

# 10-Channel ENS Logger



## Installation Guide

## Logger Features

- 24 channels of  $\mu$ -law companded digital recording, with level indicators and live monitoring give crystal-clear audio.
- All recordings are made at the legally required 64Kbps rate, using compression only when necessary, making this logger ideal for E-911 applications.
- Manual gain controls for each channel are accessible from the outside of the unit.
- Digital signatures with the time, date, and recording details are included in audio files.
- Flexible audio inputs provide easy installation. Channels are independently configured for VOX, loopstart, or continuous (manual) recording. No external adapters are required for loop current sensing.
- USB 2.0 11MBps connection improves expandability, performance, and field serviceability.
- Easily accessible hardware gain controls for each channel.
- Easy Plug and Play USB configuration under Windows 2000, 2003, and XP.
- Maximum recording length is adjustable so large files are split into easily manipulated sections.
- Disk usage can be controlled on a line-by-line basis to conserve disk space.
- Evidence Builder software produces evidentiary recordings rapidly.



## ENS Dialer Features

- Transmits pre-recorded files rapidly to a list of your choice. Transmission is “in the blind” - without call status checks.
- In-use lines are bypassed.

## Server Requirements

- A **dedicated** PC is recommended, due to the high CPU usage required for real-time audio.
- A 2-GHz or faster processor with 512MB or more of RAM.
- Windows 2000, 2003, or XP. Due to the performance required, Windows 9x and ME aren't supported.
- A free USB 2.0 High Speed port. Slower USB 1.1 ports are not recommended.

## Quick Installation

1. Run windows update from [windowsupdate.microsoft.com](http://windowsupdate.microsoft.com) to ensure you have the latest USB drivers available from Microsoft. This is essential under Windows 2000.
2. Confirm that all line input levels are below +36Bm.
3. Connect inputs via an Amphenol connector. The first 10 line pairs are used, the remaining 15 are unterminated.

4. Switch power on temporarily without the PC connected. Use the internal speaker or headphones to verify audio quality on all lines. Switch power off.
5. Attach the USB cable to a dedicated PC. Connect directly to a primary USB 2.0 *High Speed* port on a *dedicated server*, not to a hub. We recommend that the logger is the only external USB device attached to your PC. Once attached, the USB configuration on this PC should not be changed. *Note: Low speed USB 1.1 ports may not have sufficient bandwidth for this product. Long cables and USB extenders are not recommended.*
6. Switch power OFF to the logger. Switch power on to the PC. It's important that the logger remain switched off during the software installation process.
7. After boot, insert the distribution CD and install the logging application.
8. Restart the PC. Switch power ON to the logger. Follow the prompts to install drivers as shown below.
9. Start the logging application.
10. Map a network drive to the workstations used for playback. Use Windows file system security to limit access to authorized individuals.
11. Install "Evidence Builder" software on playback workstations. This program allows you to scan recordings and catalog calls by DTMF and Caller-ID.
12. Install "Real Time Player" as needed for remote monitoring.
13. Install "Call Detail Recorder" if desired for SMDR, ANI, or ALI recording from RS-232 sources.

## Included Hardware

The hardware installation kit includes:

- Qty 1 – USB Capture Unit
- Qty 1 – High Speed USB "A" to USB "B" cable.
- Qty 1 – Power Cord
- Qty 1 – UL Approved External Power Supply

## Installation Accessories

Accessories are available from DLI at (408) 330-5599:

- Octopus cables
- Patch Panels
- "Y" connectors – RJ-11, RJ-45, and Handset
- "T" cables with Amphenol connectors
- Phone tools, connectors, cables, and test and measurement equipment.



## Power and USB Connections

### Power

Verify the input voltage is correct, and plug the IEC power cord into the wall outlet. Follow the power-up sequence described below in “quick start installation”.

### USB to PC connection

The USB cable provided has a rectangular “Type A” plug on one end and a square “Type B” connector on the other. The square connector is the only connector that can be plugged into the logger. Connect the USB cable between the PC and the logger. This cable must be a *high-speed* USB 2.0 cable. Slow USB 1.1 cables simply won’t work reliably with this high speed 480Mbps device.

## Phone Line Connections

You can easily record from phone lines in three different ways: from the handset, from an outside analog phone line, or from an analog port on the PBX. If you are using a digital PBX, you may connect either to the handsets, to outside analog lines, or to an analog port, but not directly to the digital station set extensions. To record from digital set extensions, you’ll need a D/A converter which is specifically designed for your PBX.

Recording may be triggered in two ways: LoopStart or VOX.

### To bridge an outside wet line in LoopStart mode:

- Verify that the line audio levels are within standard telecom specifications. Peak levels should not exceed +3dBm. Measure the line voltage to confirm that -48V is present when the phone is on-hook.
- Use a punch-down block or RJ-11 octopus cable to connect each line to the logger channels 1-10.
- Set the line configuration mode to **LOOPSTART** using the Logger Config utility.
- The factory audio gain setting should work fine in most cases.

### To use sound activated VOX recording for a handset, radio or microphone:

- Adjust the audio gain setting so you have a full range of audio on the VU meter, without clipping in the red zone.
- Use the **VOX** line configuration option in the Logger Config utility.

## Radio Connections

Manufacturers use a wide variety of radio connectors, so you’ll first need to locate a mating connector. After that, it’s a simple two-wire connection from the receiver to the logger. You can directly bridge across the speaker, headset, or ear bud. Connect to a pair of input pins on the logger. A punch down block is usually the most convenient way to mix radio and phone lines.

If you're connecting a transceiver, and you'd like to record both the transmitted and received audio in the same recording file, you'll need a 4-wire to 2-wire converter.

## Internal Audio Gain Settings, VOX and LoopStart Modes

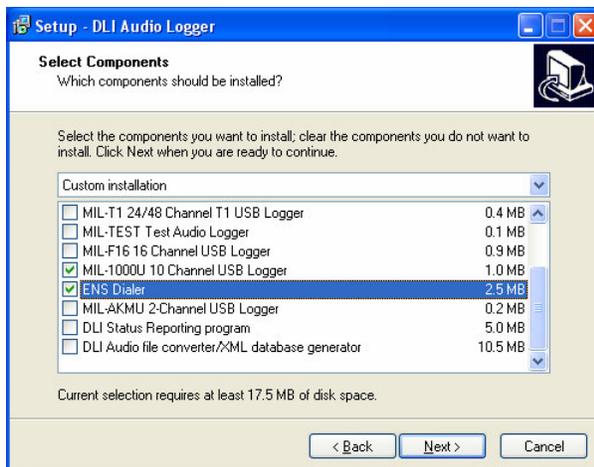
The gain controls are factory preset for outside phone lines. This setting will work with lines that have a maximum level of 0dBm. To increase the gain for handset connections or microphones, rotate the corresponding gain control clockwise. To decrease the gain for radio applications, rotate counterclockwise.

Radio, microphone, and handset applications use VOX (voice activated) triggering to start recording when the audio level exceeds a preset value. Outside phone lines use LOOPSTART triggering to start recording when a phone is lifted off the hook.

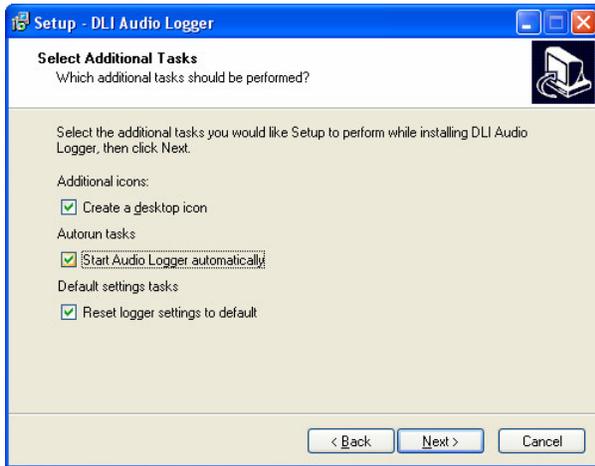
## Software Setup and Installation

We highly recommend running a Microsoft Windows update before software installation. Visit [windowsupdate.microsoft.com](http://windowsupdate.microsoft.com) to upgrade. Microsoft has made several improvements in Windows USB drivers recently. Updating your PC improves operation with all USB devices. This is essential for Windows 2000 users.

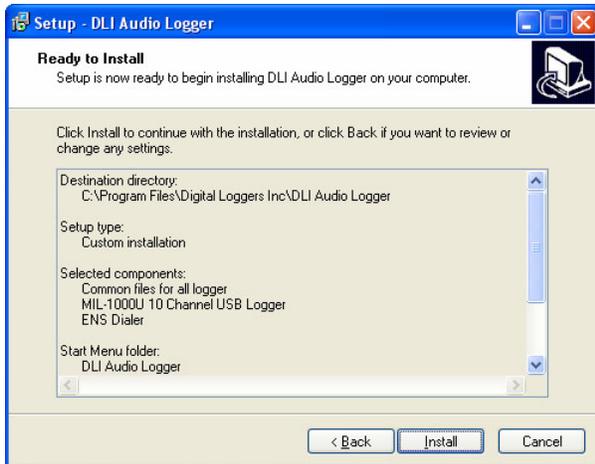
After updating, insert the logger installation CD into your CD-ROM drive. Installation starts automatically. Select the installation directory and shortcut name.



The default components "10 Channel USB Logger", "ENS Dialer" and "Common Files" should be checked. Uncheck unrelated drivers. Click "Next".



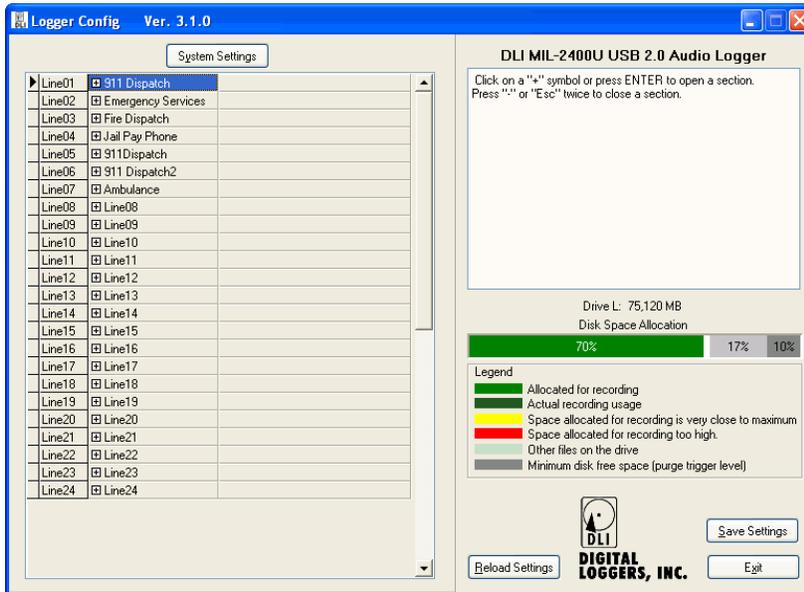
To record automatically after login, check ‘Start Audio Logger Automatically’. If a machine is left unattended, this ensures uninterrupted operation in the event of a power failure and subsequent reboot.



Verify your choices. Setup will complete automatically. Click ‘Finish’. Power down the PC, power up the logger, and reboot with the logger connected.

Depending on your system configuration, Windows may need to install drivers such as ‘USB Serial Converter’ or ‘Generic USB Hub’, or other drivers. Follow the instructions from Windows to install USB drivers. You may need to reboot again before the logger is recognized.

# Channel Configuration - Logger Config Utility



To start the configuration utility, click:

Start / Programs / DLI Audio Logger / DLI Logger Config

Each channel corresponds to one recording directory. Within each channel directory, the logger creates a subdirectory for each day.

To change settings for a particular channel, click the small + symbol to the left of the line name. The settings for that channel are displayed.

The most important settings are:

## Record Trigger Mode

Set this to **VOX** for normal operation. Choose **LoopStart** for outside wet phone lines.

## Line Name

Choose "PSAP Desk 1" or a similar name if you have a time slot assigned to a single speech path in your PBX. If you have a particular phone number assigned to that timeslot, it may be useful to include the number in the line name, such as "DLI Main Hunt Group (408) 330-5599". If you are recording from an outside trunk, a separate program will allow you to search by Caller-ID or DTMF signaling after recording. *Since this Line Name will be used as a recording directory, be careful not to include characters disallowed in file names, such as "/" ";" or "\".*

## Maximum Megabytes

The logger can automatically delete old calls to conserve the amount of disk space used on each channel. This setting controls the maximum amount of disk space used by each channel. Oldest calls are automatically deleted to free disk space. To turn this feature off, set this field to "0". If you specify a maximum, the logger will check disk space periodically. If recording size exceeds your setting, the logger will automatically delete files starting with the oldest day. The logger will continue deleting calls until disk usage reaches the setting. It's important to set this so that the total space used does not exceed the available disk space.

## Host PC USB Connection

After installing the software and setting the line configuration, connect the USB cable between the PC and the logger and power up the logger.

**Important note:** *Not all USB cables are created equally. Make sure you're using a USB 2.0 High-Speed cable rated for 480Mbps to ensure reliable operation.*

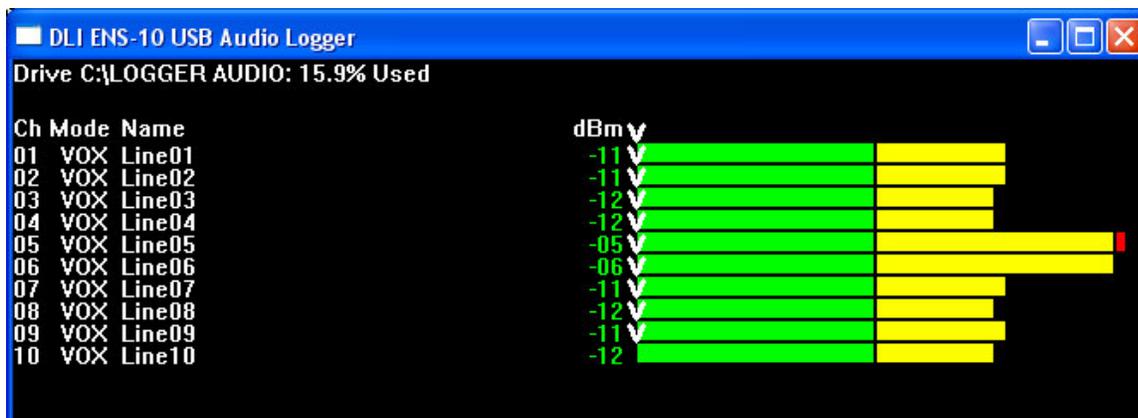
Depending on your system configuration, Windows may need to install drivers for the USB serial interfaces and USB hubs inside the logger. If these options appear, select "Install the software automatically", and press "Next".

After drivers are installed, this message appears. Click "Finish", and click on the icon to start the logger.

On some systems, this Windows process of loading drivers may repeat twice. A system reboot may also be necessary.

## Using the Logger

Click on the DLI Audio Logger icon to start the application. The main screen appears:



The recording mode for each line (for example VOX, LOOPSTART or OFF) is displayed to the left of the line name.

Click on the line name to explore the recordings for that line.

The top of the screen shows the percentage used on the target disk. Errors appear on the bottom of the screen.

### The 'Explore Calls' Function

Click on the line name to explore the recording directory for that line. Each line is stored in a separate folder, and each day is stored in a subfolder. The file names correspond to the recording

start time. From here, you can edit, copy, or transfer files using Windows Explorer by clicking the right mouse button.

## VU Meter and Status LEDs.

A separate 10 segment VU meter with 3.5dB steps is provided for each channel. In normal operation, the top red LED should rarely light. Adjust the gain controls so the full range of the meter is used without excessive “clipping” at the top.

Three status LEDs are provided:

A **green** light indicates that USB cabling is correctly installed and there is a physical link between the ENS logger and the PC. This light illuminates even if drivers are not installed.

A **red** light indicated power is correctly applied to the logger.

A **blue** light illuminates when the logger is operating in ENS mode and is dialing out on one or more lines.

## Setting Up the ENS Dialer

A separate application called ENS Dialer is provided for emergency notification. To use ENS Dialer, you need two files:

1. **The target phone number list.**

This is a text file (.TXT extension) containing the numbers you wish to dial. This file may be created using Excel, Word, WordPad, or exported from an existing database such as Microsoft Access. It is often useful to create a folder with pre-generated lists, such as the numbers of all volunteer firefighters, homes within a certain radius, etc.

2. **The announcement you wish to send.**

This is an audio file in .WAV format, recorded in 16-bit PCM format at 8,000 samples per second. This file can be created on the fly using Windows Recorder. Be sure to select 16 bit, 8KHz before recording. For professional sounding results, you can also use an audio editor such as Cool Edit or Sound Forge.

Before using these files to dial out, a few settings should be verified. Start the ENS application, then click on Settings to adjust using this dialog:

Times to Repeat Message	0
Dial-tone Delay	5
Maximum Lines	10
DTMF Send Level: -30~25 dBm	25
Delay After Hangup	5
Delay After Dialing	10
Auto-Dial Delay	1
Dialing Prefix	
Re-enable Logging After Dialing	<input type="checkbox"/>
Auto-close when the tasks are complete	<input type="checkbox"/>
Default Sould File	

### Times to Repeat

Your message will repeat this many times on each call. Since it may take time for the party to answer, we suggest playing each message at least twice. Shorter messages may be played more.

### Dial-Tone Delay

A delay of 5 seconds is usually sufficient. If you are dialing through a PBX that requires a dialing prefix, a longer delay may help.

### Maximum Lines

This sets the maximum number of lines that the dialer can use, to prevent crowding your resources.

Be sure to disable unused, unconnected and reserved outgoing lines. Lines which are already in-use will not be accessed by the dialer. They will be listed as “off-hook” on the dialing screen.

### DTMF Send Level

This is the output level of the DTMF (touch tone) generator. The 5 second default works fine in most cases.

### Delay After Hangup

A setting of 2-5 seconds will work in most cases. PBX users may fine-tune this setting for faster dialing.

### Dialing Prefix

This can be an area code, or an access code, such as a “9” dialed to get an outside line.

### Maximum Lines

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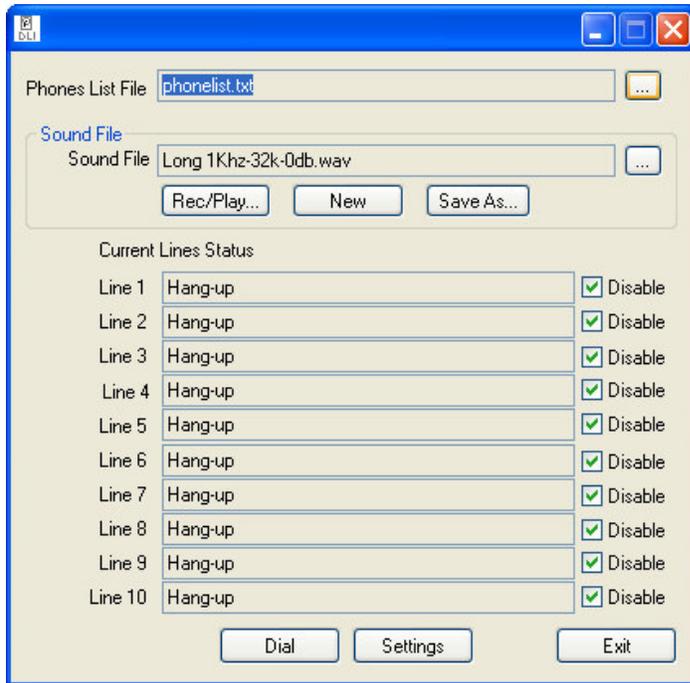
### Re-Enable Logger App After Dialing

The ENS dialer will disable the recording application when it starts. To automatically restart recording, check this box.

After verifying your settings, click “Save”, and test the system with a sample recording.

## Dialing Out

Click on the ENS Dialer icon to start the application. The main screen appears:



1. Select a list of phone numbers using the first file selector button.
2. Select an announcement audio file. To create one on the fly using a microphone, click Rec/Play to spawn Windows recorder.
3. Click Dial to start dialing. Each phone number in the list will be dialed. The announcement will be played to each number using the settings.

## Limitations of the ENS Dialing System - Disclaimer

When properly installed and used, the ENS dialer can make thousands of calls per hour, efficiently contacting large groups in a short amount of time. However, this ENS dialer has two major limitations:

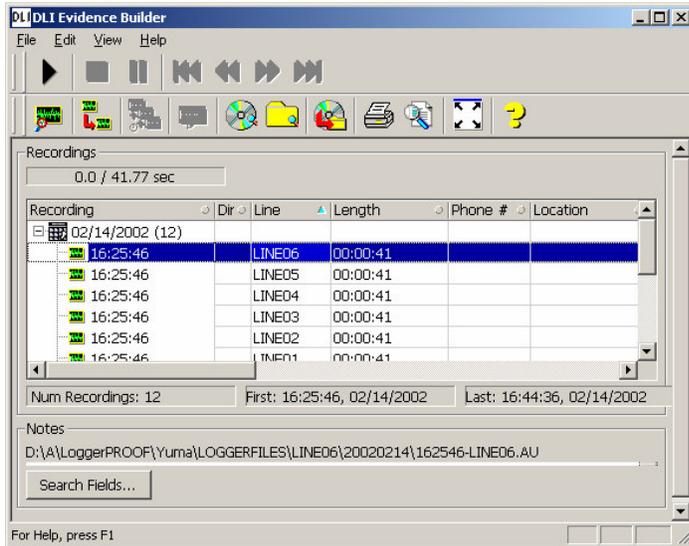
1. Call progress detection and “positive acknowledgment” are not provided. For example, the system can’t tell if the message was received, so your deputy may need to report back after he receives a summons to duty.
2. There is no provision to intercept an existing call. If you need to interrupt a deputy who is currently using his cell phone, ordinary phone lines won’t do the trick.

*For E-911, homeland security, and other vital notification applications where these limitations may be an issue, do not use this product. Instead, refer to the Department of Homeland Security National Communications System. A brochure on the Priority Telecommunications Services system is included with this product. Dial 866.NCS.CALL (866.627.2255) to reach DHS-NCS.*

## Live Monitoring with a Headset or Speakers

A live monitor with speakers is provided for ease of installation. Rotate the channel selector to the line of interest. Use headphones or the internal speaker to monitor audio quality. Connecting a headphone mutes the internal speaker.

## Evidence Builder Call Analysis Software

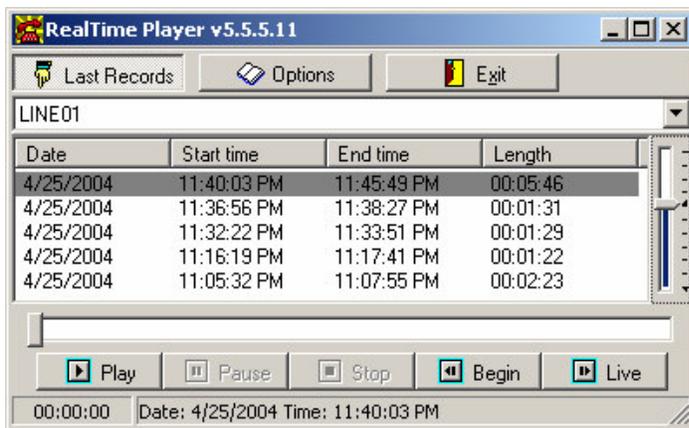


Evidence Builder Software is a powerful program used to locate and analyze recordings. It is provided on the workstation CD. Load this on a workstation and point it at the recording directories to analyze incoming calls, create call lists, sort calls, and search by DID.

To catalog files on a remote server, first create a path to the shared recording directory. Be sure to use proper security. Map this to a drive letter on your workstation.

Next, choose the “Catalog Files From Hard Drive” button and select the recording directory. The screen display can be customized by in the “preferences” menu.

## Remote Monitoring of Live Audio

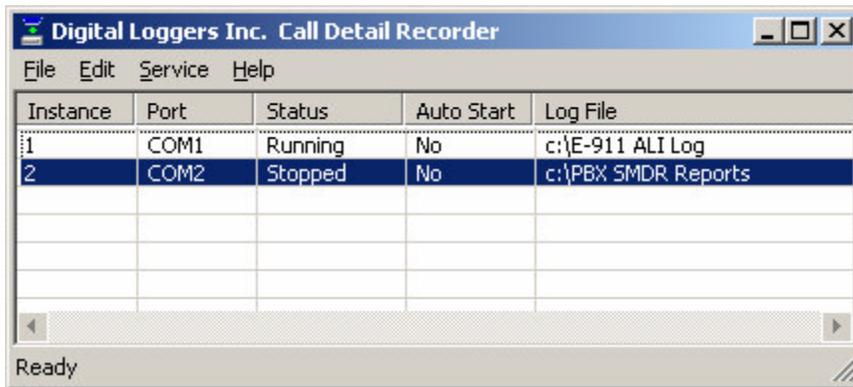


Remote users with access privileges to the recording server may monitor calls in real time via LAN or WAN connections.

A Real Time Player application is provided on the workstation CD. It's downloadable at: [www.digital-loggers.com/rtp.exe](http://www.digital-loggers.com/rtp.exe)

To remotely monitor calls, load the Real Time Player application on a workstation. Click on “options”. Use the browse button to select a source directory with archived or incoming calls. Live calls are highlighted. Select a call and press “play”, or press “live” to continuously monitor calls. Windows security may be used to selectively control access to specific lines.

## Recording SMDR, ANI, and ALI Streams



Instance	Port	Status	Auto Start	Log File
1	COM1	Running	No	c:\E-911 ALI Log
2	COM2	Stopped	No	c:\PBX SMDR Reports

ANI, ALI, or SMDR data streams may be logged using our call detail recorder utility. This utility logs up to 8 RS-232 serial ports simultaneously.

Download the latest version from [www.digital-loggers.com/cdr.exe](http://www.digital-loggers.com/cdr.exe)

## Frequently Asked Questions

### How do I connect the logger to a PBX?

There are three easy ways to link your logger to the outside world:

1. ***Record from incoming lines.***

This lets you hear the recording from the outside party's perspective. It is commonly used for quality assurance recording. This type of connection is not commonly used in agent analysis or 911 call center recording. Most of these applications use a console output or handset tap (below). When recording from incoming lines, the level of the calling and answering voices may differ. For a more balanced recording level, use a handset connection or console output.

2. ***Tap the handsets, dispatch console, or analog station sets directly.***

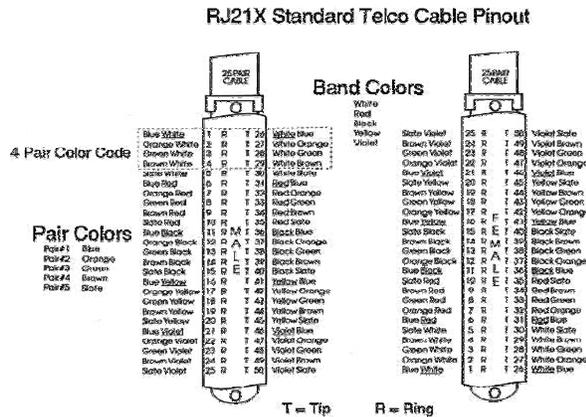
This method allows you to hear the recording from the agent's perspective. If you are recording in an E-911 dispatch environment, this connection will record things from the dispatcher's perspective, and the recording will typically include the phone conversation, radio dispatch, etc. Essentially, you will hear everything the dispatcher hears in the recording. Handset taps may be connected to the analog output of the phone, or run through a Digital to Analog (D/A) converter. They may also be connected by a digital tap card, such as those sold by Intel. When recording from a handset, Caller-ID will not be stored in the recording files.

3. ***Connect to a PBX port.***

This is the most common method of connecting a logger in large installations (100+ channels). One advantage of this connection scheme is that the PBX can be used to switch the recorder to a large number of lines. Another is that the logger can be switched to any recorder outside trunk or inside extension. Think of this method as "conferencing in" the logger with either an outside caller or an inside extension. This method requires an installer familiar with your PBX.

## What's a handset jack? How do I connect a logger to it?

A handset jack is a small 4 pin connector which carries the speaker and microphone signals from your telephone to your handset. This is a good place to bridge an audio logger, since all incoming and intercom conversations may be recorded at this point. The default VOX and ALC settings will work fine with the typical handset level of -20dBm. To record from a handset, "backhaul" the audio to the logger via either a "Y" connector or make the connection within the phone itself. This is commonly done with an unused pair on an existing cable.



## What's an octopus cable?

### What's the RJ-21X color code?

If you are connecting an RJ-21X to an RJ-11 jack, you can use either a rack mount patch panel with 24 RJ-11 jacks, or a "harmonica" or "octopus" cord pictured on the right. An Octopus cord has a single 50 pin AMP connector (RJ-21X type) on one end, and 24 RJ-11 type plugs on the other end. These optional cords are available directly from DLI.

## What's an RJ-25 jack? How do I connect a logger to it?

An RJ-25 jack is a standard 6 pin, 3 pair telephone jack. It's wired as shown:

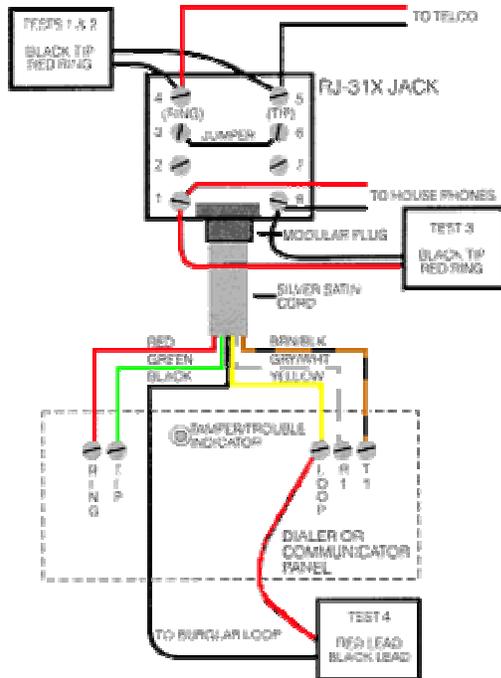
Jack Positions	USOC RJ25
1	wht/grn
2	wht/org
3	blue/wht
4	wht/blue
5	org/wht
6	grn/wht



## What's an RJ-31x? How do I connect it? How do I test it?

Most security lines use a special type of jack, called an RJ-31x. It is an "exclusion type" dialer jack. It is typically a Leviton style 8 pin jack, but similar wiring may be done on [KT-66](#) or W110 punch down blocks. Each 66 block handles 3 lines in the RJ-31x wiring configuration, and all the pin order matches the order of the RJ-31x jack pins. The first jack connects to pins 1-8, the second to pins 9-16, and the third to pins 17-24. This type of wiring is commonly encountered in 911 call centers and in most commercial alarm installations. RJ-31X jacks are required for many security and fire alarm

systems that provide exchange to alarm reporting devices. In an RJ-31x installation, the phone line is wired in series through the RJ-31X; from there, tip and ring pass through the dialer. A normally closed relay opens if the alarm is activated, seizing the circuit for alarm use, while temporarily disconnecting lower priority equipment (such as a house phone) to prevent disruption of the dialing sequence.



The most common RJ-31x installation is an 8-position, non-keyed miniature jack with shorting bars across terminals 1-4 and 5-8. Inserting the modular plug lifts the contact wires away from the shorting bars, extending the tip and ring circuit to the series leads going into the alarm device. The audio logger connects to pins 4 and 5 of the jack in a "bridging" configuration. When the plug is removed from the jack, metal tabs inside the RJ-31X provide direct connection of tip and ring back to the other locations, bypassing the alarm device.

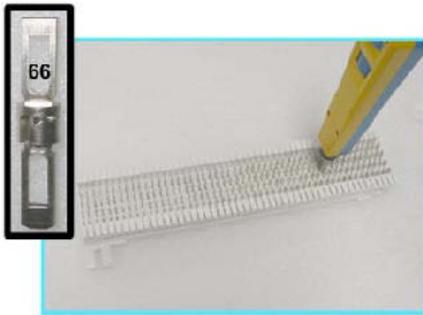
This design lets the dialer control the line for exclusive use when in alarm mode. It also helps isolate defective or improperly wired equipment by disconnecting the RJ-31x plug to route tip and ring directly to lower priority equipment. In some installations, a 911 dispatch console will be rerouted to a backup console by connecting the backup console to the "house phone" connections on pins 1 and 8.

Some technicians may install a "shortcut" or de-populated four-terminal version of the dialer jack. In the shortcut dialer jack, the jumpered terminals which supervise the presence of the plug are missing. This "shortcut" jack can't detect the presence of the modular plug. It is best to install a fully populated RJ-31X jack, and properly connect all terminals. All RJ-31 X jacks should be installed in front of any other jacks in the system so that when an alarm occurs, automatic dialing will take priority and seize the line, leaving all other phones disconnected.

## What is an RJ-21X, how do I connect to it?

An RJ-21X is a standard telephone interface which uses 50 wires to transmit up to 25 channels of digital or analog data. It is called an RJ-21x when it is used as a "demark" or attachment point for telcom equipment. The "demark" attachment point is commonly referred to as a "Network Interface Device". An RJ-21X can be attached to a standard KT-66 or 110 type punchdown block, and is typically installed by the phone company. In many installations, the customer is responsible for all wiring **after** the RJ-21X, and the phone company is responsible for all wiring **before** the RJ-21x. The circuits on an RJ-21x are provided on numbered tip and ring positions on a miniature 50 pin connector of the "Amphenol" or "telco" type. These are very common connectors on PBX, KSU, PBC, and distribution mainframes. The connector itself is sometimes called a "blue ribbon", or "grey L" connector, depending on the type of cable it's connected two. The connectors are polarized (male and female) to prevent an installer from accidentally connecting an internal extension to outside lines (or vice versa). Here's the pinout:

Pins 1 (ring) and 26 (tip) are considered position 1. Pins 2 (ring) and 27 (tip) are position 2 on thru twenty five pairs. Typically, only 24 pairs are used (48 wires). The last pair on pins 25 and 50 (slate-violet and violet-slate color) should be left as a spare pair. The spare pair keeps you from having to run a whole new cable if a single pair fails elsewhere. DLI Loggers use this pair as an earth ground connection. *Watch your polarity when wiring these cables.* Most modern phone equipment is polarity insensitive, but you can ruin a whole installation by reversing one pair of wires. There's also a single line version of the RJ-21X described above. It's called an RJ-31x.

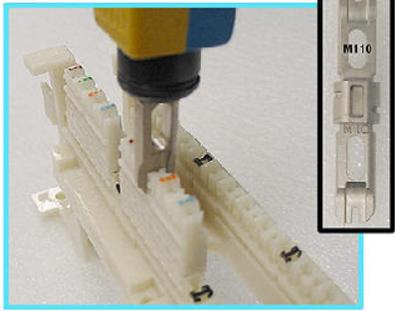


## What's a KT-66 Block? How do I connect to it?

The KT-66 block has been a standard "punch down" connector for telephone interconnects since 1958. It uses 200 bladed split contacts to make reliable connections on 28 gauge solid copper wire. It's one of the most common interconnects used in the telcom industry, and is often used to terminate an RJ-21x. KT-66 blocks, AKA "66 Blocks" use a plastic snap-on frame to mount on backboards or racks. They are "indoor only" interconnects which will fail if exposed to moisture.

KT-66 blocks come in several styles. Some are "split blocks" in which the two spade terminals on each end of the block are connected together, but the connection is "split" down the center of the block. Other KT-66 blocks may have 50 pin AMP connectors on either side of the block.

To make a reliable connection to a punch down block, you'll need a "punch down tool" as pictured below. Be sure to use the correct "66" style blade to make the connection. One side of the blade cuts the wire, the other is for "loop through" wiring.



### What's a 110 Block? How do I connect to it?

The 110 block has been a standard "punch down" connector for telephone interconnects since 1971. It was intended to be a high density replacement for the KT-66. It uses a plastic frame to which a series of 4 pin connectors may be attached. Up to 50 of these connectors may be attached to the block. With 110 blocks, connection density is 50% higher than connections made on a 66 frame. KT-66 blocks, AKA "66 Blocks" use a plastic snap-on frame to mount on backboards or racks. Like the "66 Block", a 110 block is "indoor only" and should not be

exposed to moisture. You must use the right tool with the right blade to make a reliable connection on a 110 block.

### What is an RJ-45 jack? Which wire connects to each pin?

Although it's not technically correct, the term "RJ-45" is now used to refer to any standard 8 pin jack in telephony or networking applications. RJ-45 jacks are most commonly used in Ethernet applications. Eight pin jacks are often used to carry four analog circuits.

Jack	USOC		T568B	100BT
Positions	RJ61	T568A	(AT&T)	(LAN)
1	wht/brn	wht/grn	wht/org	wht/blue
2	wht/grn	grn/wht	org/wht	blue/wht
3	wht/org	wht/org	wht/grn	wht/org
4	blue/wht	blue/wht	blue/wht	
5	wht/blue	wht/blue	wht/blue	
6	Org/wht	org/wht	grn/wht	org/wht
7	Grn/wht	wht/brn	wht/brn	
8	Brn/wht	brn/wht	brn/wht	

### What is a "Balanced Line"? What is an "Unbalanced Line"? How can I connect to them?

Balanced lines are lines use to cancel noise. In balanced phone lines, two wires are twisted together so that each wire picks up the same amount of noise. At the receiving end, the noise is subtracted, and the resulting output is the sent audio, minus the noise. A balanced line becomes "unbalanced" when unintentional leakage to ground occurs. Unbalancing a phone line causes noise. This can be a result of poor insulation somewhere along the line, or a bad connection. The problem is often worse in the winter, when outside lines are wet and leakage to ground occurs along the line.

Audio is usually sent down shorter unbalanced lines using Coaxial shielding. This shielding prevents electromagnetic noise from affecting a single wire. The inputs to all DLI loggers are balanced lines.

These inputs may be connected directly to unbalanced (ie. Coaxial) lines, and the ground may be connected to either side of the logger input.

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## What is a D/A Converter? How do I connect it?

D/A stands for Digital-to-Analog. A D/A converter is installed between digital lines (usually station sets) and an audio logger. D/A converters work by converting the signal stream from a digital station set into the standard analog format used in an audio logger. They are available in single and multi-channel versions.

Since there is no "standard" for digital station set interconnects and line formats, single channel D/A converters are usually best purchased from the manufacturer of the PBX and station sets to which you are connecting.

Multi-channel D/A converters are available as stand-alone units or PCI cards. These cards are sold by Dialogic (now Intel) and others. Another common type is built into the base of a KT-66 punchdown block. Again, every phone system has a different format, so there are hundreds of D/A converters available. Make sure you are purchasing the right one for your PBX and station sets.

## Support

Please visit [www.digital-loggers.com](http://www.digital-loggers.com) for more frequently asked questions, free driver updates, manuals and accessories. If we haven't answered your questions here, please call (408) 330-5599 or send an email to [support@digital-loggers.com](mailto:support@digital-loggers.com). We'll be glad to help.

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