

Chapter 1: Overview

This manual describes the Telephone Line Simulator-4A which tests telephones and other telecommunications devices.

The TLS-4A Telephone Line Simulator offers a convenient means for setting up temporary “telephone lines” to demonstrate or test equipment where actual central office lines are not easily available. The TLS-4A provides four simulated lines, two “talk paths” or connections, and an audio interface port, making it a versatile device for a variety of applications including:

- Demonstrating or testing telecommunications devices such as telephone sets, fax machines, and modems. Two simultaneous, independent conversations can be set up over the four lines.
- Playing prerecorded presentations over a line when the telephone handset is lifted (for example, at trade show or museum displays)
- As a teaching aid with the audio port configured to allow monitoring and/or recording of a telephone conversation (for example, when teaching children to use “9-1-1”)
- Testing telephone or key system installations
- Limited testing of loop start PBX installations

Static Protection

Use standard precautions in discharging electrostatic buildup before operating this equipment or any other electrical equipment.

Features

- Programmable operations:
 - Two phone numbers for each line
 - Forced disconnect
 - Hot line (“ringdown”) number
 - Ring cadence 1-3 rings
 - Hunt groups
 - Immediate or dial access to audio port
 - Tone or recorded message when an invalid number is dialed
 - Monitor mode (allows recording phone calls for training use)
 - PBX-like operations: call transfer, add on, hook flash
 - Timing adjustments
 - Second dial tone simulates outside line access
 - Tone following disconnect
- Provides four lines and two connections
- Portability and quick, convenient setup

- Accepts tone and rotary input
- Ringing voltage source with short circuit protection
- AC powered (battery not required)
- Non-volatile memory (battery not required)
- Generates precise call progress tones
- Ground reference jack
- -48 V ground referenced line voltage
- Audio port

Calling Operations

The TLS-4A provides dial tone to a line when the telephone handset is lifted. When a rotary dialed or tone digit is detected, dial tone stops. If a number is misdialed, reorder tone (or another programmable tone) is sent to the caller or the caller is connected to the audio port (see command 31 on page 34).

When a valid number has been dialed, ringback tone is sent to the caller and the called line rings. When the called line answers, ringback tone stops and a connection is established between the parties. When either party goes on-hook, the off-hook line receives about 2 seconds (default) of silence, followed by dial tone, or Cutoff on Disconnect. See command 38, Forced Disconnect, on page 38 for more information.

Physical Description

The TLS-4A is a portable unit weighing just over 4 pounds. A detachable power cord is supplied with the TLS-4A. As shown in Figure 1, the front panel provides: four modular RJ-11 jacks for connection of the equipment to be demonstrated or tested, a multifunction switch (see Table 1), and the indicators listed in Table 2. A 5-pin DIN jack on the back panel enables sending or receiving audio to/from any line. The audio is turned on or off by a software-driven relay. A fused, modular AC power jack and an optional chassis ground reference point are also located on the back of the unit.

For key telephone and PBX line testing, a modular/alligator clip cable is available as an ordering option (Figure 4) to enable connection of lines from a terminal block to the TLS-4A.

Position	Label	Functions
Top	MAN/RING	<p>Momentary contact position with multiple uses:</p> <p>(1) Restore defaults: Within 1 second of turning power ON, press and hold for 5 seconds to clear all programming and restore default options. Release after the POWER light turns ON.</p> <p><i>Caution: Do not use the MAN/RING feature at power up.</i></p> <p>(2) Manual ring: With Line 1 on-hook, press and hold to ring Line 1. Ringing continues until the switch is released.</p> <p>(3) Programming mode: With Line 1 off-hook, and all other lines on-hook, press and hold for 1 second to place the TLS-4A in programming mode.</p>
Center	ON	POWER ON (Press and release the top portion of the switch.)
Bottom	OFF	POWER OFF

LED Operation

The table below explains how the LEDs on the TLS-4A front panel operate and what the different blinking patterns indicate.

Indicator	State	Description
Line 1—Line 4	ON	Line is off-hook
	Flashing (fast on/off)	Line is ringing
	Blinking (slow on/off)	Programming mode: Line is selected for programming
	Half brightness	During dialing, indicates that a valid DTMF digit is present
PWR	Slow blinking	Power is present and processor is running normally
AUDIO	ON	Audio control lead is on

Chapter 2: Feature Applications

The TLS-4A offers an array of programmable features to suit a variety of applications.

Two Numbers Per Line

Each of the four lines can be assigned two telephone numbers, each number a maximum of 16 digits long.

This feature may be used to program one number with a standard ring cadence and the other with a nonstandard ring cadence. Another use might be to assign all four lines the same second number in order to setup a hunt group or ring all telephones with one call.

Ring cadences on the second phone number can be varied, confirmation and error tones disabled, and audio port access blocked from certain lines. Hot line (“ringdown”) numbers and hunt groups can be setup. These and other programmable features are described in Chapter 6. The unit is programmed by connecting a tone (DTMF) telephone to the unit and entering digit codes.

Audio Port

The audio port can be configured for immediate or dial access or as a monitor, may allow single or multiple lines to be connected simultaneously, and can vary the method of turning off the recorded message.

Distinctive Ringing

The ring cycle timing for the first number on each line is always the standard 2 seconds on, 4 seconds off. The ring cycle timing for the second number on each line is programmable. (See Programming.) This gives the ability for each line to have two different ring cycles by simply dialing the two different numbers associated with that line.

Group Ringing

It is possible to have a group of phones that can be rung simultaneously, yet still be able to ring them individually. By programming different first numbers for each line, but the same second number for each line, and having the hunt mode set to “ring all”, dialing the first numbers will ring an individual phone (with standard ringing), and dialing the second number will ring all the phones simultaneously (with distinctive ringing).

Invalid Number

You can program how the TLS-4A will respond to an invalid number. It can respond with busy tone, reorder tone, ringback tone, silence, or it can connect the calling line to the audio port. Regardless of the response you select, there will be a delay before the response is activated.

If an invalid number beginning with any number other than “1” is dialed, the TLS-4A will respond after 7 digits have been entered or after 8 seconds have passed.

-or-

If an invalid number beginning with “1” is dialed, the TLS-4A will simulate the telephone network’s delay by waiting until 11 digits have been entered or 8 seconds have passed since the last digit was entered.

If you program the TLS-4A to connect invalid numbers to the audio port, calls arriving when the audio port is already in use will get busy tone.

Uses for Off-Hook Modes

A detailed explanation of command 32, Off-Hook Modes, is provided in Chapter 6.

Standard Mode

This provides normal dialing features.

Hot Line Mode

Hot line mode is normally used to ring one phone automatically the moment you pick up another. To use this feature, program the off-hook mode for the line from which you will make the call as “hot line” (see Chapter 6 for details). Program the “revert/hotline” number to the first or second number of the line you wish to ring. When you go off-hook on the originating line, ringback will be heard, and the destination line will ring.

Silent Mode

This mode can be used to provide silence when you go off-hook. To use this feature, program the off-hook mode for “silence”. Any or all of the lines can be used in this way.

Uses for Hunt Mode

Hunt Mode, command 35, can be used to Simulate Trunk Groups/Telethons. Please see Chapter 6 for a detailed explanation of this command.

Ring First/Ring Next/Ring All

When Hunt mode is set to “ring first available”, “ring all”, or “ring next” with multiple lines set to the same phone number, it simulates a group of lines with a single pilot number (like the trunks into a PBX system). “Ring first available” will always ring the lowest non-busy line. This will cause the lowest line to receive the most calls. “Ring next” will ring the next non-busy line in sequence above the last one to have rung. “Ring all” will ring all the lines until one goes off-hook.

Chapter 8: Electrical Specifications

AC Power Input

Voltage	TLS-4A: 115 VAC (15%)
Frequency	49 to 61 Hz
Current	TLS-4A: 0.2 A maximum (nominal line voltage)
Fusing	0.25 A 5 x 20 mm slow blow
Unit dissipation	20 Watts maximum

Telephone Line Circuit (Loop Start)

On-hook voltage	-48 (5 Volts (Tip positive referenced to Ring)
Short circuit loop current	< 30 milliamps
Minimum loop current	18 milliamps with a 500-ohm loop

Transmission Specifications

Nominal impedance	900 ohms
Insertion loss	Switchable between 3.4 dB and 16 dB (2 dB @ 1 kHz when two lines are connected)

Ring Source

Ring voltage	78 VAC (10% AC @ 20 HZ sinewave)
Ring frequency	Selectable 20, 25, 30, 60 (5% Hz)
Drive capacity	Up to 5 ringer equivalents (5 REN) total @ 20 HZ sinewave
Ring termination on answer	Within 250 ms
Ring waveform	Selectable step approximated sine or square wave

DTMF Detection

Frequency accept	(1.5% + 2 Hz)
Frequency reject	(3.5%
Tone-on time	40 ms minimum
Tone-off time	40 ms minimum
Amplitude	+4 to -18 dBm per frequency
Twist	6 dB or less

Rotary Dialing Detection

Rate	8 to 22 PPS
Percent break range	40% to 80% (LSSGR 6.3.4.6)
Break time	18 ms minimum, 100 ms maximum
Make time	9 ms minimum, 75 ms maximum
Interdigit time	300 ms minimum
End-of-digit detection	100 ms minimum

Loop Current Detect

Minimum off-hook current	15 mA
Maximum on-hook current	10 mA
Off-hook detect time	100 ms max
On-hook detect time	>Flash
Hook flash detect time	300 - 1100 ms (must detect) <280 ms > 1120 must not detect

Ringling Cadence

Ring programming increment	100 ms
Rings per cycle	1 to 3 (programmable)
Ring "on" time	0 to 3 seconds
Ring "off" time	0 to 6.3 seconds

Call Progress Tone Characteristics (Tone levels referenced to 900 ohms)

Dial tone	350 Hz (0.5% and 440 Hz (5% at -19 (3 dB per tone
Busy and reorder tone	480 Hz (0.5% and 620 Hz (5% at -19 (3 dB per tone
Audible ringback tone	440 Hz (0.5% and 480 Hz (5% at -19 (3 dB per tone

Audio Input/Output Jack

Recorder tone	230 ms of 1050 - 1650Hz tone to activate
Audio In impedance	10 k ohms
Audio gain (jack to Tip/Ring)	~ -10.5 dB (-10 dBm out with 1 V in)
Audio Out impedance	600 ohms
Audio gain (Tip/Ring to jack)	~0 dB
Relay contact rating	1 Form A contact, 100 Volt maximum, 1 mA maximum, 30 volt-amps maximum

Connector pinout	Pin 1: relay contact Pin 2: ground Pin 3: relay contact Pin 4: audio in to TLS-4A Pin 5: audio out from TLS-4A Shell ground: ground
------------------	--

Mechanical Specifications

Dimensions	2.3" H x 8.5" W x 10 .0" D (58 x 22 x 254 mm)
Weight	4 lb. 5 oz. (unit only)

Environmental Specifications

Storage temperature:	
Short-term storage	-40 to +55 degrees C
Long-term storage	-20 to +50 degrees C
Operating temperature	0 to 45 degrees C
Humidity	85% noncondensing, maximum

Regulatory Specifications

Meets requirements of U.S. Federal Communications Commission (FCC), Part 15 Class A, UL 1244, and CSA, C22.2, No. 225.

Chapter 9: Ordering Information

TLS-4A Telephone Line Simulator with power cord, includes an AC power cord and reference manual (this document). This unit accepts 115 VAC.

Optional Components

AC110-7.5 (spare) AC power cord, three-pronged, power cord (No. 18-3), type SVT rubber, with NEMA 5-15 P male/SPH-386 female connectors.

TLS-CA1 (optional) Modular/alligator clip cable (P/N 208-00121-01), 4-1/2 ft. cable with RJ-11 jack at one end, color-coded alligator clips at the other. (One cable required for each test line.)

Replacement Fuses

Below are a list of fuses, with their part number and manufacturer's name, which you can purchase from an electronics distributor.

Bussman	GMD-250mA
SAN-O Industrial Corporation	SD6-250
Littlefuse	239.250
Bel	5TT-250MA