

6003 and 6004 2Wire Auto Ringdown Modules★

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1. general description

1.01 The 6003 and 6004 Two-wire Automatic Ringdown modules provide automatic ringdown (ARD) service between two stations or PBX trunks. Either module causes ringing to be applied to one end of a circuit in response to a station off-hook or PBX trunk seizure at the opposite end. One module per circuit provides automatic ringdown service in both directions. Ringing, once initiated, continues until the called party answers or until the calling party goes back on-hook.

1.02 This practice section is revised to add a second option-switch-location diagram in section 3. This new diagram shows option-switch locations and designations for a second, later manufacturing version of the Issue 2 6003 and 6004 modules (Tellabs part numbers **826003** and **826004**). This later version is not documented in previous practice revisions. Please be aware that the earlier and later versions of the 6003 and 6004 are functionally identical. However, the location and orientation of several printed-circuit-board option switches on the later version of each module are changed with respect to the earlier version. The changes are obvious enough that the two versions are easily distinguishable from one another, although it should be noted that the earlier version may have either an aluminum front panel with visible screw heads protruding (as shown in figure 1) or a plastic front panel with no screw heads protruding. Thus, comparing your module's option switch layout to those shown in figure 4 is the only way to make certain which version you have. Additional practice changes include minor corrections to the block diagram, section 5 of the practice, and updated information in the text portion of section 7.

1.03 The 6004 differs from the 6003 in that it incorporates a relay to allow the externally controlled transfer of the ringdown function at one end of the circuit between two station loops or PBX trunks, as may be required, for example, to implement a night service hookup. The 6003 does not include this transfer relay.

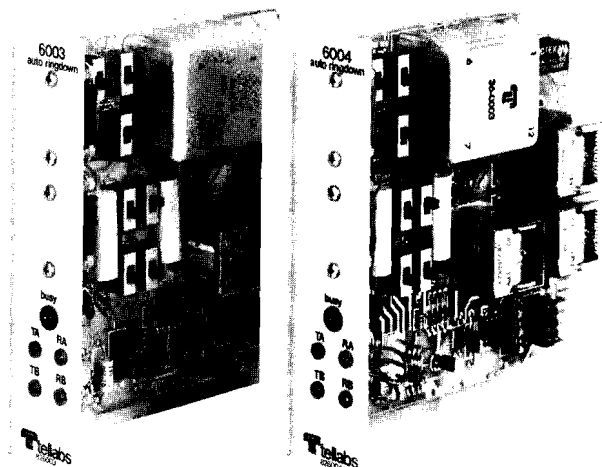


figure 1. 6003 and 6004 2Wire Automatic Ringdown modules

1.04 All normal 2wire signaling and battery feed functions for loop status detection, ringing application, ring tripping and audible ringback are implemented by the 6003 or 6004 module through standard loop signaling techniques.

1.05 Either module may be switch optioned for loop start or ground start operation in either or both directions. Seizure of the circuit, which causes the 6003 or 6004 module to apply ringing toward the opposite end of the circuit, is accomplished in the loop start mode by the detection of loop current resulting from an off-hook telephone instrument. In the ground start mode, seizure is accomplished by the detection of ground on the ring conductor of the subscriber loop.

1.06 Interrupted ringing may be provided by either 6003 or 6004 Ringdown module through use of the optional 9903 Ringing Interrupter subassembly. The 9903 plugs into receptacles on the printed circuit card of the Ringdown module to provide a nominal 2-second-on/4-second-off cycle. The 9903 accommodates ring trip during either the silent or the ringing interval.

1.07 Signaling range of either 6003 or 6004 2Wire Automatic Ringdown module is 3000 ohms maximum loop length at -48Vdc operation, or 1500 ohms at -24Vdc.

★ A Tellabs Videotape Training Program is available for this product.

1.08 Optional 600 or 900-ohm impedance matching toward the facility on each side of the 6003 or 6004 may be independently switch selected.

1.09 Grounded or biased ringing may be employed with the 6003 or 6004.

1.10 Both 6003 and 6004 provide lamp and buzzer control leads that may be used with multi-line key telephone station sets. A sleeve lead may also be provided through use of the lamp leads (See paragraph 3.04).

1.11 The front panel of each 6003 or 6004 incorporates an LED busy lamp and tip and ring test points accessing the circuit on both sides of the module.

1.12 The 6003 and 6004 each mount in one position of the Tellabs Type 10 Mounting Shelf, variations of which provide for relay rack or apparatus case installation. In relay rack applications, up to 12 modules mount across 6" vertical in a 19" rack, and up to 14 modules can be accommodated across a 23" rack in the same vertical space.

2. application

2.01 The 6003 and 6004 2Wire Automatic Ringdown modules may be applied to 2wire, metallic facilities to provide bi-directional automatic ringdown service. The 6003 is employed on metallic facilities connecting two stations or two trunks (figure 2).

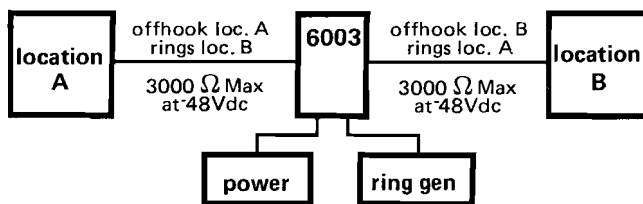


figure 2. 6003 interconnects two lines or trunks

The 6004, by virtue of its externally controlled transfer relay, may be used to interconnect three stations over metallic facilities in an arrangement whereby Station A has ringdown service with either station B1 or station B2. See figure 3. The 6004

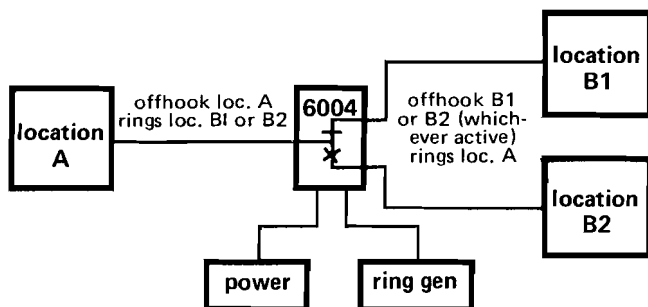


figure 3. 6004 interconnects three lines or trunks

is commonly applied to a ground start PBX ringdown circuit with an alternate connection for night service. In night service applications, the (loop start) night answer station is allowed one-way terminating service only, unless a ground start key is provided.

2.02 Switch options provided on both modules accommodate either loop start or ground start operation. The loop start mode is normally employed on lines, while the ground start mode normally finds application on trunks. Two separate and independent loop start/ground start switches allow line A on one side of the 6003 or 6004 to be optioned independently from line B on the other side of the module. A ground start trunk on one side of the module may, therefore, be interfaced for two-way ringdown service with a loop start line.

2.03 One-way ringdown service can be implemented through use of the loop start/ground start switches. If two lines employing loop start operation are interfaced by a 6003 or 6004, optioning one side of the module for the ground start mode will force the line on that side to a receive-only status. This mode of operation might typically be used on a ringdown circuit to a computer. To prevent the computer from originating a call when it (typically) opens the loop to release a call, then closes the loop again, the side of the 6003 or 6004 facing the computer is optioned for ground start. Optioned this way, the module will not recognize the computer's loop closure, nor will the circuit be seized by the computer.

2.04 Maximum signaling range of the 6003 or 6004 is 3000 ohms when powered by a -48Vdc source and 1500 ohms with a -24Vdc source, based on a 16mA current requirement. Because the tel set may require 23mA of current, transmission range of the 6003 or 6004 is somewhat lower: 2100 ohms with a -48Vdc source and 1000 ohms with a -24Vdc source. Circuit resistance calculations must include the tel set's internal resistance (typically 200 ohms) and that of the module (400 ohms).

2.05 Either continuous or interrupted external ringing generator may be used with the 6003 or 6004. If continuous ringing is the only available source and an interrupted ring is desired, the 6003 or 6004 may be equipped with the optional 2-second-on/4-second-off 9903 Ringing Interrupter subassembly. **When interrupted external generator, is used, the 9903 subassembly must not be used.**

2.06 Some form of ringing bias must be employed with the 6003 or 6004 to accommodate the ring trip function. The ring generator connected to the Automatic Ringdown module may be biased in one of several ways. See paragraph 3.10. Biasing voltage is supplied by a dc voltage connected in series with the ac ringing source. The ringing supply bias voltage determines the maximum ring trip range (which is the limiting factor in ringing) toward the station. With 24Vdc bias, maximum range is 1500 ohms, and with 48Vdc bias, maximum range is 3000 ohms.

2.07 In the ground start mode of operation, the ringing generator bias lead (pin 11) may not be biased negatively, as this effects a negative bias on the Tip lead of the called station during ringing.

The operation of the associated PBX trunk circuit may require that the Tip lead be at ground or positive potential to allow the operation of the incoming call circuitry, and therefore, a negatively biased ringing generator (or a positive voltage connected to the ringing generator bias lead) is required to allow both module and trunk circuitry to function properly.

2.08 To accommodate various lengths and types of cable, both modules may be switch-optional for either 600 or 900 ohm impedance matching. Each side of the module is optioned independently, allowing the interface of variously composed cable facilities. The 600 ohm impedance matching option is normally chosen to interface non-loaded cable, short loops and station apparatus. The 900 ohm option is used to interface loaded cable facilities.

2.09 Both 6003 and 6004 provide lamp and buzzer control leads that may be used with multiline key telephone station sets. These control leads externally connect to the standard key telephone set's lamp interrupter, lamp and buzzer supply. In the applications where buzzer ringing is used instead of standard loop ringing, certain wiring and option changes must be accommodated (see paragraph 3.11).

2.10 A sleeve lead may be provided, when required, toward the external switching equipment through use of the module's KTU lamp leads, as described in table 1, paragraph 3.04.

connect	to pin
line A Tip (TA).....	51
line A Ring (RA).....	33
line B Tip (TB).....	41
line B Ring (RB).....	49
ground (GND).....	17
battery (-BATT) (-22 to -56Vdc filtered input).....	35
ring supply machine start (MST).....	37
RING GENERATOR CONTINUOUS.....	45
RING GENERATOR INTERRUPTED.....	53
ring generator ring-trip bias (RING GEN).....	11
KTU BUZZER SUPPLY.....	36
KTU BUZZER.....	34
KTU lamp flash (LF)*.....	32
KTU lamp line A (L1A)*.....	26
KTU lamp line B (L1B)*.....	1
KTU lamp battery (LB)*.....	24
(following connections 6004 only)	
transfer line B control (TR).....	54
transfer line B Tip (TAX).....	48
transfer line B Ring (RAX).....	50
*To provide a sleeve lead, connect ground to pins 32 and 24 and the sleeve lead to pins 1 and 26.	

table 1. External connections to 6003 and 6004

Caution: An accidental reversal of the input power polarity to modules equipped with a 9903 Ringing Interrupter subassembly may damage the subassembly.

3. installation

inspection

3.01 The 6003 or 6004 ARD 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 shipper. If stored, the module should be visually inspected again prior to installation.

mounting

3.02 Each module, 6003 or 6004, mounts in one position of the Tellabs Type 10 Mounting Shelf, which is available in configurations for both relay rack and apparatus case installation. Each 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**. The 6003 or 6004 module(s) should be put into place only **after** wiring has been completed.

3.04 The following, table 1, lists connections to the 6003 or 6004 2Wire Automatic Ringdown modules. All connections are made via wire wrap at the 56-pin connector at the rear of the modules' mounting shelf position. Pin numbers are found on the body of the 56-pin connector.

options and alignment

3.05 Neither 6003 nor 6004 module requires alignment. Several switch options are provided, however, to condition the module for specific applications. Each module should be correctly optioned before being plugged into place. Figure 4 illustrates the position of the various 6003/6004 option switches. Switches are labeled on the module as shown in figure 4.

3.06 Either 600 or 900-ohm impedance matching to each of the two facilities is effected through use of slide switch S2 for line A and S3 for line B. The 600 and 900-ohm positions are labeled on the printed circuit board. If the 6003 or 6004 is connected to a gain device, that side of the module must be optioned to match the impedance of the gain device.

3.07 Loop start or ground start operation is selected by slide switch S1 for line A and slide switch S4 for line B. Loop start and ground start modes of operation on line A and line B are independent. That is, one line can be optional for loop start and the other for ground start, both can be optioned for loop start, etc. Switches S1 and S4 are labeled LS and GS on the printed circuit board.

3.08 Use with continuous or interrupted external ringing supply is effected through slide switch S6, marked on the module as CONT or INT.

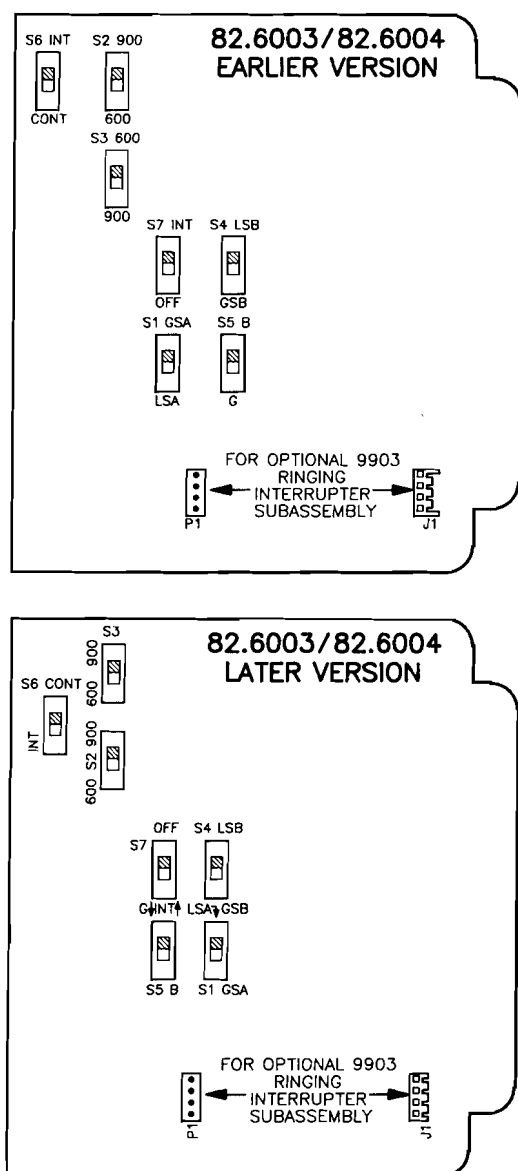


figure 4. Option switch locations

3.09 The 6003 or 6004 module is conditioned for use with the optional 9903 internal Ringing Interrupter by setting switch S7 to the INT position and installing the 9903 in the sockets provided on the module's printed circuit board. The 9903 plugs into the 6003 or 6004 by two, 4-pin connectors. When the 9903 is not used, slide switch S7 must be set to the OFF position.

3.10 Grounded ringing or ringing bias potentials are determined by slide switch S5 and those voltages applied to pins 11 and 45 or 53. With the S5 switch in the B position, the ringing generator bias is determined by the dc voltage connected to the local ring generator. When the S5 switch is in the G position, the dc voltages present on pins 45 (RING GEN) and 11 (RING GEN RETURN) are added to determine the ringing generator bias. Bias poten-

tials may be 24 or 48Vdc. Switch S5 must be set to the B position if ground-start is used on the circuit. In the ground-start mode, there may be restrictions on the polarity of the ringing generator bias (see paragraph 2.07). Resulting ring trip range limitations are discussed in paragraph 2.06.

3.11 When a buzzer (rather than standard ringing) in an associated tel set is required, the ring generator connection (pin 45) of the 6003 or 6004 module must be connected to battery (pin 35), switch S5 must be set to the B position and switch S6 must be set to CONT.

4. circuit description

4.01 Functional entities referenced in the following Circuit Description are depicted in the Block Diagram, section 5 of this Practice. The reader may find it helpful to refer to the Block Diagram while studying the following text.

4.02 When the 2Wire Automatic Ringdown module is idle, all relays are released and the two facilities interfaced by the module are coupled together by a repeat coil for voice transmission. Seizure of one of the subscriber loops initiates ringing of the second subscriber loop. Ring trip is accomplished by a loop seizure of the second subscriber loop. Abandoned calls caused by the originating station returning to an on-hook condition during an unanswered call will terminate the ringing mode of operation. Re-ring may be accomplished after both stations return to an on-hook status. The release of one station on an answered call will not cause an automatic re-ring of the on-hook station.

4.03 In the loop start mode, a call originated from station A is initiated by line A loop current and is sensed by Loop A Current Sense circuitry. The Loop A Sense circuitry operates relay LA causing the ring generator to be connected via the Ring Trip Circuitry to line B. When station B answers, by placing the instrument off-hook, loop current is caused to flow in loop B. The loop current is sensed by the Ring Trip circuit, which causes the RT Relay to operate. The operation of the RT Relay releases the LA Relay, which removes ring voltage from line B, and cause the front-panel LED of the 6003 or 6004 to light. The ringing of station A is similar to that described above, except the LB Relay, rather than the LA Relay, is involved.

4.04 Ground start operation is similar to loop start operation except that seizure of line A is initiated by a ground on the ring lead, which causes Relay LA to operate. The operation of Relay LA connects the tip lead of both lines A and B to ground and supplies ringing to line B. Ring trip and the operation of Relay RT are identical to the same functions in loop start operation. The operated RT Relay maintains the ground on the tip lead of lines A and B.

4.05 Ringback tone is provided by the ringing current flow through the repeat coil. Additionally,

the motor start (MST) lead, which initiates the 9903 Ringing Interrupter subassembly when used, is grounded during the ringing of either station.

4.06 The TR relay, used to transfer the "B" side of the 6004 ARD module from one line or trunk to a second line or trunk, is activated by placing an external ground on the TR lead, pin 4.

4.07 The internal voltage regulator in the 6003 or 6004 consists of a series regulator with zener diode reference.

6. specifications

loop range limitation (either line)

—24Vdc operation: 1500 ohms

—48Vdc operation: 3000 ohms

ringing supply voltage

85 to 130Vac, 16 to 67Hz (battery-connected or ground-connected ring generator)

ring-trip range (either superimposed or grounded ring generator)

24Vdc bias: 1500 ohms

48Vdc bias: 3000 ohms

ringing interruption (using Tellabs 9903 Ringing Interrupter subassembly)

2 seconds ringing, 4 seconds silent (starts in ringing state; trips ringing in either ringing or silent state)

minimum facility leakage resistance

20 kilohms

frequency response

300 to 3400Hz +0.4dB, —1.2dB re 1004

insertion loss

0.8dB maximum

echo return loss

23dB minimum

power requirements

—22 to —56Vdc, 18mA idle

6003: 45mA operated talking; 60mA operated maximum

6004: 70mA operated talking; 85mA operated maximum (plus both loop currents)

longitudinal balance

60dB minimum

longitudinal environment

60Vac rms line induction (measured with module removed, and tip and ring connected together to ground through a 500-ohm resistor)

operating environment

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

dimensions

5.58 inches (14.17cm) high

1.42 inches (3.61cm) wide

5.96 inches (15.14cm) deep

weight

6003: 20 ounces (567 grams)

6004: 21 ounces (595 grams)

9903: 1 ounce (28 grams)

mounting

relay rack or apparatus case via one position of Tellabs Type 10 Mounting 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 6003 or 6004 2Wire Automatic Ringdown 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 Atlantic	(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

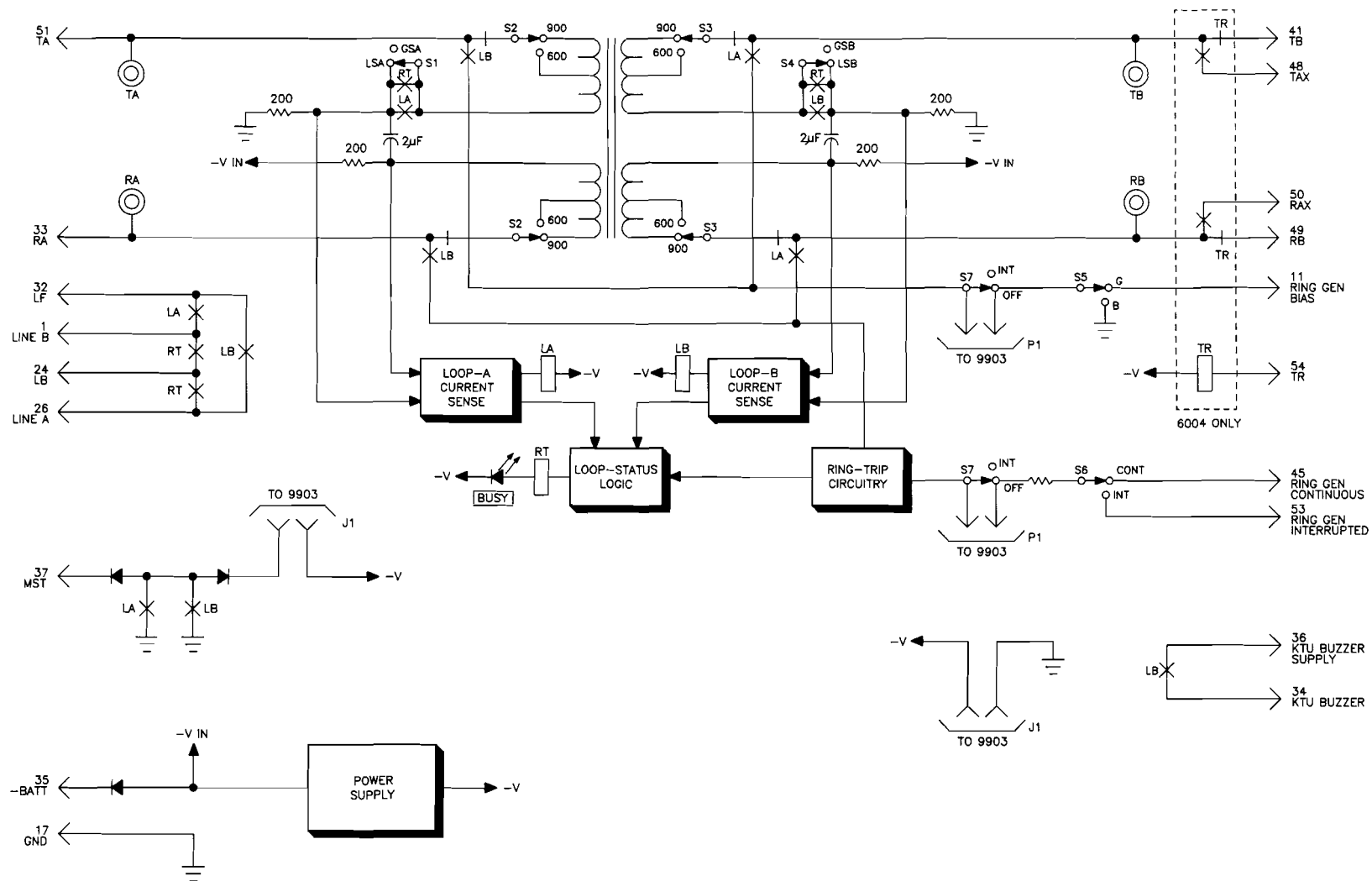
Canadian customers: Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)624-0052.

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.

text continued on page 7;
testing guide checklist on page 8



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5. block diagram

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 on page 8

testing guide checklist

TEST	TEST PROCEDURE	NORMAL CONDITIONS	TROUBLESHOOTING: IF NORMAL CONDITIONS ARE NOT MET, VERIFY:
Circuit Idle (loop start)	With circuit idle, access test points TA and RA, and TB and RB with VOM on 50 or 250Vdc scale.	Busy lamp out <input type="checkbox"/> . Minimum 48Vdc local talk battery on TA and RA <input type="checkbox"/> . Minimum 48Vdc local talk battery on TB and RB, with TB positive <input type="checkbox"/> .	Local power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Switch S4 in LS position <input type="checkbox"/> . No excessive cable leakage <input type="checkbox"/> . No ground on Ring conductor <input type="checkbox"/> . No open switching cable pairs <input type="checkbox"/> . Switching equipment operating properly <input type="checkbox"/> . Replace 6003 or 6004 and retest <input type="checkbox"/> .
Circuit Idle (ground start)	With circuit idle, place VOM set to 50 or 250 Vdc scale across test point RA and ground, and across test point RB and ground.	Busy lamp out <input type="checkbox"/> . -48Vdc on line A Ring (RA) <input type="checkbox"/> . -48Vdc on line B Ring (RB) <input type="checkbox"/> .	Local power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Switch S4 in GS position <input type="checkbox"/> . No ground on Tip conductors <input type="checkbox"/> . No open or ground on Ring conductors <input type="checkbox"/> . No excessive cable leakage <input type="checkbox"/> . No open switching cable pairs <input type="checkbox"/> . Switching equipment operational <input type="checkbox"/> . Replace 6003 or 6004 and retest <input type="checkbox"/> .
Ringing (LS or GS)	While accessing front panel test points with VOM set to 250Vac scale, create off-hook condition line A to test line B ringing, and vice versa.	Busy lamp out <input type="checkbox"/> . Ringing of station follows immediately other station off-hook <input type="checkbox"/> . 65Vac minimum ringing voltage <input type="checkbox"/> .	Option switches S5, S6 and S7 set correctly <input type="checkbox"/> . Local power and other external conditions as per Idle tests above <input type="checkbox"/> . Replace 6003 or 6004 and retest <input type="checkbox"/> . *See note.
Ring Trip	With VOM set to 250Vac scale across TB and RB, ring line B by placing line A off-hook. Answer by going off-hook at distant station B during both ringing and silent interval. Repeat procedure line B to Line A.	Ring trip verified by removal of ringing voltage from called station line within 100ms of going off-hook <input type="checkbox"/> . Busy lamp lights when called station answers <input type="checkbox"/> .	Stations within specified loop resistance limits <input type="checkbox"/> . Ringing generator properly biased <input type="checkbox"/> . Replace module and retest <input type="checkbox"/> .
Talking	Using test tel set across TA and RA, converse with station B. Repeat procedure opposite direction.	Normal conversation possible between stations <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Replace 6003 or 6004 and retest <input type="checkbox"/> .
Call release	Starting with completed call, place stations back on-hook.	Busy lamp out when both stations returned to on-hook <input type="checkbox"/> . No re-ring occurs after only one station returned to on-hook <input type="checkbox"/> .	Option switches correct <input type="checkbox"/> . Longitudinal voltages (Tip or Ring to ground) less than 10Vac <input type="checkbox"/> . No excessive cable leakage <input type="checkbox"/> . Replace module and retest <input type="checkbox"/> .
<p>*Note: If the loop between the module and the station has excessive leakage resistance, or if capacitance in excess of 5μF exists between Tip and Ring, or from Ring to Ground, pre-trip may occur. This will be evidenced by a short burst of ringing during each ringing cycle. If this symptom occurs, the abnormal loop condition should be corrected.</p>			