

✓ Section 13

Section 1. X.21 Operation

X.21 is a protocol that runs over subscriber networks (i.e. leased line connections). X.21 can operate as a full duplex connection with data rates from between 9,600 bps to 2 megabits.

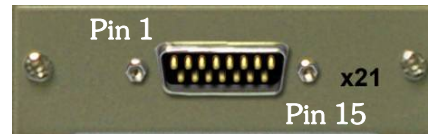
64 – 384 kbps connections are most common and these are the rates supported by **Tieline** codecs. Ensure that the bit rate setting in your codec is matched to that of your ISDN TA/X.21 DCE device. If you are unsure of the bit rate of your ISDN TA/X.21 DCE device, please check its user manual to discover the correct setting.

An X.21 module will usually connect via an ISDN Terminal Adapter (TA). **Tieline** codecs only support X.21 leased line mode with C/DTR call establishment. The connection profiles supported are mono, stereo, dual mono and mono/IFB.

Once a call has been made successfully between two codecs that are programmed to use the X.21 protocol, any data can be transferred over the connection. In **Tieline** codecs, choose from *G.711*, *G.722*, MPEG 2 Layer 2 (*MP2*), *AAC*, *AAC+¹* and **Tieline Music** Algorithms (**Tieline Music** is capable of 15 kHz mono or stereo over 64kbps or 128kbps with 70ms delay) as standard.

1.1. How Do X.21 Modules Connect to the Network?

X.21 modules use a D-15 connector to connect to leased line networks. The X.21 module has a male connector and it connects to a female version of the same connector.



1.2. How Does it Work?

First you will require a **Tieline** X.21 module in each of your codecs. Next, you will need to ensure that you have correctly connected the codecs to your leased line network. A diagram follows with an example of how this might look.

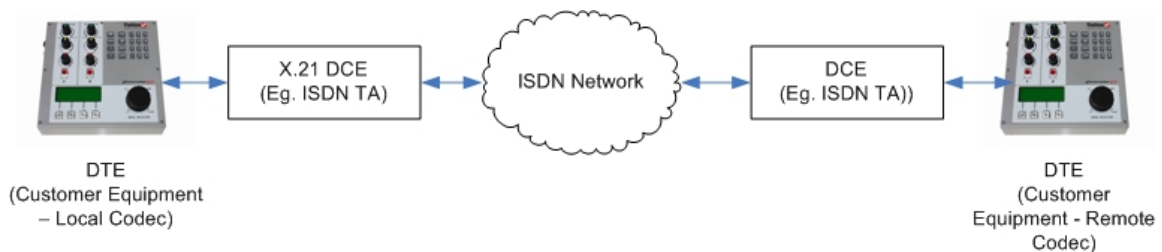


Figure 1: X.21 ISDN Interface Connection

¹ AAC and AAC+ algorithms are scheduled to be implemented into **Tieline** codecs in the second half of 2006. Check with support@tieline.com for more details on implementation dates.

1.3. Connecting Via X.21

First install the X.21 module into your codec. The connection should then appear in the root menu of the main codec LCD screen. For the procedure to connect over X.21, please see the [Quick Start](#) section of this user manual. This will display the menu wizard for X.21 module connections and explain the Quick Start connection procedure to get you connected.

1.3.1. X.21 over Leased Lines

As previously mentioned, **Tieline** codecs only support X.21 leased line mode with C/DTR call establishment. A 'C' (Control Signal) is used to enable and disable call control protocols. An 'I Signal' (incoming call signal) is used to indicate the presence of an incoming call.

When dialing from one codec to another, the dialing codec (DTE1) changes the C Signal from off to on to initiate an outbound call. At the codec (DTE2) receiving the call an 'I Signal' ('Indication' or incoming call signal) changes from off to on, indicating the presence of an incoming call. The codec receiving the call then initiates a C Signal state change, from off to on, and replies to the dialing codec, which receives the incoming signal and changes its I Signal state from off to on. This completes the call connection process over X.21.

To clear a call, press **HANG UP** on either codec to change the C Signal from on to off. This will terminate the connection between the codecs.

For more information on how to connect via X.21 using **Tieline** codecs, please see the [Quick Start](#) section of this user manual or contact customer support at support@tieline.com for more info.

1.4. Mono X.21 Connection

With this profile send a 15 kHz mono X.21 program feed between two codecs. **Tieline** codecs support X.21 leased line mode with C/DTR call establishment, from 64 - 384 kbps.

1. Disconnect power from the codec before you install an X.21 module into it.
2. Attach a cable with a D15 connector from your ISDN TA/X.21 DCE Device to the installed X.21 module and connect power to the codec.
3. Turn on power to the codec and `X21 1> Press Enter` will display on the LCD screen if the module is in the right side of a **COMMANDER G3** codec, or if you are using an **i-Mix G3**. If you have two modules installed in a **COMMANDER G3** codec, you will see the second module's connections displayed as well. There is only one module slot in an **i-Mix G3**. (Please note: In this example we are using a codec with a right hand X.21 module installed to connect).
4. Plug your microphones and/or music sources into the codec and adjust the gain settings and other audio settings by pressing `SOFTKEY 1 [Aud]`.
5. Press `SOFTKEY 2 [Profile]` and select the `[ManDflt Mono Pgm]` profile.
6. Scroll with the MENU SELECTOR (MS) to `X21 1> Press Enter` and use the connection wizard to adjust connection settings by pressing `SOFTKEY 3 [Wiz]`. (Check the user manual of your ISDN TA/X.21 DCE Device for the bit rate supported. This should match the bit rate setting in your codec.)
7. Now scroll the MS so that the square brackets [] are around `X21 1> Press Enter` and press the ENTER DIAL button on the grey keypad to connect the local codec to the remote codec. You should now see the codec connect to the remote codec you are dialing.
8. If you hear audio drop-outs the current bit rate cannot be sustained and should be renegotiated down. To negotiate bit-rates up press "F2" then "3", for lower bit-rates press "F2" then "9".

Please Note: The manual default algorithm setting is *Music*. For more information on selecting different algorithms and their required bit-rates, please see the [Connection Bitrates and Algorithm Options](#) section in this manual.

1.5. Stereo X.21 Connections


With this profile you can send a 15 kHz stereo X.21 program feed between two codecs. **Tieline** codecs only support X.21 leased line mode with C/DTR call establishment, over 64 – 384 kbps connections.

1. Disconnect power from the codec before you install an X.21 module into it.
2. Attach a cable with a D15 connector from your ISDN TA/X.21 DCE Device to the installed X.21 module and connect power to the codec.
3. Turn on power to the codec and **X21 1> Press Enter** will display on the LCD screen if the module is in the right side of a **COMMANDER G3** codec, or if you are using an **i-Mix G3**. If you have two modules installed in a **COMMANDER G3** codec, you will see the second module's connections displayed as well. There is only one module slot in an **i-Mix G3**. (Please note: In this example we are using a codec with a right hand X.21 module installed to connect).
4. Plug your microphones and/or music sources into the codec and adjust the gain settings and other audio settings by pressing **SOFTKEY 1 Aud**.
5. Press **SOFTKEY 2 Profile** and select the **ManDflt Stereo** profile.
6. Scroll with the **MENU SELECTOR (MS)** to **X21 1> Press Enter** and use the connection wizard to adjust connection settings by pressing **SOFTKEY 3 Wiz**. (Check the user manual of your ISDN TA/X.21 DCE Device for the bit rate supported. This should match the bit rate setting in your codec.)
7. Now scroll the **MS** so that the square brackets [] are around **X21 1> Press Enter** and press the **ENTER DIAL** button on the grey keypad to connect the local codec to the remote codec. You should now see the codec connect to the remote codec you are dialing.
8. If you hear audio drop-outs the current bit rate cannot be sustained and should be renegotiated down. To negotiate bit-rates up press "F2" then "3", for lower bit-rates press "F2" then "9".

Please Note: The manual default algorithm setting is *Music*. For more information on selecting different algorithms and their required bit-rates, please see the [Connection Bitrates and Algorithm Options](#) section in this manual.

1.6. Manual X.21 Connections

If you are confident that the X.21 profile with all the connection settings you want is loaded in your codec, then once you power-up the codec simply follow the next steps to connect.



```
ManDfl t MonoPgm
[X21 1< Press Enter]
X21 2> Press Enter
Aud Profile Wiz Menu
```

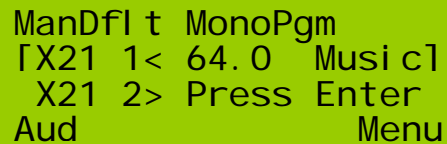
1. Use the **MS** to scroll to the **X21** connection you want on the codec startup LCD (**X.21 1<** or **X21 2>** in the example above). There is no requirement to dial a number with X.21 connections. The connection will display **Press Enter** once an X.21 module has a cable attached to a connection from your ISDN TA/X.21 DCE Device.

2. Press the ENTER/DIAL button on the keypad to make the call. The connection you are using should then display **Connecting** on the LCD. While the codec is connecting it will display as shown in the right-hand image.



```
ManDfl t MonoPgm
[X21 1< Connecting.]
X21 2> Press Enter
Aud Menu
```

- a. By default, a **Tieline** codec receiving a call will auto answer.
- b. Once a call is answered the connection screen will display as shown in the right-hand image. In this example the connection is at **64k** and the algorithm selected is **Music**. Only one X.21 module is connected in this screen.



```
ManDfl t MonoPgm
[X21 1< 64.0 Music]
X21 2> Press Enter
Aud Menu
```

- c. (Related topic: [Manual Default Profiles](#), [Powerup Profile](#) and [X.21 Connections](#))