, testing or troubleshooting of the 260 Signaling and Terminating System. The 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 one should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 260 System. Unauthorized testing or repairs may void the system's warranty.

Note: *Warranty service does not include removal of permanent customer markings on the front panels of Tellabs modules. If a module must be marked* **defective,** *we recommend that it be done on a piece of tape or on a removable stick-on label.*

5.02 Before beginning the testing procedure, verify that all modules are properly optioned for the specific application, and that power is supplied to the System, and that a low-resistance local ground has been provided. Also verify that connections have been properly made to terminal blocks *TB1* and *TB2* and that there are no broken or loose wires.

5.03 Tests presented herein are general in nature and are used only to isolate a specific problem to the module level. Practices on the individual modules will also be required. Each module may be individually tested from the Testing Guide Checklist in its respective Practice.

5.04 Many of the tests suggested in this Testing Guide and in individual module Testing guides require level measurements. In all cases, test results are contingent on the System's having been aligned in accordance with the "alignment" part of section 3 in this Practice. Therefore, the circuit should be carefully aligned before performing any tests.

5.05 If a situation arises that is not covered in the Checklist, contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle, Illinois, or Mississauga, Ontario, Headquarters. Telephone numbers are as follows:

US central region: (312) 969-8800
US northeast region: (412) 787-7860
US southeast region: (305) 645-5888
US western region: (702) 827-3400
Lisle Headquarters: (312) 969-8800
Mississauga Headquarters: (416) 624-0052

5.06 If a 260 System is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is more expedient, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

5.07 To obtain replacement equipment, notify Tellabs via letter (see addresses below), telephone (see numbers above), or twx (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8XXXXX part number that indicates the issue of the equipment in question. Upon notification, we shall ship replacement equipment to you. If the equipment in question is in warranty, the replacement will be shipped at no charge. Pack the defective equipment in the replacement equipment's carton, sign the packing slip included with the replacement, and enclose it with the defective equipment (this is your return authorization). Affix the preaddressed label provided with the replacement equipment to the carton being returned, and ship the equipment prepaid to Tellabs.

repair and return

5.08 Return the defective equipment, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532

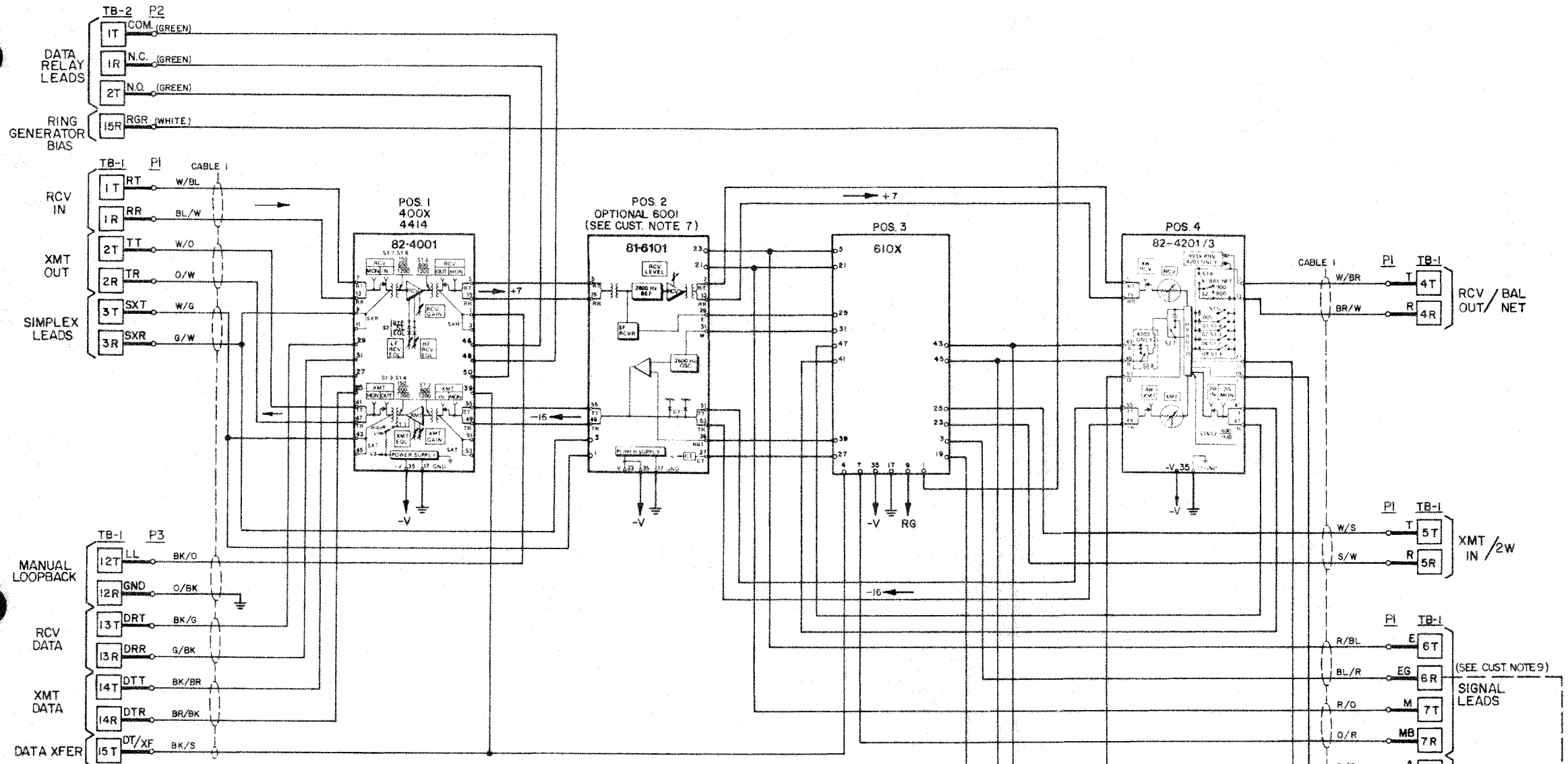
in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7

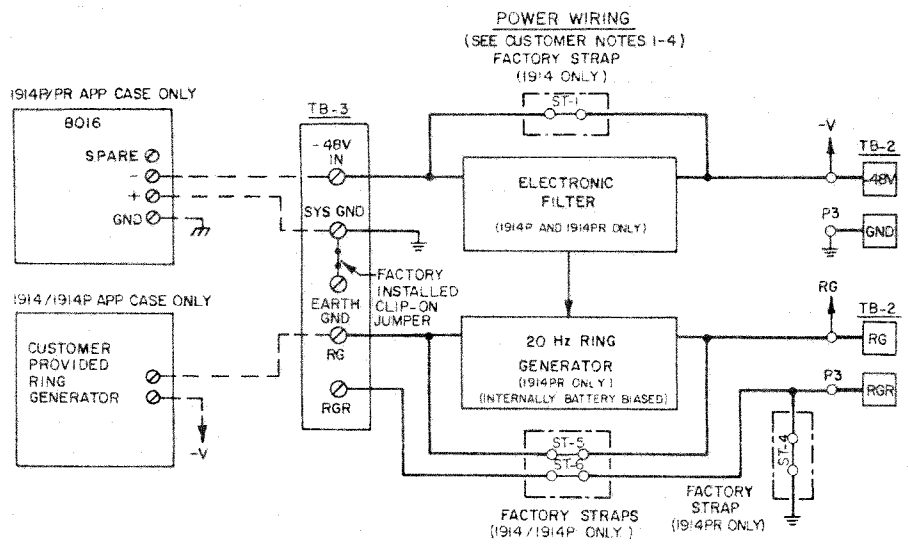
Enclose an explanation of the equipment's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the equipment and ship it back to you. If the equipment is in warranty, no invoice will be issued.

It is assumed that the alignment procedure in part 3 of this Practice has been performed prior to beginning this checklist procedure or that a problem has occurred while trying to align the System. While testing or troubleshooting via this procedure, refer to the 260 System wiring diagram in part 3 of this Practice as necessary.
Note: *To extend testing or troubleshooting to the individual modules in your 260 System, Practices on those modules will be required for their individual testing guide checklists.*

testing guide checklist

test	test procedure	normal result	if normal conditions are not met, verify:
power supply	Set VOM to 50Vdc scale and connect to *–48 IN* and *GND* terminals on *TB3*.	–42 to –56Vdc present ☐.	8016 plugged into active 117Vac outlet ☐. Check input power wiring ☐. Replace 8016 and retest ☐.
ringing supply (if equipped)	Set VOM to 250Vac scale and connect to *RG* and *RGR* terminals on *P3*.	100 to 106Vac present ☐.	8016 plugged into active 117Vac outlet ☐. Internal wiring ☐. Replace apparatus case and retest ☐.
power to System modules	Using VOM, verify that power is present at pins 35 (–batt) and 17 (gnd) of each module position in 260 Assembly (50Vdc scale).	Voltage at each module position is same as supply voltage ☐.	Assembly wiring between module positions ☐.
receive channel transmission continuity	Remove position-3 signaling converter module. Request distant end to send 1000Hz tone at appropriate level. Connect transmission measuring set (TMS) at proper impedance to the *2W IN* jack if 420X Term Set is used in position 4, or to the *RCV OUT* jack if 4405 4Wire Station Termination module is used in position 4.	Level at the *2W IN* or *RCV OUT* jacks in accordance with that specified on circuit level record (CLR) ☐.	Appropriate level measured when TMS connected to output of position-4 module ☐. If this level OK, check Assembly wiring between position-4 module and the terminal block ☐. If this level **not** OK, work backward, checking levels at outputs of position-2 and position-1 modules and checking intermodule wiring between module positions. This narrows source of problem to specific module or to intermodule wiring. If problem traced to module, consult *testing guide checklist* in that module's individual Practice ☐.
transmit channel transmission continuity	Remove position-3 signaling converter module, Connect test oscillator arranged for 1000Hz at proper level and impedance to the *2W IN* jack (420X) or *XMT IN* jack (4405). Connect TMS at proper impedance to the *XMT OUT* jack of the 4001 module and measure level.	Level in accordance with that specified in CLR ☐.	Level OK when TMS connected to output of position-1 module ☐. If this level OK, check wiring between the terminal block and position-1 module ☐. If this level **not** OK, work forward, checking levels at outputs of position-2 and position-4 modules and checking intermodule wiring between module positions. This narrows source of problem to specific module or to intermodule wiring. If problem traced to particular module, consult *testing guide checklist* in that module's individual Practice ☐.
signaling	Insert position-3 signaling converter module. With System powered and operational, check for proper end-to-end signaling conditions.	Normal end-to-end signaling takes place ☐.	Proper operation of position-3 and position-2 modules in accordance with *testing guide checklists* of individual Practices for these modules ☐.





SYMBOLS:

1. ∘ Denotes wire-wrap terminal on 56 pin connector mounted on rear of enclosure.
2. ----- Denotes customer wiring.
3. Denotes twisted pair.
4. ⊘ Denotes screw terminal.
5. —►x Denotes direction of transmission and appropriate test tone alignment level in dBm.
6. [x] Denotes quick-connect terminal of 66 type block mounted inside 1914 Apparatus Case. "X" denotes terminal number.
7. —o Denotes foil trace and wire-wrap terminal mounted on printed circuit board inside 1914 Apparatus Case to associated Type 66 terminal.

CUSTOMER NOTES:

1. The 260DOO Mounting Assembly requires a customer-provided –48Vdc filtered power supply and ring generator. The 260DPO provides –48Vdc at .55 amps. Ring generator must be customer-provided. The 260DPR provides –48Vdc at .55 amps and 4 watts of 20Hz ring generator.
2. The Tellabs 8016 Power Supply will be shipped as loose equipment and will require mounting and wiring to the apparatus case.
3. If 8016 is not used, connect negative (–) and positive (+) terminals of customer-provided power supply to *–48V IN* and *SYS GND* screw terminals, respectively (same as 8016).
4. When a customer-provided ring generator is used, battery biasing (as shown) is required for proper ring trip operation of Tellabs' modules.
5. If using 6103 module in position 3, set switch *S5* to *IN* position.
6. If using 6104 module in position 3, set switch *S6* to *IN* position.
7. If using 6001/2 module in position 2, set switch *S12* to *DX1* and *S15* to *Type I*.
8. For proper operation of the mercury-wetted relay in the 6001, 6002, or 6102 modules, the 260 Assembly must be installed in a vertical, upright position.
9. When Type I E&M signaling is required, a customer-provided strap must be placed between terminals *6R* and *11R* on *TB1*.