

4410 and 4410S Pad/Transformer Modules

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1. Description and Application

Note: Throughout this practice, the 4410 and 4410S Pad/Transformer Modules will be referred to as “4410/S”, except when making comparisons between the two modules’ functionality.

- 1.1 The 4410/S modules each provide level coordination via prescription-set attenuation in both the transmit and receive channels of a 4-wire voice-frequency transmission facility. The 4410/S also provide DC isolation, longitudinal balance, and impedance matching via transformers that are center tapped to derive balanced simplex (SX) leads. Unlike the 4410, the 4410S contains an integral, switch-selectable current source that supplies nominal 20mA sealing current to the facility if required. This current source has a “ZAP” feature that applies a greater amount of current for a few seconds when power is initially applied to the module.
- 1.2 In both the transmit and receive channels of the 4410/S, from 0 to 36dB of prescription set attenuation, in 0.1dB increments, can be introduced via front-panel DIP switches. Insertion loss in each channel is 0.6dB; thus, the attenuation range of each channel is 0.6 to 36.6dB.
- 1.3 On the terminal side of the 4410/S, terminating impedances at both ports (receive output and transmit input) are fixed at 600 ohms, unbalanced. On the module’s facility side, both ports (receive input and transmit output) offer a switch-selectable choice of 1200, 600, or 150-ohm balanced terminating impedance. The 1200-ohm option is generally used to interface loaded cable; the 600-ohm option, to interface nonloaded cable or carrier; and the 150-ohm option, to provide a small amount of slope-type amplitude equalization for long sections of nonloaded cable through the deliberate impedance mismatch. Lightning surge protection for the facility-side ports is provided via six metal oxide varistors. (No such protection is required for the terminal-side ports because they typically interface indoor customer premises equipment.)
- 1.4 Six bantam-type test jacks on the front panel of the 4410/S provide test access to the module (see Figure 1-1.) Both opening and bridging (monitoring) jacks are provided at the facility-side ports, while the terminal-side ports are equipped with opening jacks only.

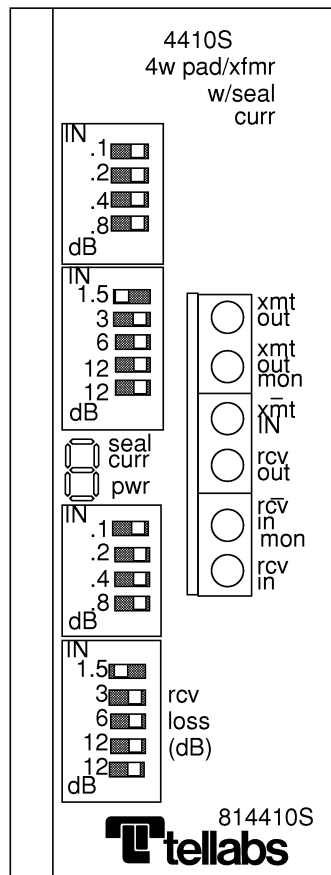


Figure 1-1 4410/S Front Panel Layout

- 1.5 The 4410/S modules are used in customer premises applications requiring attenuation, impedance matching, SX-lead derivation, DC isolation, and longitudinal balance on a 4-wire metallic facility terminated at a distant central office, and the terminal side typically interfaces a short station cable loop or a carrier channel. The 4410/S modules are designated “facility” units. Please note that this does not define the physical location of the modules in the circuit (which is normally a customer’s premises). Instead, it indicates that the modules’ transformers face the facility terminated at the distant central office rather than facing the station loop or carrier channel.
- 1.6 The facility-side ports of the 4410/S can be switch-optional to provide 20mA (nominal) of internally generated sealing current, to establish a return path for externally generated sealing current applied at the distant end of the facility, or to provide SX-lead availability at the module’s card-edge connector. The higher ZAP current applied by the 4410/S’s integral sealing current source for a few seconds upon initial powering-up retards oxidation at cable splices and at metallic connections between terminations. The 4410/S’s front-panel seal curr LED lights when either the internal or external (return path) sealing-current option is selected and current is flowing. If neither of these options is selected, the option switch is set for SX-lead availability at the module’s card-edge connector, thereby providing for DC signaling or for sealing-current application from a local source external to the module. Please note that the 4410/S’s seal curr LED does not light when sealing current is supplied from a local external source (“SX option” on the S16 switch).
- 1.7 The SX leads of the 4410/S can be switch-optional for either a normal or reverse arrangement. In the normal arrangement, the receive input SX lead is connected to the receive input SX pinout (pins 9 and 11), and the transmit output SX lead is connected to the transmit out-

put SX pinout (pin 43). In the reverse arrangement, the receive input SX lead is connected to the transmit output SX pinout (pin 43), and the transmit output SX lead is connected to the receive input SX pinout (pins 9 and 11).

- 1.8 The 4410 is an entirely passive module and therefore does not require input power. The 4410S, on the other hand, requires filtered, ground-referenced -42 to -56VDC input power in applications where its internal sealing-current source is to be used. Reverse-battery protection is provided for the 4410/S, whose front-panel power LED lights when power is applied to the module. In applications where sealing current is supplied from the distant end of the facility, the front panel sealing current LED will light.
- 1.9 As a Type 10 module, the 4410/S modules can each be mounted 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, while up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical rack space is used.

Reason for Change

- 1.10 This practice reflects the changed input power requirements current level from 20mA nominal to 35mA maximum and sealing-current output from 20mA nominal to 30mA nominal.

2. Installation

Inspection

- 2.1 The 4410/S should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

Mounting

- 2.2 The 4410/S mount in one position of a Tellabs Type 10 Mounting Shelf. The module plugs physically and electronically into a 56-pin connector at the rear of its shelf position.

Connections

- 2.3 Before making any connections to the mounting shelf, make sure that the power is off and modules are removed. Modules should be put into place only after they are properly optioned and after wiring is completed.
- 2.4 All connections are made via wire-wrapping to the 56-pin connector at the rear of each module's shelf position. Pin numbers are found on the body of the connector.

Connect:	To Pin:
RCV IN TIP	7
RCV IN RING	13
XMT OUT TIP	41
XMT OUT RING	47
RCV OUT TIP	5
RCV OUT RING	15
XMT IN TIP	55
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Table 2-1 External Connections to 4410/S

Connect:	To Pin:
XMT IN RING	49
RCV IN SX (simplex, facility side)	9 and 11
XMT OUT SX (simplex, facility side)	43
-BATT (-42 to -56VDC filtered input, 4410S only)	35
GND (ground)	17

Table 2-1 External Connections to 4410/S

Prescription Optioning and Alignment

- 2.5 Because optioning and alignment of the 4410/S are performed via slide and DIP switches, prescription optioning and alignment are possible for each module. Figure 2-1 shows the locations of the option switches on the modules' printed circuit board, and Table 2-2 summarizes all option-switch settings. For prescription optioning and alignment, all required option-switch settings and all required transmit and receive transmission-loss settings should be determined from circuit records prior to installation of the module. These required option and alignment settings should then be noted in the checklist column of Table 2-2 or on the Circuit Layout Record (CLR), if preferred. Then during installation, the module can be quickly and easily optioned and aligned without referring to the instructions that follow in paragraphs 2.6 and 2.7. Simply refer to the checklist column of Table 2-2 (or to the CLR) and set all option and alignment switches as indicated.

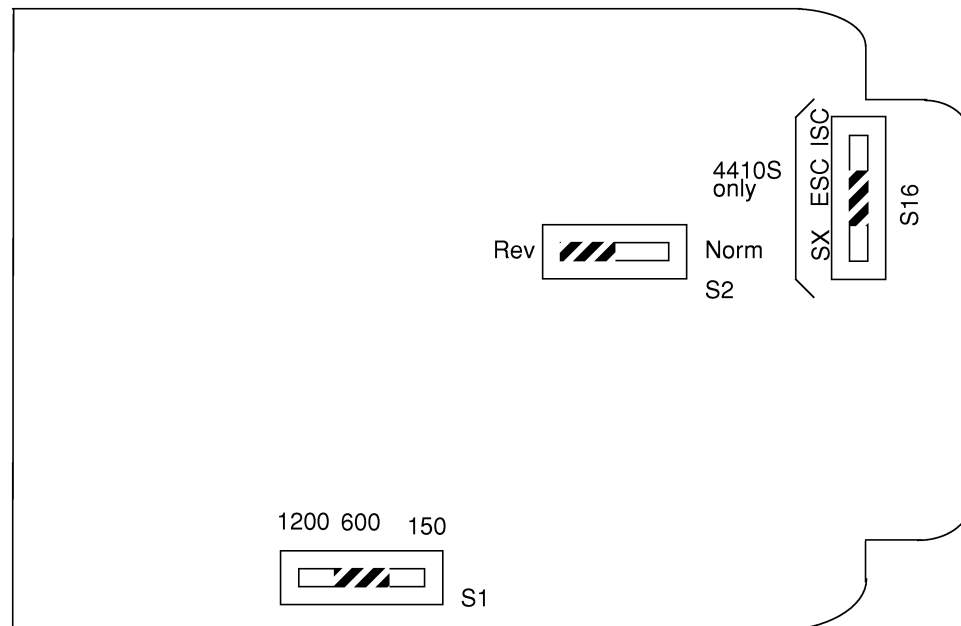


Figure 2-1 4410/S Option Switch Locations

Non-prescription Optioning

- 2.6 Two option switches on the 4410 and three on the 4410S must be set before either module is placed into service. Locations of these switches on the modules' printed circuit boards are shown in Figure 2-1. Set each switch as directed in the appropriate portion of Table 2-2.

Switch Option or Alignment Function	Switch	Selection	Settings	Check -list
Facility-side (xmt out and rcv in) terminating impedances	S1	1200 ohms (for loaded cables)	1200	
		600 ohms (for non-loaded cable or carrier)	600	
		150 ohms (extra equalization for non-loaded cable)	150	
Facility-side simplex-lead arrangement	S2	Normal simplex-lead arrangement	NORM	
		Reverse simplex-lead arrangement	REV	
Facility-side sealing-current and simplex-lead options (4410S only)	S16	Return path for sealing current from far end of facility	ESC	
		Sealing current from internal 20mA source	ISC	
		Facility-side simplex leads available at card-edge connector	SX	
Receive-channel loss	Front-panel rcv loss DIP switch*	0.1dB loss	.1 to IN	
		0.2dB loss	.2 to IN	
		0.4dB loss	.4 to IN	
		0.8dB loss	.8 to IN	
		1.5dB loss	1.5 to IN	
		3.0dB loss	3 to IN	
		6.0dB loss	6 to IN	
		12.0dB loss	12 to IN	
		12.0dB loss	12 to IN	
Transmit-channel loss	Front-panel xmt loss DIP switch*	0.1dB loss	.1 to IN	
		0.2dB loss	.2 to IN	
		0.4dB loss	.4 to IN	
		0.8dB loss	.8 to IN	
		1.5dB loss	1.5 to IN	
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Table 2-2 4410/S Option and Alignment Switch Summary and Checklist

Switch Option or Alignment Function	Switch	Selection	Settings	Check -list
Transmit-channel loss	Front-panel xmt loss DIP switch	3.0dB loss	3 to IN	
		6.0dB loss	6 to IN	
		12.0dB loss	12 to IN	
		12.0dB loss	12 to IN	
* The specific amount of loss (in dB) introduced by each rcv loss and xmt loss DIP-switch position is indicated on the switch body adjacent to the switch position. These switch positions are cumulative. The total amount of flat loss introduced into a channel is the sum of that channel's DIP switch portions set to IN plus the nominal 0.6dB insertion loss introduced by the transformer in that channel.				

Table 2-2 4410/S Option and Alignment Switch Summary and Checklist

Non-prescription Alignment

- 2.7 In applications where prescription alignment settings are unavailable, non-prescription alignment of the 4410/S is necessary. Perform the non-prescription alignment procedure as follows:

Receive Channel

1. Request personnel at the distant (facility-side) end to send 1004Hz tone at the level specified on the CLR.
2. Arrange the receive portion of a Transmission Measuring Set (TMS) for terminated measurement at the appropriate impedance, and measure the incoming test tone level at the module's rcv in monitor jack to verify that the received tone is at the correct level.
3. Arrange the receive portion of the TMS for 600-ohm terminating impedance and measure the tone level at the module's rcv out jack.
4. Add loss via the front-end panel rcv loss DIP switch until the appropriate (e.g., CLR-specified) receive-channel output level is achieved.

Transmit Channel

1. Arrange the transmit portion of the TMS for 1004Hz tone output at the appropriate (e.g., CLR-specified) transmit input level. (If the TMS has a separate transmit impedance setting, select 600 ohms.)
2. Insert this signal at the module's xmt in jack.
3. Arrange the receive portion of the TMS for terminated measurement at the appropriate impedance, and measure the level at the module's xmt out jack. (As an alternative, have personnel at the distant-end of the facility measure and report their received level.)
4. Add loss via the front-panel xmt loss DIP switch until the appropriate (e.g., CLR-specified) transmit-channel output level is achieved (or until the appropriate level is received and reported by distant-end personnel).

3. Circuit Description

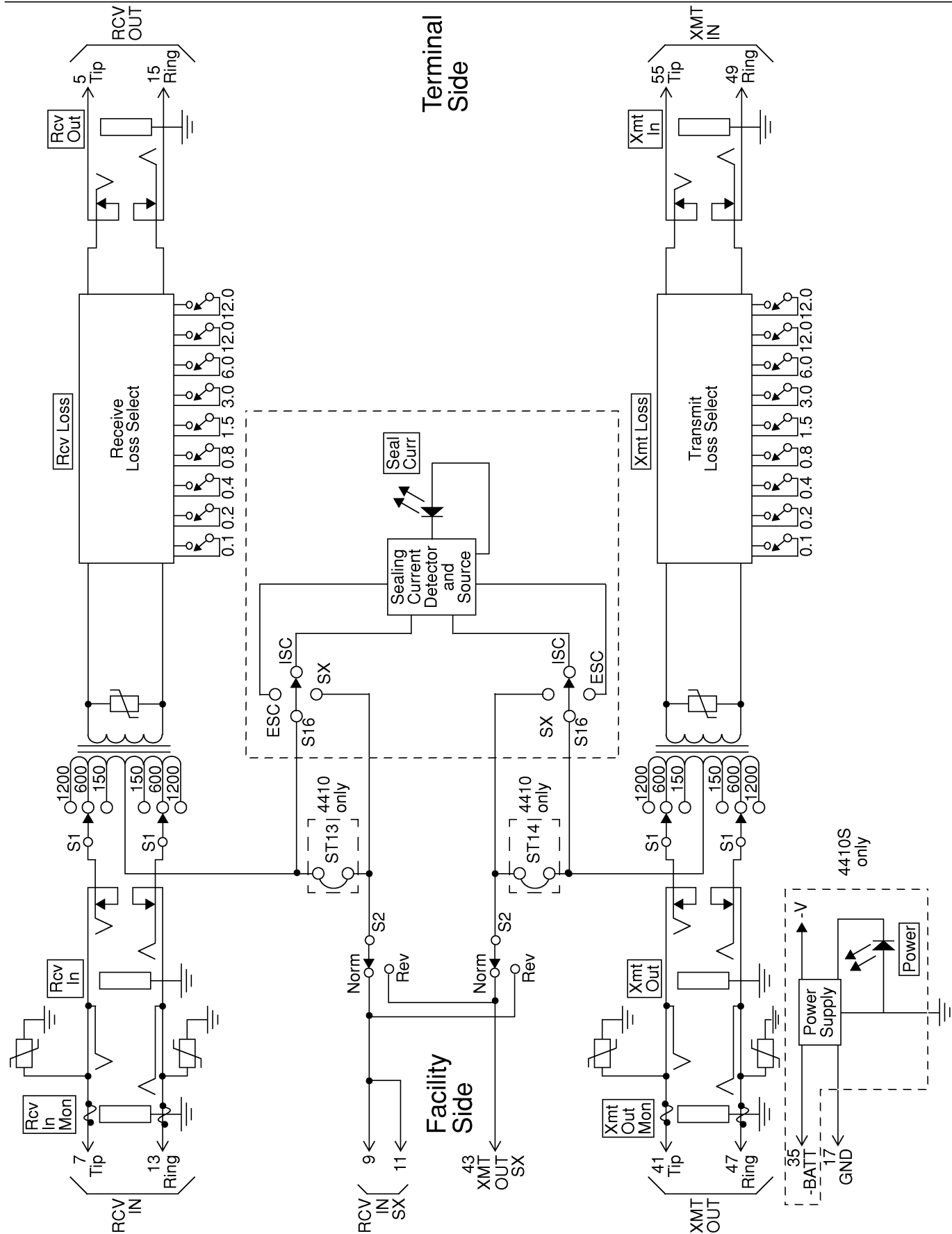
- 3.1 This circuit description is intended to familiarize you with the 4410/S for application and engineering purposes only. Attempts to troubleshoot these modules internally aren't recommended and may void their warranty. Troubleshooting procedures should be limited to those prescribed in Section 6. For more information on the circuit description, refer to the block diagram in Section 5.
- 3.2 The 4410/S modules contain two prescription 600-ohm T-pad attenuators, one in the transmit channel and the other in the receive channel. In addition, an isolation transformer in each channel on the modules' facility side provides balanced, switch-selectable 1200, 600, or 150-ohm terminating impedances. Both of these transformers are center-tapped to derive balanced SX leads. A switch option on each module selects either a normal or reverse SX-lead arrangement. On each module's terminal side, terminating impedances are fixed at 600 ohms, unbalanced, in each channel. Six metal-oxide varistors provide lightening surge protection for the facility-side ports. Four 1.5A fuses are provided for power-cross protection.
- 3.3 A switch option on the facility side of the 4410/S affords a choice of internally generated sealing current from a nominal 20mA source, establishment of a return path for external sealing current from a distant facility-side source, or availability of SX leads at the card-edge connector.

4. Specifications

Pad/Transformer Modules

Terminating Impedances	<ul style="list-style-type: none"> Facility-side ports (rcv in xmt out): 1200 ohms, 600 ohms, or 150 ohms, balanced, switch-selectable Terminal-side ports (xmt in, rcv out): 600 ohms fixed, unbalanced
Attenuation Range (xmt and rcv)	0.6 to 36.6dB in switch-selectable 0.1dB increments (including 0.6dB insertion loss)
Simplex-Lead Current	100mA maximum, with 2mA maximum unbalance
Sealing-Current Output (from Internal Source 4410S only)	30mA nominal at -48VDC, switch-selectable; integral ZAP feature provides momentarily higher current upon initial sealing-current activation
Insertion Loss, Each Channel	0.6dB maximum at 1004Hz
Echo Return Loss (Facility Side)	20dB minimum
Maximum Isolation Between Windings	500 volts rms at 60Hz
Envelope Delay	Less than 100 μ s, 400 to 3000Hz, re 1800Hz
Longitudinal Balance	74dB minimum at 200Hz, facility side only
Input Power Requirements (4410S Only, with Internal Sealing-Current Source Active)	<ul style="list-style-type: none"> Voltage: -42 to -56VDC, filtered, ground-referenced Current: 35mA maximum at -48VDC
Operating Environment	20° to 130° F (-7° to 54° C), humidity to 95% (no condensation)
Weight	<ul style="list-style-type: none"> 4410: 7 ounces (198 grams) 4410S: 8 ounces (227 grams)
Mounting	Relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf

5. Block Diagram



6. Troubleshooting, Technical Assistance, Repair and Return

Technical Assistance

- 6.1 The following testing guide will assist in the installation, testing, or troubleshooting of the 4410/S, and will aid in the localization of trouble to this specific equipment. If the equipment seems to be defective, substitute new equipment (if possible), and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement (see paragraph 6.3). We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment; unauthorized testing or repairs may void their warranty.

Testing Guide

Test	Test Procedure	Normal Result	If Normal Conditions are Not Met, Verify:
Transmission Continuity, Receive Channel	Request personnel at distant end of circuit to send 1004Hz test tone at CLR-specified level. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to rcv out jack. Verify level.	<ul style="list-style-type: none"> Signal appears at output port at specified level. 	<ul style="list-style-type: none"> Wiring Attenuator settings Impedance switches properly set Replace module and retest
Transmission Continuity, Transmit Channel	Connect xmt portion of TMS arranged for 1004Hz tone output at CLR-specified xmt input level to xmt in jack. (If TMS has a separate transmit impedance setting, select 600 ohms.) Arrange rcv portion of TMS for appropriately terminated measurement and connect it to xmt out jack. Verify level.	<ul style="list-style-type: none"> Same as above. 	<ul style="list-style-type: none"> Same as above.
Sealing Current (4410S only)	With module optioned for internal sealing current (switch S16, SX/ESC/ISC, set to ISC), connect VOM (arranged to measure up to 50mA) across pins 41 and 13.	<ul style="list-style-type: none"> Front-panel seal curr LED lights. VOM indicates approximately 20mA. 	<ul style="list-style-type: none"> Power Wiring SX/ESC/ISC switch set to ISC Replace module and retest

6.2 Contact Tellabs Technical Assistance as follows:

Location	Telephone	FAX
Martis Oy, Espoo, Finland	+358.0.502.771	+358.0.502.7815
Tellabs Pty Ltd., Milsons Point, NSW, Australia	+61.2.966.1043	+61.2.966.1038
Tellabs Canada Ltd., Mississauga, Ontario, Canada	905/858-2058	905/858-0418
Tellabs International, Inc., Beijing, PRC, China	+861.501.1873	+861.501.1871
Tellabs International, Inc., Dubai, U.A.E.	+971.4.373250	+971.4.376526
Tellabs U.K. Ltd., Buckinghamshire, England	+44.1628.660345	+44.1628.667735
Tellabs GmbH, Munich, Germany	+49.89.212133.0	+49.89.212133.20
Tellabs H.K. Ltd., Hong Kong	+852.2866.2983	+852.2866.2965
Tellabs Singapore Private, Ltd., Singapore	+65.736.2855	+65.736.1231
Tellabs, Ltd., County Clare, Ireland	+353.61.471433	+353.61.471000/472004
Tellabs S.A. DE C. V., Mexico	525.282.1107, .1432, .1050, or .0981	525.282.0218
Tellabs International, Inc., Seoul, South Korea	+82.2.589.0667 or .0668	+82.2.589.0669
Tellabs Southern Europe s.a., Barcelona, Spain	+34.3.414.70.16	+34.3.414.69.25
Tellabs International, Inc., Stockholm, Sweden	+46.8.678.4040	+46.8.678.4041
Tellabs International, Inc., Bangalore, India	+91.80.6610826	+91.80.6610826
USA and Puerto Rico	(800) 443-5555*	708/512-7097
*All other Caribbean and South American locations, or if the toll-free number is busy, telephone 708/969-8800		

Repair and Return

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

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

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