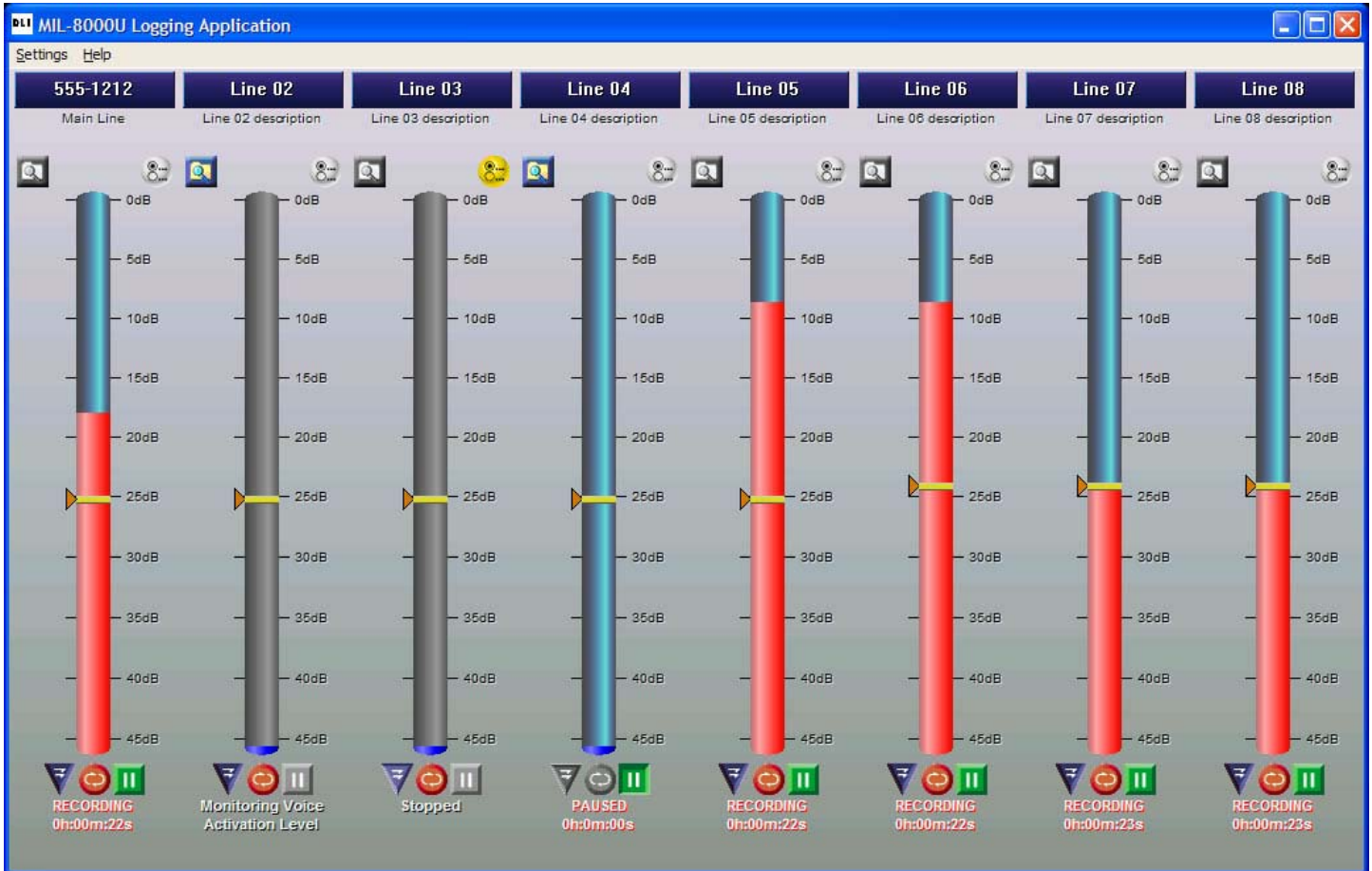


DIGITAL LOGGERS, INC.

The MIL-8000U is a Windows-based 8-channel audio logger that can digitally record from a variety of audio resources, including phone lines, radios, and microphones.



Features include:

- Eight channels of companded digital audio recording, each with its own level indicator and recording controls.
- Each channel can be independently configured for voice-activated switch (VOX) or continuous (manual) recording.
- Easily adjustable Voice Activated Switch (VOX) recording trigger level and timeout.
- Each channel can be independently configured for transient noise suppression.
- Any recording can be manually started, stopped or paused.
- Digital signatures indicating the time, date, and device used for recording are included in each file.
- Can be configured to start automatically when a user logs into Windows.
- Easily accessible hardware gain control for each channel.
- Easy Plug and Play USB configuration.
- Stability assured by the use of Windows 2000, 2003, and XP
- Maximum recording length can be easily set so large files are split into easily manipulated sections.

- Each channel's maximum disk usage can be controlled to conserve disk space.
- DLI's Evidence Builder software (available separately) can be used to analyze calls for Touch-Tones (DTMF) and Caller-ID information and add notes to calls.

System requirements:

- A **dedicated** PC is essential for full audio performance, due to the high CPU usage required for real-time audio recording and processing.
- A 1-GHz or faster processor.
- 256MB or more of RAM.
- An AV Hard-drive (i.e. 7200 RPM IDE drive) is highly recommended.
- Windows 2000, 2003, or XP. Due to the performance and stability required for this application, Windows 9x and ME can not be supported.
- A free USB 1.0, 1.1, or 2.0 port on your PC.

QUICK INSTALLATION INSTRUCTIONS

1. Connect inputs to either handsets with a "Y" tap, or to outside phone lines. When connecting to outside lines, the outside phone line connects to the right jack, and the phones, PBX, or KSU connects to the left jack.
2. Attach the USB cable to a dedicated PC. Connect directly to a primary USB port, 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.**
3. Connect the power adapter to the 5V jack on the logger. Switch the PC power on *after* powering the logger.
4. If USB drivers are needed on your machine, you will be prompted to insert your Microsoft Windows CD for USB HID drivers.
5. After installing USB drivers, Insert the MIL-8000 distribution CD and follow the instructions to install the logging application. Restart the PC and start the logging application.
6. Test each line and adjust the recording level to prevent distortion. When properly adjusted, the VU meter should never reach the top of the scale during normal conversation.

Download FAQs, and manuals from www.digital-loggers.com. Register today for free software upgrades.

Hardware Installation

The MIL-8000U installation kit includes the following components:

Qty 8 – Phone to Handset Cords
 Qty 1 – USB "A" to USB "B" cable.
 Qty 8 – Handset to RJ-11 Cords
 Qty 8 – Handset "Y" Connectors
 Qty 8 – RJ-11 "Y" Connectors
 Qty 1 – MIL-8000 Logging Unit
 Qty 1 – 5V Switching Power Supply

Power

Plug the power cable into the wall outlet and the other end into the jack marked 'Power' on the MIL-8000U.

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 MIL-8000U.

At this point, start your computer. Windows will automatically install four ‘USB Audio’ drivers. The installation should not require you to access files from the Windows installation CD, but have this handy just in case.

Follow the Windows installation wizard instructions and restart the computer if necessary.

Microphone Power

DLI loggers use pins 1 and 6 of the RJ-12 to send power to remote microphones. To wire an RJ-12 jack in a single line configuration, just make sure the red and green pair is connected to pins 3 and 4 of the jack. The MIL-8000U will require a separate external power supply connected to these pins and will then distribute the power internally to all 16 connectors on the logger.

A microphone power adapter is available from Digital Loggers, Inc, with the RJ-12 jack pre-wired for your convenience.

Phone Line connection

You can record from phone lines in three different manners: from the handset, from an outside analog phone line, or from an analog port on your 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 to the digital station set extensions.

To connect to an outside analog line, install the connectors as follows:

- 1) Use an RJ-11 to RJ-11 patch cord to connect each outside line the left side of the logger.
- 2) Use another cord to connect the PBX , CPE, or telephone to the corresponding jack on the right side of the logger.



To connect to an analog port on your PBX, attach a single RJ-11 to RJ-11 cord between the logger and the phone switch port.

To connect to a handset, attach cords as follows:

- 1) Disconnect the handset cord from the base of your phone – you can also disconnect the cord connecting directly from the handset if you cannot access the base.
- 2) Attach the handset cord to a “Y” adapter from the bag marked “Handset Ys”.
- 3) Attach a cable from the bag marked “Handset to RJ-11 Cords” between the Y connector and the jack on the right side of the logger.



MIL-8000U Software Installation

Insert the MIL-8000U installation CD into your CD-ROM drive. Installation should start automatically, but if it doesn't, navigate to your CD-ROM drive in Windows Explorer and click on Setup.exe.

Please read the licensing agreement in full and, if you agree with it, continue with the installation. Select the installation directory and name of the shortcut folder that will appear on the Programs section of the Start menu.

The next window allows automatic application start up whenever a user logs into the computer.

If you have selected the 'Run the application when a user logs in' check box mentioned above, it is suggested that you restart the computer to assure that the application is installed correctly.

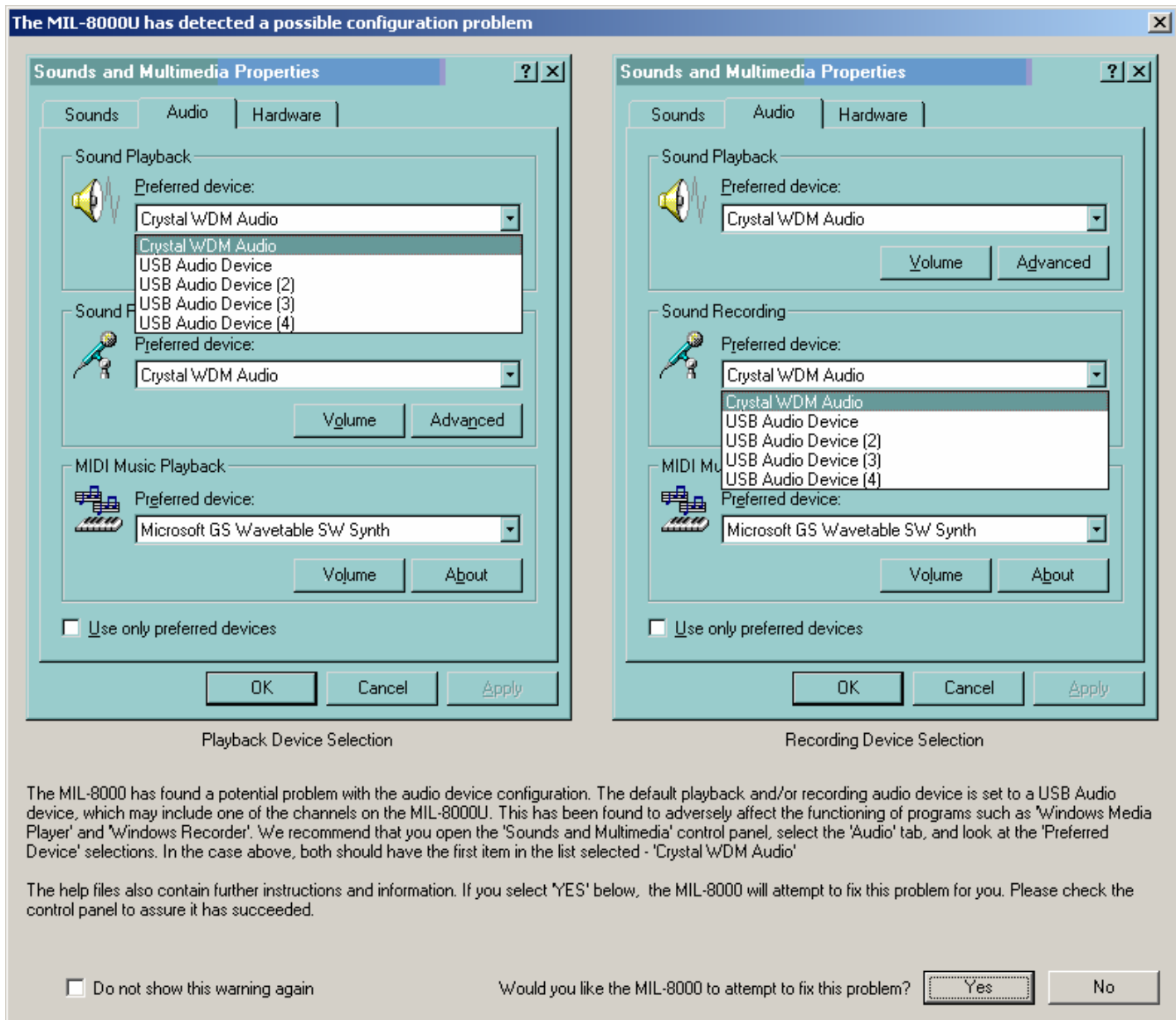
Windows Audio Device Configuration

When the application is run, it will scan the current USB and audio configurations for possible setup issues. The first issue you may encounter involves the functioning of other applications such as Windows Media Player.

When installing new audio devices that can record and/or play, Windows will assume that the newly installed audio device should be the default one used. Programs such as Windows Media Player and Winamp will use this 'default' device to play the sound from your MP3 and movie files.

Installation of the MIL-8000U hardware may cause Windows to set the default recording and playback devices to audio devices on the MIL-8000U, and since the MIL-8000U has no speakers, the result will be that Winamp and Windows Media Player will suddenly stop making sounds when you try to play audio files. If this occurs, your audio applications will appear to function normally, but no sound will come from your speakers.

If the MIL-8000U application determines that one of the audio devices on the MIL-8000U has been selected as a default playback device, it will pop up a dialog box that looks like this:

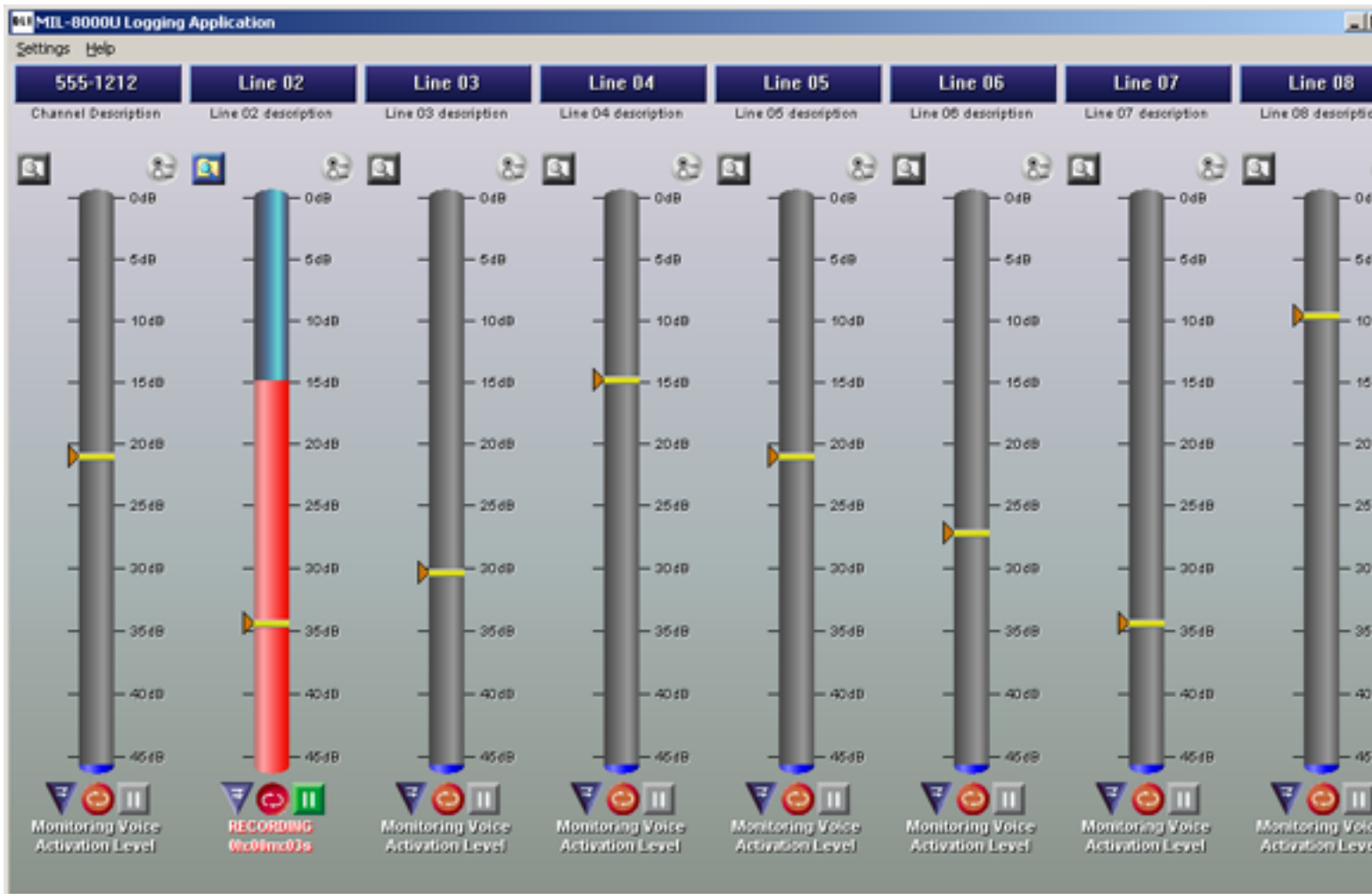


To have the MIL-8000U automatically change the default audio device to one that will likely fix the problem, press the 'Yes' button on the lower right of the window. To have the application ignore these configuration issues in the future, check the 'Do not show this warning again'.

To confirm the changes to the audio device configuration, open the 'Sounds and Multimedia' control panel by selecting 'Start Menu|Settings|Control Panel|Sounds and Multimedia'. Click the 'Audio' tab.

You want to make sure that the newly installed USB Audio Devices are not the preferred devices selected. In the example above, the first items in the list for 'Sound Playback' and 'Sound Recording' should be selected ('Crystal WDM Audio'). If your computer contains a built-in USB microphone, select that device (usually the first in the list) as your preferred recording device.

Using the Logger



Each channel should, by default, open in Voice Activated mode, as 'Line 01' above.

Pressing the purple triangular button places the associated channel in Voice Activated mode. Pressing the red circular button places the channel in Continuous (Manual) mode and immediately starts recording. Please note that all buttons will display a tool tip describing their function when you place the mouse cursor over them.

TO STOP THE CHANNEL FROM RECORDING AND/OR MONITORING IN VOX OR CONTINUOUS MODE, PRESS THE BUTTON AGAIN.

Recording will start when the application is set to Continuous mode, or when a sound level is detected above the specified threshold in VOX mode.

When recording, the screen display changes, as shown in 'Line 02' above.

1. The text below the 'RECORDING' prompt indicates how long the channel has been recording
2. The background of the level indicator turns a yellow color, giving you further feedback that recording is occurring

The pause button will turn green when the channel is recording. When recording, you can pause recording at any time by pressing the green 'Pause' button.

Before making any threshold adjustment on the software, you will need to set the hardware levels on the logger.

Pick up a phone which is attached to line 1 and press and hold down a digit.

While the key is held down, adjust the knob by the label 'SIGNAL 1' until the level in red indicates just below the top (0 dB) mark.

Now, release the key and hang up the phone. Be sure that the yellow line (Voice Activated trigger threshold) is above the level now displayed on the voice level indicator.

Repeat this procedure for each the remaining lines.

You can change the Voice Activated trigger threshold, indicated by the yellow bar, at any time – even while recording. Set this level only after you have adjusted the hardware level controls on the logger. To change the VOX threshold trigger:

1. Place your mouse cursor over the yellow bar you wish to adjust – the cursor will turn to an up-down arrow
2. Press the left mouse button
3. Move the mouse up or down to adjust the position of the threshold indicator
4. When you release the mouse button, the threshold setting will be saved to a file and the channel will use this threshold level the next time you start the application. Moving the bar down will make the recording trigger more sensitive. Moving it up will reduce sensitivity. Adjust the threshold when the attached phone is "on-hook", or the trunk line is idle. Set it so that the threshold is located slightly above the noise level on that line.

The 'Explore to Today' button

The small blue folder button on the left side of each channel window will enable when a channel has recorded anything on that particular day. By pressing this button, the application will open up Windows Explorer to the current day's recording directory, where you will be able to edit, copy, delete and/or play the days recordings, or explore to other recording folders.

Channel Configuration

The line must be stopped for the settings button to highlight. The line is stopped if the word 'Stopped' is displayed below the three buttons located at the base of the Voice Level indicator. If the word 'Stopped' is not displayed, stop the line as described above. To open the configuration dialog for a particular channel, select the yellow 'Settings' button, or select the channel from the 'Settings' menu. A dialog box opens as shown below:

The Settings Tab – This button accesses settings for channel 'Line 01'

Channel Name – The name of the channel shown in the blue box at the top of the channel window. A good example would be 'Front Desk' or 'Bob's Phone'

Channel Description – A further description of the channel can be placed here. This may be more verbose.

Channel Storage Location – This list box indicates where recordings for this channel will be saved. Previous storage paths will be indicated if you press the down button. To change the location, press the Browse button ('...') and select the folder to which you wish to save this channel's files.

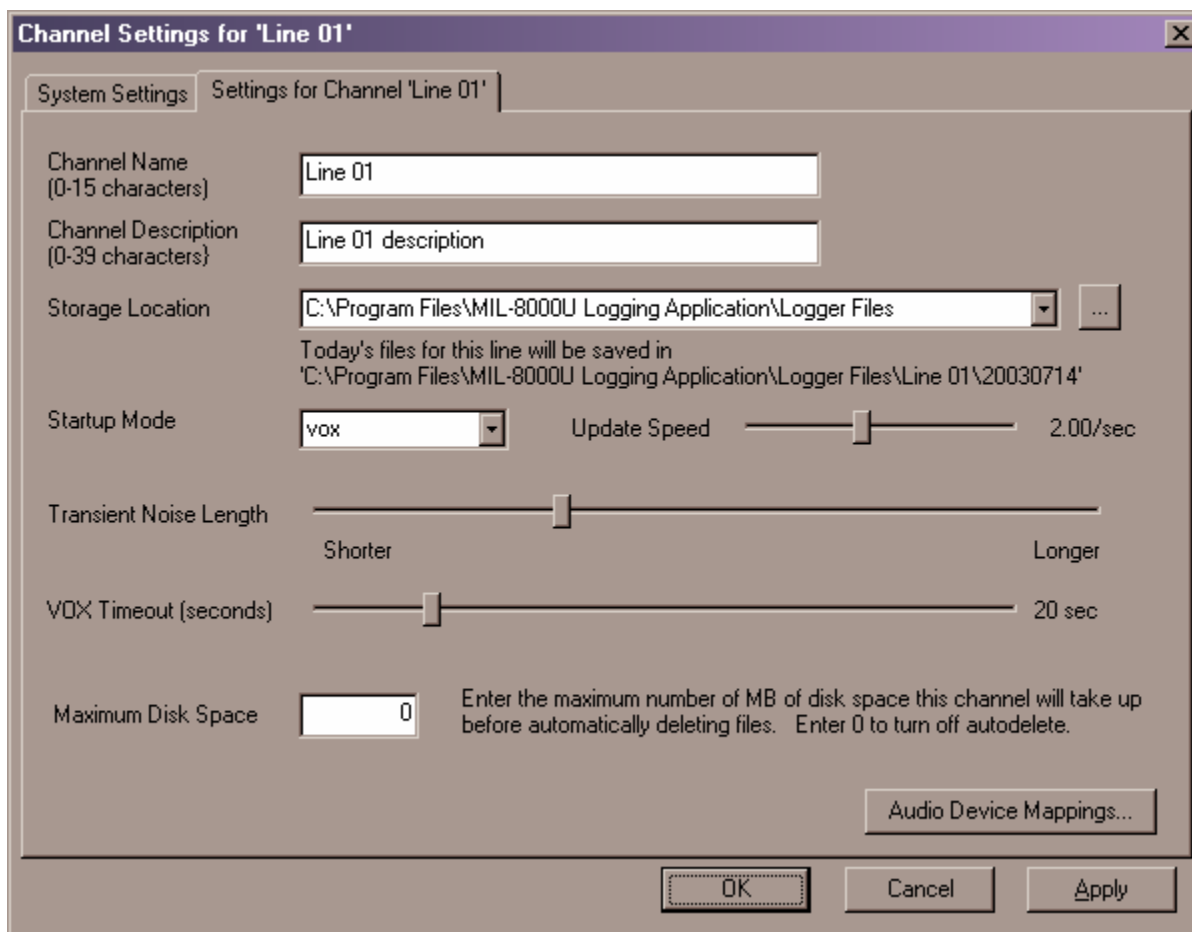
Startup Mode – This list indicates how you wish this channel to behave when the application starts up. Select 'vox' when you want the channel to start up in 'VOX' mode, 'continuous' when you want the channel to start recording immediately on startup, and 'disable' if you want to manually determine channel mode.

Update Speed – This slider bar indicates how often the screen display for this channel will update itself. On slower systems, or those with slower or older video cards, the CPU usage required to redraw the screen may affect the performance of the application. If the user interface flickers annoyingly and/or you do not care to see 'realtime' updates of the recording level, move this slider to the right to slow the update speed down and conserve CPU resources.

Transient Noise Length – This setting only applies to VOX recording. Phone lines and other recording sources will occasionally have noise on them – the striking of a bolt of lightning or a microwave oven nearby can often cause short 'transient', meaning short clicks which can be sensed by the logger. Normal phone calls and conversations have long periods of sound that you want to record, whereas you wish to ignore the noise. The Transient Noise Length setting indicates how long a sound must exist above the VOX recording threshold before recording will start. In very noisy environments, select a 'Longer' setting. When connecting to recording sources which are quiet when on-hook, choose a 'Shorter' setting.

VOX Timeout – This setting applies when the recording mode is set to "VOX". This number indicates how much silence must be detected before recording terminates and the file is closed. Typical conversations tend to have pauses and silences in them. Setting this value too low (such as 5 seconds) will stop recording frequently and your conversations may be broken up into several smaller recordings. Setting this value too high will waste disk space and add excessive silence to the end of your recordings. A VOX timeout of 30 seconds typically works well for phone connections, and a setting of 10 seconds is good for most radio recordings. Microphones may require longer timeouts.

Maximum Disk Space – The MIL-8000U can automatically delete old calls to limit the amount of disk space used on each channel. This setting is the maximum amount of disk space you want each channel to use. To turn this feature off, set this field to "0". If you place a number greater than 0 in this field, then every hour or so, the application will check to see if recordings for this channel use more space than this threshold value. If so, the application will automatically delete files starting with the oldest day folder. The application will then move up through the directory tree and continue deleting calls until disk usage is below the indicated threshold. THE APPLICATION WILL NEVER DELETE THE CURRENT DAY'S CALLS.



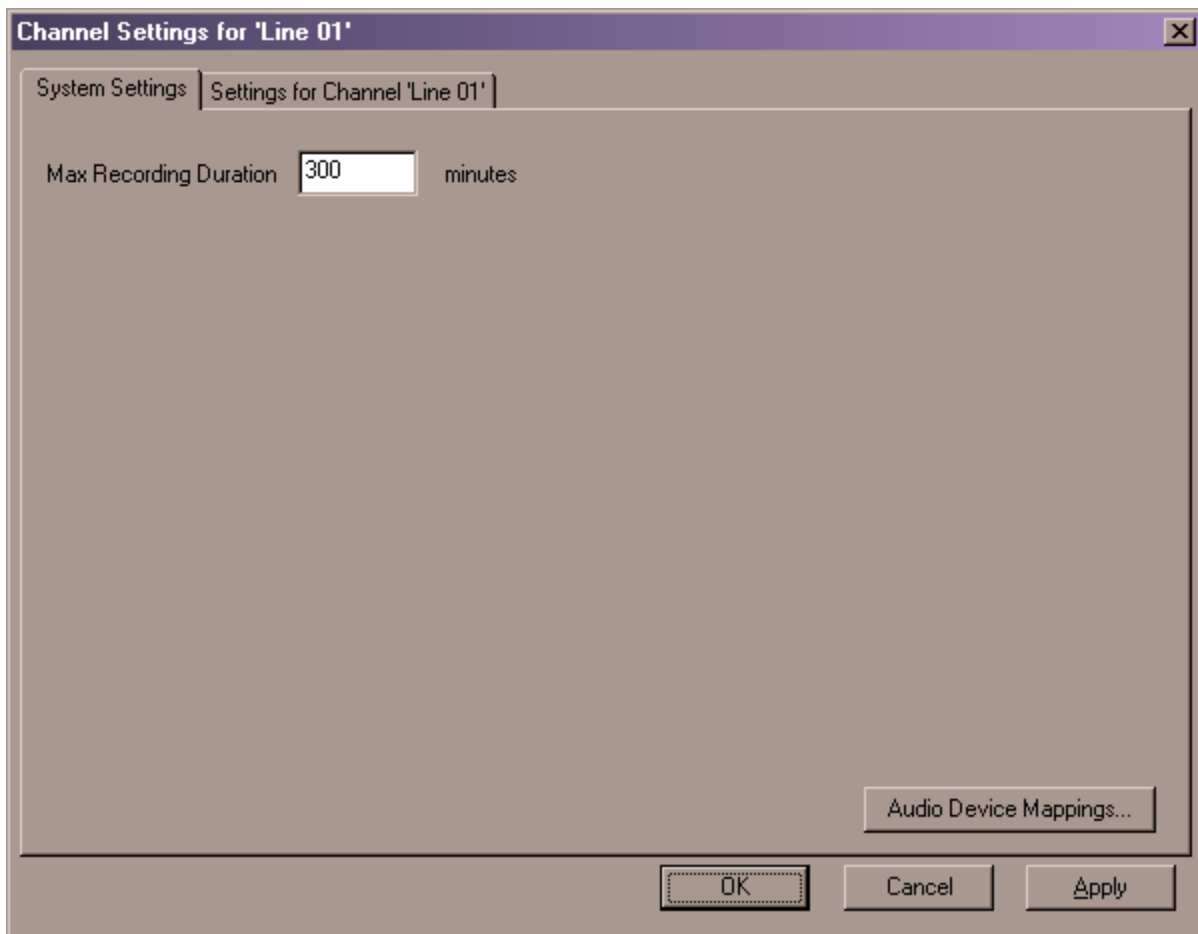
The image shows a Windows-style dialog box titled "Channel Settings for 'Line 01'". It has two tabs: "System Settings" (selected) and "Settings for Channel 'Line 01'". The "System Settings" tab contains the following controls:

- Channel Name** (0-15 characters): A text box containing "Line 01".
- Channel Description** (0-39 characters): A text box containing "Line 01 description".
- Storage Location**: A dropdown menu showing "C:\Program Files\MIL-8000U Logging Application\Logger Files" with a browse button "...". Below it, a note states: "Today's files for this line will be saved in 'C:\Program Files\MIL-8000U Logging Application\Logger Files\Line 01\20030714'".
- Startup Mode**: A dropdown menu set to "vox".
- Update Speed**: A slider control ranging from 2.00/sec to an unlabeled maximum.
- Transient Noise Length**: A slider control ranging from "Shorter" to "Longer".
- VOX Timeout (seconds)**: A slider control ranging from an unlabeled minimum to "20 sec".
- Maximum Disk Space**: A text box containing "0". To its right, a note reads: "Enter the maximum number of MB of disk space this channel will take up before automatically deleting files. Enter 0 to turn off autodelete."
- Audio Device Mappings...**: A button located at the bottom right of the settings area.

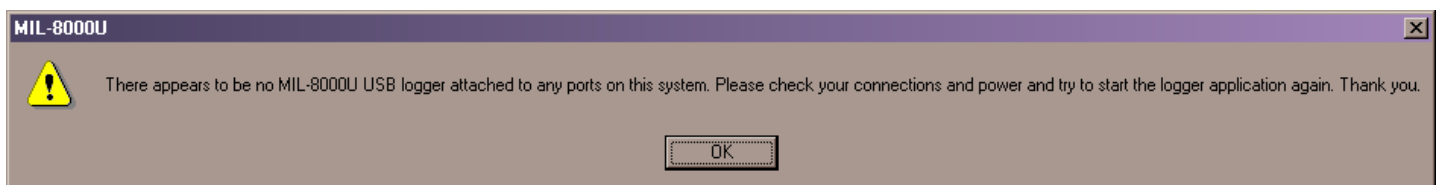
At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

The System Settings Tab – System Settings

Max Call Duration – If you let recordings record for too long, they might not fit on CDs or be difficult to email. This setting indicates how long a recording can be.



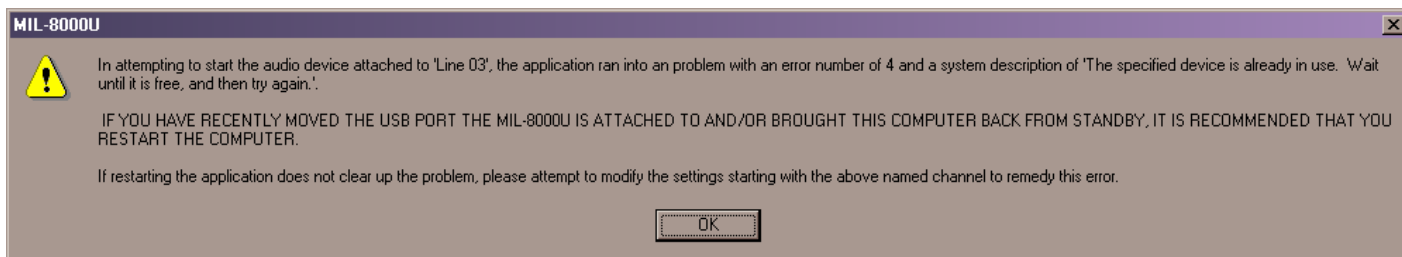
Error Messages



If the MIL-8000U hardware has been disconnected or powered down when the software is started, you will see this error message. Check to see that the connection between the MIL-8000U and the PC is properly configured and that power is flowing to the unit. A red light will appear if power is flowing to the unit, the USB cable is correctly wired, and the system has enabled power to this port.



Only one MIL-8000U can be connected to a PC at any one time. If you have more than one MIL-8000U connected to this PC, the application will detect this and notify you with this message.



This window pops up for the same reason as above. Restarting the application and/or restarting the computer is recommended if this error occurs.

For additional troubleshooting or frequently asked questions, visit our web site: <http://www.digital-loggers.com/faqs>

Wiring Basics for Logger Installation

This section contains basic wiring information which may assist you in connecting your MIL-8000U logger.



Question: How do I connect a radio?

Answer: Manufacturers use different radio connectors, so you'll first need to locate a mating connector. After that, it's a simple two-wire connection to the logger. You can directly bridge across the speaker, headset, or ear bud.

Question: How do I connect the logger to a PBX?

Answer: These are the four common ways to link your logger to the outside world:

You can 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 the handset tap (below).

You can tap the handsets 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.

You can 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.

Question: What's a demark point?

Answer: A "demark point" is a single point of entry into a building for CO wiring. In most situations, the customer is responsible for all wiring after the demark point, and the phone company is responsible for all wiring before that point. A lightning arrestor is typically installed by a phone company near the "demark point."

Question: What's a CO (Central Office)? Where does my phone line go?

Answer: A central office is a local switching facility which routes voice and data over telephone lines. It is typically located within the center of a city. The phones in your home or office connect to a Central Office and are routed from there through the worldwide Public Telephone Switching Network (PTSN).

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

Answer: 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 connect an audio logger, since all your incoming conversations may be recorded at this point. A typical signal level to the handset earpiece is -20dBm, and this is adequate for most logging applications.

To connect to a handset, use the handset splitter supplied with your logger and the small handset jacks. Pay careful attention as these jacks look very similar to the RJ-11 and [RJ-12](#) jacks described below. Putting a handset plug into a larger RJ-11 or RJ-12 jack will result in an unreliable connection.



Question: What's an RJ-11 jack? How do I connect a logger to it?

Answer: Most analog phone lines use an RJ-11 jack and plug in a single line configuration. An RJ-11 jack has four wires and is called a 4P4C connector, since it has 4 conductors in 4 places. Wires on an RJ-11 jack are colored black, red, green, and yellow. The center pair (red and green wires) is used to connect the ring and tip side of a single phone line. The yellow and black wires are reserved for other purposes. The photo below shows a 6 pin [RJ-12](#) jack on the right, and a 4 pin RJ-11 jack on the left.



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 an "harmonica" or "octopus" cord. 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.

OCTOPUS CORD



Be careful not to confuse the RJ-11 plug with a handset plug. They look almost identical, but inserting a handset plug into an RJ-11 or [RJ-12](#) jack will give you an unreliable connection.

You'll find that a 6P6C crimp tool will work fine for both RJ-11 and [RJ-12](#) connectors. You'll need a different tool for handset connectors and RJ-45s.



Question: What's an RJ-12 jack? What's an RJ-14 jack? What wire colors connect to each pin of the jack? How do I connect a logger to it?

Answer: Most analog phone lines use an RJ-11 jack and plug in a single line configuration, but there's a similar connector called an RJ-12 which expands the capacity of this jack to 6 pins. The 6P6C RJ-12 jack has the same physical outline as an RJ-11 jack, but can contains 3 pairs of wires. An RJ-12 plug will fit into an RJ-11 jack and vice versa. If you insert a 4 pin RJ-11 plug into a 6 pin RJ-12 jack, you will be connected to pins 2,3,4 and 5 of the RJ-12 jack. The "translation" of pin numbers when mismatching jacks and connectors can lead to confusion.

DLI loggers use pins 1 and 6 of the RJ-12 to send power to remote microphones. To wire an RJ-12 jack in a single line configuration, just make sure the red and green pair is connected to pins 3 and 4 of the jack. The MIL-8000U will require a separate external power supply connected to these pins and will then distribute the power internally to all 16 connectors on the logger.

Jack	USOC	USOC
Positions	RJ11	RJ12/14
2		wht/org
3	blue/wht	blue/wht
4	wht/blue	wht/blue
5		org/wht

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

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

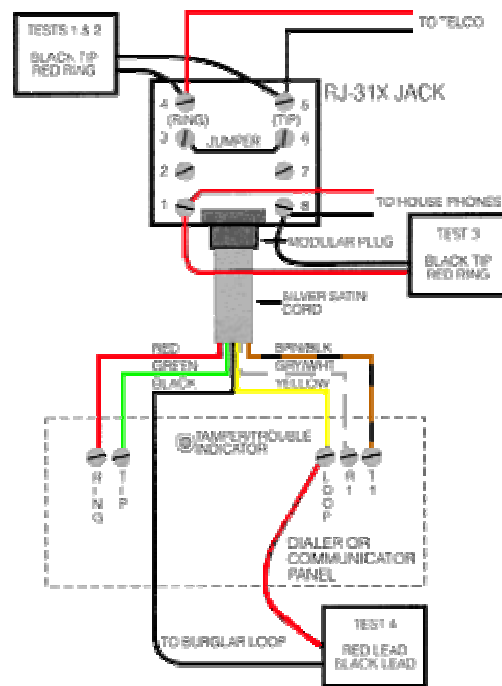


Jack	USOC
Positions	RJ25
1	wht/grn

- 2 wht/org
- 3 blue/wht
- 4 wht/blue
- 5 org/wht
- 6 grn/wht

Question: What's an RJ-31x? How do I connect a logger to it? How do I test it?

Answer: 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 house phones and wiring disconnected.

Verifying RJ-31x wiring with a [TIMS](#) or Tone Test Set -and- dial tone is simple. With a Tone Test Set switch in the OFF position, connect the tone set leads to terminals 4 (ring) and 5 (tip) of the RJ-31Xjack. The LED should glow bright, steady red, indicating voltage is supplied to the line and dialtone is available. A green LED indicates the line is off hook, and a pulsing orange LED indicates a ringing line. Activate the security device and the logger and check the recording as explained below.

When installing logging and security equipment before dialtone is connected, it is especially important to check the panel, dialer, and jack wiring to be certain that the alarm, phone, and logger will work properly after dialtone is supplied. Without dialtone, incoming polarity cannot be verified, but Telco standard polarity color coding is shown in Fig. 2-2 on page 2-2. Professional installers will observe this color code when connecting dialtone. Although all DLI loggers are polarity insensitive, it is important to connect all lines with the correct polarity to the loggers. Additional equipment may be connected in the future in a "daisy chain" fashion. This additional equipment may fail if the polarity of the logger wiring was incorrect during installation. To verify RJ-31x wiring, without dialtone, follow these 5 steps:

- 1) With the [TIMS](#) or Tone Test Set switch set to TONE, connect it to terminals 4 (ring) and 5 (tip) of the RJ-31X jack. Be sure to observe proper polarity.
- 2) Trace the generated tone through the entire circuit. Tone should be heard throughout.
- 3) Then, to verify the operation of the alarm dialer, set the alarm panel off and check the house phone wiring with the probe. No tone should be heard on the house wiring. This indicates that the dialer has seized the line.
- 4) Verify that the tone has activated the VOX circuit in the logger.
- 5) Play the recorded file and make sure the .au file sounds identical to the injected tone.

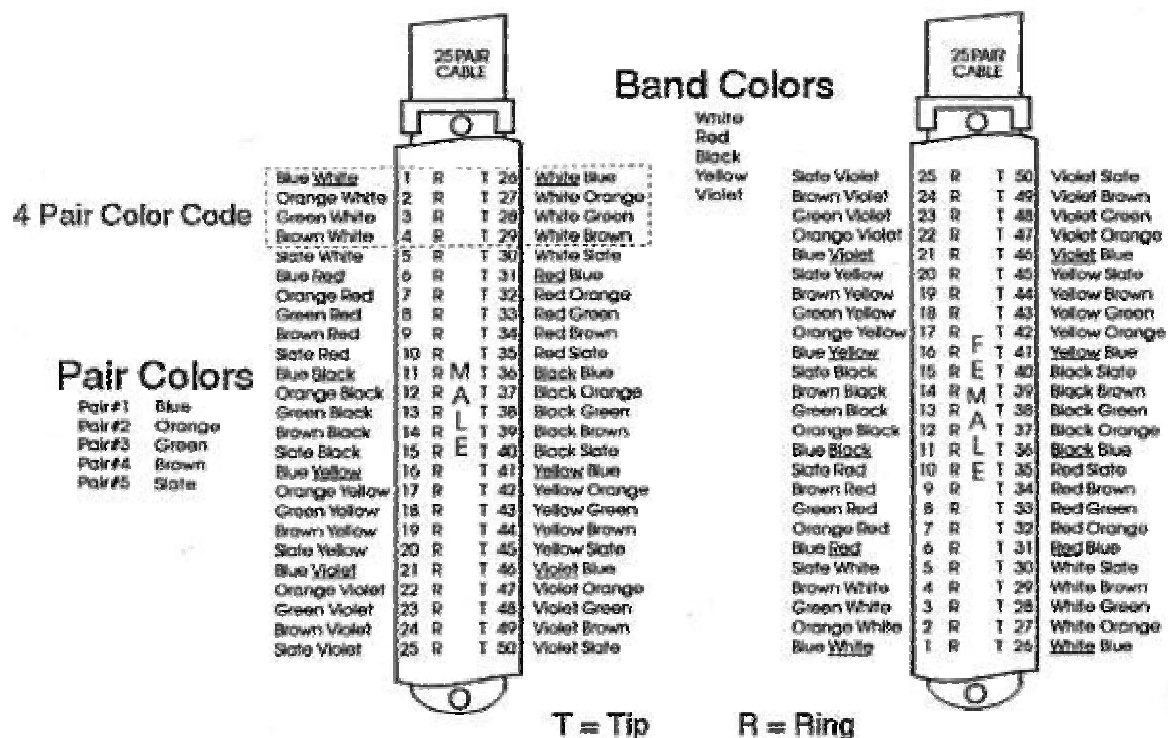
There's a 24 line version of the RJ-31x without the bypass contacts. It's called an [RJ-21x](#) (described below).

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

Answer: 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,

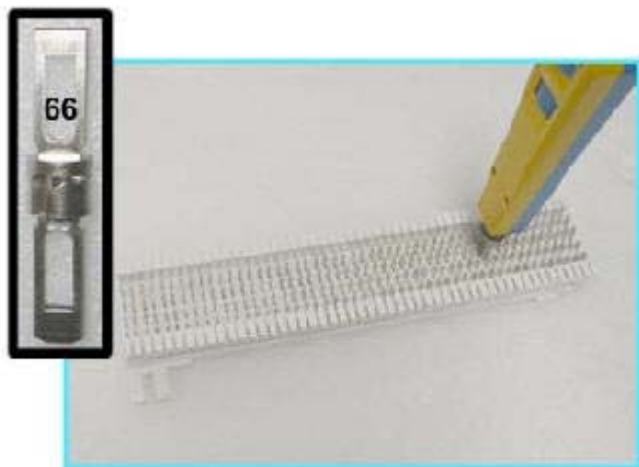
PBC, and distribution mainframes. The connector itself is sometimes called a "blue ribbon", or "grey L" connector, depending on the type of cable it's connected two. The connectors are polarized (male and female) to prevent an installer from accidentally connecting an internal extension to outside lines (or vice versa). Here's the pinout:

RJ21X Standard Telco Cable Pinout



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.

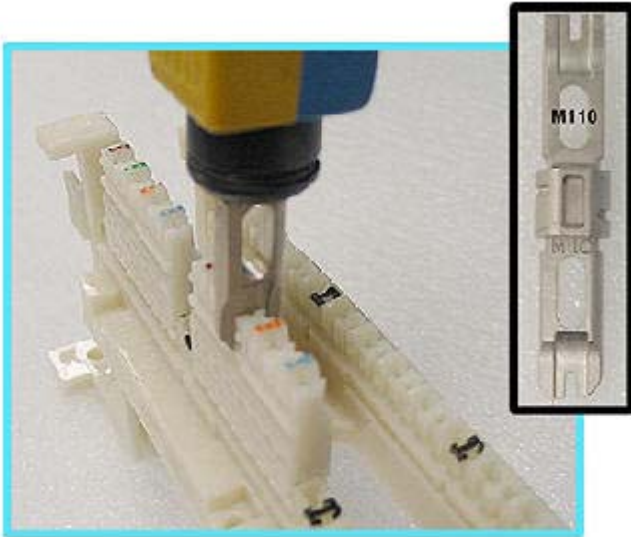
To make a reliable connection to a punch down block, you'll need a "punch down tool" as pictured below. Be sure to use the correct "66" style blade to make the connection. One side of the blade will cut the wire, and the other is for "loop through" wiring.



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

Answer: 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 as shown below.



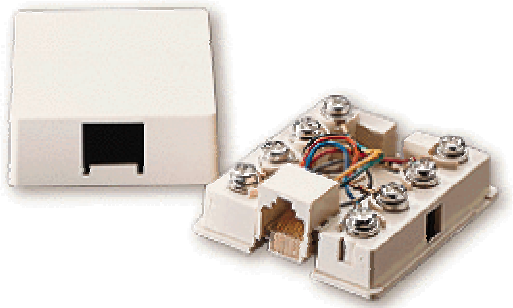
Question: What's a 270 Block? How do I connect to it?

Answer: The 270 block is more common in Europe than the US, but chances are you'll run across them when installing loggers. Here's the tool you'll need to make a reliable connection to these blocks:



Question: What is an RJ-45 jack? Which wires connect to each pins?

Answer: 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. Here are the correct wire colors for each pin in an RJ-45 jack connected to CAT-5 cable:



Pin 1 - Orange/White

Pin 2 - Orange

Pin 3 - Green/White

Pin 4 - Blue

Pin 5 - Blue/White

Pin 6 - Green

Pin 7 - Brown/White

Pin 8 - Brown

In telcom applications, eight pin jacks are used to carry four analog circuits. The most common pinouts are:

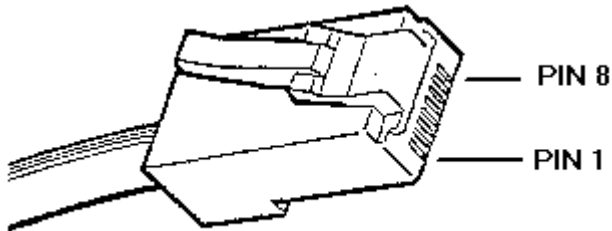
Jack Positions	USOC RJ61	T568A	T568B (AT&T)	100BT (LAN)
1	wht/brn	wht/grn	wht/org	wht/blue
2	wht/grn	grn/wht	org/wht	blue/wht
3	wht/org	wht/org	wht/grn	wht/org
4	blue/wht	blue/wht	blue/wht	
5	wht/blue	wht/blue	wht/blue	
6	org/wht	org/wht	grn/wht	org/wht
7	grn/wht	wht/brn	wht/brn	
8	brn/wht	brn/wht	brn/wht	

These 8 pin jacks look identical to an RJ-48 (described below), but the wiring is different. An RJ-48 is just for T1/E1 lines.



Question: What is an RJ-48 jack? What is the pinout? What is the impedance of a T1 line?

Answer: An RJ-48 jack is the standard termination for a T1 or E1 line. Here is the standard pinout:



Transmit + = Pin 1

Transmit - = Pin 2

Receive + = Pin 4

Receive - = Pin 5

Pins 3,6,7 and 8 are unused. T1 line impedance is nominally 120 ohms. If you're bridging a T1 line with a channel bank or logging card, you'll want an input impedance of at least 1K ohms on the bridging device.

Question: What is the pinout required for an RJ-48 T1 crossover cable?

Answer: Just cross connect the transmit and receive pairs as shown below:

1->4

2->5 Tx goes to Rx

4->1

5->2 Rx goes to Tx

Question: What is an LBO level on a T1 channel bank? Why would I need to adjust it?

Answer: To ensure that a T1 channel bank will work on a large variety of lines, it is adjustable over range of analog levels. LBO levels are usually set by dip switches or potentiometers within the channel bank. It's essential that these be adjusted correctly so that DTMF and caller-ID can be decoded properly. Audio fidelity is also increased when the line is properly adjusted. To adjust the level, measure the line with a [TIMS](#) set and set it to a maximum level of +0dBm.

Question: How can I make a waterproof telephone wiring connection?

Answer: There are several types of waterproof connectors used in phone wiring. The three most common types are:

EX Connectors or "Jelly Filled Beanies"

Use these where you have exposed leads or corroded wires. Beanies cut through and displace the insulation on up to 3 conductors. Beanies take longer to crimp than the Scotchflex connectors below, but they have a larger contact surface area. These are filled with a waterproof gel and work well on a wide range of conductor sizes, from 18 to 30AWG.

UR and UY Connectors

Made by Scotchflex, these connectors are quick to install. The UR is a butt-splice type connector, and the UY is an inline connector. Use pliers for a good crimp, and make sure the red button ends up level with the body of the connector. If it is tilted, it won't make a good connection. Scotchflex connectors work on wire sizes from 19 to 28 AWG.

There are also larger connectors, such as BPTS splices which can handle up to 200 conductors.

Question: What is the minimum equipment I'll need to install a logger? What is a "butt-set"? What is a "hound"? What is a "toner"? What is a [TIMS](#)?

Answer: In addition to the correct connection tool (probably one pictured above), you'll need a way of checking what's on a line to properly install a logger. There are two devices which will help. One is a "butt set".

"BUTT SET"



A "butt set" is essentially a portable telephone which will allow you to test analog wet or dry lines. It has a switch marked "M" which will [capacitively couple](#) the set to the line. Use the "M" mode to monitor the line in high impedance, and switch to "D" to put the set in 600 ohm mode. The green LED will illuminate if the line polarity is correct (black to ring, red to tip). If line polarity is reversed, a red LED will illuminate.

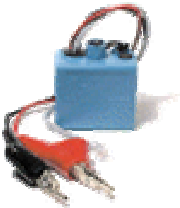
"HOUND"



Another handy tool that will take the place of a butt-set is a "hound". A hound is nothing more than an inductively coupled amplifier with a small speaker in a hand-held tool. Use it to monitor the audio on the line and verify you have the right pair before connecting it. Since it won't load

the line, you'll be able to monitor [on-hook noise](#) better than you can with a butt-set.

"TONER"



Another handy tool is a "toner". This is essentially a signal injector without level controls. Most toners send either a warbling tone at +14 dBm or a constant tone at about +6 dBm.

"TIMS SET"



To really do the job right, you'll want a TIMS set. TIMS stands for Transmission Impairment Measurement Set. A TIMS is a combination of a calibrated signal injector with a calibrated meter. It can be adjusted to match line impedance and can measure noise levels on the line. A TIMS will help you install loggers by verifying the incoming line levels and checking the quality of your wiring. DLI carries affordable used and new TIMS - [take a glance at our inventory](#).

Question: How can I adjust the VOX timeout?

Answer: Our larger loggers use a program called "LoggerConfig" to modify the values stored in a configuration file named "Logger.INI". Use this editor to modify your line settings including line names and VOX timeouts. To start the editor, click on Start->Programs->Digital Loggers->LoggerConfig.

Our CD loggers and 4 channel network loggers have a separate VOX timeout parameter for each line in the setup menu.

A typical timeout value for radio calls is 10 seconds, and 30 seconds is commonly used for phone calls.

Question: How can I inject a record tone into the handset of a phone being recorded?

Answer: There are two ways to do this:

One is with a small logger patch which connects externally to the handset connector. A typical unit is the [Dynametrix patch](#). Make sure you order the correct patch for your type of phone. Since there are several types of microphones, (dynamic, electret condenser, and carbon), there are several different patches available. Also, you may need an adapter cable if you have a Sony or Panasonic phone system which does not use standard handset wiring. External logger patches typically cost \$100 per set.

To reduce the clutter on the desktop, there's a second, more expensive option. Send your phone set in to a dealer, and they can install the record tone inside the set. This is commonly done on Avaya station sets in telemarketing applications. Plan on spending \$150 to \$200 per set if you choose this option.

Of course, if you are connecting a logger to an outside analog line or to a port on the PBX, you can inject the tone directly, so you won't need this patch.

Question: How can I adjust the VOX sensitivity on my 24 channel logger?

Answer: The sensitivity is automatically adjusted using a noise-canceling VOX IC from Motorola. If the input level is well over 0dBm, you may need to add a series resistor to increase sensitivity and eliminate clipping. A 27K ohm resistor will shave off about 5dBm.

Question: How many recordings can I store on disk? Can I compress evidence recordings?

Answer: That depends on the length of each recording, and the sampling rate. Higher sampling rates equate to higher sound quality, but use more disk space. Lower sampling rates are called "compression", and they sacrifice audio quality in exchange for smaller files. Defense attorneys have argued that modifying recordings using audio compression amounts to "tampering" with the original recording. If you have the choice, record all lines in full fidelity. All DLI loggers are capable of uncompressed recording on all channels simultaneously. They are also capable of compressing audio on all channels simultaneously. This allows you to keep a legal, full quality copy of each recording. If the recording is not accessed, it can be automatically compressed to conserve disk

space. u-law recorded files take up about 1MB for each 2 minutes of recording. That equates to 2,000 minutes (or about 33 hours) per gigabyte of disk space. A 650MB CD holds about 21 hours of recording in u-law format.

Question: How can I eliminate radio interference in the recordings?

Answer: You can attenuate the overall level going into your logger, or you can add a separate external RFI (Radio Frequency Filter) to the unit. To attenuate the line, add a series resistor (ie. 20K) to reduce the level going into the logger. Confirm the level with a [TIMS set](#).

Question: How do I connect a [microphone](#)?

Answer: Your microphone should be connected through a preamplifier that brings the output level of the microphone up to an acceptable level (approximately 0dBm peak). [DLI Microphones](#) are self-powered and include an internal preamplifier. They are connected using a 6 pin RJ-12 cable. Power to the microphone is provided on pins 1 and 6 of the connector. The MIL-8000U requires an external microphone power supply connected to these pins.

Question: How do I cable a [microphone](#)?

Answer: If you are using a DLI microphone with a higher level output (0dBm Peak), you can use standard unshielded twisted-pair telephone cable. DO NOT attempt to run multiple microphones through a single CAT-5 cable. The crosstalk may be unacceptable. If you are using lower level microphone sources, you must use shielded twisted pair cable to eliminate noise and crosstalk. Don't use twisted pair cables for low-level microphones, particularly when the cables will be located near fluorescent lights. Be sure to connect the shielding braid at the microphone end of the cable and avoid ground loops.

Question: What is a "Speech Path Connection"? What is a "port"? What is a "channel"?

Answer: A speech path connection is an electrical path inside a phone switch which allows communications between two or more stations. In logging, each speech path typically requires a logging port. A channel is the same as a port. Each port on a logger is separate input source for a speech path. The number of channels you require depends on the number of conversations you need to record simultaneously. You can reduce the number of channels required by switching a smaller number of logger ports to a larger number of speech path connections through a switch, multiplexer, or PBX.

Question: What is a Decibel? What is a dB?

Answer: Telecommunications line levels are measured in decibels (dB). Decibels are a power ratio measurement. Voltage, sound intensity, and electrical power may be expressed in decibels. Telecommunications levels are typically expressed as a ratio of power in either dBm or dBv. The most common measurement is the dBm, which refers to a decibel level measured with respect to a one milliwatt signal (typically on a 600 ohm line). Zero dBm is defined as a reference level of one milliwatt of power into 600 ohms. A change of three decibels is approximately double the power. A change of 60 decibels refers to a power ratio of 1,000,000 to 1. Typical phone line levels are –3dBm peak for bridging outside lines, and –13dBm for bridging handsets. DLI Loggers will operate reliably with peak input levels in the range of –40dBm to +3dBm. Higher levels need to be attenuated, and lower levels need to be amplified prior to connection to the logger. A transmission impairment measurement ([TIMS](#)) set or true RMS voltmeter with differential input is useful for checking input levels prior to installation, and for troubleshooting logger connections. Click to read more on [how decibels are used in measuring audio levels](#) and [to brush up on what a logarithm is](#).

Question: What is a Noise Floor?

Answer: Phone line noise floors may range between –84dBm for a very quiet line to –35dBm for a noisy line. Noise is typically worst on [wet lines](#) when all phones are on-hook and the line is unterminated. Local telephone companies have noise specifications based on the line distance to the central office. Noise may be measured using a [TIMS](#), and line distance is measured using a time domain reflectometer (TDR). Noise floors can be significantly increased when analog pairs are located near digital pairs. An example would be a long run handset back-haul from a digital phone. If noise floors exceed acceptable levels, a separate cable with a tighter wire twist should be considered. In the real world, this translates into the use of CAT-5 or CAT-6 quality cables when lines are run near transformers or fluorescent lights, or over long distances.

Question: What is Line Impedance?

Answer: Impedance is a measure of AC resistance. Lower resistances require higher currents to achieve the same voltages. Telephone lines are terminated and matched to their “characteristic impedance”. A “characteristic impedance” is the most efficient way to transmit power through that particular type of wire. Most phone lines are 600 Ohm impedance, although 135 and 120 ohm lines are also common.

To achieve efficient transfer of energy over a transmission line, the impedances of both the sending and receiving equipment must be matched. If this is not done correctly, [transmission loss](#) will occur. The total impedance present on a phone line at a customer site is typically 900 ohms. All DLI loggers will directly connect to lines in this impedance range, as well as to high impedance sources, such as handsets.

Question: What is the impedance of a Headset or Handset?

Answer: Most headset and handset impedances are in the range of 600 Ohms to 10K Ohms. These connections may be directly bridged using a “Y” connector, which ties to the logger. In call center applications, the connection to the headset may be made inside the telephone itself, and the

audio may be back-hauled through an unused pair on the cable, or through a separate recording cable.

Question: What is the Impedance of a Radio output?

Answer: Most radio audio sources intended for connection to speakers are very low impedance (typically 4 to 8 ohms). If you are connecting to a radio receiver output that is intended for a speaker, bridge the line directly at the speaker connection. If you choose to disconnect the speaker, a load resistor placed across the line may be necessary for the radio amplifier to function properly.

In an E-911 application, the console will typically have a recording output which is a 600 ohm [balanced line](#).

If the output level at the bridging point is over +3dBm, you should add a series resistor to bring it within the logger's input range of -40 to +3dBm. An example of a high level audio source is a 70-volt public address speaker system. Connecting a 470K ohm resistor in series with a 70-volt system will bring levels within the recording range of the logger. A transformer may also help to match impedance if the logger is located a long distance from the radios.

Keep in mind that the input impedance of the logger is over 10K ohm. The logger is ["AC coupled"](#), and "DC Blocked" with capacitors at the input stage, so you cannot measure the logger impedance directly with a DC meter.

Question: What is a Wet Line? How can I tell if I have a Wet line?

Answer: Wet lines are phone lines that draw power from the central office, or from a PBX. Audio is superimposed upon the DC power. Power to the station set is direct current (DC), and is typically 48 volts. To determine if you have a wet line, you can connect a DC voltmeter across the line. A typical voltage range for a 48-volt wet line in on-hook state is 44-50VDC. A typical voltage range for a 48-volt wet line in the off-hook state is 5-15VDC when measured across the equipment seizing the line. The MIL-4000N may be connected directly to either wet or dry lines due to the DC blocking within the logger.

Question: What is "On Hook Noise"?

Answer: On Hook Noise is the noise present on a telephone communications line when the phone is not in use.

Question: What is a "Loop Start Line"? How do I connect a loop start controller?

Answer: Loop start lines are phone lines which use a loop current to control on-hook or off-hook conditions. Your home phone line is probably a [wet loop start line](#). Loop start lines can also carry signaling information when the phone is on-hook. A common example is a CENTREX line with COV

signaling. To log the audio only (and avoid recording the signaling), you'll need a [Loop Start Interface Card](#).

A loop start controller is a unit which disconnects the phone line from the recording equipment when the customer equipment is not in use (on-hook). It does this by sensing the line current on the loop-start line. A current between 8 and 80 milliamperes indicates an active loop.

If you are installing a MIL-8000U in an application with noisy lines, you may want to consider adding a loop start controller.

To install a loop start controller, you'll need to make three connections. The first two go to the outside line (CO), and to the customer equipment (CPE). The controller will monitor the current between these two connections and activate the third port only when the customer equipment goes off-hook. Connect the third port to your logging device and you're done.

Question: What is a "Wink Start Line"? How can I tell if I have one?

Answer: Not to be confused with loop-start, wink start signaling is commonly used on DID lines. On a wink start line, the CPE or PBX first seizes the line by going off-hook. Before connecting the call, the CPE waits for an acknowledgement from the other end. The acknowledgement is a reverse of line polarity (off hook) for a duration of 140 to 290ms. This is called a "wink". The wink serves as an integrity check and can be used to identify a malfunctioning trunk. If the CPE detects a malfunctioning trunk, it may switch to another line. Just use a voltmeter connected across the line to tell if you have a wink-start line. You'll notice the polarity reversal when the line is picked up (seized). If you're using a "butt-set", the red and green LEDs will flash alternately when the line is seized.

Question: What is an "Immediate Start Line"?

Answer: An immediate start line uses no line seizure handshaking. The originating side (CPE or PBX) seizes the line by going off-hook, and just starts sending digits without checking the line condition or waiting for a response.

Question: What is a "Wet Delay Dial Line"?

Answer: In Delay Dial mode, the originating side (CPE or PBX) seizes the line and then waits for 150 to 150ms. After that, it checks to see if the line is on-hook (with normal battery voltage). If so, it will dial digits. If not, it waits until the line goes to normal polarity and then dials.

Question: What is a "Ground Start Line"?

Answer: Ground start lines are seized when the originating side briefly connects the ring side of the line to earth ground. Ground start lines are used to connect most pay phones. The most common use of loggers with ground start is in correctional facilities which monitor inmate pay phones.

Question: What is a “Dry Line”?

Answer: Dry lines are phone lines, which transmit audio, but not power. Dry lines measure 0VDC at all times when checked with a DC voltmeter. Dry lines may be connected directly to the logger. To connect a dry line, first verify that it is within the levels mentioned above, then bridge it directly to the logger input. Dry lines do not require a [loop start interface card](#) or [line voltage interface card](#). Connect dry lines directly to your logger.

Question: What is a “Balanced Line”? What is an “Unbalanced Line”? How can I connect to them?

Answer: 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.

Question: What is a “Capacitive Coupling”?

Answer: Capacitive coupling refers to the type of circuitry used in DLI loggers to connect to an outside line. This type of coupling draws no DC current from the phone line, so there is absolutely no DC loading (no DC current flows through the logger) when connected to [wet lines](#).

Question: What is a “2 Wire” line?

Answer: A two wire line uses a single [pair of balanced conductors](#) to carry both the transmitted and received audio paths. The most common "POTS" or Plain Old Telephone System lines are 2 wire lines. Better audio quality and separation is achieved when using [4 wire lines](#). A hybrid can be used to convert from 2 wire to [4 wire line](#) configurations.

Question: What is a “4 Wire” or “E&M)” Line? How do I connect to it?

Answer: Four wire lines employ a separate path for both heard (ear) and spoken (mouth) audio. These lines are also called E&M or Ear and Mouth lines. An external transformer combiner is required to convert a four-wire E&M system into a two-wire output for the logger. Please contact DLI for

technical support if you are recording from four-wire E&M lines. Four wire E&M lines should not be confused with single-pair lines in which a four-wire cable is used, but only the center pair carries audio.

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

Answer: 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 commonly available on 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.

Question: What's a DSL line? How do I connect to a logger to record the analog audio on a Digital Subscriber Line (DSL)? What types of DSL lines are there and what's the difference? What do all these acronyms mean?

Answer: DSL stands for Digital Subscriber Line. DSL refers to a technology used by the phone company to increase the amount of communications (data or audio) that can be passed down a single pair of copper wires for short distances. Getting more out of an existing phone wire is referred to "increasing copper bandwidth" or "pair gain". By transferring data faster, the existing (and expensive to replace) telephone infrastructure becomes more valuable (read: more profit for the local carriers!). DSL increases the amount of data sent on an analog pair by sending much more than the 64Kbps required for a single analog line down the same copper pairs used by analog lines.

Some types of DSL lines are "hybrid", and carry both digital and analog data simultaneously. When things are working perfectly, there should be no interference between the two signals: digital data and analog voice. In the real world, filtering is sometimes needed to prevent the digital subharmonics from entering the analog channel.

While DSL is usually as fast or faster than a T1, it is not necessarily as reliable. Phone companies try to counter this downside by offering refunds and "service level agreements" for DSL lines.

Although it's somewhat beyond the scope of this logging FAQ, here's a quick explanation of the various types of DSL lines.

ADSL stands for "Asymmetric Digital Subscriber Loop", and it usually supports downstream rates up to 8 Mbps, and upstream of 1024 Kbps. ADSL is the most widely deployed consumer DSL. ADSL is capable of sharing data with a POTS (or ISDN) voice line. ADSL service is usually limited to 18,000 ft

(5.5 km). Almost all ADSL installations will require either a splitter or filters to isolate the DSL signal from POTS. ADSL is sometimes referred to as "full rate" ADSL to differentiate it from G.Lite.

G.Lite is also called "DSL Lite", "Universal DSL" or "splitterless ADSL". G Lite is a slower version of ADSL that USUALLY requires no splitters or filters. G.lite uses a "fast retrain" technique to negate the various signal disturbances caused by normal POTS usage. Currently G.Lite supports speeds up to 1.5 Mbps/512 Kbps.

SDSL is "Symmetric Digital Subscriber Loop" indeed symmetric with a maximum rate of 1.5 Mbps/1.5 Mbps. SDSL requires a dedicated line. You won't be attaching an analog logger to an SDSL line, as they are only for digital data.

ISDN-DSL is "ISDN Digital Subscriber Loop." At 144 Kbps/144 Kbps, this is really a custom ISDN variant designed by Lucent. It uses the same 2B1Q data encoding as ISDN. IDSL does require a dedicated line however and does not support a concurrent POTS line, so you can't attach an analog data to an IDSL line unless you use an IDAC.

RADSL is "Rate Adaptive Digital Subscriber Loop". Developed by Westell, RADSL runs at 2.2 Mbps downstream and 1.0 Mbps upstream. RADSL adapts by changing speed in response to line conditions. Like ADSL, RADSL can piggyback on the POTS line. RADSL providers will tell you that no filters are needed, but don't trust them. Most installations do require a filter in our experience.

HDSL is "High bit-rate DSL" and is the original versions of DSL. HDSL requires multiple, dedicated wire pairs, and is symmetric at 1.5 Mbps/1.5 Mbps (the speed actually depends on number of wire pairs used). HDSL cannot piggyback a POTS line, so there is no analog transmission capability.

VDSL is "Very high rate Digital Subscriber Loop". This is a DSL still in under development with downstream capacity of 52.8 Mbps, and upstream of 2.3 Mbps. VDSL may work on copper connections up to 80 meters, but is really designed for fiber optic technology.

UDSL is "Unidirectional Digital Subscriber Loop", a proposed new standard from Europe that is not yet available.

Question: What's a DSL line filter and why do I need one?

Answer: A logger may be connected to DSL lines which support concurrent POTS operation by inserting an analog filter between the line and the logger. When connected in this manner, the logger will record the ANALOG data on the line, not the superimposed digital data stream. These filters are usually provided by your local carrier when the ISDN line is installed. The most common filter is the simple "PI" filter pictured below:



It usually provides about a 20dBm improvement in separation. For particularly noisy lines, you'll need a filter like this:



These Malmax filters will give approximately an improvement of approximately 38dBm.

Purchased a network logger from DLI? Need filters? Call us (408) 330-5599.

Question: What's ISDN? What's B-ISDN? What's an ISDN line? How do I connect a logger to record from an ISDN line?

Answer: ISDN stands for Integrated Services Digital Network. It's really a complete design for a high-speed telecommunications network. It was originally designed to carry voice and data at high speeds over copper, fiber optic, and microwave connections. ISDN is still being installed in many US locations, but most experts agree that it will eventually be replaced by DSL for applications of 3 miles or less. However, in some locations where the physical wire lengths from the office are over 3-4 miles, ISDN may be more practical than DSL.

B-ISDN is "Broadband" ISDN. (Original ISDN is often called Narrowband ISDN.) B-ISDN is a complete redesign of ISDN to provide higher bandwidths on both long and short lines connections.

To connect a logger to an ISDN line, you'll need to use an ISDN to POTS converter. They're manufactured by companies like ADAK, AT&T, ELSA and KNX. These converters provide a bridge between the ISDN digital format and the more common analog format used in logging recorders. These are also commonly called iDACs.

ISDN is also often used in PBX's and Centrex installations as a communications format between the PBX or CO and the station sets. A passive tap is required to bridge from the ISDN connection in these applications. [Learn more about ISDN here.](#)

Question: What a "hybrid"? What is transmission loss? What is a "duplexer"? How do I adjust it?

Answer: When a signal is sent down a transmission line, it is received at a lower level than it was transmitted at. This loss of signal is referred to as "transmission loss". A hybrid or "duplexer" is used to compensate for the transmission loss that occurs on a transmission line. The most common duplexer you'll encounter is used on a [2-wire balanced analog line](#). [Learn more about duplexers and how they work here.](#)

Question: What is a T1 line? How does it work? How do I connect to a T-1 Line (DS1 Line)?

Answer: The Bell System designed the T1 carrier communications system in the early 1960s to handle interoffice communications between COs. A T1 line is a digital phone trunk which carries up to 24 channels of u-law data at 64Kbps for an aggregate rate of 1.544Mbps.

A T1 line can carry audio, data, or a mixture of both. A T1 line is purely digital, unlike the hybrid [DSL lines described here](#). In general, T1 lines are much more reliable than DSL lines. T1s function well over distances from 15Km to 65Km on ordinary copper pairs.

T1 lines work by time division multiplexing 24 voice channels into time slots in a round-robin manner. Each voice signal is first sampled at a rate of 8000 samples per second in the standard u-law format. This format is identical to the recording format used in all DLI logging products. The least significant bit of each sample is periodically (usually once every 6 samples) used to send signaling information. This signaling information includes the information necessary to set up the call, start or stop the call, detect errors, and handle billing. Each of the 24 channels is then interleaved in a specific method of combining which was designed to use the existing multiplex equipment available in early phone switching facilities. A set of 24 eight-bit samples (one from each channel) form what is called a "frame". Each frame occupies a time period of 125µsec. A single bit is inserted after each 192 (24x8) bit frame to synchronize the data and prevent "channel skip". This makes a total of 193 bits sent 8,000 times a second, or 1.544Mbps.

T1's are normally installed as [4-wire lines](#) (Ear and Mouth configuration). Recently, some COs have started installing DSL bridges to cut the wiring involved down to a single pair. These bridges typically are installed at the [demark](#) point in the customer facility and are usually used only when the customer is less than 15,000 wire feet from the CO.

To connect a logger to a T1 line, your best bet is usually [a channel bank](#). They are flexible, [inexpensive](#), and easy to install. You can also use an Intel (formerly Dialogic) board, but a channel bank usually works better in the long run. New channel banks are available in 1-U high 19" rack mount or wall mount configurations. One important thing to watch for when using a channel bank is the analog line level. Channel banks use switches called LBO's to adjust the analog line levels. Most channel banks provide separate receive and transmit adjustments. These adjustments must be set correctly, or problems decoding caller-ID and DTMF touchtones in recordings may occur. Getting these settings right will also keep the echo cancellation on the line working properly. To set these levels, use a [TIMS](#) set.

Question: What is a "Contact Closure Input"?

Answer: Contact closure inputs are common on radio dispatch consoles, 911 systems, and courtroom recorders. They provide a positive start/stop signal which is more reliable than VOX recording. By using a contact closure to start and stop recording, recording will continue if the phone is off-hook, even if there is no audio on the line. This is often the case when a 911 caller leaves the phone for a few minutes. The MIL-8000U does not support contact closure inputs. Consider one of our other products if you need this type of recording control.



When Air Traffic Control
Needed Reliable Logging
They Chose DLI

If we haven't answered your questions here, please call (408) 330-5599 or [send us an email](#). We'll be glad to help.

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