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technical manual
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practice section 82261

261 Signaling and Terminating System

contents

1. general description

system overview

1.01 The Tellabs 261 Signaling and Terminating System (figure 1) is a self-contained, modular System that provides SF or DX signaling over a metallic or carrier-derived transmission facility; termination of the facility; and either E and M, foreign exchange, or ringdown signaling interface toward the terminal equipment. Either 2wire or 4wire terminal equipment may be interfaced. The *standard* 261 System is housed in a prewired Type 15A KTU apparatus case equipped with its own power supply and, optionally, with a ringing generator. The 261 System may also be provided in other types of apparatus cases, or the 261 System modules may be supplied alone for relay rack installation and on-site wiring.

Note: *Except where specified, this practice pertains to the standard 261 System housed in a Type 15A Apparatus Case. Much of the information provided is, however, applicable to 261 Systems housed in other types of mounting apparatus.*

1.02 The 261 System is universally wired, allowing the use of printed circuit modules to determine the various operational modes and interfaces. The universal wiring of Issue 2 or later Systems is designed to accommodate alternate voice/data (AVD) operation without the need for additional wiring when an AVD amplifier (see paragraph 1.14) is used in place of a conventional line amplifier. (Issue 1 Systems must be specially wired internally if AVD capability is to be provided.) Aside from this, initial installation or subsequent changes of the 261 System require no internal wiring revision. All changes are made by substitution of modules and by option selection on the individual modules.

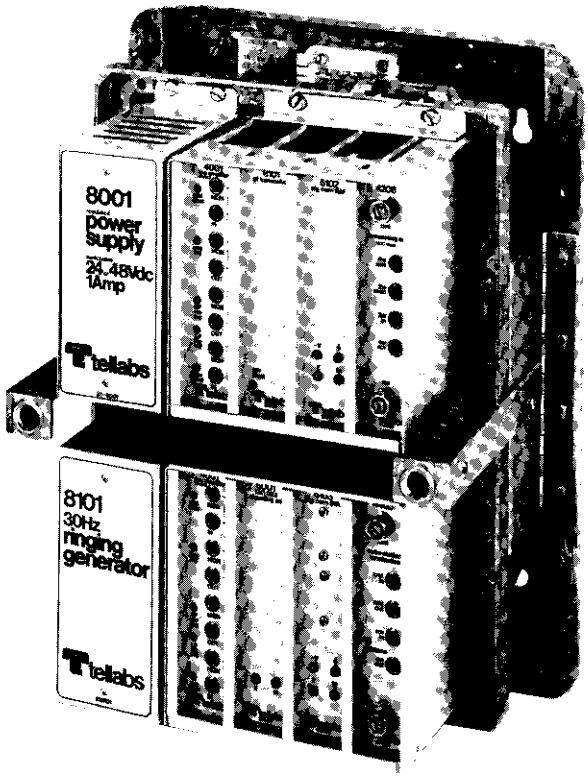


figure 1. Typical 261 System showing 15A Apparatus Case equipped with two circuits

1.03 The most commonly provided 261 System Assembly, exclusive of modules, includes:

★ one 15A (WECo Type 31B) Apparatus Case
★ one Type 66 quick-connect terminal block mounted to inside backplate of Apparatus Case (figure 2)
★ one or two Type 1004 Mounting Shelves
★ one 8001 Power Supply: switchable 24/48Vdc, 1 ampere
★ one 8101 30Hz Ringing Generator (optional)
★ all internal wiring, with external connections brought out to the Type 66 terminal block (figure 2)

Each 1004 Mounting Shelf houses the two, three or four modules necessary for a complete circuit. Power, ringing, and hardware are common to the one or two circuits provided.

1.04 Each of the four mounting positions in each 1004 Shelf has a designated function. Starting from the front far-lefthand position in the Shelf, these functions are as follows:

Position 1: facility interface
Position 2: signaling
Position 3: signaling/terminal converter
Position 4: terminal interface

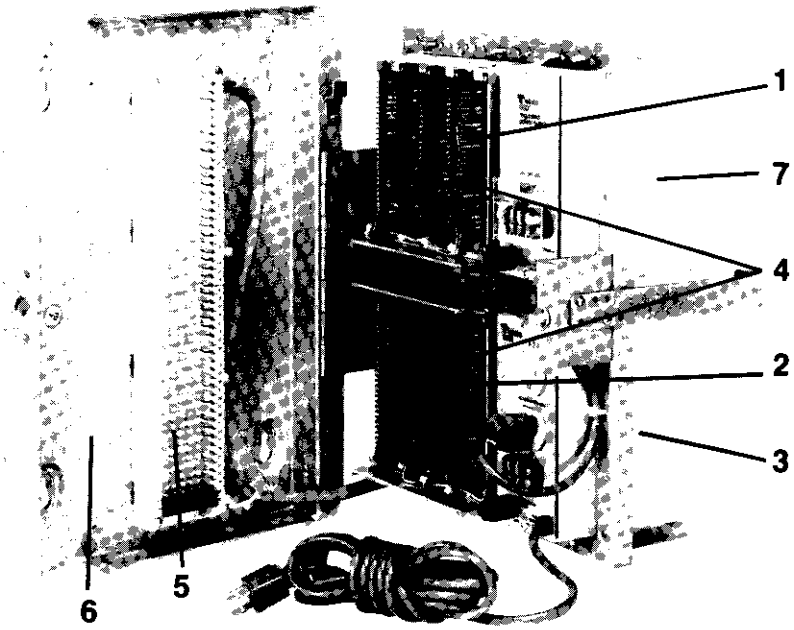


figure 2 (left). Open rear view of a typical Type 261 Signaling and Terminating System as provided in a 15A Apparatus Case. This particular System is provided with two circuits **1** *and* **2** *and the optionally available 8101 Ringing Generator* **3** *. Internal interconnections are universally prewired at the pinfields* **4** *at the rear of each Type 1004 module mounting enclosure. All external leads are brought out to the quick-connect terminal block* **5** *, where necessary connections to external circuitry are made. Lead nomenclature and numbering are provided on the terminal block itself and on vinyl labels affixed to the backplate of the Apparatus Case* **6** *. The System's 8001 Power Supply* **7** *plugs into the convenience receptacle of the 8101 Ringing Generator, which, in turn, is plugged into a conventional 117 Vac outlet.*

Position One (facility interface):
4001 Four-Wire Line Amplifier module
4001A Four-Wire Line Amplifier module
4003A/4003B 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 Signaling Converter module (E and M)
6103 Signaling Converter module (FX, Station)
6104 Signaling Converter module (FX, Office)
6105 Signaling Converter module (Ringdown)
6106 Signaling Converter module (Data Ringdown)

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 employed in the 261 System. In less common applications, other modules may be used in their place.*

table 1. Mounting position functions and module options

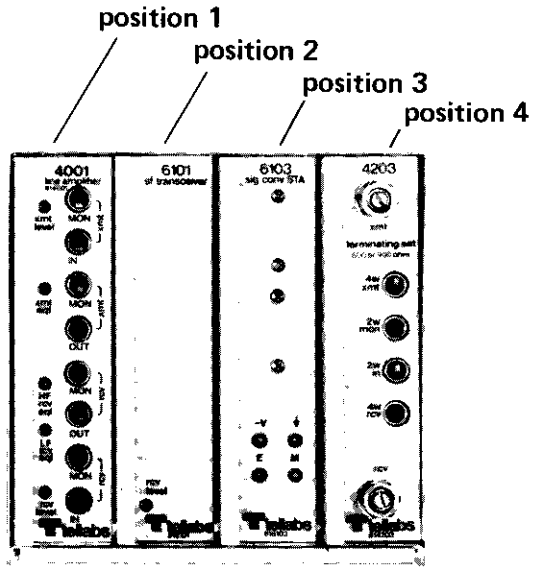


figure 3. Module mounting enclosure with position numbers

1.05 Specific modes of operation are determined by the module selected for each position. Each position in the shelf accommodates a choice of two or more modules, or may, in some applications, be be left unoccupied. See figure 3 and table 1.

1.06 Flexibility inherent to the 261 Signaling and Terminating System allows conversion from DX to SF facility signaling, or vice versa, by the exchange of a single module (the position-2 SF or DX Signaling module) — without any wiring or alignment changes.

1.07 The choice of the (position 3) Signaling Converter module provides the 261 System with one of its five modes of terminal signaling interface: E and 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.

1.08 The choice of position-4 module permits use with either 2wire or 4wire terminal equipment.

1.09 Options on all modules are selected by means of DIP switches or slide switches. No strapping or wiring is needed in the selection of options.

1.10 Power is provided to the 261 System by Tellabs' 8001 Power Supply. The 8001 derives a well-regulated, switchable 24 or 48Vdc, 1 ampere maximum output from conventional 105-130Vac, 60Hz input. A current foldback circuit in the 8001 output protects the Power Supply and associated equipment from overload or short circuit conditions.

1.11 Ringing may be supplied to the 261 System by Tellabs' 8101 30Hz Ringing Generator. Because not all applications require a local ringing supply, the 8101 is an optional component of the 261 package.

individual modules

Following is a brief functional description of each of the printed circuit modules normally associated with the 261 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 4001A Line Amplifiers (figure 4)

1.12 The 4001 and 4001A Line Amplifier modules (shelf position 1 in the 261 System) provide interface with a 4wire transmission facility. Each of these Line Amplifiers provides −3 to +36dB of gain in both transmit and receive channels. (Transmit and receive channels are independent.) In the 4001, one of three optional modes of amplitude equalization may be switch-optioned into the receive channel to match the attenuation characteristics of loaded cable, nonloaded cable, or carrier transmission facilities. The transmit channel provides equalization for nonloaded cable only. In the 4001A, three optional modes of equalization are available in both receive and transmit channels. Both 4001 and 4001A Line Amplifiers incorporate a full set of front-panel test jacks. Other features of the 4001 and 4001A modules include optional 600 ohm or 1200 ohm impedance matching on both the input and output of the transmit and receive channels; derived simplex leads for dc signaling compatibility; switch selection of an alternate (−15 to +6dB) transmit channel gain range, and precision, highly-stable gain and equalization controls that are accessible from the front panel of the module.

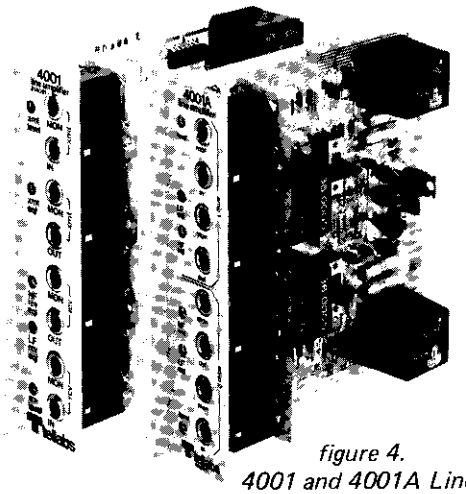


figure 4.
4001 and 4001A Line Amps

4003A and 4003B Line Amplifiers (figure 5)

1.13 The 4003A and 4003B Line Amplifiers with tone-activated or dc-activated Loopback may also be used in position 1. These modules provide from −10 to +35dB of gain in the receive channel and −15 to +30dB of gain in the transmit channel. The same equalization modes are available as in the 4001, i.e., a choice of three equalization modes in the receive channel and nonloaded cable equalization in the transmit channel. Equal-level loopback is provided for circuits with +7 receive and −16 transmit transmission level points (TLP's) or other TLP's with a 23dB differential. The 4003A and 4003B differ only in the method used to effect tone loopback release. A timeout circuit in the 4003B releases loopback after 60 to 120 seconds; the 4003A requires a second tone burst to release loopback. Refer to the latest 4003-family Practice or Catalog Sheet for complete information.

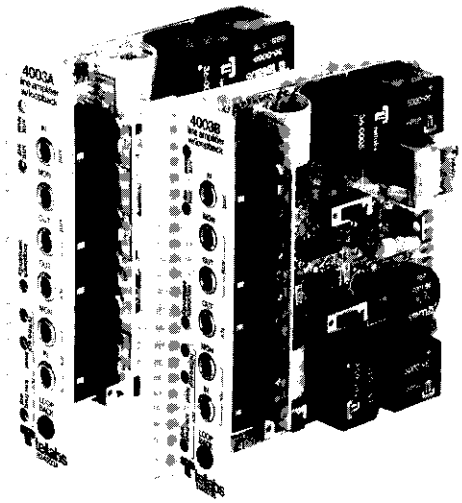


figure 5. 4003A and 4003B Line Amps

4414 AVD Amplifier (figure 6)

1.14 The 4414 Alternate Voice/Data (AVD) Amplifier module (position 1) provides adjustable gain and amplitude equalization in both transmit and receive directions of a 4wire voice-frequency transmission facility used to transmit, at separate times, both voice and data signals. The 4414 derives two sets of ports on its terminal side, one for voice and signaling and the other for data transmission.

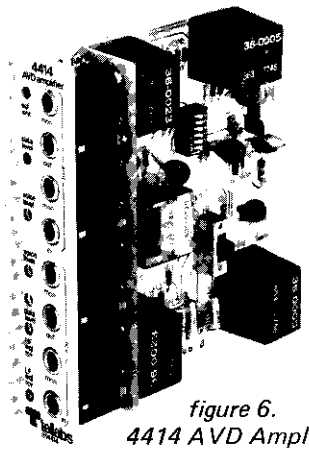


figure 6.
4414 AVD Amplifier

Because voice and data signals normally require different transmission levels, the terminal side of the 4414 incorporates a transfer relay and two independent gain adjustments to achieve levels for each of these two modes of operation. Overall gain ranges are −15 to +36dB in the voice mode and

–35 to +16dB in the data mode. The module remains in the voice mode until the data mode is selected by application of local ground. The 4414 features the same three optional modes of receive-channel amplitude equalization as do all of the afore-mentioned amplifiers, and transmit-channel equalization for nonloaded cable. A full complement of front-panel access and monitor jacks facilitates alignment and adjustments. Other features of the 4414 include optional 150, 600, or 1200 ohm facility-side (receive input and transmit output) impedance; fixed 600 ohm terminal-side (receive output and transmit input) impedance; derived simplex leads for dc signaling compatibility; and highly stable front-panel-accessible gain and equalization controls.

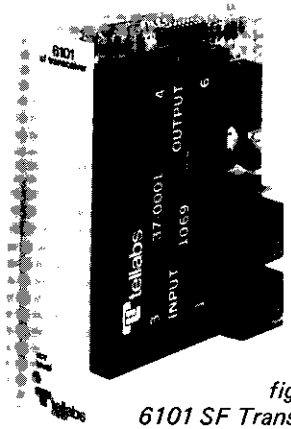


figure 7.
6101 SF Transceiver

6101 SF Transceiver module (figure 7)

1.15 The 6101 SF Transceiver module provides an integral SF tone supply and tone gates for the transmission of SF signals over the facility, and SF receive circuitry for the detection of incoming SF signals from the facility. The (position 2) 6101 SF Transceiver must be used in conjunction with a (position 3) Signaling Converter module, which interfaces the "internal" E and M signals* of the 6101 with the signaling mode at the termination (i.e., foreign exchange, ringdown, or E and M). 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. Precision components are used for all timing functions. A 10dB signal-to-guard ratio ensures extremely low talk-off probability.

*The 6101 converts SF signaling on the facility side to "internal" E-and-M-state signals on the terminal side.

6001 DX Signaling module (figure 8)

1.16 The 6001 DX Signaling module provides switch-selectable DX1 or DX2 signaling over a 4wire metallic facility. In the 261 System, the (position 2) 6001 DX Signaling module converts E and 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 assures reliable operation. Capacitive and resistive balance network values are switch-selected.

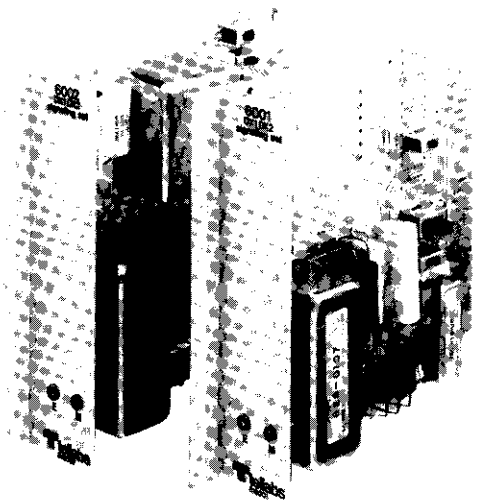


figure 8. 6001 and 6002 DX1/DX2 Signaling modules

6002 DX Signaling module (figure 8)

1.17 The 6002 DX Signaling module provides optional DX1 or DX2 Signaling as does the 6001 DX module (paragraph 1.16). 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 Signaling Converter module (E and M) (figure 9)

1.18 The 6102 Signaling Converter module (E and M) provides E and M lead conditioning between "external" E and M-leads of the terminal equipment and those "internal" E and M states derived in the 6101 SF Transceiver module. 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 and 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 and M signals of the terminal equipment. Front-panel LED's indicate both E-lead and M-lead busy conditions. In the 261 System, the 6102 Signaling Converter may be used with DX signaling as well as with SF. In DX applications, the 6102 provides E and M-lead conditioning in the form of pulse correction.

6103 Signaling Converter module (FX-Station) (figure 9)

1.19 The (position 3) 6103 Signaling Converter module provides signaling conversion between the internal E and M leads of a (position 2) 6101 SF

or 6001/2 DX Signaling 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. Transmit precut is provided by the 6103 in both SF and DX applications, and transmit dial pulse delay is provided in DX applications. In the SF mode, the 6103 also provides cut-and-terminate functions, while in the DX mode, idle line termination and dial pulse transient suppression are provided. 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 and B leads only or tip, ring, A and B leads may be used for station-side signaling. A precision, balanced loop current detector allows the 6103 to operate in the presence of large longitudinal voltages.

6104 Signaling Converter module (FX-Office) (figure 9)

1.20 The (position 3) 6104 Signaling Converter module is the office-end counterpart of the 6103 station-end Signaling Converter described above. As such, the 6104 provides conversion between the internal E and M-lead signals of the (position 2) SF 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. An optional precision Pulse Corrector subassembly (model 9901 or 9902) may be provided to correct incoming (E-lead) dial pulses. Transmit cut-and-terminate control is provided in SF applications, as is idle-line-termination in DX applications. In SF applications, the 6104 also provides 20Hz modulation of outgoing tone, regardless of input ringing frequency. In ground-start DX application, provision is made for optional M-lead wink upon ringing. Either A and B-lead only or tip, ring, A and B-lead connection to the 2wire switching side loop may be accommodated. A front-panel LED indicates circuit-busy status.

6105 Signaling Converter module (ARD) (figure 9)

1.21 The (position 3) 6105 Signaling Converter module provides interface between the E and M-lead signals of the (position 2) DX or SF 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. In the SF signaling mode, the 6105 provides tone off during idle in both the transmit and receive directions of SF signaling when used with a 6101 SF Transceiver module. 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 time-out, 2-second burst ringing, or calling party controlled (CPC) ringing. An optional 9903 Ringing Interrupter subassembly plugs into 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 effected. In either SF or DX multipoint 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 and B-lead or tip, ring, A and 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 Signaling Converter module (special ARD)

1.22 The (position 3) 6106 Signaling Converter module, in combination with the position 2 signaling module, provides a special form of automatic 2-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.

figure 9. 6101 SF Transceiver module and 6102 through 6105 Signaling Converter modules. Signaling Converter modules may be used with the SF Transceiver (shown) or with either of the DX Signaling modules (figure 8).

The 6106 may be optioned for either loop start or ground start operation. A front-panel LED lights to indicate busy status in either direction of seizure. 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 and B-lead or tip, ring, A and B-lead connection to the terminal-side equipment; transmit cut-and-terminate control during idle in SF application; 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.

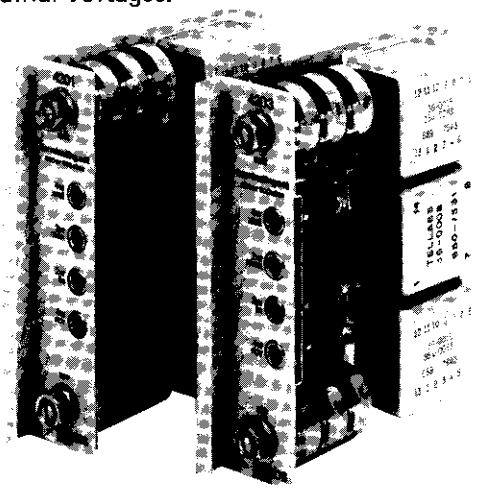


figure 10. 4201 and 4203 Terminating Set modules

4201 and 4203 Terminating Sets (figure 10)

1.23 A 4201 or 4203 Terminating Set may be used in position 4 of the 261 Assembly to convert 4wire facility-side operation to 2wire terminal-side operation. Both modules feature switchable 600/900 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 and 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 A and B-lead isolation inductors) be used in station-end applications involving foreign exchange or ringdown modes of operation. (The 4201 is best suited for E and M operation.)*

4405 4Wire Station Termination module (figure 11)

1.24 The 4405 4Wire Station Termination module occupies position 4 of the 261 System module

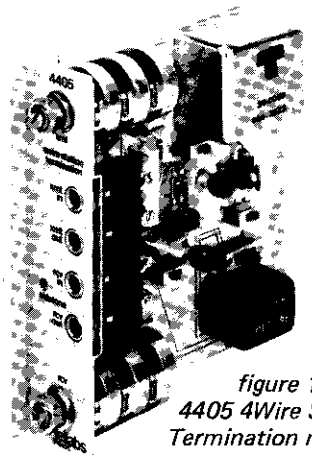


figure 11. 4405 4Wire Station Termination module

enclosure in place of a 420X Term Set whenever a 4wire telephone instrument is to be interfaced. The 4405 provides transmit and receive attenuation (via 0-30dB variable pads), transformer coupling in transmit and receive paths for dc isolation and impedance matching, a sidetone amplifier to provide sidetone to the 4wire instrument, and A and 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 through the transmit A and B-leads, or via receive simplex lead to ground.

1.25 Test points, jacks and adjustments required to install, align and test the 261 System are all provided on the front panels of the various modules. The System may therefore be aligned and maintained with all equipment mounted in place.

1.26 More thorough descriptions of the above modules and of other modules that may occasionally be used in the 261 System are available in the Tellabs Practice or Catalog Sheet on each individual module.

2. application

2.01 In this description, the term "facility side" refers to the side of the 261 System (or module within that System) facing the facility over which SF or DX signaling is transmitted to the distant end of a communications channel. Conversely, "terminal side" refers to the side of the 261 System (or module within that System) facing the near-end equipment or station apparatus, and toward which loop or E and M signaling is extended by the 261 System. See figure 12 for the application of this terminology to a typical end-to-end circuit.

general application

2.02 The 261 Signaling and Terminating System may be configured to accommodate a wide range

of voice frequency signaling and terminating applications. Basically, these applications include 2wire or 4wire facility interface; 2wire or 4wire terminal interface; use of either ac (inband SF) or dc (DX) signaling over the facility; and E and M, foreign exchange, or ringdown mode of 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 12 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, from left to right as you look at the front of the module enclosure. (Module positions in the left-hand System of figure 12 are shown reversed only for diagrammatic clarity.) The *general application* section of this Practice will discuss 261 System usage in terms of these module positions, their functions, their common applications, and their attendant modules.

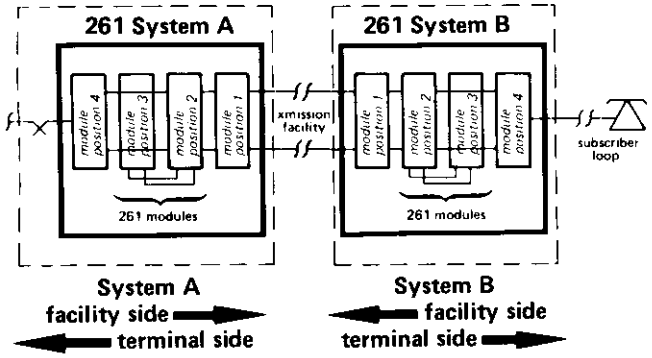


figure 12. "Facility side" and "terminal side" nomenclature

facility-side interface (position 1)

2.04 The 261 System applies SF or DX signaling to 2wire metallic or 4wire metallic or carrier transmission facilities. If SF signaling is to be used, a 4wire facility (metallic or carrier) is necessary. In DX applications, a metallic facility (2wire or 4wire) is utilized. Facility interface is provided by the position 1 module in the 261 System.

2.05 Two-wire metallic facility applications may be served by DX signaling only. In these applications, position 1 is not occupied (see figures 13-I and 13-M). Facility termination (optional 600 or 900 ohms) is provided by the repeat coil circuitry within the 6002 DX Signaling module. The 600 ohm option is chosen for nonloaded cable facilities; the 900 ohm option is chosen for loaded cable facilities. Level adjustments, if required, must be made by equipment external to the 261 System. A 2wire repeater providing 2wire level control may be used for this purpose.

2.06 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 4402 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 261 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 is required if position 1 is left open in 4wire applications (see figure 13-H). If amplitude equalization of the carrier facility is desired, however, a Line Amplifier will then be required in position 1.

2.07 As the majority of 261 Signaling/Terminating System applications involve 4wire metallic facilities, position 1 will normally be equipped with a 4001 Line Amplifier module (see paragraph 1.12). (The 4002 Line Amplifier may also be used, but as it requires a 9801 Card Extender for alignment access, it is not commonly employed.) Gain provided in the transmit channel of the 4001 is continuously adjustable from −15 to +36dB, while the receive channel gain may be continuously adjusted from −3 to +36dB. The maximum output of either channel is +18dBm. Receive and transmit gain ranges will thus accommodate the levels required by the position 2 Signaling module (usually standard +7 and −16TLP's), with facility-side levels meeting all voice frequency circuit requirements within the limits of good transmission practice. Impedance-matching options of 600 or 1200 ohms on the facility side (transmit output and receive input) of the 4001 provide for interface with loaded cable (1200 ohms), or nonloaded cable or carrier (600 ohms). Amplitude equalization is provided in both transmit and receive channels of the 4001. The receive channel is provided with more extensive equalization capabilities, as post-equalization is generally preferable to pre-equalization. Options allow a choice of receive equalization (post-equalization) characteristics to complement the frequency response of loaded cable, nonloaded cable and carrier facilities. Transmit equalization (pre-equalization) is limited to applications with nonloaded cable. Equalization in either channel may be optionally adjusted or switched to a flat response (i.e., no equalization). Transformers at all ports of the 4001 contribute to longitudinal isolation of the 261 package. These transformers derive simplex leads to provide a dc path when used with DX signaling. The 4001 also protects the 261 System from facility-side surges.

2.08 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 261 System. The 4001A provides a choice of three equalization modes in both receive and transmit channels.

2.09 A 4003A or 4003B 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. While these modules offer tone or dc activated loopback, only the tone mode may be used in standard 261 System applications. The 4003A and 4003B differ only in the method used to release loopback. The 4003B employs a timeout circuit (60 to 120 seconds) to release loopback, whereas the 4003A releases loopback in response to a second tone burst. While equalization characteristics of the 4003A and 4003B 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.

signaling modes (position 2)

2.11 The mode of facility-side signaling used by the 261 System is determined by the position 2 module. One of three modules may be utilized in position 2. In 4wire SF applications, a 6101 SF Transceiver is used. In 4wire DX applications, a 6001 DX Signaling module is normally used, although a 6002 may be optioned for 4wire use. And in 2wire DX applications, a 6002 DX Signaling module (with integral repeat coil) is used. In general, DX signaling is more economical over shorter (metallic) facilities. On longer circuits, noise and signaling range considerations usually mandate carrier rather than metallic facilities; thus, SF signaling must be applied.

2.12 The flexibility of the 261 System permits interchangeability between SF and DX modes of signaling by the exchange of a single (position 2) module. A circuit can be converted from 4wire DX signaling to inband SF signaling by removing the 6001 DX Signaling module and inserting a 6101 SF Transceiver module in its place (assuming that the 261 System being converted is equipped with a 4001 Line Amplifier module in position 1). The System may be converted from SF to DX signaling by the same simple exchange of a module. No wiring changes and no unusual level adjustments need be made in either an SF-to-DX conversion or a DX-to-SF conversion. (In foreign exchange applications, a slide switch on the 6103 or 6104 Signaling Converter module must be moved from the *SF* to the *DC* position, or vice versa, when the System is converted from one mode of signaling to another.) This signaling mode flexibility allows one Assembly to meet all contingencies, whether SF or DX.

2.13 When in the DX mode, DX1-format signaling is normally utilized. DX2-format signaling, while rare, requires no special considerations other than the correct optioning of the DX module.

Note: *For proper operation of a dx circuit in a universally wired 261 System, the DX module at one end of the circuit must be switch optioned for "NORM" input leads and the DX module at the opposite end of the facility must be optioned for "REV" input leads.*

signaling mode interface (position 3)

2.14 The Signaling Converter module adapts the facility-side signaling of the position 2 Signaling module to the mode of signaling required on the terminal side of the 261 System. Any of the available (position 2) Signaling modules may be combined with any of the (position 3) Signaling Converter modules to integrate either SF or DX facility-side signaling with E and M, foreign exchange (office), foreign exchange (station), ringdown, special data ringdown, or other (nonstandard) terminal-side signaling schemes.

2.15 Most 261 Systems employ a two-module (positions 2 and 3) combination to provide signaling and signaling conversion. However, when DX signaling employed over a facility is interfaced with E and M terminal-side signaling, a signaling converter module (6102 in this case) is not required unless pulse correction circuitry is needed (see figure 13-O). When used strictly for loop to E and M conversion in applications with external E and M carrier or signaling, the 261 System may be provided without a Signaling module in position 2 (see figure 13-P). (Bypass strapping of position 2 is required in this application.)

2.16 In the SF mode, the various two-module combinations meet all E and F-Type SF specifications. They are, therefore, end-to-end compatible with other manufacturers' equipment meeting these same criteria, in the respective (E and M, Foreign Exchange or Ringdown) mode (see table 2).

2.17 Signaling/terminating systems of various manufacture are end-to-end compatible with the 261 System in the DX mode of terminal interface if standard DX1 operation is employed. Unlike the rather strict end-to-end compatibility limitations of SF operation, the terminal interface mode at one end of a DX signaling facility is compatible with various terminal interface modes at the opposite end. Certain end-to-end combinations will work. Others won't. Note that an E and M terminal inter-

face is compatible with any other mode at the opposite end of the facility (see table 3).

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

*The 261 System may be adapted to operate in the foreign exchange mode, in a foreign exchange application, end-to-end with a signaling/terminating system operated in the E and M mode. See "special applications", paragraph 2.42.

**This relates only to Systems using the modes of ringdown operation as found in 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 261 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

terminal mode . . . (is compatible with) . . . terminal mode(s)
E and M. . . . . E and M, Foreign Exchange (office or station), or Ringdown
Foreign Exchange (office) . . . . . Foreign Exchange (station), or E and M
Foreign Exchange (station) . . . . . Foreign Exchange (office), or E and M
Ringdown (any mode w/6105) . . . . . Ringdown (any mode), or E and M

table 3. End-to-end compatibilities in DX mode

2.18 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 4, with which they are end-to-end compatible.

Tellabs modules . . . . . WECo counterpart	
E and 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 (orFLB)+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 4. Western Electric counterparts in SF mode

Other Western Electric F-type signaling configurations (except those providing carrier group alarm control circuitry) can be provided by the 261 System through special wiring and additional modules. Note that Tellabs' Type 261 SF signaling configurations are not equipped for switched-access testing.

2.19 In SF applications, the position 3 Signaling Converter modules of the 261 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.

2.20 In DX applications where a 2wire drop (terminal-side circuit) is served, the position 3 Signaling Converter module controls an idle line termination function. Idle line termination in the 261 System operates during dialing and idle both to provide dial pulse transient suppression and to prevent singing due to circuit imbalance at the 2w/4w term set during idle circuit conditions.

2.21 In both SF and DX applications, the position 3 Signaling Converter module provides (50ms) minimum-break pulse correction in all transmit dial pulsing circuits, and either minimum-break or precision pulse correction in all receive pulsing circuits.

2.22 A variety of automatic and manual ringdown applications may be served by the 261 System. A 6105 Signaling Converter ARD module in position 3 of the 261 module enclosure provides automatic ringdown service with either 30 second timed ringing, 2 second burst ringing, or calling party controlled (CPC) ringing. Manual ringdown operation in either the dc or ac (switchboard) 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.

2.23 A unique form of automatic ringdown signaling usually associated with data ringdown terminals may be provided through use of the 6106 Signaling Converter ARD module in position 3. Like the 6105, the 6106 interfaces the terminal-side equipment via A and B leads alone, or via tip, ring, A and B leads, and converts signaling on these leads to E and 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-on/4-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.

2.24 When 261 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 a 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.

2.25 Individual features and options provided by the position 2 Signaling modules or position 3 Signaling Converter modules allow adaptation of the 261 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 261 System.

terminal-side interface (position 4)

2.26 The 261 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 in position 4 when the 261 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 261 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 261 System with a 2wire terminal-side drop, position 4 is left vacant. (No bypass strapping is required.)

2.27 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. The 4405 4Wire Station Termination module offers optional 600 or 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 261 Package directly interfaces a 4wire tel set (over a very short drop). In 2wire-to-2wire DX applications, the integral repeat coil of the 6002 DX Signaling module provides optional 600 or 900 ohm impedance matching toward the terminal as well as toward the facility.

2.28 Series 420X Term Sets are available with or without A and B-lead inductors. For 261 Systems in station-located applications, it is recommended that only 4203 Term Sets, which are equipped with A and 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. See paragraph 1.23 for Term Set descriptions.

2.29 Standard interface levels of +7 receive output and −16 transmit input are usually required at the terminal side of the position 2 Signaling module. (These levels are standard with SF signaling and often used with DX signaling as well.) 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.

2.30 Maximum terminal-side signaling range of 261 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). In standard E and M applications involving use of the 6102 Signaling Converter module in position 3, terminal-side range is limited to 1000 ohms of external M-lead resistance. 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 261 System.

2.31 The scope of this Practice does not allow the presentation of detailed information about the features and options of modules available for use in position 4 of the 261 System. Relevant information may be found in the Catalog Sheet or Practice available from Tellabs on each individual module.

power and ringing

2.32 The 261 System features a self-contained 8001 Power Supply that provides optional 24Vdc or 48Vdc output at 1 ampere maximum. A switch at the rear of the 8001 selects 24 or 48Vdc operation. Input power required by the 8001 is 105-130Vac, 60Hz. In 261 Packages provided with ringing, the 8001 is equipped with a short cord that plugs into a convenience outlet at the rear of the 8101 Ringing Generator (see figure 2). The Ringing Generator, in turn, has a 10-foot power cord that plugs into a standard, grounded 117Vac outlet. When the 261 System is not equipped with a Ring-

ing Generator, the 8001 Power Supply is provided with a 10-foot input power cord. The 8001 Supply provides power for the equipment within the 261 System, terminal-side signaling current in DX applications, leads for auxiliary equipment requiring power from the 261 System, and external loop talking battery where applicable. (Voltage regulation and low noise levels of the 8001 Supply allow its use in talk battery applications.) Current requirements for equipment within each 261 System vary according to application, but, generally, 100 to 120mA plus external loop current is required by each complete circuit within the System.

2.33 The 8001 Power Supply incorporates a foldback circuit that shuts down all power output (except a small sensing current) under overload or short circuit conditions. This protects the internal circuitry of the 8001, and, under certain circumstances, associated equipment. In Issue 2 or later Supplies, the foldback circuit automatically restores normal output voltage within approximately 10 seconds of removal of the overload, if the load current after restoration is under 1.2 amperes.

2.34 Where only 220Vac power is available, the 261 System may be equipped with an 8005 Power Supply. Output specifications of the 8005 are the same as those of the 8001.

2.35 Certain applications have some restrictions concerning power. For example, when the 261 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 261 System is operated in the ground start mode, the 261 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 261 System ground.

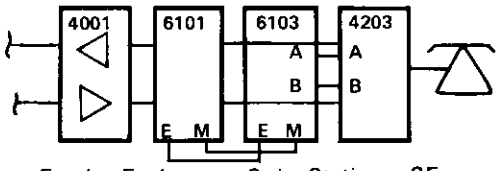
2.36 All modules used within the 261 System incorporate internal voltage regulation that permits operation on –22 to –56Vdc input. External M-lead potentials and loop current feeds are derived prior to regulation, allowing these potentials to be limited only by the external Supply potentials.

2.37 The 8101 Ringing Generator, included with the 261 System in station-end applications requiring ringing, provides 30Hz ringing voltage capable of operating at least five straight-line ringers (WECo Type C4A or equivalent) simultaneously. The 8102 Ringing Generator, which provides 20Hz ringing output, may also be used in the 261 System. Its use, however, will be infrequent because it costs more than an 8101, and the 6104 Signaling Converter converts 30Hz ringing to 20Hz M-lead modulation in all applications requiring a 20Hz signal.

standard applications

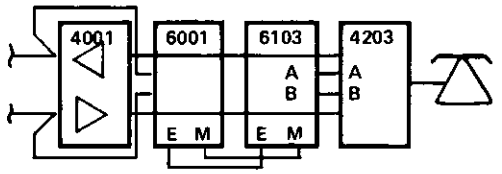
2.38 While other module combinations may be used to satisfy specific applications, the following module combinations, figures 13-A through 13-P, provide the most common circuit configurations in which the 261 System is employed.

figure 13-A



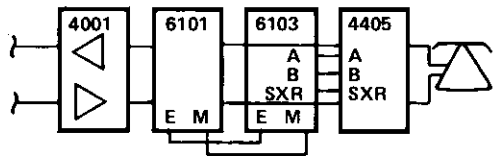
Foreign Exchange – 2wire Station – SF

13-B



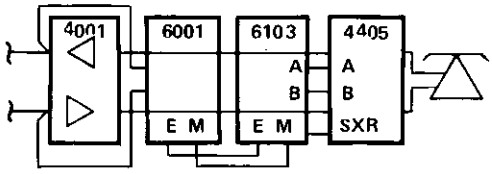
Foreign Exchange – 2wire Station – DX

13-C



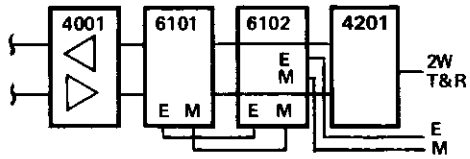
Foreign Exchange – 4wire Station – SF

13-D



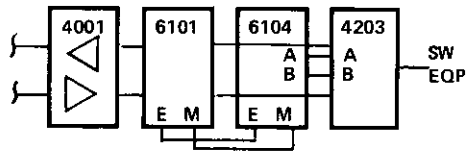
Foreign Exchange – 4W/4W Station – DX

13-E



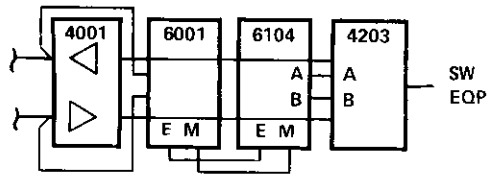
E and M – 2wire – SF

13-F



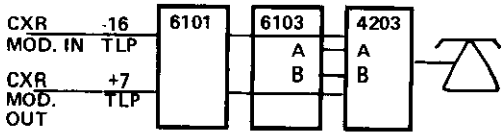
Foreign Exchange – Office – SF

13-G



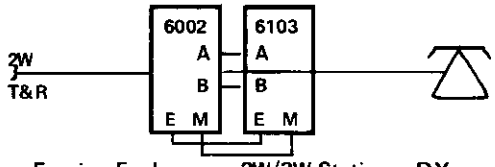
Foreign Exchange – 4W/2W Office – DX

13-H



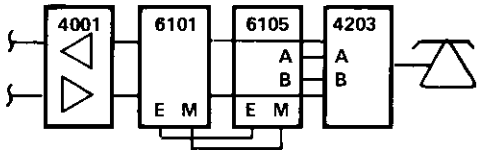
Foreign Exchange – 4W Carrier/2W Station – SF

figure 13-I



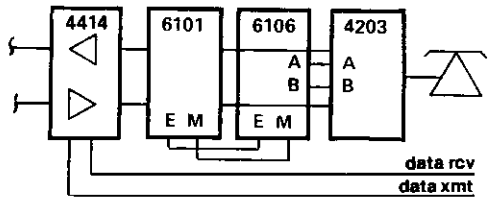
Foreign Exchange – 2W/2W Station –DX

13-J



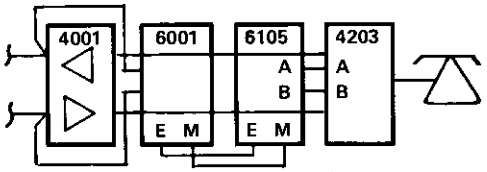
Automatic Ringdown – 4W/2W – SF

13-K



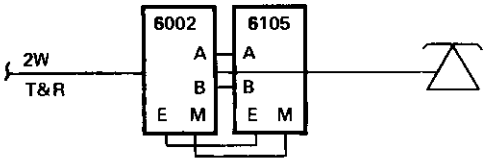
Special Auto Ringdown–4W/2W –SF– AVD

13-L



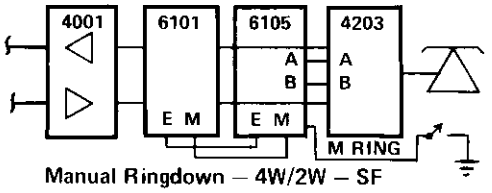
Automatic Ringdown – 4W/2W – DX

13-M



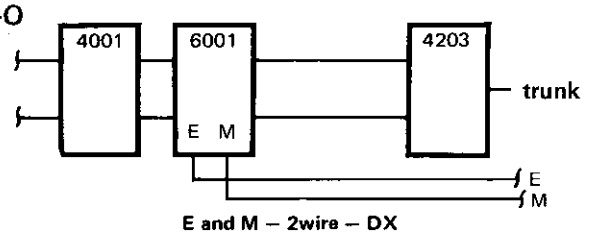
Automatic Ringdown – 2W/2W – DX

13-N



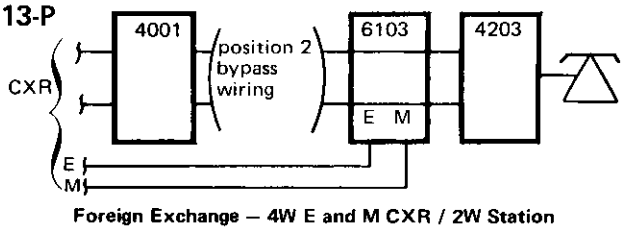
Manual Ringdown – 4W/2W – SF

13-O



E and M – 2wire – DX

13-P



Foreign Exchange – 4W E and M CXR / 2W Station

special applications

2.39 While the basic 261 System will satisfy most conventional applications for SF or DX Signaling/Terminating Assemblies, its inherent flexibility allows reconfiguration with additional Tellabs modules (or into nonstandard mounting apparatus) to provide for more specialized applications. Paragraphs 2.40 through 2.43 offer examples of special applications. They represent only a few of the many special applications that Tellabs' line of modular signaling/terminating/line conditioning equipment may be used to satisfy.

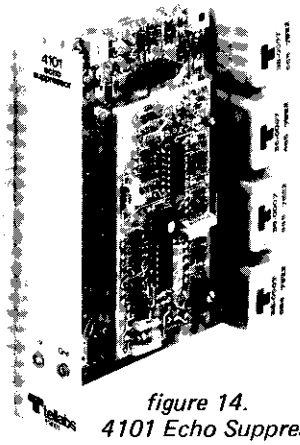
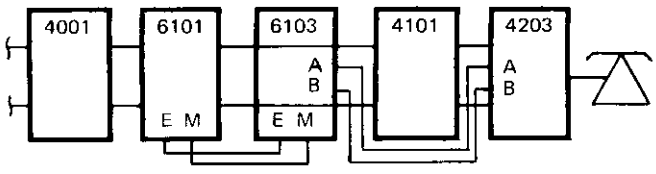


figure 14.
4101 Echo Suppressor module

2.40 A 4101 Echo Suppressor module (figure 14) may be combined with the standard modules of the 261 System to provide voice-switched echo suppression for 4-wire terrestrial or satellite circuits. Echo suppression may be applied to 261 Signaling/Terminating Systems employing either SF or DX signaling with any mode of terminal interface – E and M, ringdown or foreign exchange. A diagram of a typical 261 System circuit with echo suppression is provided in figure 15. With the addition of a fifth module (4101), standard universal 261 System wiring and standard mounting configurations do not apply. Wiring for a 261 System with an Echo Suppressor is universal, however, within the context of the five-module scheme. Various relay rack and apparatus case mounting arrangements may be provided. See the 4101 Echo Suppressor Catalog Sheet or Practice for specific operational details.



Foreign Exchange – 2W Station – SF with Echo Suppression

figure 15. Typical 261 System with Echo Suppression

2.41 With additional modules in place of standard modules in the 261 System, other special applications can be satisfied. Therefore, new modules developed by Tellabs that may be used in the 261 System are provided, if possible, with pinouts compatible for use with the 261 universal wiring scheme.

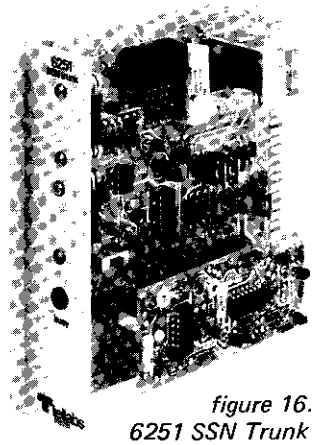


figure 16.
6251 SSN Trunk module

The 6251 SSN Trunk module (figure 16), for example, may be used in position 3 of a standard 261 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 17). Refer to the Catalog Sheet or Practice describing the 6251 SSN Trunk module for specific operational details.

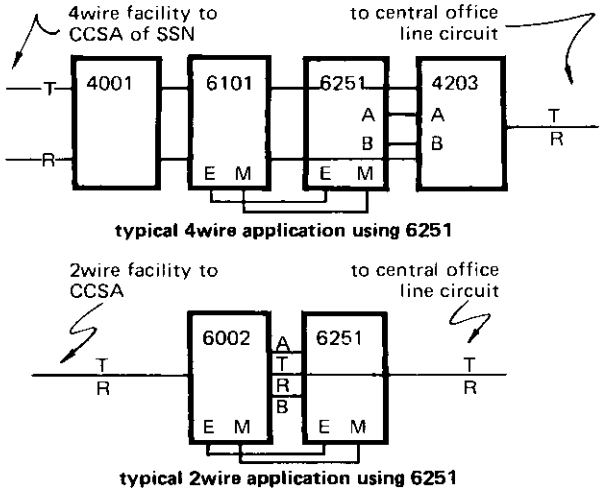


figure 17. 261 Systems incorporating 6251 SSN Trunk

2.42 In applications where, because of choice or availability of equipment, standard E-and-M-format SF signaling and termination is provided at one end of a *foreign exchange* circuit, the 261 System can easily be adapted for operation at the opposite end (in either station-end or office-end foreign exchange SF mode) without any additional modules or wiring. This application is met by optioning the 6103 (station end) or 6104 (office end) Signaling Converter module for the dc mode of operation — even though the application is SF. In figure 18, Western Electric, Wescom and Tellabs equipment configurations for this application are illustrated. Note that when the 6103 or 6104 module is optioned for dc operation, the 20Hz modulation of the SF ringing signal is deactivated. However, in this particular application, 20Hz modulation of the ringing signal is not required.

2.43 Mounting Assemblies for the 261 System are not limited to the 15A Apparatus Case. For example, several 261 circuits may be provided in 16C, 6A, or 6AW apparatus cases. Also, universally-wired relay rack installations of the 261 System provide central office signaling flexibility. Contact Tellabs for details.

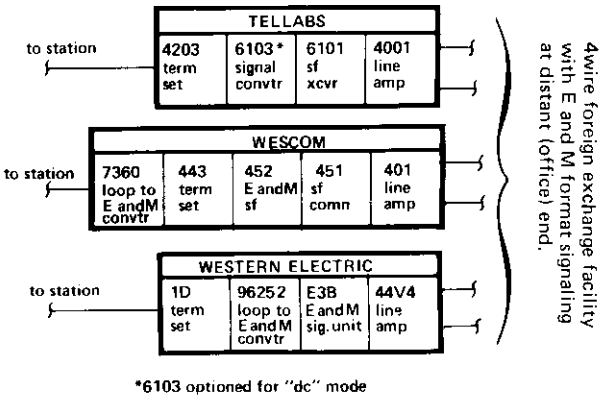


figure 18. E and M format signaling over FX facilities

2.44 Other Signaling and Terminating packages manufactured by Tellabs include the 260 and 269 Systems. These Systems perform functions parallel to the 261, and differ mainly in packaging design. See the 260 and 269 Practices or brochures for additional information.

3. installation

inspection

3.01 The 261 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.

mounting and wiring

3.02 Installation of the 261 System consists of mounting the Apparatus Case (if provided) to a wall or other surface, using the template enclosed with the System as a guide for hole locations. Because a fully equipped System may weigh in excess of 40 pounds (18.14kg), be certain to use the proper type of mounting hardware for the type of wall on which the System will be mounted. Also be certain to leave an 8 inch space both to the right and in front of the System for clearance when the hinged chassis of the 261 Assembly is rotated outward for access to System wiring. The 261 Assembly should be located within 8 feet of a nominal 117Vac 60Hz, single-phase power receptacle, and provision should be made for a reliable ground connection to the equipment at terminal block punching 9R or at the positive terminal of the 8001 Power Supply.

Note: *A reliable, low-resistance connection to local ground is essential for proper operation of the 261 System. If a metallic cold-water-pipe connection cannot be made, connection may be made to the ground conductor used for station protection grounding. (Use separate connection lugs for station protection grounding and for grounding the 261 Assembly.)*

3.03 External connections to the 261 System are made via the Type 66 quick-connect terminal

block located on the Apparatus Case back panel. Lead designations and punching numbers are provided on printed labels positioned next to the terminal block on the backplate of the Apparatus Case. Punching numbers are also provided on the block itself (see figure 2). The Wiring Diagram, figure 19, shows all internal and external connections required to **universally** wire the System. Tables 5, 6 and 7 list external connections to the System for specific applications. Table 5 provides external connections normally required in SF and 4wire DX applications. Table 6 provides external connections normally required in 2wire DX applications. Auxiliary leads, not normally used, are listed in table 7.

Note: *Not all connections shown in tables 5 and 6 are required in every application. For example, external E and M-leads need be connected only when the 6102 Signaling Converter is employed.*

function	assignment circuit #1	assignment circuit #2
4wire facility receive	.1T, 1R	13T, 13R
4wire facility transmit	.2T,2R	14T,14R
2wire terminal-side Tip*	.5T	17T
2wire terminal-side Ring*	.5R	17R
4wire terminal-side transmit*	.5T,5R	17T,17R
4wire terminal-side receive*	.4T,4R	16T,16R
E-lead (with 6102 only)	.7T	19T
M-lead (with 6102 only)	.7R	19R
dc ringdown control (with 6105 only)	.12T	24T

*wire for either 2wire or 4wire operation

table 5. Normal external connections – SF and 4wire DX applications

function	assignment circuit#1	assignment circuit#2
2wire facility-side Tip	.3T	15T
2wire facility-side Ring	.3R	15R
2wire terminal-side Tip	.5T	17T
2wire terminal-side Ring	.5R	17R
dc ringdown control (with 6105 only)	.12T	24T
E-lead (E and M applications only)	.7T	19T
M-lead (E and M applications only)	.7R	19R

table 6. Normal external connections – 2wire DX applications

function	assignment circuit #1	assignment circuit#2
receive simplex (4wire facility)	.3T	15T
transmit simplex (4wire facility)	.3R	15R
external bal. network or 4wire receive	.4T,4R	16T, 16R
D-lead	.8T	20T
F-lead	.8R	20R
G-lead	.9T	21T

table 7. Auxiliary lead external connections

option selection

3.04 After verifying external circuit connections, power, and ground, use the slide switch at the rear of the 8001 Power Supply to select either 24 or 48Vdc potential to power the 261 System. Before inserting the appropriate complement of modules, ensure that each module is properly optioned. Each module used in the 261 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 1.11 through 1.26, and a more detailed explanation of options is available in the individual Practice for each module.

3.05 The position 1 module used for facility interface must be optioned for terminating impedance, and if gain is involved, for amplitude equalization.

3.06 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 position 2 in DX signaling applications do, however, require option conditioning as detailed in the 6001/6002 Practice.

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

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

alignment

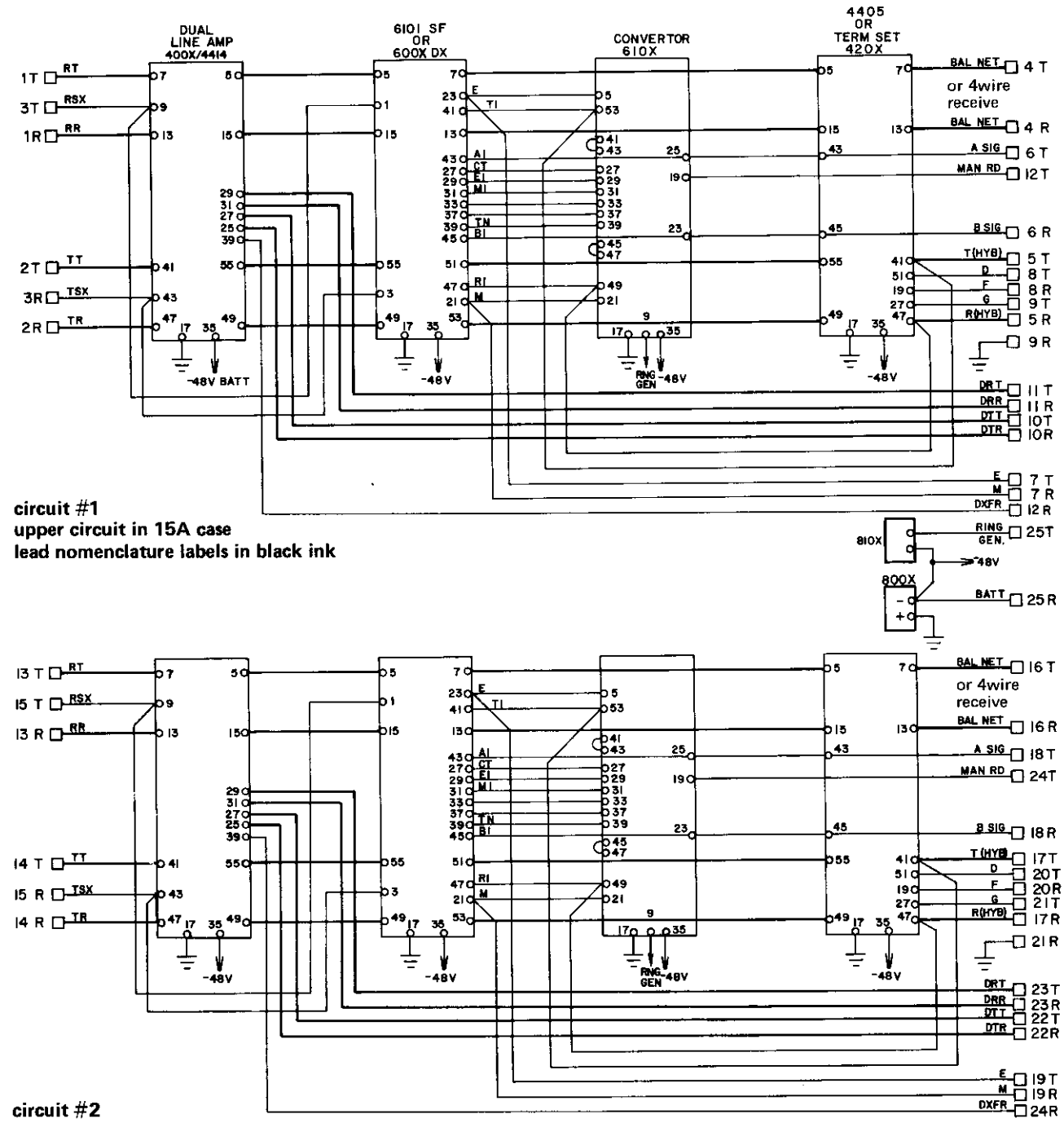
3.09 Procedures for aligning the 261 System when adapted for SF or 4wire DX applications follow. To supplement these alignment procedures, a Transmission Block and Level Diagram (figure 21) is provided on page 18, and a photograph of the 261 System (figure 20) is number-keyed to the text.

Note: *If the 261 System to be aligned is provided with standard Tellabs wiring, the position-3 Signaling Converter module may be disconnected (unplugged) during the alignment procedure. 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. Removal of the position-3 module permits use of the "short method" of alignment. If the "short method" is chosen, paragraphs 3.12B and 3.12C may be deleted from the following procedure. The "short method" of alignment may be accomplished with any oscillator/voltmeter. If the System does not employ standard Tellabs 261 wiring, the "long method" (i.e., all steps in the following procedure) must be used. When the "long method" is followed, the position-3 module must be in place, and alignment instrumentation capable of functioning under wet-loop conditions must be employed. Tellabs' standard 261 System wiring allows the more expeditious "short method" alignment procedure because transmission leads bypass the position-3 module, and signaling is provided via the A and B-leads.*

alignment – SF applications

Note: *The following 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.*

3.10 Alignment of the 261 System for SF applications involves adjustment of gain in the (position



circuit #1
upper circuit in 15A case
lead nomenclature labels in black ink

circuit #2
lower circuit in 15A case
lead nomenclature labels in red ink

Note: The above wiring diagram is applicable only to the Tellabs Type 261 universal wiring scheme for Tellabs modules. Not all connections shown need be implemented in all 261 Signaling/ Terminating System applications.

tellabs

261 System Universal Wiring Diagram 82261

figure 19. System wiring diagram

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

3.11 *Receive Section*. After all modules have been properly optioned, proceed as follows:

A. 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.

B. 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).

C. If RCV equalization is desired, set the Line Amplifier's mode switch to the *EQL* or *NL* position, as appropriate, and adjust the *HF* and *LF* potentiometers **5** and **6** to derive a "flat" transmission response as tone of frequencies from 400 through 3200Hz is received from the distant location. For details concerning equalizer alignment, see the 440X Line Amplifier Practice.

D1. 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* gain potentiometer 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 E1.

D2. 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, ad-

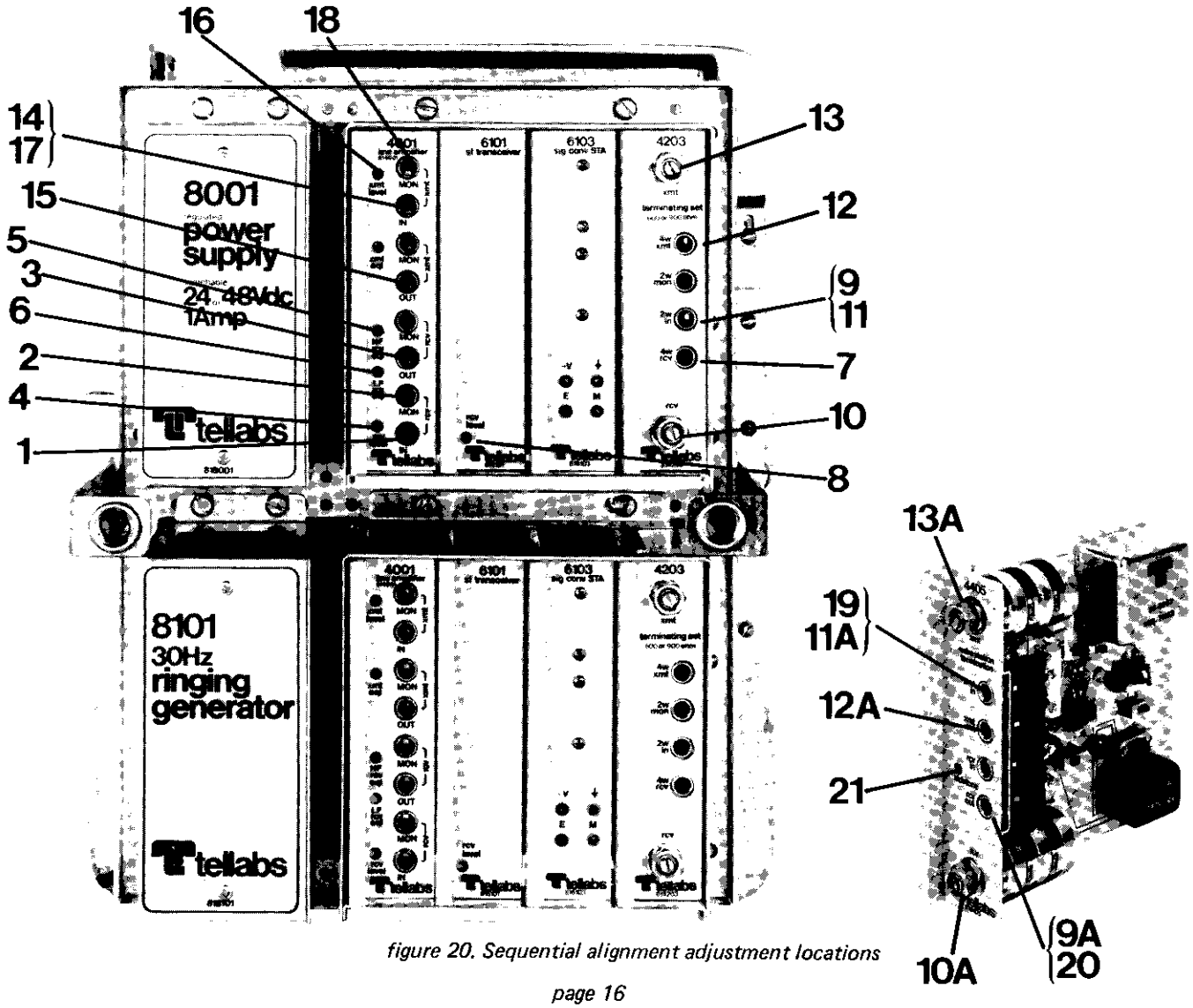


figure 20. Sequential alignment adjustment locations

just the 6101 *rcv level* control **8** until a level of +6.5dBm is measured. Proceed to alignment step E2.

E1. 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 2w receive is realized.

E2. 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 alignment of the receive channel.

3.12 *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 (4405) **11A**. Measure the tone level at the *XMT* 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. Remove the oscillator and level meter from the Terminating module, and carefully adjust the oscillator level to −16dBm at 1000Hz (600 ohm terminated measurement).

C. Insert oscillator tone, preset as described in 3.12A, into the *XMT IN* jack **14** of the 4001. (This approach is suggested because the cut and terminate relay in the [position 2] 6101 SF Transceiver module prevents transmission of tone through the transmit portion of that module during idle circuit conditions.)

D. Connect the TTS to the *XMT OUT* jack **15** of the 4001 and adjust the *XMT level* potentiometer **16** to achieve the test level specified for the circuit at the 4wire facility transmit channel interface (600 ohm terminated measurement).

E. 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.

3.13 To verify transmission of SF tone, condition the terminating equipment to cause the 261 System to transmit tone as indicated in table 8 (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* **17** jack of the 4001, and connect the TTS (set for 600 ohm terminated measurement) into the *XMT IN MON* jack **18** 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 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	Local 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 8. Conditions under which SF tone is transmitted

3.14 *Sidetone.* In 4wire station applications, the 4405 4wire Station Termination module must be adjusted to provide proper 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 **19** of the 4405.

B. Connect the TTS, set for the proper terminating impedance, to the *RCV OUT* jack **20** of the 4405, and adjust the *SIDETONE* control **21** until a level 10dB lower than the station *4W RCV* level is realized.

C. Remove the test cords from the 4405 module.

alignment — 4wire DX applications

3.15 Alignment of a circuit employing DX signaling is less critical than alignment or circuits employing SF signaling. Alignment of a DX circuit involves only the coordination of gains and losses for optimum transmission performance. It is suggested, however, that Line Amplifier gain and Terminating module losses be adjusted as they are in SF applications. This will accommodate possible changes from DX to SF signaling without the need for realignment. It is assumed that all modules are properly optioned before the alignment procedure is started.

3.16 To align the receive section of the 261 System in 4wire DX applications, follow steps A, B, C, and either E1 or E2 of paragraph 3.11 above.

3.17 To align the transmit section of the 261 System in 4wire DX applications, perform steps A, D, and E of paragraph 3.12 above.

3.18 If the 4wire DX circuit terminates in a 4wire station instrument, adjust the sidetone level in the 4405 module as described in paragraph 3.14 above.

alignment — 2wire DX applications

3.19 No alignment is required in 2wire DX applications. All modules, however, must be properly optioned.

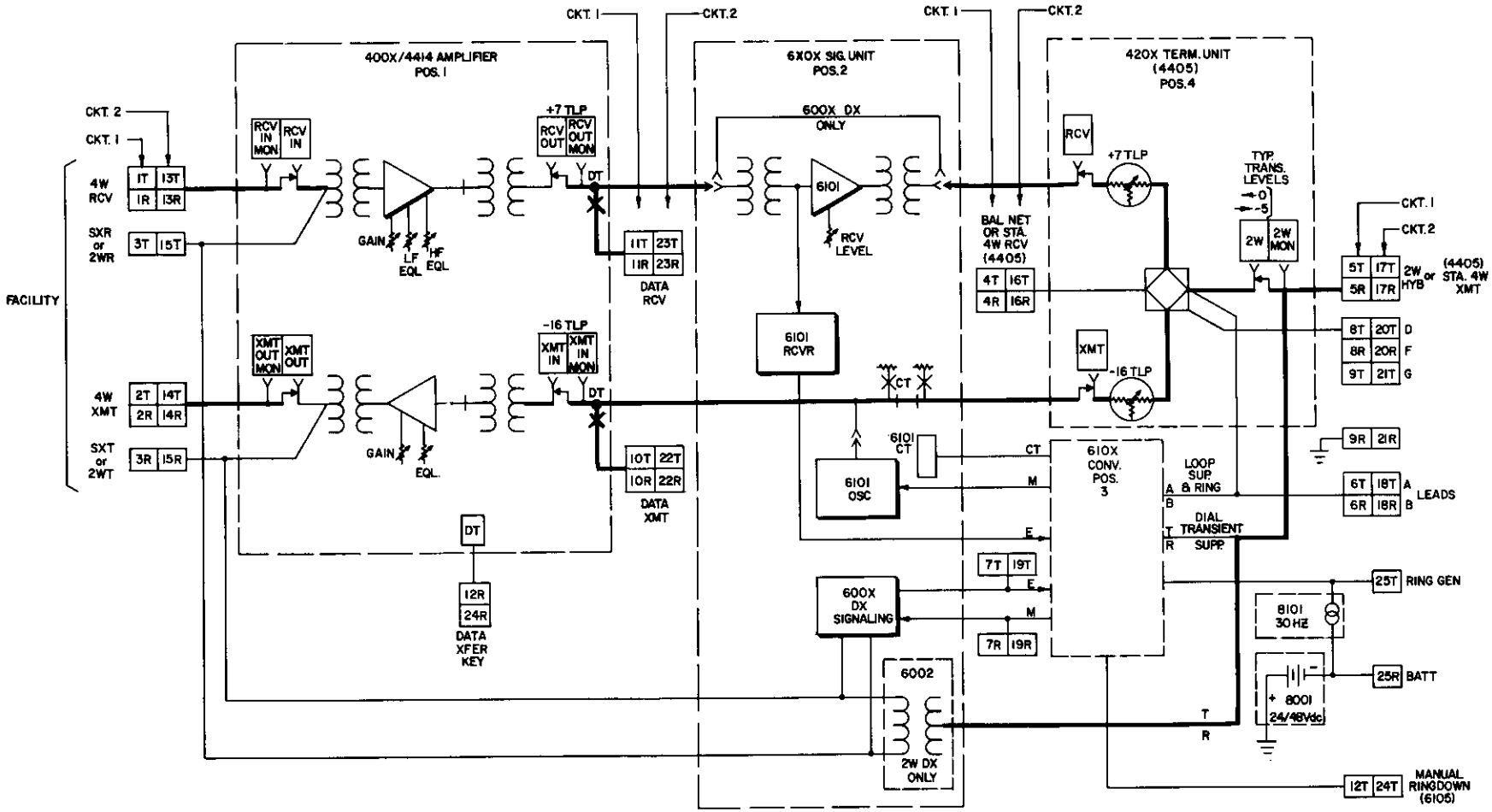


figure 21. Transmission block and level diagram

4. specifications

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

dimensions (261 Assembly)
16.25 inches (41.28cm) high
13 inches (33.02cm) wide
10.25 inches (26.04cm) deep

weight in heaviest configuration
with power, ringing, and two 1004 Shelves but no modules: approximately 32 pounds (14.51kg)
same as above with two four-module circuits using heaviest module available for each position: approximately 43 pounds (19.51kg)

5. testing and troubleshooting

5.01 This Testing Guide is intended as an aid in verifying proper operation of the 261 System and as a guide for locating and isolating circuit problems. The tests suggested herein should enable the installer to determine that the 261 System is operating properly, and if trouble is encountered, to determine whether the problem is in the 261 System, the transmission facility, or the terminal equipment.

5.02 Before beginning the testing procedure, verify that all modules are properly optioned for the specific application, 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 the Type 66 block 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 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 problem is isolated to an individual module within the System, a replacement module should be substituted for the defective module to verify the diagnosis of the problem and to effect proper operation. Internal (component level) testing or repair of an individual module is not recommended and may void the Tellabs warranty.

5.06 This Testing Guide assumes SF or 4wire DX operation. For 2wire DX operation, access to the circuts must be made at the Type 66 terminal block because the modules involved in this type of application are not equipped with jacks.

5.07 If a situation arises that is not covered in this or the modules' Testing Guide Checklists, contact Tellabs Customer Service at (312) 969-8800 for further assistance.

5.08 If equipment 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

5.09 If defective equipment is encountered, notify Tellabs directly via telephone [(312) 969-8800], letter [see below], or twx [910-695-3530]. Notification should include all relevant information, including the 8XXXXX part number (from which we can determine the Issue of the equipment in question). Upon notification, we shall ship replacement equipment to you. If the warranty date of the defective equipment has not elapsed, the replacement equipment will be shipped at no charge. Package the defective equipment in the replacement equipment cartons: sign the packing list included with the replacement equipment and enclose it with the defective equipment (this is your return authorization); affix the preaddressed labels provided with the replacement equipment to the cartons being returned; and ship the equipment prepaid to Tellabs.

repair and return

5.10 Return the defective equipment, shipment prepaid, to: Tellabs Inc.
4951 Indiana Avenue
Lisle, Illinois 60532
attn: repair and return dept.

Enclose an explanation of the malfunction that the equipment has experienced. Follow your company's standard procedure with respect 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.

testing guide checklist on page 20

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 troublehsooting via this procedure, refer to the 261 System wiring diagram and transmission block and level diagram in part 3 of this Practice as necessary.

Note 1: *To extend testing or troubleshooting to the individual modules in your 261 System, Practices on those modules will be required for their individual testing guide checklists.*

Note 2: *All 261 Assembly quick-connect block punching designations in this checklist apply to circuit 1 only. When testing circuit 2 (if provided), use corresponding circuit 2 designations.*

testing guide checklist

test	test procedure	normal result	if normal conditions are not met, verify:
power supply	Using VOM, measure local Supply voltage between punching 25R and ground (50Vdc scale). Be sure Supply is switch-optioned to 24Vdc or 48Vdc operation, as desired.	Voltage measures −24±1 or −48±1Vdc from 25R to ground ☐. (Normal current drain will be about 120mA plus external loop current.)	AC power applied to System ☐. Power Supply properly fused ☐. Power connections to individual modules ☐. [If current drain greater than 1 amp, Power Supply will automatically fold back.] Remove modules, one by one, to see if short exists in any module. ☐. Either reset 8001 Supply (Issue 1) or allow 10 seconds for auto reset (Issue 2) ☐].
ringing supply (if equipped)	Using VOM, measure local ringing potential between 25R and 25T (250Vac scale).	Ringing potential measures 90 to 130Vac between 25T and 25R ☐.	AC power applied to System ☐. Ringing generator properly fused ☐.
power to System modules	Using VOM, verify that power is present at pins 35 (−batt) and 17 (gnd) of each module position in 261 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 punchings 5T and 5R if 420X Term Set is used in position 4, or to punchings 4T and 4R if 4405 4Wire Station Termination module is used in position 4.	Level at punchings 5T/5R or 4T/4R 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 punchings 5T/5R or 4T/4R ☐. If this level **not** OK, work backward, checking levels at outputs of position-2 and position-1 modules and checking Assembly wiring between module positions. This narrows source of problem to specific module or to Assembly 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 punchings 5T and 5R on 261 Assembly quick-connect block. Connect TMS at proper impedance to punchings 2T and 2R and measure level.	Level at punchings 2T and 2R 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 punchings 2T and 2R and position-1 module ☐. If this level **not** OK, work forward, checking levels at outputs of position-2 and position-4 modules and checking Assembly wiring between module positions. This narrows source of problem to specific module or to Assembly 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. (These depend upon particular position-3 signaling converter module and position-2 SF or DX signaling module used. See paragraph 3.13 in this Practice.)	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 ☐.