

# 4406 KTU 4Wire Station Termination

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## 1. general description

1.01 The 4406 KTU 4Wire Station Termination module (figure 1) performs the functions required to integrate a 4wire KTU station instrument into a 4wire voice network. The 4406 provides impedance matching on the station side, contains pickup and push-to-talk relays with auxiliary contacts for activating lamps on the station instrument, and contributes from 0 to 30dB of attenuation in both the transmit and receive channels. A loudspeaker output is available at the receive output port for use in voice-paging networks. The 4406 also provides talk battery and, optionally, sidetone to the station. The 4406 does not directly interface a 4wire facility; a 4wire repeat coil, line amplifier, or other line interface device must be used.

1.02 This practice section covers the Issue 2 version of the 4406 module (Tellabs part number **824406**). The Issue 2 4406 differs from the Issue 1 version through the addition of two LEDs to the module's front panel. The practice is revised to update the text portion of section 7.

1.03 On the station side, the 4406 provides a switch-selectable terminating impedance of 1200, 600, or 150 ohms at the receive port and 600 or 900 ohms at the transmit port. On the facility side, the 4406 provides a fixed terminating impedance of 600 ohms at both the transmit and receive ports.

1.04 The pickup relay on the 4406 is activated by the station instrument's A lead whenever the station goes off hook. This completes the transmission path and extends talk battery to the station. The push-to-talk relay allows the 4406 to be used with station instruments that are equipped with a manual push-to-talk key and in radio-telephone applications. Both relays provide auxiliary contacts for control of lamps on the station instrument. Contacts on the A relay mute the loudspeaker output in voice-paging applications.

1.05 Variable attenuators on the 4406 provide level coordination between the station and the facility-interface device. These attenuators can be adjusted, via front-panel controls, to provide from 0 to 30dB of attenuation in both the transmit and receive channels (this is in addition to 0.5dB of insertion loss).

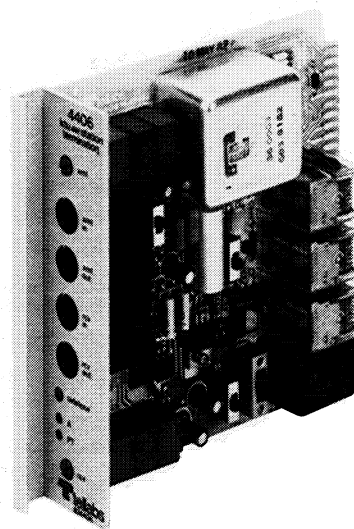


figure 1. 4406 KTU 4Wire Station Termination

1.06 In addition to the transmit and receive attenuator controls, the front panel of the 4406 contains a sidetone level control and four test jacks, one at each port. All four are opening jacks facing the module. The front panel also contains two LEDs, a red one that lights when the A relay is activated and a yellow one that lights when the PT relay is activated.

1.07 An internally regulated power supply in the 4406 permits operation on filtered, ground referenced  $-22$  to  $-28$ Vdc input. Maximum current requirement is 105mA plus loop current. Reverse-battery and transient-limiting circuitry are provided in the module's internal power supply circuitry. Resistance-capacitance (RC) filtering and decoupling networks minimize crosstalk coupling and the effects of noise on the input power leads.

1.08 A Type 10 module, the 4406 mounts in one position of a Tellabs Type 10 Mounting Shelf, versions of which are available for relay-rack and apparatus-case installation. In relay-rack applications, up to 12 modules can be mounted across a 19-inch rack, and up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical rack space is used. The 4406 can also be supplied as part of a self-contained 265A Voice Signaling System for use in voice paging applications.

## 2. applications

2.01 The 4406 KTU 4Wire Station Termination module provides a 4wire termination for a multi-point voice network. The 4406 provides attenuation, talk battery, sidetone amplification, and transformer isolation and balance for the station instrument. Loudspeaker outputs are available for use in

voice-paging networks. The 4406 interfaces the 4wire facility through a separate repeat coil, line amplifier, or other 4wire line-interface device.

**2.02** The most common application of the 4406 is in voice paging networks (commonly known as "hoot 'n' holler" or "junkyard" circuits). For such applications, the 4406 can be supplied as part of a Tellabs 265A Voice Signaling System. The System consists of a Tellabs 265A Mounting Assembly, the 4406, and either a 4422 Repeat Coil or a Tellabs 400X Line Amplifier. Please refer to the Tellabs 265A Voice Signaling System Practice for detailed information on this application.

**2.03** Level coordination between the station and the line-interface device is provided by attenuators in the transmit and receive channels of the 4406. These attenuators each provide from 0 to 30dB of loss and are adjusted by controls on the module's front panel.

**2.04** Two transformers on the 4406 provide switch-selectable impedance matching on the station side. The transformer at the receive output port can be optioned for 1200, 600, or 150 ohms. The 1200-ohm option is normally selected when the station-side receive port interfaces loaded cable; the 600 ohm option is selected for interface with intermediate lengths of nonloaded cable or for direct interface with a telephone set; and the 150-ohm option is selected for interface with longer sections of nonloaded cable. The transformer at the transmit input port can be optioned to provide 600- or 900-ohm terminating impedance. The 900-ohm option is selected when the station-side transmit path interfaces loaded cable, and the 600-ohm option is selected for interface with nonloaded cable or a telephone set. Both transformers provide fixed balanced 600-ohm terminating impedance at the facility-side ports.

**2.05** The pickup (A) relay on the 4406 is operated by the A lead from the KTU station when the station goes off-hook. A-relay contacts at both station-side ports establish a transmission path through the 4406 and, at the transmit input port, extend talk battery to the station (via the module's TT2 and TR2 leads). These contacts can be bypassed by making station connections to the 4406's TT1 and TR1 leads. In addition to normally open contacts at the receive output port, the A relay provides a set of normally closed contacts in the loudspeaker output leads (LST and LSR). These contacts mute the loudspeaker when the station is off-hook in voice-paging applications. The A relay also provides auxiliary relay contacts that can be used to light lamps and sound buzzers on the telephone set or to serve other applications that require a contact closure. An LED labeled A on the module's front panel lights to indicate that the A relay is activated.

**2.06** The push-to-talk (PT) relay on the 4406 can be optioned to be operated either manually by an external push-to-talk switch or automati-

cally when the station goes off-hook. When optioned for manual operation, the PT relay is activated by a ground signal on the 4406's PT lead. When optioned for automatic operation, the PT relay is activated by current flowing from the 4406's transmit input port. The PT relay provides normally open contacts at the 4406's transmit input port that can be used in conjunction with, or independently from, the A-relay contacts to complete the transmission path through the 4406. The PT relay also provides auxiliary relay contacts that can be used, for example, to key a radio transmitter in radio-telephone applications. An LED labeled PT on the module's front panel lights to indicate that the PT relay is activated.

**2.07** The sidetone amplifier on the 4406 can be switch-optioned into or out of the circuit as required. The sidetone amplifier couples a portion of the voice energy present in the transmit channel to the receive channel. This aids in achieving a natural speaking level and prevents the circuit from sounding dead. The sidetone amplifier's gain can be adjusted from -20 to +5dB via a front-panel control.

### 3. installation inspection

**3.01** The 4406 KTU 4Wire Station Termination module should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should be filed immediately with the carrier. If stored, the module should be inspected again prior to installation.

#### mounting

**3.02** The 4406 mounts in one position of a Tellabs Type 10 Mounting Shelf. The module plugs physically and electrically into a 56-pin connector at the rear of the shelf.

#### installer connections

**3.03** Before making any connections to the mounting shelf, ensure that power is **off** and that modules are **removed**. The 4406 module should be inserted into place only **after** it is properly optioned and **after** wiring is completed.

**3.04** Table 1 lists external connections to the 4406. All connections are made via wire wrapping at the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector.

#### option selection

**3.05** Optioning the 4406 consists of selecting the terminating impedance at both station-side ports, selecting sidetone (if desired), and selecting manual or automatic operation of the PT relay. Locations of the option switches on the 4406's printed circuit board are shown in

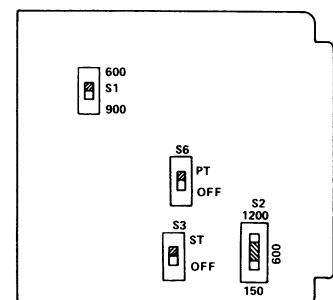


figure 2. 4406 option locations

figure 2. Table 2 provides a brief explanation of the function and settings of each option switch and a convenient option checklist. The checklist can be filled out (by checking the appropriate box for each switch) either prior to installation to allow prescription optioning of the module, or as the module is being optioned to provide a record for future reference. Detailed instructions for optioning the 4406 are provided in paragraphs 3.06 through 3.08.

| connections                                                           | 4406 connector pin number |
|-----------------------------------------------------------------------|---------------------------|
| <b>FACILITY INTERFACE:</b>                                            |                           |
| T1: xmt out tip. . . . .                                              | 55                        |
| R1: xmt out ring. . . . .                                             | 49                        |
| T2: rcv in tip . . . . .                                              | 5                         |
| R2: rcv in ring . . . . .                                             | 15                        |
| <b>STATION:</b>                                                       |                           |
| TT1: xmt in tip (both relays bypassed) . . . . .                      | 45                        |
| TR1: xmt in ring (both relays bypassed) . . . . .                     | 47                        |
| TT2: xmt in tip (via A-relay contacts) . . . . .                      | 20                        |
| TR2: xmt in ring (via A-relay contacts) . . . . .                     | 8                         |
| TTS: xmt in tip (via A-and PT-relay contacts) . . . . .               | 18                        |
| TRS: xmt in ring (via A-and PT-relay contacts) . . . . .              | 10                        |
| RT1: rcv out tip (A-relay bypassed) . . . . .                         | 39                        |
| RR1: rcv out ring (A-relay bypassed) . . . . .                        | 41                        |
| RT: rcv out tip (via A-relay contacts) . . . . .                      | 26                        |
| RR: rcv out ring (via A-relay contacts) . . . . .                     | 32                        |
| LST: rcv tip loudspeaker output. . . . .                              | 28                        |
| LSR: rcv ring loudspeaker output. . . . .                             | 30                        |
| PT: push-to-talk (input from push-to-talk switch) . . . . .           | 6                         |
| A: station A lead. . . . .                                            | 52                        |
| NQR: A-relay coil (normally wired to -BATT, pin 35) . . . . .         | 56                        |
| C: station C lead (A-lead multiple) . . . . .                         | 48                        |
| RSX: rcv simplex lead . . . . .                                       | 19                        |
| 1 LEAD: loop sense (outputs ground when loop current flows) . . . . . | 37                        |
| <b>RELAY CONTACTS:</b>                                                |                           |
| A relay: normally opened . . . . .                                    | 46                        |
| common . . . . .                                                      | 44                        |
| normally closed. . . . .                                              | 42                        |
| A relay: normally opened . . . . .                                    | 43                        |
| common . . . . .                                                      | 38                        |
| normally closed. . . . .                                              | 40                        |
| A relay: normally opened . . . . .                                    | 24                        |
| common . . . . .                                                      | 34                        |
| A relay: normally opened . . . . .                                    | 22                        |
| common . . . . .                                                      | 36                        |
| PT relay: normally opened . . . . .                                   | 16                        |
| common . . . . .                                                      | 12                        |
| normally closed . . . . .                                             | 14                        |
| <b>POWER:</b>                                                         |                           |
| -BATT (-22 to -28Vdc filtered input) . . . . .                        | 35                        |
| GND (ground) . . . . .                                                | 17                        |

table 1. external connections to 4406

3.06 Switches *S1* and *S2* select the terminating impedance at the station-side ports of the 4406. Switch *S1* selects either 600 or 900 ohms at the transmit input port, and switch *S2* selects either 1200, 600, or 150 ohms at the receive output port. Generally, when the 4406 interfaces loaded cable on the station side, *S1* is set to the 900 position and *S2* is set to the 1200 position. For intermediate lengths of nonloaded cable or direct in-

terface with a telephone set, both switches are set to the 600 position. When the 4406 interfaces longer sections of nonloaded cable *S1* is set to the 600 position and *S2* is set to the 150 position.

3.07 Switch *S3* conditions the 4406 to provide sidetone to the station. Set *S3* to the *ST* position to provide sidetone to the station. If sidetone is not desired, set *S3* to the *OFF* position.

| function                                               | switch | selections             | settings | check-list |
|--------------------------------------------------------|--------|------------------------|----------|------------|
| station-side transmit input port terminating impedance | S1     | 900 ohms               | 900      |            |
|                                                        |        | 600 ohms               | 600      |            |
| station-side receive output port terminating impedance | S2     | 1200 ohms              | 1200     |            |
|                                                        |        | 600 ohms               | 600      |            |
|                                                        |        | 150 ohms               | 150      |            |
| sidetone                                               | S3     | sidetone to station    | ST       |            |
|                                                        |        | no sidetone to station | OFF      |            |
| PT relay                                               | S6     | manual operation       | PT       |            |
|                                                        |        | automatic operation    | OFF      |            |

table 2. Option summary and checklist

3.08 Switch *S6* conditions the PT relay for manual or automatic operation. With *S6* set to the *PT* position, the PT relay is activated by a ground signal on the PT lead from the station's push-to-talk switch. With *S6* set to the *OFF* position, the PT relay is activated by current flowing from the transmit input port when the station is off-hook.

#### alignment

3.09 Alignment of the 4406 consists of adjusting the transmit and receive attenuators for the desired levels and adjusting the sidetone level if the module is optioned for sidetone.

3.10 Align the 4406 as follows:

**Note:** The following procedures assume that the *Transmission Measuring Set (TMS)* used has separate impedance settings for both transmit and receive channels. If this is not the case, the impedance option switches *S1* and *S2* on the 4406 should be reset to match the impedance of the TMS. If the difference between the impedance selected on the 4406 and that of the TMS is 25 ohms or less the resultant impedance mismatch will not affect the level reading significantly.

- A. Ensure that the module is properly optioned and that all front-panel controls are adjusted fully counterclockwise.

#### transmit channel:

- B. Arrange the transmit portion of a transmission measuring set (TMS) (properly terminated at the impedance selected by *S1*) to output 1004Hz tone at the level required at the transmit input port of the 4406 (typically, 0dBm) and connect it to the *xmt in* jack.
- C. Arrange the receive portion of the TMS for terminated measurement at 600 ohms

and connect it to the *xmt out* jack. Adjust the *xmt* control for the required transmit output level (typically  $-16\text{dBm}$ ).

#### sidetone level

- D. If the 4406 is not optioned for sidetone (*S3* set to *OFF*), proceed to step E. If the 4406 is optioned for sidetone (*S3* set to *ST*), leave the transmit portion of the TMS connected to the *xmt in* jack. Connect the receive portion of the TMS (arranged for terminated measurement at the impedance selected by *S2*) to the *rcv out* jack. Adjust the *sidetone* control for the desired sidetone level (typically  $-10\text{dBm}$  i.e.,  $10\text{dB}$  below the received test tone level).

#### receive channel

- E. Arrange the transmit portion of a TMS (set for 600-ohm terminating impedance) to output 1004Hz tone at the level required at the receive input port of the 4406 (typically  $+7\text{dBm}$ ), and connect it to the *rcv in* jack.
- F. Arrange the receive portion of the TMS for terminated measurement at the impedance selected by *S2* and connect it to the *rcv out* jack. Adjust the *rcv* control for the required receive output level (typically,  $-9\text{dBm}$ ). Remove all test connections; alignment is completed.

#### 4. circuit description

4.01 This circuit description is intended to familiarize you with the 4406 KTU 4Wire Station Termination module for engineering and application purposes only. Attempts to troubleshoot the 4406 internally are not recommended and may void your warranty. Troubleshooting procedures should be limited to those prescribed in section 7 of this Practice. Refer to the 4406 block diagram, section 5 of this Practice, while reading this circuit description.

4.02 The 4406's *power supply* is a simple series voltage regulator that uses a zener diode as a reference source. A series diode in the negative input lead protects the circuit against reversed input power connections, and a high-voltage zener diode between input battery and ground limits high-level supply transients to a safe level.

4.03 Variable *T-pad attenuators* in both the transmit and receive channels of the 4406 provide level coordination between the station and the facility-interface device. Transformers *T1* and *T2* provide fixed 600-ohm terminating impedance at each channel's facility-side port. On the station side, transformer *T1* provides switch-selectable 900 or 600-ohm terminating impedance at the transmit input port, and transformer *T2* provides switch-selectable 1200, 600, or 150-ohm terminating impedance at the receive output port.

4.04 The *A relay* on the 4406 is activated by a ground from the station's A lead. When the sta-

tion goes off-hook, *A-relay* contacts at both station-side ports complete the transmission path through the 4406 and, at the transmit input port, extend talk battery to the station through a 400-ohm current-feed circuit. *A-relay* contacts are also provided to mute the loudspeaker output in voice-paging applications. The *PT relay* can be optioned to be activated manually or automatically. When optioned for manual activation, the *PT relay* operates when a ground is applied to the module's *PT* lead by an external push-to-talk switch. When optioned for automatic activation, the *PT relay* operates in response to current flowing in the current-feed circuit when the *A relay* is activated. The *PT relay* provides contacts at the transmit input port in series with the *A-relay* contacts. Both relays provide auxiliary contacts that can be used for various applications.

#### 6. specifications

##### receive channel

##### attenuation range

0 to  $-30\text{dB}$  (not including insertion loss), continuously adjustable

##### insertion loss

0.5dB nominal at 1004Hz

##### frequency response

$\pm 1\text{dB}$  re 1004Hz level, 300 to 3500Hz

##### input impedance

600 ohms  $\pm 10\%$ , balanced (unbalanced with sidetone option selected)

##### output impedance

150 ohms  $\pm 15\%$ , 600 ohms  $\pm 10\%$ , or 1200 ohms  $\pm 10\%$ , balanced, switchable

##### transmit channel

##### attenuation range

0 to  $-30\text{dB}$  (not including insertion loss), continuously adjustable

##### insertion loss

0.5dB nominal at 1004Hz

##### frequency response

$\pm 1\text{dB}$  re 1004Hz level, 300 to 3500Hz

##### input impedance

600 ohms  $\pm 10\%$  or 900 ohms  $\pm 10\%$ , balanced, switchable

##### output impedance

600 ohms  $\pm 10\%$ , balanced

##### common specifications

##### sidetone frequency response

$\pm 1\text{dB}$  re 1004Hz level, 300 to 3500Hz

##### sidetone amplifier gain range

$-20$  to  $+5\text{dB}$ , continuously adjustable

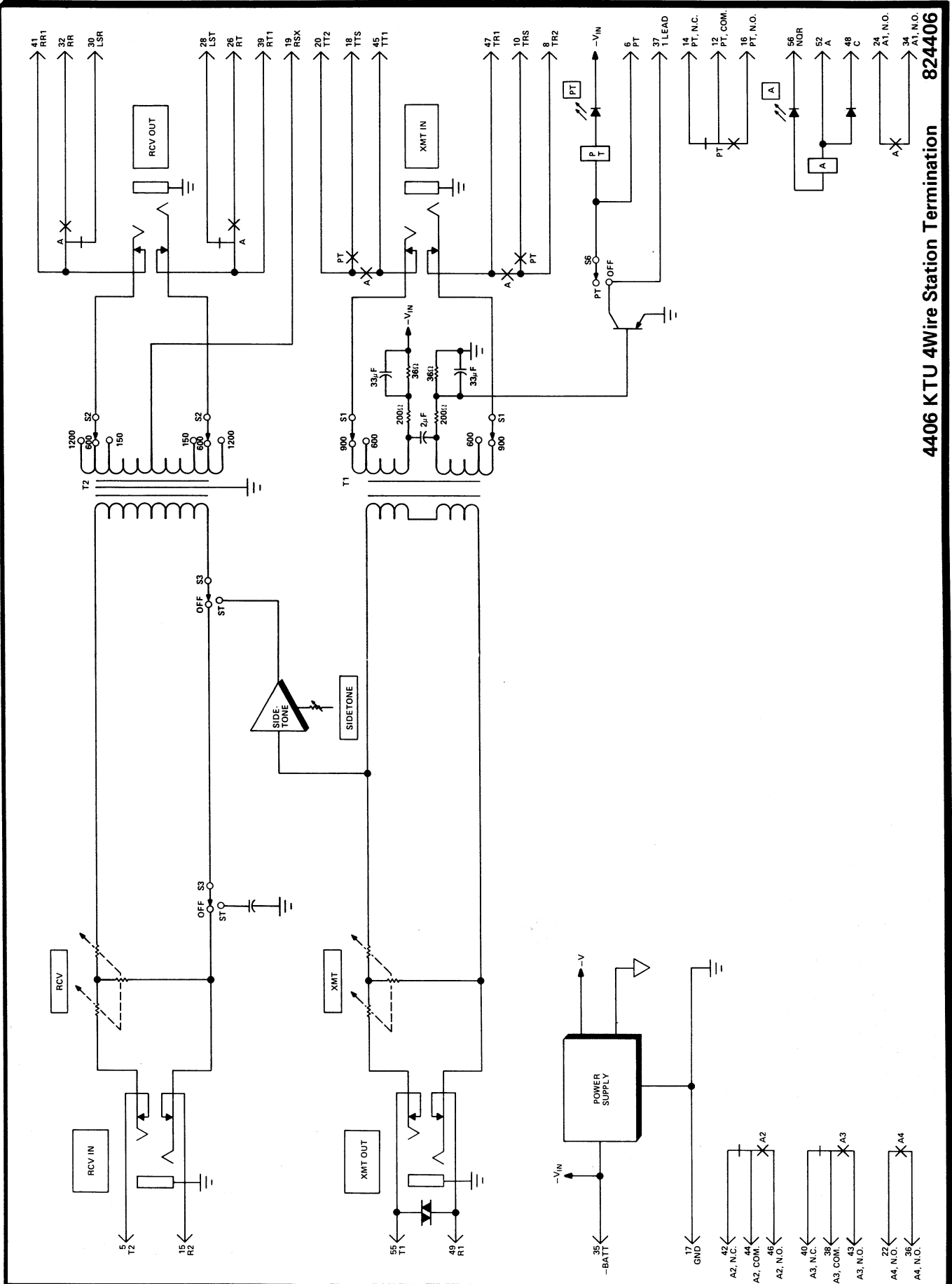
##### echo return loss (station side)

20dB minimum

##### isolation between transformer windings

500Vrms maximum at 60Hz

specifications continued on page 6



4406 KTU 4Wire Station Termination 824406

5. block diagram

*envelope delay distortion*

less than 100 $\mu$ s, 400 to 3000Hz

*longitudinal balance (station side)*

60dB minimum, 200 to 4000Hz

*A-lead station range*

75 ohms maximum

*relay contact rating*

1 ampere for both pickup and push-to-talk relays

*input power requirements*

voltage: -22 to -28Vdc, filtered, ground referenced

current: 105mA maximum, plus loop current

*operating environment*

20° to 130°F (-7° to +54°C), humidity to 95%  
(no condensation)

*weight*

22.5 ounces (638 grams)

*dimensions*

5.58 inches (14.17cm) high

1.42 inches (3.61cm) wide

5.96 inches (15.14cm) deep

*mounting*

relay rack or apparatus case via one position of a  
Tellabs Type 10 Mounting Shelf or one position  
of a Tellabs 265A Mounting Assembly

## 7. testing and troubleshooting

7.01 The **testing guide checklist** in this section may be used to assist in the installation, testing, or troubleshooting of the 4406 KTU 4Wire Station Termination module. The checklist is intended as an aid in the localization of trouble to this specific equipment. If the equipment is suspected of being defective, substitute new equipment (if possible) and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment. Unauthorized testing or repairs may void its warranty. Also, if the equipment is part of a registered system, unauthorized repairs will result in noncompliance with Parts 15 and/or 68 of the FCC Rules and Regulations.

**Note:** *Although repair service always includes an attempt to remove any permanent markings made by customers on Tellabs equipment, the success of such attempts cannot be guaranteed. Therefore, if equipment must be marked **defective** or **bad**, we recommend that it be done on a piece of tape or on a removable stick-on label.*

### technical assistance via telephone

7.02 If a situation arises that is not covered in the **testing guide checklist**, contact Tellabs Customer Service as follows:

**USA customers:** Contact your Tellabs Regional Office listed below.

### region

US Atlantic

US Capital

US Central

US Southeast

US Southwest

US Western

### telephone

(203)798-0506

(703)478-0468

(312)357-7400

(305)834-8311

(214)869-4114

(714)850-1300

### office location

Danbury, CT

Washington, DC

Chicago, IL

Orlando, FL

Dallas, TX

Orange County, CA

**Canadian customers:** Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)624-0052.

**International customers:** Contact your Tellabs distributor.

### selecting correct product service procedure

7.03 If equipment is diagnosed as defective or if in-service equipment needs repair, follow the **product return procedure** in paragraph 7.04 in all cases except those where a critical service outage exists (e.g., where a system or a critical circuit is down and no spares are available). In critical situations, or if you wish to return equipment for reasons other than repair, follow the **product replacement procedure** in paragraph 7.05.

### product return procedure (for repair)

7.04 To return equipment for repair, first contact Tellabs Product Services (see addresses and numbers below) to obtain a Material Return Authorization (MRA). A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the repair transaction). The service representative will then give you an MRA number that identifies your particular transaction. After you obtain the MRA number, send the equipment prepaid to Tellabs (attn: Product Services).

### in the USA:

Tellabs, Inc.

4951 Indiana Avenue

Lisle, Illinois 60532

telephone (312) 969-8800

### in Canada:

Tellabs Communications Canada, Ltd.

1200 Aerowood Drive, Unit 39

Mississauga, Ontario, Canada L4W 2S7

telephone (416) 624-0052

Enclose an explanation of the malfunction, your company's name and address, the name of a person to contact for further information, and the purchase order number for the transaction. Be sure to write the MRA number clearly on the outside of the carton being returned. Tellabs will inspect, repair, and retest the equipment so that it meets its original performance specifications and then ship the equipment back to you. If the equipment is in warranty, no invoice will be issued. Should you need to contact Tellabs regarding the status of a repair, call or write the Product Services department at our Lisle or Mississauga headquarters as directed above.

**product replacement procedure**

7.05 For critical service outages, Tellabs offers a choice of two replacement services (if the product is in replacement stock) in lieu of the 15-day repair and return service described above. These are **overnight express service** (at extra cost) anywhere in the USA and **five-day expedited delivery** (at no extra cost) anywhere in the USA and Canada. To obtain replacement equipment via either of these services, contact your Tellabs Regional Office in the USA or our Canadian headquarters in Mississauga, Ontario, for details, costs (if applicable), and instructions. Telephone numbers are given in paragraph 7.02. A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the

replacement transaction). Tellabs will then ship the replacement to you in accordance with the replacement service you request. An invoice in the amount of the replacement's current price plus any applicable service charges will be issued after the replacement is shipped. When you receive the replacement, pack the equipment to be returned in the replacement's carton, sign and enclose the packing list, affix to the carton the preaddressed label provided, and ship the carton prepaid to Tellabs at our USA or Canadian headquarters. When we receive the defective equipment (within 30 days of our issuing the replacement), the invoice will be adjusted to reflect only service charges (if applicable). Please note that OEM, modified, and manufacture-discontinued equipment is not available via overnight express service.

**testing guide checklist**

| test           | procedure                                                                                                                                                                                                                                                                                                                                                         | normal result                                                                              | if normal conditions are not met, verify:                                                                                                                                                                                                                                                                                              |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| transmit level | Arrange transmit portion of TMS for 1004Hz tone output at 0dBm and at station-side port impedance selected on module. Connect this signal to <i>xmt in</i> jack. Arrange receive portion of TMS for terminated measurement at 600 ohms and connect it to <i>xmt out</i> jack. Vary <i>xmt</i> control over its entire range.                                      | Signal level at <i>xmt out</i> jack varies from -0.5 to -30.5dB <input type="checkbox"/> . | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Proper impedance termination <input type="checkbox"/> . Impedance switch <i>S1</i> properly set <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> .                                                                                       |
| receive level  | Arrange transmit portion of TMS for 1004Hz output at 0dBm and at 600 ohms. Connect this signal to <i>rcv in</i> jack. Arrange receive portion of TMS for terminated measurement at station-side port impedance selected on module and connect it to <i>rcv out</i> jack. Vary <i>rcv</i> control over its entire range.                                           | Signal level at <i>rcv out</i> jack varies from -0.5 to -30.5dB <input type="checkbox"/> . | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Proper impedance termination <input type="checkbox"/> . Impedance switch <i>S2</i> set properly <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> .                                                                                       |
| sidetone level | Arrange transmit portion of TMS for 1004Hz tone output at 0dBm and at station-side port impedance selected on module. Connect this signal to <i>xmt in</i> jack. Arrange receive portion of TMS for terminated measurement at station-side port impedance selected on module and connect it to <i>rcv out</i> jack. Vary side-tone control over its entire range. | Signal level at <i>rcv out</i> jack varies over a range of 25dB <input type="checkbox"/> . | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Proper impedance termination <input type="checkbox"/> . Impedance switches <i>S1</i> and <i>S2</i> set properly <input type="checkbox"/> . Option switch <i>S3</i> set to ST position <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> . |

testing guide checklist continued on next page

## testing guide checklist

| test                                                                                                                                                                                                                                                          | procedure                                                                                                                                                      | normal result                                                                                                                                           | if normal conditions are not met, verify:                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *A relay                                                                                                                                                                                                                                                      | Arrange VOM to measure resistance (RX100 scale) and connect one lead to pin 24 and the other lead to pin 34. Connect ground (pin 17) to A-lead input (pin 52). | VOM initially reads infinity, then goes to zero when relay energizes <input type="checkbox"/> . A LED on front panel lights <input type="checkbox"/> .  | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . NOR lead (pin 56) connected to -24Vdc (pin 35) <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> . |
| *PT relay (manual operation)                                                                                                                                                                                                                                  | Arrange VOM to measure resistance (RX100 scale) and connect one lead to pin 12 and the other lead to pin 16. Connect ground (pin 17) to PT-lead input (pin 6). | VOM initially reads infinity, then goes to zero when relay energizes <input type="checkbox"/> . PT LED on front panel lights <input type="checkbox"/> . | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> .                                                                           |
| *PT relay (automatic operation)                                                                                                                                                                                                                               | Arrange VOM to measure resistance (RX100 scale) and connect one lead to pin 12 and the other lead to pin 16. Connect a jumper across pins 45 and 47.           | Same as above <input type="checkbox"/> .                                                                                                                | Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Option switch <i>S6</i> set to <i>OFF</i> <input type="checkbox"/> . Replace 4406 and retest <input type="checkbox"/> .      |
| *These tests are arranged to check basic relay operation. If a specific contact is suspected of being faulty, or if the test is inconclusive, refer to the 4406 block diagram and connect the VOM across each individual set of contacts and repeat the test. |                                                                                                                                                                |                                                                                                                                                         |                                                                                                                                                                                                 |