OPERATOR'S MANUAL
MICRO SEVEN, INC®
MODEL LS25
TELEPHONE LINE SIMULATOR

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All requests for repairs should be directed to the factory.

There will be no warranty when the instrument is misused, or when the factory seal on the instrument is broken.

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Specification and price change privileges are reserved.

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INTRODUCTION

Micro Seven model LS25, The Cheapest Telephone Line Simulator, is a one-directional device for simulating telephone line simulator for testing and demonstrating of telecommunication equipment in engineering, manufacturing, and fields. There are two telephone jacks on LS25, line 1 for Call Originating and line 2 for Call Receiving. The LS25 contains dual frequency call progress tones, 30Hz sine wave ring signal, short and programmable telephone number, stutter dial tone, and random noise generation. The LS25 is operated by a standard 117VAC/DC adapter. Car Battery Adapter and International AC/DC power adapter for 90-260VAC with four different power plugs are available as options. The LS25 is also equipped with a forced-disconnect feature where disconnect signals are sent to calling and called lines. Programmable network response delay simulates time delay after completion of dialing. Simulated PBX mode returns dial tone after dialing 9. The secondary call progress tone generates a single-frequency tone instead of dual-frequency call progress tone. If you require two-way telephone line simulators, models LS15, LS100, and LS200 are available.
LS25 is also available as PCB only without the enclosure and AC/DC power adapter for less cost.

SECTION 2

SPECIFICATIONS

Note: Programming of parameters are restored upon powering off and on of model LS25 because parameters are protected in non-volatile memory component in LS25. The factory parameters are restored upon dialing "04#".

Dialing:

Telephone numbers:
1. (factory default) Primary (short) telephone number: selected by dialing 043: 2
2. Secondary (programmable) telephone number: selected by dialing 044, detail numbers are 2345678901.
DTMF dialing signal power: -13dBm to +5dBm per a frequency with no more than 4dB difference between frequencies.
DTMF dialing detection time: 45 ms
Pulse dialing: Break period: 45 to 75 ms (60 ms nominal), make period: 30 to 60 ms (40 ms nominal)

Programming Secondary Telephone Number for line 2: dial 022+ (new telephone number)
Note: Total digits of a secondary telephone number must match with a programmed telephone number length. For detail, see Section 3.16 Secondary Telephone Number Programming.

Telephone Number Length Programming: 0#178*nnn*, where "nnn" is a 3-digit decimal number between 0 and 18. For detail, see Section 3.15 Telephone Number Length.

Simulated PBX Mode:

The following dialing enables the simulated PBX mode where dial tone returns after dialing 9:
0#252*004* with dual frequency call progress tone and 0#252*012* with secondary call progress tone.
To return to non-PBX mode, dial 0#252*000* or dial 0#252*008* with secondary call progress tone.

Line characteristics:

Input impedance at 1 k Hz: 600 ohms +/- 5%
Signal Bandwidth: 150 HZ to 3.5 k HZ
Signal Range: -45 to +5 dBm

Random noise command:

When ``002'' is dialed, pseudo-line impairment circuit with random noise is added to signals between line 1 and 2. The ring signal is generated at the opposite line. Line impairment mode stays on until power is off or non-impairment mode is selected. All

subsequent calls will contain random noise until reprogrammed by no-random noise command.

No-random noise command:
When a number of ``092" dialed, the random noise is removed. All subsequent calls will contain no random noise until reprogrammed by random noise command.
insertion loss between lines becomes only 1 dB. This is a power-up default condition. The ring signal is generated at the opposite line. Non-impairment mode stays on until power is off or line-impairment mode is selected.

Battery-feed voltage (loop voltage): -20 volts minimum

Ring Signal:
30 +/- 2% Hz square wave. Normally 2 sec on 4 sec off with exception of distinctive ringing features programmed.
Amplitude: 75V RMS into open circuit. It is 66 V RMS into RN=0.1, 56 V RMS into RN=0.5, 48V RMS into RN=1, and 40V RMS into RN=1.7.
Note: According to the FCC-part 68 rule, the RN=7000/(equivalent resistive value in ohms) for ring signal of 20Hz +/- 3%.

Distinctive ring signal: not available

Off-hook impedance requirement: 400 ohms maximum DC, 600 ohms nominal AC

Call Progress Tones:
Dual-frequency call progress tones as a power-up default condition, nominal -16 dBm
Dial Tone: 350 Hz + 440 Hz, continuous unless programmed for stutter dial tone
Ring-back Tone: 440 Hz + 480 Hz, 2 sec ON/4 sec OFF.
Busy Tone: 480 Hz + 620 Hz, 0.5 sec ON/0.5 sec OFF.
Accuracy in frequency component: +/- 1%.

Secondary Call Progress Tones:
Dialing 07 enables the secondary call progress tones. Instead of generating dual frequency call progress tones, single-frequency tone of 480 Hz is produced with signal power of –18.5 dBm. Dialing 07 switches back to the dual frequency call progress tones.

Stutter dial tone:
Dialing 046 enables stutter dial tone with three of 0.1 seconds on/off period following with continuous dial tone.
Dialing 045 disables the stutter dial tone. It is a power-up default condition.

Line Input Jacks: USOC-RJ11-C, standard modular phone jacks, line 1: call originating and line 2: call receiving

Hot Line Mode: Dialing 06 enables the hot line mode, which calls the other line without dialing a number. To return to non-hot-line mode, remove power connection to LS25. turn-off the power and back dial 06 during the first 0.1 seconds right after off-hook.

Network response delay:
Time delay between the end of dialing and ring-signal application is programmable by the following dialing:
0#170*nnn*, where nnn is a 3-digit decimal number between 1 and 255. The time delay is determined by 8.6 ms x (nnn-1). The number, nnn, should not be zero.
The power-up default condition is 0 seconds.

Forced called-party disconnect:
When two lines are connected and one line hangs up, disconnect signal is generated to both lines.

Programmable disconnect signal:
The disconnect signal, which is interruption of loop current at the end of call when one line hangs up is programmable by the following dialing:
0#169*nnn*, where nnn is a 3-digit decimal number between 1 and 255. The time delay is determined by 8.6 ms x (nnn). The number, nnn, should not be zero.
The power-up default condition is 320 ms.

Restore of factory default condition:

Programming of parameters are restored upon powering off and on of model LS25 because parameters are protected in non-volatile memory component in LS25. The factory parameters are restored upon dialing “04#”.

Standard AC/DC Adapter that is provided as a standard accessory: 117VAC +/- 5%

DC input: 24VDC unregulated, 200mA maximum , with 2.1mm power connector (center positive)

Calibration: not required

Power Indicator: green LED display

Dimensions: 6.5 cm (2.5") W x 3.3 cm (1.5") H x 18 cm (5") L

Weight: about 250g (about 0.5 lbs.)

Environmental: Operating temperature: 0 to 35 degree C, Humidity: 85% RH at 35 degree C
Warranty/Service: 6 months limited warranty. No warranty if any factory seal is broken. Service is performed at the factory, usually within 5 working days.

Options and Accessories:
Car Battery Adapter
International AC/DC Adapter for 90-260VAC input with four different power plugs (US, UK, Europe and Australia)

PCB only option

Country of Origin: Manufactured in United States of America

SECTION 3

OPERATION

3.1 AC/DC Adapter and External DC Input Operations

The LS25 is operated with AC/DC Adapter or Car Battery Adapter (external DC operation). The standard AC/DC Adapter for LS25 inputs 117V-AC power. International AC/DC power adapter is available as an option.

3.2 First-time AC/DC Operation and Dialing Primary Telephone Number

Use this procedure when turning the instrument on for the first time. The procedure will also serve to explain the operation of the instrument. Here, two telephone sets, or one telephone set and an auto-answer modem.

Connect AC/DC Adapter to the power-input connector, and apply input power source, 117V or 220V depending on standard or international AC/DC Adapter. Observe that the POWER INDICATOR indicator LED comes on.

Connect a standard telephone-set, either rotary or tone, to Line 1 call originating line. Connect an auto-answer modem or another telephone set to line 2: call receiving line.

Lift line 1 telephone receiver; the dial tone should be audible. Assuming that the Primary Dialing method (single-digit dialing as power-up default) is employed, dial a rotary pulse or DTMF ``2" at line 1; after completing the dialing, the ring-back tone should be audible. The high-voltage ring signal is generated at line 2.

When the call from line 1 is answered at line 2 by closing relay contacts in the modem or lifting the receiver, the ring-back tone at line 1 and the high-voltage ring signal at line 2 will be turned off. A signal path has been established between Line 1 and Line 2. When an auto-answer modem is used at line 2, it generally waits 2 to 3 seconds before generating a continuous 2.2 kHz answer tone.

3.3 Dialing Secondary Telephone Number

Next, hang up the telephone sets. Lift the Line 1 telephone receiver, and dial ``044" to select the Secondary Telephone Number mode, and hang up the receiver. Lift the Line 1 telephone receiver again, dial a rotary or tone ``2345678901"; after completing the dialing, the ring-back tone should be audible. And the high-voltage ring signal is generated at the line 2. Then hang-up the Line 1 telephone receiver, and dial "043" to return to the Primary Telephone Number. The Secondary Telephone Number is programmable, and the power-up default condition is " 1234567890" for the Line 1, and ``2345678901" for the Line 2.

3.4 Pseudo-line impairment with random noise

The power-up default condition is non-impairment mode, so dial "002" at the Line 1 telephone receiver to select the Pseudo-Line Impairment Mode and to call Line 2. Random noise is added to signals between two lines. After the programming for the Pseudo-Line Impairment Mode is completed, either Primary or Secondary Telephone Number will not affect the Line Impairment programming setting. To select non-impairment mode, dial ``092" at line 1 to call line 2 without random noise.

3.5 Noise Amplitude Adjustment

The random noise in the Line Impairment Mode, which is described in 3.10, may be adjusted by dialing ``0#168*nnn*, where ``nnn" forms a 3-digit decimal number. The random noise amplitude is set at -55 dBm as a factory default value with ``nnn" =011. The smaller number for ``nnn" , the lower signal power.

3.6 Dual-Frequency and Secondary Call Progress Tones

As defined in the Section 2, Specifications, the standard call progress tones in LS25 including dial tone, ring-back tone, and busy tone are dual frequency call progress tone types as being used in U.S. and Canada. The Secondary Call Progress Tones of a single frequency of 480 Hz may be selected instead of the dual frequency type by dialing 07 and hang up the receiver. The tone duration will not be affected. To return to the dual frequency call progress tones, dial ``0#252*000*" for non-PBX mode or ``0#252*004*" for PBX mode.

3.7 Simulated-PBX Mode

The Simulated-PBX Mode generates dial tone again after receiving dialing of "9" as dialing ``9" is required to access an outside line. To enable this Simulated PBX Mode, DTMF dialing of ``0#252*004*" for dual frequency call progress tones or dialing of ``0#252*012*" for the secondary call progress tones. Note that dialing ``9" is not required to complete dialing; for example, dialing ``92" or ``2" at the Line 1 will ring the Line2. To return to non Simulated-PBX Mode, dial "0#252*000*" for dual frequency call progress tones or ``0#252*008*" for secondary call progress tones. Also note that dialing ``9" as a primary telephone number in non-Simulated-PBX mode will generate busy signal.

3.8 Stutter Dial-Tone

By dialing ``046" , the stutter dial tone is enabled. By dialing ``045" , it is switched back to non-stutter dial tone. Note that the stutter dial-tone is interrupted at its beginning.

3.9 Hot-Line Mode

The Hot-Line Mode eliminates dialing. When one line goes off-hook and receives dial tone, the other line will be ringing. Dialing ``06" enables the Hot-Line Mode, and dial ``06" during the 0.1 seconds right after off-hook to disable the Hot-Line Mode.
To disable the hot line mode, turn off the power to LS25.

3.10 Network Response Delay

The network response delay, that is between the end of dialing and start of ring signal application and ring-back tone generation, may be implemented by dialing ``0#170*nnn*" where ``nnn" forms a 3-digit decimal number. The delay is determined by 8.64 ms multiplied by a number, ``nnn" .
For example, by dialing ``0#170*255*" , the network response delay of 2.2 seconds is obtained.

3.11 Forced Called-Party Disconnect and Programming Disconnect Signal

When two lines are connected and one line hangs up, disconnect signal, which is interruption of loop current, is generated at two lines for 320 ms.

The disconnect signal duration is programmable by dialing ``0#169*nnn*, where ``nnn" forms a 3-digit decimal number. The duration is determined by 8.64 ms multiplied by a number, ``nnn" .

3.12 Programming Telephone Number Length

Programming for variable length of calling numbers and secondary telephone number is obtained by dialing: 0#178*nnn*, where "nnn" is a 3-digit decimal number between 0 and 18. The maximum telephone number is eighteen digits. The power-up default is set at 10 digits.

3.13 Secondary Telephone Number Programming

The power-up Secondary Telephone Numbers are:
Line 2: 2345678901

To change the Secondary Telephone Number, dial the following code:

022 + telephone number

Note: The telephone number length is defined in Section 3.12.

Example 1: to program 503-987-6543 as a new secondary number for line 2, dial 0225039876543 upon power-up, and hang up.

Example 2: Program 800-555-1212 for line 2, dial 0228005551212 upon power-up, and hang up.

SECTION 4

FCC RULES, PART-15

Warning

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Sub-part J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which cases the user at his own expense will be required to take whatever measures may be required to correct the interference.

APPENDIX A

PROGRAMMING SUMMARY of LS25

Caution: LS25 restore programmed parameters upon power-up except hot line mode.
Note: "nnn" is a 3-digit decimal number. It must be 3 digit long.

-To select Primary Telephone Number: 043 (Power-up default)

-To select Secondary Telephone Number: 044

-Telephone number length: 0#178*nnn*, 10 digits power-up default

-Programming secondary telephone number: 022 + (new telephone number)
Note: Total digit of a new telephone number must match with a telephone number length.

-Pseudo Line Impairment mode with random noise: 00

-No Line-Impairment mode with no random noise: 09 (power-up default)

-045: disable stutter dial tone (power-up default)

-046: enable stutter dial tone

-06: Hot Line mode

-07: switch from/to the secondary call progress tone

-0#169*nnn*: disconnect signal programming

-0#170*nnn*: network response delay

-0#252*004* (with dual frequency call progress tones) or 0#252*012* (with secondary dial tone): PBX mode is selected.

-0#252*000* (with dual frequency call progress tones) or 0#252*008* (with secondary dial tone): Non-PBX mode is selected.

APPENDIX B

SIGNAL POWER TABLE (dBm)

1. dBm versus peak-to-peak voltage of sine wave with no harmonic distortion

$dBm = 10 \log_{10}(((\text{peak-to-peak voltage})*0.3535)^2/600E\text{-}3)$

dBm	Peak to-Peak Voltage								
10	6.92716	-7	0.97849	-24	0.13822	-41	0.01952	-58	0.00275
9	6.17384	-8	0.87208	-25	0.12318	-42	0.01740	-59	0.00245
8	5.50244	-9	0.77724	-26	0.10979	-43	0.01551	-60	0.00219
7	4.90405	-10	0.69272	-27	0.09785	-44	0.01382	-61	0.00195
6	4.37074	-11	0.61738	-28	0.08720	-45	0.01232	-62	0.00174
5	3.89543	-12	0.55024	-29	0.07772	-46	0.01098	-63	0.00155
4	3.47180	-13	0.49041	-30	0.06927	-47	0.00979	-64	0.00138
3	3.09425	-14	0.43707	-31	0.06173	-48	0.00872	-65	0.00123
2	2.75775	-15	0.38954	-32	0.05502	-49	0.00777	-66	0.00109
1	2.45785	-16	0.34718	-33	0.04904	-50	0.00693	-67	0.00097
0	2.19056	-17	0.30943	-34	0.04371	-51	0.00617	-68	0.00087
-1	1.95234	-18	0.27578	-35	0.03895	-52	0.00550	-69	0.00077
-2	1.74002	-19	0.24579	-36	0.03472	-53	0.00490	-70	0.00069
-3	1.55080	-20	0.21906	-37	0.03094	-54	0.00437	-71	0.00061
-4	1.38215	-21	0.19523	-38	0.02758	-55	0.00390	-72	0.00055
-5	1.23184	-22	0.17400	-39	0.02458	-56	0.00347	-73	0.00049
-6	1.09789	-23	0.15508	-40	0.02191	-57	0.00309	-74	0.00043

2. dBm versus RMS voltage

$dBm = 10 \log_{10} (V^2/600\ E\text{-}3)$

Note: The term "dBm" is defined as a log-scale comparison of signal power into 600 ohms to 1 milliwatts.

dBm	RMS VOLTAGE								
10	2.44949	-7	0.34600	-24	0.04887	-41	0.00690	-58	0.00097
9	2.18311	-8	0.30837	-25	0.04356	-42	0.00615	-59	0.00086
8	1.94570	-9	0.27484	-26	0.03882	-43	0.00548	-60	0.00077
7	1.73411	-10	0.24495	-27	0.03460	-44	0.00489	-61	0.00069
6	1.54552	-11	0.21831	-28	0.03084	-45	0.00436	-62	0.00061
5	1.37745	-12	0.19457	-29	0.02748	-46	0.00388	-63	0.00054
4	1.22765	-13	0.17341	-30	0.02450	-47	0.00346	-64	0.00048
3	1.09415	-14	0.15455	-31	0.02183	-48	0.00308	-65	0.00043
2	0.97516	-15	0.13775	-32	0.01946	-49	0.00275	-66	0.00038
1	0.86911	-16	0.12276	-33	0.01734	-50	0.00245	-67	0.00034
0	0.77460	-17	0.10942	-34	0.01546	-51	0.00218	-68	0.00030
-1	0.69036	-18	0.09752	-35	0.01377	-52	0.00195	-69	0.00027
-2	0.61528	-19	0.08691	-36	0.01228	-53	0.00173	-70	0.00024
-3	0.54837	-20	0.07746	-37	0.01094	-54	0.00155	-71	0.00021
-4	0.48874	-21	0.06904	-38	0.00975	-55	0.00138	-72	0.00019
-5	0.43559	-22	0.06153	-39	0.00869	-56	0.00123	-73	0.00017
-6	0.38822	-23	0.05484	-40	0.00775	-57	0.00109	-74	0.00015