

4411A Pad/Transformer/Tone Loopback Module

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1. general description

1.01 The 4411A Pad/Transformer/Tone Loopback module (figure 1) provides adjustable pads and impedance matching transformers for attenuation and dc isolation of both the transmit and receive channels of a metallic 4wire VF transmission facility. In addition, the 4411A provides tone- or dc-activated, adjustable-level loopback of the 4wire facility.

1.02 This practice section is revised to correct the *attenuation range* and *tone-loopback release time* specifications and to update the text portion of section 7.

1.03 Front-panel attenuators introduce from 0.5 to 30dB (nominal) of continuously adjustable loss into the transmit channel and from 0.9 to 30dB (nominal) of continuously adjustable loss into the receive channel. (For each channel, this range includes insertion loss.) Loss adjustment for each channel is independent; this loss is introduced via variable T-pads.

1.04 Impedance matching transformers facing the facility (receive input and transmit output ports) may be switch optioned for balanced impedances of 150, 600 or 1200 ohms. Fixed, balanced, 600 ohm impedance is presented toward the terminal side (transmit input and receive output ports) of the module.

1.05 Loopback circuitry in the 4411A incorporates a multitude of options and adjustments to adapt the module to virtually any mode of loopback operation. As previously mentioned, three types of loopback activation are provided: one tone activated and two dc-activated modes.

1.06 In the tone-operated mode, loopback activates upon *removal* of a 2713Hz tone of at least 1.4 seconds duration. Tone-activated loopback is released by one of two optional methods: automatic timeout, or application of a second 2713Hz tone. An option switch is used to select the method. In the timeout mode, the length of time that the module remains in the looped condition before automatically releasing loopback may be varied. A front-panel control permits the loopback interval to be adjusted

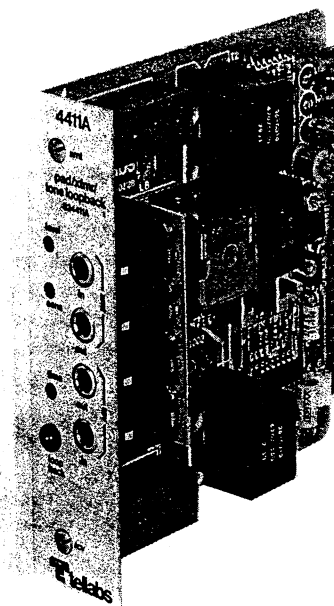


figure 1. 4411A Pad/Transformer/Tone Loopback Module

from 1 to 70 (nominal) seconds. In the tone-released mode, the 4411A releases loopback *during* the second tone burst. A minimum of 0.7 second of tone is required.

1.07 The sensitivity threshold of the tone loopback circuit may be adjusted, via front panel control, to respond to signals with amplitude levels from +6 to -28dBm. This, along with a 3dB signal-to-guard ratio, prevents inadvertent looping of the circuit by other than the intended signal.

1.08 In the dc (simplex) loopback mode, one polarity of current through the 4411A's simplex leads provides sealing current, and a reversal of that polarity effects loopback. The 4411A remains looped for the duration of the polarity reversal.

1.09 DC loopback can also be locally activated by placing ground on one of the module's pins; and the module remains looped until the ground is removed.

1.10 The loopback path through the 4411A module includes both transmit and receive channel attenuators. An amplifier in the loopback path may be adjusted from -15 to +25dB (nominal) to provide equal-level (or other desired level) loopback operation. The loopback level control is front-panel accessible.

1.11 The 4411A's simplex leads may be converted, via switch option, for external use (e.g., as signaling leads). When optioned for external use, the simplex leads are not available for loopback purposes.

1.12 For alignment and maintenance ease, the 4411A is designed with front-panel accessibility to all adjustments and jacks. The front panel incorporates four test jacks for convenient, isolated-module measurement of transmit and receive input and output levels; transmit and receive attenuator controls; loopback level, threshold sensitivity and timeout duration controls; and an LED to indicate loopback activation.

2. application

2.01 The 4411A Pad/Transformer/Tone Loopback module is used to provide level control (via attenuation), impedance matching, dc isolation, and, when needed, facility loopback at the station end of a 4wire voice-frequency transmission facility. The 4411A differs from the less complex and now manufacture-discontinued Tellabs 4411 Pad/Transformer/Loopback module in that the 4411A adds 2713Hz two-tone (remote) loopback capability to the 4411's dc manual loopback. In comparison to the more complex Tellabs 4412C Data Station Termination (DST) module (which, at the time of this writing, is the only 4412-series DST that is not manufacture-discontinued), the 4411A lacks the 4412C's switch-selectable choice of 11 different frequencies for two-tone loopback, continuously adjustable gain or loss (instead of loss only) in the receive channel, and continuously adjustable amplitude equalization in both channels. If you are uncertain as to whether the 4411A, 4412C, or other Tellabs module is the most effective and economical choice for your particular application, please consult your Tellabs Regional Office (see section 7 of this practice for telephone numbers).

2.02 The 4411A is normally located at the customer's premises in close proximity to the terminal equipment. The 4411A may be installed at a physical distance from the terminal equipment consistent with its level ranges, and with the overall level requirements of the facility.

2.03 While the 4411A module is not limited to data applications, it is probably most often used for line treatment and loopback at the modem/4wire transmission facility interface of a data station (figure 2). The 4411A may be required here because levels out of a modem are generally too high for transmission over a Telco facility and an impedance mismatch may exist between the modem and the facility.

2.04 A major advantage of the passive transmission characteristics of the 4411A is that the transmission path maintains integrity in the event of a failure of the 4411A's power source. This is particularly significant if the 4411A is located at the customer's premises. (Note that the loopback function of the 4411A is, however, rendered inoperative by a local power failure.)

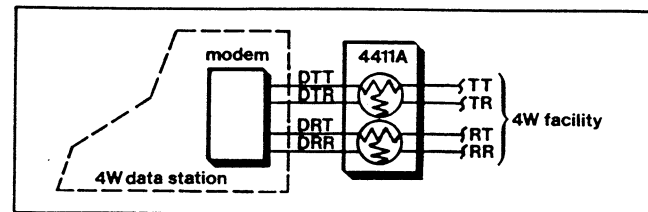


figure 2. Common application of the 4411A

levels

2.05 Levels in both the transmit and receive channels of the 4411A module are continuously adjustable. From 0.9 to 30dB (nominal) of loss adjustment is available in each channel. Transmit and receive level adjustments are separate and independent. These ranges permit adjustable attenuation to TLP's within the scope of what are commonly accepted as good transmission practices.

impedance matching

2.06 The fixed, balanced, 600 ohm impedance provided toward the module's terminal side (receive output and transmit input ports) provides a good match with the impedance of the data modem or other terminal apparatus that may be encountered at those ports. Optional impedances of 150, 600 or 1200 ohms may be switch-selected at the facility-side ports (transmit output and receive input). Normally, loaded cable requires the 1200 ohm interface. Nonloaded cable, carrier, sf signaling devices or term sets located on the facility-side of the module may be interfaced by selection of the 600 ohm option. Or, non-loaded cable may be provided with nominal slope equalization by selecting the 150 ohm option.

simplex leads

2.07 Transformers at the facility-side ports of the 4411A are center-tapped to derive simplex (sx) leads. The module may be switch-optional to allow use of the sx leads for simplex (dc) signaling over the facility, or for remotely controlled dc loopback with the opposite dc polarity accommodating sealing current. See section 3.08 for details of this option.

loopback

2.08 In addition to providing line treatment, the 4411A also aids in circuit alignment and testing. The loopback circuitry of the 4411A permits both the transmit and receive pair of a 4wire facility to be tested from the end of that facility remote from the 4411A module. A source of trouble may, thereby, be isolated to either the transmission facility or to the terminal equipment. If the data station or other terminal equipment is provided by the customer, remote loopback is often useful in determining the maintenance responsibility involved in a particular trouble case. In this respect, the 4411A acts as an interconnect device, providing end termination of the transmission facility.

2.09 The loopback path through the 4411A includes both the transmit and the receive attenuators, passing from the receive input port to the transmit output port. An amplifier in the loopback path provides gain or loss (front-panel-adjustable) for the desired loopback transmission level. Loopback-path gain is normally adjusted to provide the transmission level at the module's transmit output port as specified on the CLR. From -15 to $+25$ dB (nominal) of gain is available in the loopback path to provide equal-level loopback with most commonly encountered transmit and receive-channel attenuator settings.

2.10 An auxiliary set of loopback relay contacts is brought out to implement visual or audible external indication of loopback or to implement data set disabling during loopback.

dc loopback

2.11 As mentioned earlier, the 4411A's loopback function may be controlled by tone or dc (via the simplex leads or local ground) signals. When the 4411A is switch-optional for dc loopback via the simplex leads, a polarity reversal of the dc sealing current passing through the module activates loopback. If sealing current is not used, application of a current of the correct polarity activates loopback. The module remains in loopback for the duration of the sealing current polarity reversal.

A. When the receive input SX lead is positive with respect to the transmit output SX lead, sealing current flows in the transmit and receive 4wire pairs.

B. A reversal of this SX current (the transmit output SX lead positive with respect to the receive input SX lead) effects the loopback mode.

2.12 A ballast lamp in series with the simplex loopback circuitry provides protection from excessive current. This allows the 4411A to be used in applications where short facility-side loops may result in excessive simplex current.

local loopback

2.13 The 4411A loopback function also may be initiated at the installation site by using the *local loopback* lead, brought out on one of the module pins. Grounding this lead forces the module into the looped-back mode, and the module may not be released from this mode except by removing the ground from the *local loopback* lead.

tone loopback

2.14 Tone-activated loopback is accomplished by placing a 2713Hz tone on the module's receive input pair for 1.4 seconds or longer, then removing the tone. The module will initiate loopback only upon removal of that tone. Loopback activation at the end of (rather than during) the initial tone burst prevents accidental looping of other than the intended loopback point on a multi-point circuit. The tone loopback circuit will respond to levels from $+6$ to -28 dBm (as measured at the receive *output* port), with a center frequency of 2713Hz, $\pm 0.2\%$ stability, with a 75Hz maximum bandwidth. A front-panel *sensitivity* control allows adjustment of

the detection threshold level within the $+6$ to -28 dBm range. This sensitivity adjustment, along with a 3dB signal-to-guard ratio, prevents raw data signals, harmonics of those signals, or other spurious signals from initiating loopback.

2.15 The tone loopback function may be disabled entirely by turning the sensitivity control completely counterclockwise.

2.16 The 4411A module may be conditioned, via slide switch option, to release tone-activated loopback either in response to a second 2713Hz tone or by automatic timeout. When the former method (two-tone-burst operation) is chosen, the module releases loopback upon application of a second 2713Hz tone of at least 0.7 second duration. Unlike the tone-activate procedure, the release sequence operates *during* application of the tone. If the timeout method of loopback release is selected, the module automatically returns the circuit to a non-looped condition after a period of time that may be continuously adjusted, via front-panel *time* control, over a nominal 1 to 70 second span.

2.17 Each method of tone loopback release, two-tone-burst or timeout, has advantages. Timeout operation, for example, makes it impossible to inadvertently leave the circuit in a looped condition. On the other hand, two-tone-burst operation permits the 4411A to maintain loopback for as long, and only as long, as is required.

2.18 In those situations where loopback has been tone activated, a dc (simplex) signal may be applied and removed to release loopback. However, tone will not release a dc-activated and held loopback condition.

2.19 Power interruptions will not activate an unwanted loopback condition.

front panel

2.20 The 4411A's front panel is designed to simplify alignment and maintenance. All adjustments and jacks are accessible from the front panel. Jacks provide isolated-module measurements at each of the module's four ports. An LED provides a quick visual check for loopback. It glows red to indicate a loopback condition.

3. installation inspection

3.01 The 4411A Pad/Transformer/Loopback module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again, prior to installation.

mounting

3.02 Each 4411A module mounts in one position of the Tellabs Type 10 Mounting Shelf. The module plugs physically and electrically into a 56-pin connector at the rear of the Type 10 Shelf.

installer connections

3.03 Before making any connections to the mounting shelf, make sure that power is off and

modules are removed. Modules should be put in place only after properly optioned and after wiring has been completed.

3.04 Table 1 lists connections to the 4411A module. All connections are made via wire wrap at the 56-pin connector at the rear of each module's mounting shelf position. Pin numbers are found on the body of the connector.

connect	to pin
XMT TIP OUT	41
XMT RING OUT	47
transmit simplex lead	51
RCV TIP IN	7
RCV RING IN	13
receive simplex lead	9
XMT TIP IN	55
XMT RING IN	49
RCV TIP OUT	5
RCV RING OUT	15
loopback relay, common (TEK 5)	45
loopback relay, normally open	29
loopback relay, normally closed (TEK 6)	43
local loopback	1
BATT (-22 to -56Vdc battery input)	35
GND (ground)	17

table 1. External connections to 4411A module

options

3.05 Four option switches must be set on the 4411A before inserting the module into its shelf position. Figure 3 shows the relative positions of these four switches on the printed circuit board.

3.06 Switches S1 and S2 select the impedance matching option for, respectively, the receive input and transmit output (facility side) ports. Each switch may be set to provide 150, 600 or 1200 ohm impedance matching characteristics. Positions 150, 600 and 1200 are labeled on the printed circuit board adjacent to the switch. For common usages of these options, consult the Application section of this Practice, paragraph 2.06.

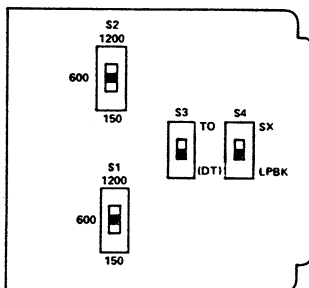


figure 3. Switch locations

3.07 Switch S3 selects either the timeout or two-tone-burst method of tone loopback release (see paragraphs 2.16 and 2.17). The two switch positions, TO (timeout) and DT (dual tone), are labeled on the printed circuit board adjacent to S3.

Note: When switch S3 is set to the DT position, ensure that the front-panel time control is not turned fully counterclockwise, as this may cause the 4411A to reactivate loopback after the release tone is removed.

3.08 Switch S4 selects either internal or external use of the simplex leads. The external option allows the simplex leads to be used for simplex signaling. The internal option adapts the 4411A for simplex

(dc) loopback/sealing current operation; see paragraphs 1.10 and 2.07. Positions SX (external) and LPBK (internal) are labeled on the printed circuit board adjacent to switch S4. Set S4 accordingly.

alignment

3.09 After all option switches have been set, adjust all front-panel controls fully counterclockwise, except *time* and *sens*, which should be fully clockwise. Insert the module into its mounting, apply power, and adjust the receive level attenuator control *rcv* to the desired loss at 1000Hz as follows:

A. Insert a test oscillator into the *rcv in* jack at the proper level and impedance as specified by the Circuit Layout/Level Record (CLR).

B. Adjust the *rcv* attenuator control for the intended level, measured at the *rcv out* jack with a transmission measuring set (TMS) optioned for 600 ohm terminated measurement.

3.10 Transmit channel alignment is accomplished by arranging the oscillator output for the transmit input level specified on the CLR and 600 ohm impedance and inserting this signal into the *xmt in* jack. Once again, arrange the TMS for the level and impedance shown on the CLR, and access the *xmt out* jack. Adjust the *xmt* attenuator control for the level indicated on the CLR.

alignment (loopback sensitivity)

3.11 When signals other than the specifically intended 2713Hz loopback tone falsely trigger loopback, the loopback detector can be de-sensitized to these signals via the front-panel *sens* control. Loopback sensitivity is adjusted by the trial-and-error method. A 2713Hz signal at a level 1dB lower than the intended loopback detection threshold level is inserted into the *rcv in* jack. The sensitivity control is then slowly turned counterclockwise until loopback occurs, as evidenced by the front-panel LED lighting. The input tone level is then raised to the lower threshold limit and applied again to verify proper operation.

alignment (loopback level)

3.12 Loopback level (see paragraph 2.09) is adjusted by inserting a 1000Hz test tone, at the level and impedance specified on the CLR, into the *rcv in* jack. Access the *xmt out* jack with a TMS set to the correct impedance. Loop the 4411A (via tone, simplex or local loopback lead), and adjust the front-panel loopback amplifier *level* control to provide the correct level at the *xmt out* port (as specified by the CLR).

timeout duration adjustment

3.13 If the module is optioned for timed-out release of tone loopback, the front-panel *time* adjustment is used to control the length of elapsed time between the activation and the automatic timeout release of loopback. The control is adjusted for the desired loopback interval (from 1 to 70 seconds, nominal) by the trial-and-error method. Full clockwise adjustment provides the maximum loopback time.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 4411A Pad/Transformer/Tone Loopback module for engineering and application purposes only. Attempts to troubleshoot the module internally are not recommended and may void its Tellabs warranty. Troubleshooting procedures should be limited to those prescribed in section 7 of this practice. Please refer to the 4411A **block diagram**, section 5 of this practice, as an aid in following the circuit description.

4.02 The transmit and receive sections of the 4411A are relatively simple. Each consists of an impedance matching transformer facing the channel's facility-side port, a switch that provides 1200, 600, and 150 ohm facility-side impedance options, and a variable T-pad attenuator. The transformers are center-tapped to derive simplex leads.

4.03 The input signals for the tone-activated loopback detector are obtained from the RCV attenuator output through a high-impedance bridge. The signals are processed by a frequency selective, variable gain AMPLIFIER to improve immunity to spurious signals capable of initiating the loopback mode. The tone signals then pass through a passive L-C tuned FILTER, to further enhance selectivity, and a LIMITER and DETECTOR to enhance signal-to-guard ratio. The DETECTOR output then is integrated by the TIMER .7/1.4 SEC circuit, which is set for 1.4 seconds if the LB RELAY is released or 0.7 seconds if the LB RELAY is operated by the LOGIC CIRCUIT. If the LB RELAY was released, at the end of receipt of at least 1.4 seconds of continuous tone, the TIMER commands the LOGIC CIRCUIT to operate the LB relay, disconnecting the receive output and transmit input ports, and connecting the receive attenuator output to the transmit attenuator input through the variable gain loopback AMPLIFIER. If the module is optioned for dual tone burst operation and the LB RELAY is operated, after receiving approximately 0.7 seconds of continuous tone, the TIMER would cause the LOGIC CIRCUIT to release the LB RELAY, restoring the module to its non-looped condition.

4.04 The tone-activated timed-release mode is similar to that described in section 4.03, except that the LOGIC CIRCUITRY, upon detection and subsequent removal of tone, initiates a preset timing interval and commands the LB RELAY to operate. When the preset timing interval expires, the 1 to 70 SEC TIMER commands the LOGIC circuit to release the LB relay.

4.05 The (simplex) SX SENSE circuitry operates the LB RELAY when simplex current is applied in the proper polarity to the 4Wire XMT (OUT) and RCV (IN) pins. If the XMT OUT pair is at positive potential with respect to the RCV IN pair, the SX SENSE circuitry causes the LB RELAY to operate.

4.06 Grounding the LOCAL LOOPBACK lead causes the LOGIC CIRCUIT to operate the LB RE-

LAY, and remain in that state until the ground is removed from the LOCAL LOOPBACK lead.

4.07 The power supply in the 4411A module is a series voltage regulator using 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. Tantalum filter capacitors are used to provide filtering and decoupling.

6. specifications

attenuation (loss) range (nominal, including insertion loss)

transmit: 0.5 to 30dB, continuously adjustable

receive: 0.9 to 30dB, continuously adjustable

insertion loss (nominal)

transmit: 0.5dB (with attenuator at minimum setting)

receive: 0.9dB (with attenuator at minimum setting)

frequency response

±0.5dB, re 1000Hz, 300 to 4000Hz

facility-side impedance (transmit output and receive input ports)

150 ohms ± 15%, balanced; 600 or 1200 ohms ±10%, balanced; selected via switch option

station-side impedance (transmit input and receive output ports)

600 ohms ± 10%, balanced

echo return loss (facility side)

20dB minimum

maximum isolation between windings

500 volts RMS at 60Hz

envelope delay

less than 100µs, 300 to 4000Hz

simplex lead current

120mA maximum (external option) 5mA maximum unbalanced (external option)

40mA maximum (when optioned for loopback/sealing current mode)

longitudinal balance

60dB minimum, 200 to 4000Hz, facility side only

loopback-path amplifier gain range (nominal)

-15 to +25dB, continuously adjustable

loopback path noise

20dB BrNC0 maximum

tone loopback frequency

2713Hz center frequency (± 0.2% stability), 75Hz bandwidth maximum

tone loopback minimum sensitivity threshold

-28 to +6dBm, adjustable (levels as measured at receive output port); if sens adjustment is rotated completely counterclockwise, the tone loopback function is disabled

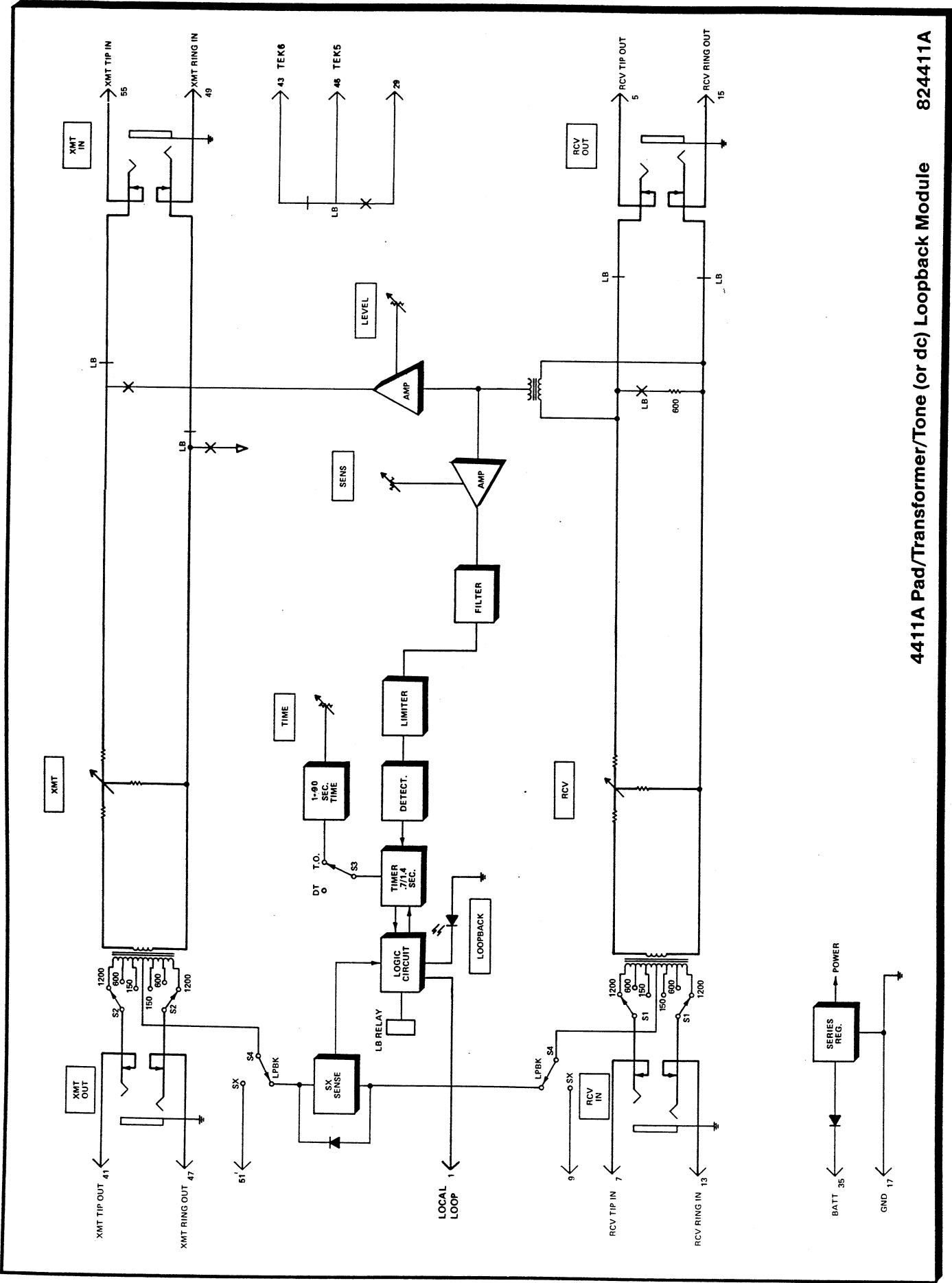
tone loopback signal-to-guard ratio

3dB minimum

tone loopback initiate time

initiate: 1.4 seconds, minimum (loopback after removal of tone)

specifications continued on page 7



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4411A Pad/Transformer/Tone (or dc) Loopback Module

5. block diagram

tone loopback release time

two-tone-burst operation: 0.7 second maximum, release during tone

timeout release mode: from 1 second to 70 ±20 seconds (adjustable)

simplex loopback current

10mA minimum, 40mA maximum (internally current regulated)

simplex loopback polarity

transmit output positive with respect to receive input (opposite polarity for sealing current)

simplex loopback time

duration of applied dc, maximum 20ms operate and release times

input power

−22 to −56Vdc, 40mA maximum, 20mA quiescent

operating environment

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

dimensions

5.58" (14.17cm) high

1.42" (3.61cm) wide

5.96" (15.14cm) deep

weight

15 ounces (.425kg)

mounting

relay rack or apparatus case via one position of Tellabs Type 10 Shelf or one position Wescom Type 400 Shelf

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 4411A Pad/Transformer/Tone Loopback 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	telephone	office location
US Northeast	(203)798-0506	Danbury, CT
US Capital	(703)359-9166	Washington, DC
US Central	(312)357-7400	Chicago, IL
US Southeast	(305)834-8311	Orlando, FL
US Southwest	(214)869-4114	Dallas, TX
US Western	(714)850-1300	Orange County, CA

Canadian customers: Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)858-2058.

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 60532-1698
telephone (312)969-8800

in Canada:

Tellabs Communications Canada, Ltd.
2433 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 5S2
telephone (416)858-2058

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.

testing guide checklist on page 8

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. The defective equipment must be received within 30 days of the replacement's ship date. When we receive the defective equipment, a credit will be issued, leaving a balance due on the replacement's invoice that reflects only the express service and/or out-of-warranty charges, if any. Returns received more than 30 days after the replacement's ship date **will not be accepted for credit** but instead will be returned to you, thereby rendering the replacement's invoice due and payable. Please note that OEM, modified, and manufacture-discontinued equipment is not available via overnight express service.

testing guide checklist

test	test procedure	normal result	if normal conditions are not met, verify:
Transmit Level	Connect 1000Hz test signal at level specified on CLR to connector pins 49 and 55, or to xmt in jack. Measure output at pins 41 and 47, or at xmt out jack.	With xmt level control fully counterclockwise (CCW), output level at 1000Hz approx. 35dB lower than input <input type="checkbox"/> . With control fully clockwise (CW), output within 0.5dB of input <input type="checkbox"/> .	All wiring to module correct <input type="checkbox"/> . Proper impedance terminations (check for double terminations) <input type="checkbox"/> . Impedance switches properly set <input type="checkbox"/> . Module not in loopback <input type="checkbox"/> .
Receive Level	Connect 1000Hz test signal at level specified on CLR to receive input via pins 7 and 13 or rcv in jack. Measure output at pins 5 and 15 or rcv out jack.	With rcv level fully CCW, output level approx. 35dB lower than input <input type="checkbox"/> . At full CW, output level within 0.9dB of input <input type="checkbox"/> .	Terminating impedances correct <input type="checkbox"/> . Module not in loopback (no ground on pin 1) <input type="checkbox"/> .
Tone Loopback (conducted local to module)	Connect 2713Hz test signal at level indicated on CLR to rcv in jack; after 2 seconds minimum, change frequency to 1000Hz.	Loopback lamp glows red <input type="checkbox"/> .	Loopback sensitivity control properly adjusted <input type="checkbox"/> . Power applied to module <input type="checkbox"/> .
Loopback Level	With tone loopback operated as above, measure output at xmt out jack or pins 41 and 47.	Test level indicated on CLR \pm 1dB <input type="checkbox"/> .	Adjust loopback level control <input type="checkbox"/> . Transmit and receive levels properly aligned <input type="checkbox"/> .
Tone Loopback Release (two tone operation)	Change test signal from 1000Hz back to 2713Hz.	Loopback lamp off after approx. 1 second <input type="checkbox"/> .	Switch S3 set properly <input type="checkbox"/> .
Tone Loopback Release (timeout)	Remove 2713Hz test signal used to activate loopback.	Loopback off after 1 to 70 seconds <input type="checkbox"/> . Adjust time (timeout) front panel control to desired loopback duration (1 to 70 second nominal range) <input type="checkbox"/> .	Switch S3 set properly <input type="checkbox"/> .
Simplex Loopback (remote test from CO)	Apply simplex loopback current and send 1000Hz test signal on transmit pair from serving central office. Measure test signal at receive pair at central office.	Test level \pm 1dB from that specified on CLR <input type="checkbox"/> . Note that loopback follows loopback sx current (front panel lamp) <input type="checkbox"/> .	Switch S4 set correctly <input type="checkbox"/> . Positive potential of simplex loopback supply applied to transmit pair <input type="checkbox"/> . Proper alignment of transmit, receive, and loopback levels <input type="checkbox"/> .