Addendum to the Sage 935AT and 930i Operating Manual
Echo Sounder and Echo Generator
Option Menu #28, #84, and #85

Echo Sounder, Option Menu #28

Audible echoes can be a significant telephone voice quality problem. The Sage Echo Sounder test measures echoes on any telephone call, presenting the results in terms of echo level and delay.

Echo on the Network

Echo is an inherent part of any telephone network, caused by the reflection of a signal back to its source. The two factors that combine to make echo a voice quality problem are the level of the echo (its loudness) and the time it takes the echo to return to the origin (its delay). Echo Sounder measures these two factors. The Echo Sounder test works by sending a complex test signal over the line, and measuring multiple echoes.

Echo Sounder Purchase Options

Echo Sounder is an optional feature on the Sage 93X family of test units.

Sage 93X Model	Echo Sounder Purchase Option
Sage 930A-L3	Option 930 A-55
Sage 930i	Option 930i-55
Sage 935AT	Option 935AT-555

Echo Sounder Configuration

The Echo Sounder test requires only one Sage test unit connected to a two or four wire test line in the field. The far end can be any piece of equipment that can answer a telephone call. Once begun, the test runs continuously until the operator stops it.
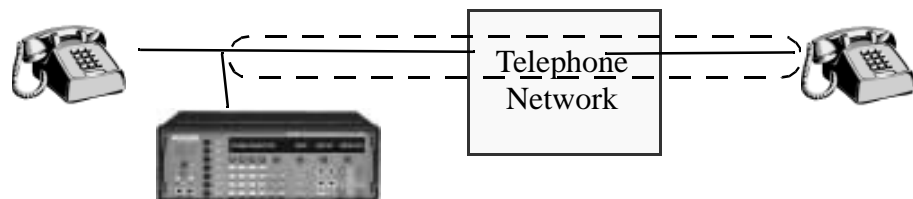
Echo Sounder Configuration

Echo Sounder Test Specifications

The Echo Sounder test allows you to modify the level of the test signal, and to disable the network's echo cancelling functions. The default test signal level is -10dBm. The default setting for the disabling signal is NO (i.e., echo cancellers enabled).

The table below presents Echo Sounder test specifications.

Test Parameter	Low Value	High Value
Echo Sounder test signal level	-15 dBm	-5 dBm
Two wire echo delay (precision = +/- 1 ms)	5 ms	505 ms
Four wire and E1 echo delay (precision = +/- 1 ms)	0 ms	900 ms
Echo level measurement (precision = +/- 1 dB)	-37 dB	-1 dB

Measurement Results

The Sage 93X unit displays a maximum of four echoes as they occur. The echo with the highest level displays first, followed by the next three loudest echoes. The display updates automatically as echoes are measured.

Test Setup

Set up and perform the Echo Sounder test at any four wire or two wire access point.

1 Connect the circuit to the Sage unit and select the appropriate trunk type.

This example is correct for a 2 wire trunk type:

```
  NORMAL        LOOP   TERM   CONTACT   2W 600

  ▼   ▲   ◄   ►     K1      K2        K3        K4
```

2 Establish a test call.

3 Press the Option Menu key, and select Option Menu #28.

```
  OPTION MENU #   28 ECHO SOUNDER

  ▼   ▲   ◄   ►     K1      K2        K3        K4
```

4 Press ENT or any soft key.

```
  ECHO SOUNDER:       SET-UP   MEASURE   EXIT

  ▼   ▲   ◄   ►     K1      K2        K3        K4
```

Set up functions are optional. If desired, use the set-up function to:

- define the level of the Echo Sounder test signal
- disable the network's echo cancelling functions

Use the measure function to begin the test (i.e., send the test signal over the network and measure echoes).

Test Signal Level

By default, the Sage unit sends the Echo Sounder test signal at -10dB, however the unit accepts values between -5dBm and -15dBm. Adjusting the test signal to a louder or softer level does not yield more accurate results.

Press K2 to display the Test Signal Level screen. Use the numeric keypad to change the level, if desired.

```
TEST SIGNAL LEVEL:-10dBm  DEFAULT   MORE
```
▼ ▲ ◄ ► | K1 | K2 | K3 | K4

Echo Canceller Disable Signal

The Echo Sounder test includes the ability to send an echo canceller disabling signal during the test. This signal should disable the echo cancellers on the network.

1 From the Test Signal Level screen, press K4 (MORE) to display the Disable Echo Canceller screen.

```
DISABLE ECHO CANCELLER?     YES     NO
```
▼ ▲ ◄ ► | K1 | K2 | K3 | K4

2 Press K4 (NO) to leave all echo cancelling systems on the network in place and return to the Echo Sounder menu. In the default Echo Sounder configuration, the echo canceller disabling signal is not sent over the network.

-- OR --

Press K3 (YES) to send the echo canceller disabling tone during the Echo Sounder test. At the conclusion of the Echo Sounder test, the absence of tone should return the network's echo cancelling system to normal operation.
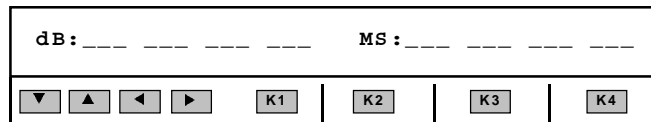
#28 Echo Sounder

Beginning the Test

From the main Echo Sounder menu, press K3 (MEASURE) to send the test signal and begin measuring echoes.

```
ECHO SOUNDER:      SET-UP   MEASURE   EXIT

 ▼   ▲   ◄   ►     K1       K2        K3       K4
```
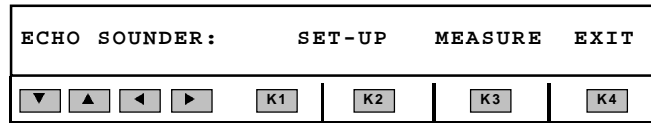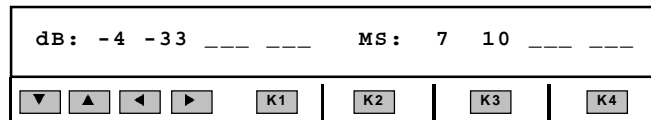
Measurements Display

The screen displays no measurements until the system detects echoes.

```
 dB:___ ___ ___ ___       MS:___ ___ ___ ___

 ▼   ▲   ◄   ►     K1       K2        K3       K4
```

As the test detects echoes within the -1dB and -37dB range, the level and delay of up to four echoes display on the screen.

```
 dB: -4 -33 ___ ___       MS:  7  10 ___ ___

 ▼   ▲   ◄   ►     K1       K2        K3       K4
```

Echo values automatically update on the display as they are detected. The example above shows two echoes:

Echo Example	Level	Delay
Loudest echo	-4 dB	7 ms
Next loudest echo	-33dB	10 ms

Stopping the Test

To stop sending the test signal and measuring echoes, press any function key, or end the call.

Echo Generator, Option Menu #84

Echo Generator creates one or two echoes with programmable echo delay and echo level. It echoes back any signal on a two wire, four wire, or digital call connection. When combined with Echo Sounder (Option Menu #28), Echo Generator facilitates ITU G.165 and 168 echo canceller tests.

Uses and Features

Echo Generator is useful for:

- Echo canceller tests
- Facilitating round trip delay and loss measurements
- Two and four wire loop back tests

You can use Echo Generator in conjunction with the Sage Echo Sounder to:

- Determine echo cancellation depth
- Determine echo cancellation tail length
- Detect delay introduced by echo cancellers

Modes of Operation

Echo Generator operates in two modes:

- Manual mode (Echo Generator, Option Menu #84)
- Responder mode (EGEN Test Line, Option Menu #85)

In manual mode (Option Menu #84), echo level and delay may be changed from the Sage unit front panel while the test is underway.

In responder mode (Option Menu #85), Echo Generator operates like a loop back responder, automatically answering test calls and generating programmed echoes.

In either manual or responder mode, you can change the level or delay of the generated echoes with DTMF digit commands (for example, from a remote touchtone telephone).

NOTE For more information about remotely programming echo parameters, see *Echo Generator Test Line, Option Menu #85.*

Echo Generator Purchase Options

Echo Generator is an optional feature on the Sage 93X family of test units. It includes both manual and responder features (Option Menu #84 and #85).

Sage 93X Model	Echo Generator Purchase Option
Sage 930A-L3	Option 930 A-56
Sage 930i	Option 930i-56
Sage 935AT	Option 935AT-556

Echo Generator Configuration

The Sage Echo Generator (Option Menu #84 and #85) functions can be run from anywhere in the telephone network.

Set Up and Operation

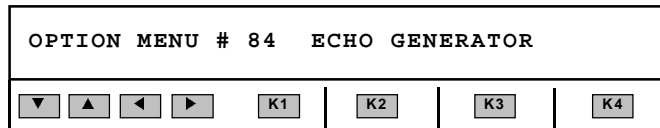This section describes how to set up and operate Echo Generator (Option Menu #84).

1 Ensure the trunk type is correctly set on the Sage 93X unit.

The 93X unit must be operated in terminated mode; selecting Option Menu 84 automatically places the unit in TERM mode.
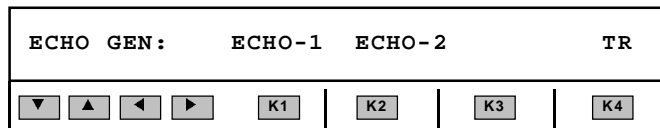
NOTE For CONTACT trunk types, set the toggle switch to Off Hook before invoking Option Menu #84.

NOTE For two wire trunk types, Echo Generator requires stable and quiet conditions during the initial moments of a call connection. This allows a brief training tone to determine the condition of the termination. If there is sound on the line, you hear a beeping alert tone. In this case, you must eliminate the signal on the line, exit Option Menu #84, and start again.

2 Press the Option Menu key and select Option Menu #84.

```
 ┌──────────────────────────────────────────────────────┐
 │                                                        │
 │  OPTION MENU # 84   ECHO GENERATOR                     │
 │                                                        │
 ├──────────────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►      K1       K2       K3        K4     │
 └──────────────────────────────────────────────────────┘
```

3 Press ENT or any soft key to display the main Echo Generator screen.

```
 ┌──────────────────────────────────────────────────────┐
 │                                                        │
 │  ECHO GEN:     ECHO-1   ECHO-2            TR           │
 │                                                        │
 ├──────────────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►      K1       K2       K3        K4     │
 └──────────────────────────────────────────────────────┘
```

The Sage 93X unit automatically generates echoes as the Echo Generator function begins. Echo parameters used are those set in the Echo-1 and Echo-2 definition screens.

The TR on the screen example above indicates that echoes are being transmitted through the TR output jack on the front panel of the Sage 93X unit.

From the main Echo Generator screen, you can:

• Display the Echo-1 definition screen

• Display the Echo-2 definition screen

• Turn all echo generation off and on

4 From the ECHO GEN screen, press K4 to toggle both echoes on and off.

```
ECHO GEN:     ECHO-1  ECHO-2          OFF
```
[▼] [▲] [◄] [►] [K1] [K2] [K3] [K4]
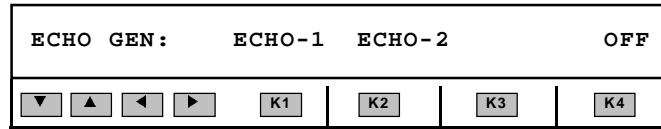
The output designator (TR in the example) changes to OFF when no echoes are being generated.

Defining Echo Delay and Level

If desired, use the echo definition screens to set echo level and delay. The 93X unit continues to generate echoes as you use the echo definition screens.

Follow the optional steps in this section to change the default values for one or both echoes, or to return the values to their default settings. The default values are:

Echo	Default Level	Default Delay
Echo-1	-3 dB	60 ms
Echo-2	-6 dB	250 ms

The range of valid values for level and delay depend on the circuit under test (i.e., trunk type). Valid ranges are:

Circuit/Trunk	Level Range	Delay Range
Analog 2 wire	-40 dB to 9 dB	17 ms to 600 ms
Analog 4 wire	-60 dB to 9 dB	17 ms to 600 ms
Digital T1/E1	-60 dB to 9 dB	12 ms to 600 ms

1 Press K1 to display the Echo-1 definition screen.

```
ECHO-1:       ON   60ms  -3dB   DEFAULT
```
[▼] [▲] [◄] [►] [K1] [K2] [K3] [K4]
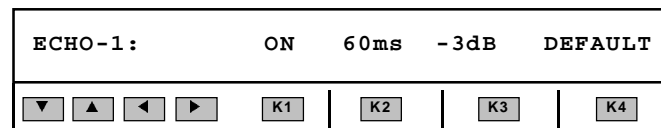
2 Press K1 to toggle Echo-1 on (enable) or off (disable).

3 Press K2 to place the cursor on the delay definition. Use the numeric keypad to enter the desired value.

4 Press K3 to place the cursor on the level definition. Use the numeric keypad to enter the desired value.

To restore the default values for both delay and level, press K4.

5 Press the Option Menu key to return to the main Echo Generator display.

Alternately, press the up arrow key to display the Echo-2 definition screen.

6 From the main display, press K2 to display the Echo-2 definition screen.

```
ECHO-2:       ON    250ms   -6dB    DEFAULT
```

`▼` `▲` `◄` `►` `K1` `K2` `K3` `K4`
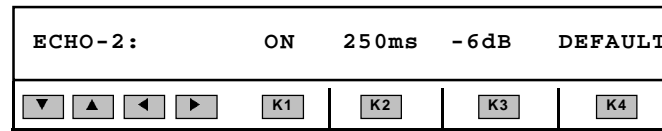
7 Repeat the steps above to define the delay and level values for Echo-2.

8 Press the Option Menu key to return to the main Echo Generator screen.

Using DTMF Digits to Remotely Set Echo Parameters

In addition to using the Sage 93X front panel keys to set echo parameters, you can also set echo parameters remotely with DTMF digits. DTMF digits can be sent from any calling device including another Sage unit.

The procedure for using DTMF digits to set echo level and delay are described in *Echo Generator Test Line, Option Menu #85*.

#84 Echo Generator

Echo Generator Test Line, Option Menu #85

The Echo Generator Test Line (EGEN Test Line) allows a Sage 93X unit to act as a responder, automatically answering calls and generating echoes. As a responder, the EGEN Test Line can respond to a call from another Sage unit, or from any device that can initiate a telephone call.

Echo level and delay can be defined using setup functions. Additionally, echo level and delay, and the test call duration, can be remotely programmed using DTMF digits.

Echo generator answers incoming calls with a two second test progress tone, and then begins generating echoes on any signal on the line. The Sage unit remains off hook and continues to send echoes for the duration of the call, or until supervision changes or a key is pressed. At the end of the call connection, the Sage unit goes on hook and waits for another call.

EGEN Test Line Purchase Options

Echo Generator Test Line is an optional feature on the Sage 93X family of test units. The Purchase Option includes both the EGEN Test Line and the manual Echo Generator, Option Menu #84.

Sage 93X Model	Echo Generator Purchase Option
Sage 930A-L3	Option 930 A-56
Sage 930i	Option 930i-56
Sage 935AT	Option 935AT-556

Setup

Follow the steps in this section to set up the 93X to act as an Echo Generator Test Line.

NOTE To use EGEN Test Line in conjunction with Echo Sounder (Option Menu #28) on another 93X, set up the Echo Generator test set first.
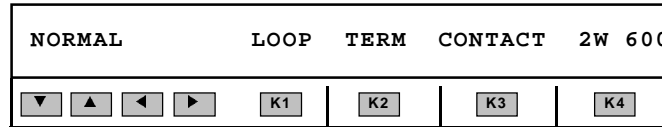
1 Set trunk type to the desired configuration.

For more information about selecting trunk types and termination, see the *Trunk Type Function Key* section of the Sage 93X operating manual.

2 Toggle the hookswitch to ON HOOK.

3 Connect the Sage 93X test set to the network under test.

**NOTE** EGEN Test Line automatically sets the Sage 93X to operate in terminated mode.

The example below is correct for an analog 2 wire circuit on the customer side of a typical POTS local loop.

```
NORMAL          LOOP   TERM   CONTACT   2W 600
 ▼   ▲   ◄   ►      K1        K2         K3        K4
```

4 Press the Option Menu key and select Option Menu #85.

```
OPTION MENU # 85   EGEN TEST LINE
 ▼   ▲   ◄   ►      K1        K2         K3        K4
```
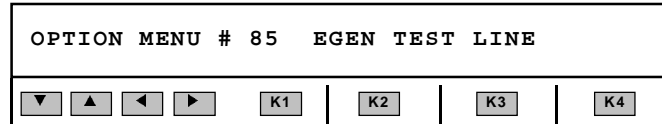
5 Press ENT or any soft key to display the main EGEN Test Line screen.

```
EGEN TEST LINE:    ACTIVATE   SET-UP  EXIT
 ▼   ▲   ◄   ►      K1        K2         K3        K4
```
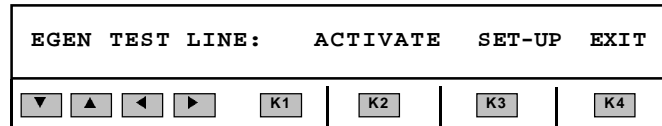
Use the Activate function to turn on the EGEN Test Line, activating the Echo Generator responder. Use the Set-Up function to define echo levels and delays for Echo-1 and Echo-2.

Defining Echo Delay and Level

Use the steps in this section to change the default values for one or both echoes, or to return the values to their default settings. The default values are:

Echo	Default Level	Default Delay
Echo-1	-3 dB	60 ms
Echo-2	-6 dB	250 ms

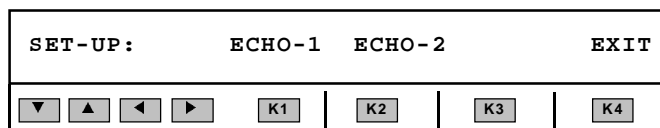The range of valid values for level and delay depend on the circuit under test (i.e., trunk type). Valid ranges are:

Circuit/Trunk	Level Range	Delay Range
Analog 2 wire	-40 dB to 9 dB	17 ms to 600 ms
Analog 4 wire	-60 dB to 9 dB	17 ms to 600 ms
Digital T1/E1	-60 dB to 9 dB	12 ms to 600 ms

Setup functions are optional. If desired, use the Set-up screens for each echo to:
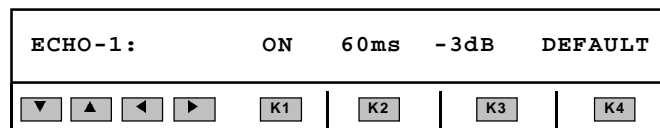
- Enable or disable each echo
- Set the number of milliseconds delay
- Set the echo level

NOTE The steps in this section describe how to use the Sage 93X front panel keys to set echo parameters. You can also set echo parameters remotely with DTMF digits from any calling device keypad or from another Sage unit. The steps for using DTMF digits to set echo level and delay are described in the *Using DTMF Digits* section below.

1 From the EGEN TEST LINE display, press K3 to display the set-up screen.

```
SET-UP:        ECHO-1   ECHO-2            EXIT

 ▼   ▲   ◄   ►      K1       K2         K3        K4
```

2 Press K1 to display the Echo-1 definition screen.

```
ECHO-1:        ON    60ms   -3dB    DEFAULT

 ▼   ▲   ◄   ►      K1       K2         K3        K4
```

3 Press K1 to toggle Echo-1 on (enable) or off (disable).

4 Press K2 to place the cursor on the delay definition. Use the numeric keypad to enter the desired value.

5 Press K3 to place the cursor on the level definition. Use the numeric keypad to enter the desired value.

Press K4 to restore the delay and level to their default values.

6 Press the Option Menu key to return to the main set-up display.

Alternately, press the up arrow key to display the Echo-2 definition screen.

7 From the main set-up display, press K2 to display the Echo-2 definition screen.

```
ECHO-2:        ON   250ms   -6dB    DEFAULT

 ▼   ▲   ◄   ►      K1       K2         K3        K4
```
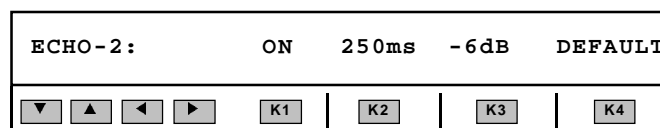
8 Repeat the steps above to define the delay and level values for Echo-2.

9 Press the Option Menu key to return to the main Echo Generator set-up screen.

Activating the EGEN Test Line

After you define the delay and level for Echo-1 and Echo-2, the Echo Generator test line is ready to activate. Once turned on, the EGEN Test Line is ready to answer a call (for example, from another Sage 93X unit transmitting the Echo Sounder test signal).

NOTE The steps in this section apply to all trunk types except E1. For E1 trunk types, see the *Activating the EGEN Test Line on E1 Trunks* section below.
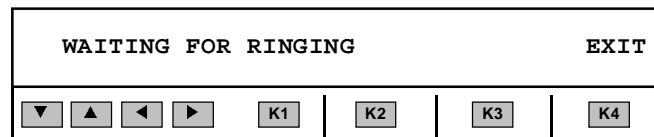
To activate the EGEN Test Line, follow these steps:

1 From the main Echo Generator set-up screen, press K2 to activate the EGEN Test Line.

```
EGEN TEST LINE:    ACTIVATE   SET-UP  EXIT

  ▼   ▲   ◄   ►      K1        K2        K3        K4
```
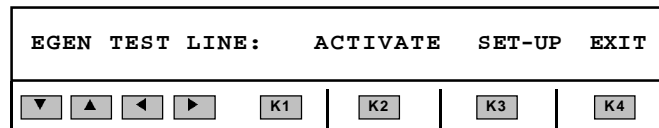
When the EGEN test line is active, the display indicates that the Sage 93X unit is waiting for a call.

If the Sage 93X unit is set for CONTACT supervision, the screen displays WAITING FOR RINGING.

```
  WAITING FOR RINGING              EXIT

  ▼   ▲   ◄   ►      K1        K2        K3        K4
```

If the Sage 93X unit is set for BATTERY supervision (or any supervision except CONTACT), the screen displays WAITING FOR SEIZURE.

```
  WAITING FOR SEIZURE              EXIT

  ▼   ▲   ◄   ►      K1        K2        K3        K4
```
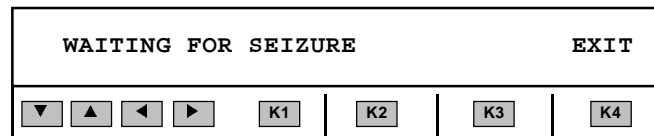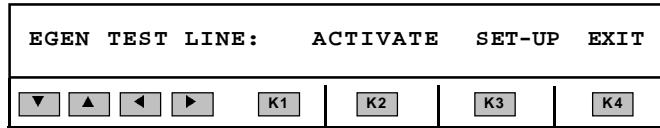
The EGEN Test Line remains in this mode until a call connection is made or it is disabled. Press K4 or any function key to disable this waiting mode.

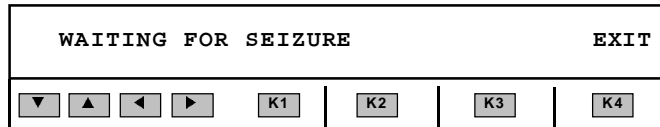## Activating the EGEN Test Line on E1 Trunks

This section describes the steps to activate the EGEN Test Line on E1 trunk types on the Sage 930i test set.

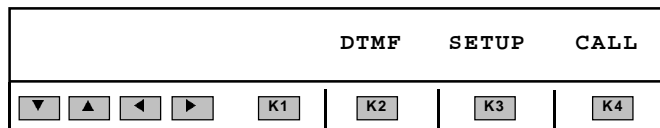To activate the EGEN test line on E1 trunk types, follow these steps:

1 From the main EGEN TEST LINE screen, press K2 to activate the EGEN Test Line.

```
 ┌─────────────────────────────────────────────┐
 │  EGEN TEST LINE:   ACTIVATE   SET-UP   EXIT  │
 ├─────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►     K1      K2      K3      K4 │
 └─────────────────────────────────────────────┘
```

The screen briefly displays the WAITING FOR SEIZURE message, and then displays the make/receive call screen.

```
 ┌─────────────────────────────────────────────┐
 │   WAITING FOR SEIZURE               EXIT     │
 ├─────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►     K1      K2      K3      K4 │
 └─────────────────────────────────────────────┘
```

The make/receive call screen indicates the EGEN Test Line is ready to answer a call.

```
 ┌─────────────────────────────────────────────┐
 │                  DTMF    SETUP     CALL      │
 ├─────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►     K1      K2      K3      K4 │
 └─────────────────────────────────────────────┘
```

NOTE The make/receive screen (above) is the same screen displayed when you press the Dial/Ring function key on the Sage 93X front panel. The SETUP function allows selection of predefined protocols. For more information about protocols, see the protocol manual for your Sage test set.

Call In Progress

When an activated EGEN Test Line answers a call, the display indicates a call is in progress. Depending on its setup, the EGEN Test Line generates one, two, or no echoes for the duration of the call.

NOTE For two wire trunk types, the EGEN Test Line requires stable and quiet conditions during the initial moments of a call connection. This allows a brief training tone to determine the condition of the termination. If the line is not quiet, you hear a beeping alert tone. In this case, eliminate the signal on the line. When the line is quiet, you should hear the brief training tone. When the training tone ends, the EGEN Test Line begins generating echoes.

```
 ┌─────────────────────────────────────────────┐
 │   CALL IN PROGRESS .....            EXIT     │
 ├─────────────────────────────────────────────┤
 │  ▼   ▲   ◄   ►     K1      K2      K3      K4 │
 └─────────────────────────────────────────────┘
```

#85 EGEN Test Line

Duration of the Call	The EGEN Test Line controls the duration of the call connection. Its display remains in the CALL IN PROGRESS state until it terminates the incoming call connection, or until the incoming call's supervision changes (i.e., the incoming call goes on hook).

The EGEN Test Line default call connection time is 10 minutes. Remotely sent DTMF digits can override the default, and set a call connection from 1 to 999 minutes.

Ending the Call Connection	By default, the activated EGEN Test Line automatically ends the call connection after 10 minutes.

After a call connection ends, the active EGEN Test Line reverts to its passive responder mode. The screen again displays WAITING FOR RINGING, WAITING FOR SEIZURE, or the make/receive call screen.

The duration of the call connection can be programmed remotely with DTMF digits. To remotely program call connection duration, see the steps in the *Using DTMF Digits* section below.

Using DTMF Digits

This section describes how to use a telephone keypad (or other device) to remotely program Echo Generator parameters on a Sage 93X unit where an EGEN Test Line call is in progress. You can remotely program any Echo Generator call whether it was set up using Option Menu #85 (EGEN Test Line responder mode) or Option Menu #84 (manual mode).

Sample DTMF digit sequences are provided at the end of this section.

NOTE Remotely programmed settings do not change the set-up display screen on the remote Sage 93X unit's display.

NOTE In all cases described below, begin the remote programming sequence with a **∗** key press, and end with a **#** key press.

Minimum On and Off Requirements

To recognize DTMF digits, Echo Generator requires DTMF digits remain on for a minimum of 50 milliseconds.

Except following the **∗** key, the pause between all DTMF digits (the off time) must be at least 50 milliseconds. The ∗ key initiates remote programming, and is followed by a 480 milliseconds prompt tone. The minimum off time following a ∗ key press must be at least 530 milliseconds (i.e., 480 plus 50).

When using the Sage 93X unit Dial/Ring function to send DTMF digits, insert a pause (left arrow key) after the **∗** key press to allow time for the prompt tone.

Correcting DTMF Digit Mistakes

Incorrect digit sequences produce an alert signal. If you make a mistake during remote programming, simply start over. Each ∗ key press begins a new programming sequence.

Using DTMF Digits to Disable Echoes

Use the steps in this section to remotely disable all echo generation. Use these steps after there is a call in progress on the EGEN Test Line.

Follow the steps in this section to remotely disable both Echo-1 and Echo-2.

1 Dial the EGEN Test Line responder telephone number and establish the call with the remote Sage 93X unit.

2 Press the * key, and wait for the prompt tone to cease.

The * digit indicates to the remote Sage 93X unit that remote programming follows. Echo generation temporarily suspends.

3 Press the # key and wait for the prompt tone to cease.

The # indicates to the remote Sage 93X unit that conclusion of remote programming.

This two-key sequence disables both Echo-1 and Echo-2.

NOTE To remotely enable both echoes on a EGEN Test Call in progress, follow the steps to remotely set echo level and delay.

Using DTMF Digits to Set Level and Delay

Follow the steps in this section to remotely set the level and delay for Echo-1 or for both Echo-1 and Echo-2. Use these steps on an Echo Generator call in progress.

The pattern for DTMF digits to set *Echo-1 only* is *-L-L-D-D-D-# where L is a level digit, and D is a delay digit.

The pattern for DTMF digits to set *both Echo-1 and Echo-2* is
*-L-L-D-D-D-L-L-D-D-D-# where L is a level digit, and D is a delay digit.

1 Dial the EGEN Test Line responder telephone number and establish the call with the remote Sage 93X unit.

2 Press the * key, and wait for the prompt tone to cease.

3 Press the number keypad to set level and delay.

NOTE In most cases, echo level should be set at a decibel value less than zero. To set the value at zero or greater than zero, precede the number with 9.

4 Press the # key and wait for the prompt tone to cease.

Using DTMF Digits to Set Call Connection Duration

The EGEN Test Line controls the duration of a call connection. Follow the steps in this section to remotely set the duration of the incoming call connection from 1 to 999 minutes. Remotely set call duration overrides the 10 minute default.

1 Dial the EGEN Test Line responder telephone number and establish the call with the remote Sage 93X unit.

2 Press the * key, and wait for the prompt tone to cease.

3 Press the 8 number key followed by the desired number of minutes.

The valid range is 1 to 999 minutes.

4 Press the # key.

Call duration is now defined on the remote Sage 93X unit.

Sample DTMF Digit Sequences

The table below provides DTMF digit sequence examples.

Desired Result	Digit Sequence	Notes
End an EGEN Test Line call connection	*-8-#	This sequence ends the call connection. The EGEN Test Line on the remote Sage 93X unit is ready to answer another call.
Set level and delay of Echo-1 only (level less than 0 dB)	*-L-L-D-D-D-#	where L=level in negative dB, D=delay in milliseconds
Set level and delay of Echo-1 only (level greater than 0 dB)	*-9-L-D-D-D-#	To set a level between 0 dB and 9 dB, precede the level with 9
Set level of Echo-1 and Echo-2 (both levels less than 0 dB)	*-L-L-D-D-D-L-L-D-D-D-#	where L=level in negative dB, D=delay in milliseconds
Set level and delay of Echo-1 and Echo-2 (both levels greater than 0 dB)	*-9-L-D-D-D-9-L-D-D-D-#	To set a level between 0 dB and 9 dB, precede the level with 9
Set call connection time	*-8-M-M-M-#	where M = minute