

BLUEBOX POTS CODEC

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SECTION 1.**INTRODUCTION***BLUEBOX FEATURES*

The Comrex BlueBox is a digital audio transmission device for analog telephone lines. The BlueBox allows wideband, broadcast quality audio over normal “toll quality” telephone circuits. Here’s a short list of the BlueBox’s POTS Codec features:

- ◆ Full duplex FM quality (15 kHz) audio bandwidth at connect rates of 24 kb/s and above.
- ◆ Full duplex audio scales from 12.7 kHz to 4.7 kHz at connect rates of 21.6 kb/s to 9.6 kb/s.
- ◆ Separate “Voice Mode” allows 7 kHz audio with a 300 BAUD ancillary data channel and extra forward error correction.
- ◆ Easy to use dialing and configuring interface.
- ◆ Automatically connects at highest possible rate supported by telephone connection.
- ◆ Monitors line quality and renegotiates should line degrade.
- ◆ Two tally closures (one on connection, one triggered by the user).
- ◆ Ability to work with a Comrex HotLine, Vector or Matrix.
- ◆ Can store 19 telephone numbers and last number dialed in nonvolatile memory.
- ◆ Short coding delay (100 mS) allows seamless two-way conversation.

UNIT INCLUDES

One Mic/Line selectable input.
Additional fixed level tape input.
One headphone output (adjustable mix of send/receive audio).
One balanced line level audio out (adjustable mix of send/receive audio).
One hands-free cellular phone port.
Multi-purpose port through which flash upgrades can be performed.

ABOUT THE ALGORITHM

The BlueBox utilizes audio coding which is uniquely suited to the task of moving high quality audio along the narrow data channels provided by analog modems. The BlueBox algorithm draws on principles from various previous coding methods yet doesn’t incorporate the long processing delays (which equates to audio delay) that plague other coding schemes. While the BlueBox algorithm does not provide true “transparency” to the reconstructed audio, much work has been done to place the artifacts that do exist in a range where they will be less irritating to the listeners.

*WHAT COMES WITH
A BLUEBOX?*

The following items are shipped with a new BlueBox:

- (1) Comrex BlueBox POTS codec
- (1) AC Power module with AC cord
- (1) RJ11C modular telephone cord
- (1) Operating manual
- (1) Warranty card (Please fill out and return)

UPGRADES

A substantial portion of the functions and features of the BlueBox is software driven, allowing upgrades to these units by a simple exchange of EPROMs or reprogramming of existing EPROMs. Many software updates may be downloaded from the Comrex website and performed by connecting your BlueBox to a com port on your PC. (See Section 10 on page 33 for instructions.) We will keep our customers apprised of software updates and make these available at no charge. In order to assure that we will be able to contact you, please return the warranty card with complete address and contact information.

*OPERATIONAL
CONSIDERATIONS*

For use on POTS (Plain Old Telephone Service), two Comrex POTS codecs are required — one at each end of the telephone line. (Any combination of BlueBox, Matrix, HotLine or Vector will work.) POTS codecs require moderately high quality telephone lines on each end of the call and may have performance issues if the telephone connection has excessive noise, hum or crosstalk. As a general rule, avoid connecting through in-house PABX systems. A direct, outside line should be used for best performance. For further details on telephone quality issues, we suggest you read the “Modem Line Checklist” in Appendix A on page 51. Also, because the BlueBox’s algorithm creates a small coding delay, it is necessary to send a “Mix Minus” feed from the studio back to the remote site. (For more on Mix-Minus, refer to Appendix B on page 56.)

For wireless circuits, the BlueBox provides a mini-jack for connection to the 2.5mm hands-free port on mobile phones. Although this utility does not add any codec enhancement to the wireless call, it makes a useful back-up tool. The addition of professional microphones can make a substantial difference in audio quality.

SECTION 2. BLUEBOX MENU SELECTION TREE

BLUEBOX MAIN STATUS DISPLAY

Max24 AA MM Music
Press Enter or Qdial

Enter	Dial	Keypad	Dial Number
		Ext Phone	Dial with Ext Phone <Enter>when Ringing ...connecting
	Answ connecting.....		
Test	Voice	33.6 - 9.6 kb/s	Loopback active
	Music	33.6 - 9.6 kb/s	Loopback active
	HotLine	33.6 - 12 kb/s	Loopback active
	GSM	13.2 - 9.2 kb/s	Loopback active
Config	Pgm Qdial	Enter Qdial#: 01-19 Enter Phone Number	
	Codec	Voice Mode	Algorithm Selected
		Music Mode	Algorithm Selected
		GSM (POTS Side)	Algorithm Selected
	Max Rate	33.6 - 9.6 kb/s	Maximum Rate Stored
	More	Auto Ans	On
			Off
			6 Rings
		Dialing	Tone Dialing
			Pulse Dialing
		ModMon	Modem Monitor On
			Modem Monitor Off
		Line Out	Variable
			Fixed
			Local
			Return
Qdial	Enter Qdial#: 01-19 (Note: For last number redial, enter 00)		

BLUEBOX "HIDDEN MENU"

(PRESS THE HANGUP KEY THREE TIMES FROM THE MAIN STATUS SCREEN)

Country	Country Code 00-20		
Reneg	Reneg/Retrain ON		
	Retrain ON		
	None		
Flush Modem	Erase All Settings? Enter = Continue		
More	STL	1)Enable STL Mode	
		2)Disable STL Mode	
	Rev (Shows current software version)		
	GSMext	1) Enable GSM ext phone	
		2) Disable GSM ext phone	
	Symbol Rate	1) A (Disable top rate)	
		2) A&B (Disable top two rates)	
		3) Enable ALL Rates	
	DialTone	1) Require DialTone	
		2) Ignore DialTone	
GSM14	1) Enable GSM 14.4		
	2) Disable GSM 14.4		

PRIMARY AND SECONDARY USES OF FUNCTION KEYS**HANGUP**

Disconnects call.

Secondary functions:

1. Backs out of any screens involving dialing functions.
2. Accesses the *HIDDEN MENU* (press key 3 times).

QDIALSpeed dials numbers prestored in memory, including *QDIAL 00* to redial the last number dialed.

Secondary functions:

1. If pressed once when line is connected, modem drops one connect speed down.
2. If “double clicked” when line is connected, modem performs a complete renegotiation, without disconnecting the line.
3. Qdial inserts two second pause in dialing string entries.

ENTER

Initiates functions via the menu screen.

Secondary function:

1. When line is connected, it sends a momentary contact closure to far end.

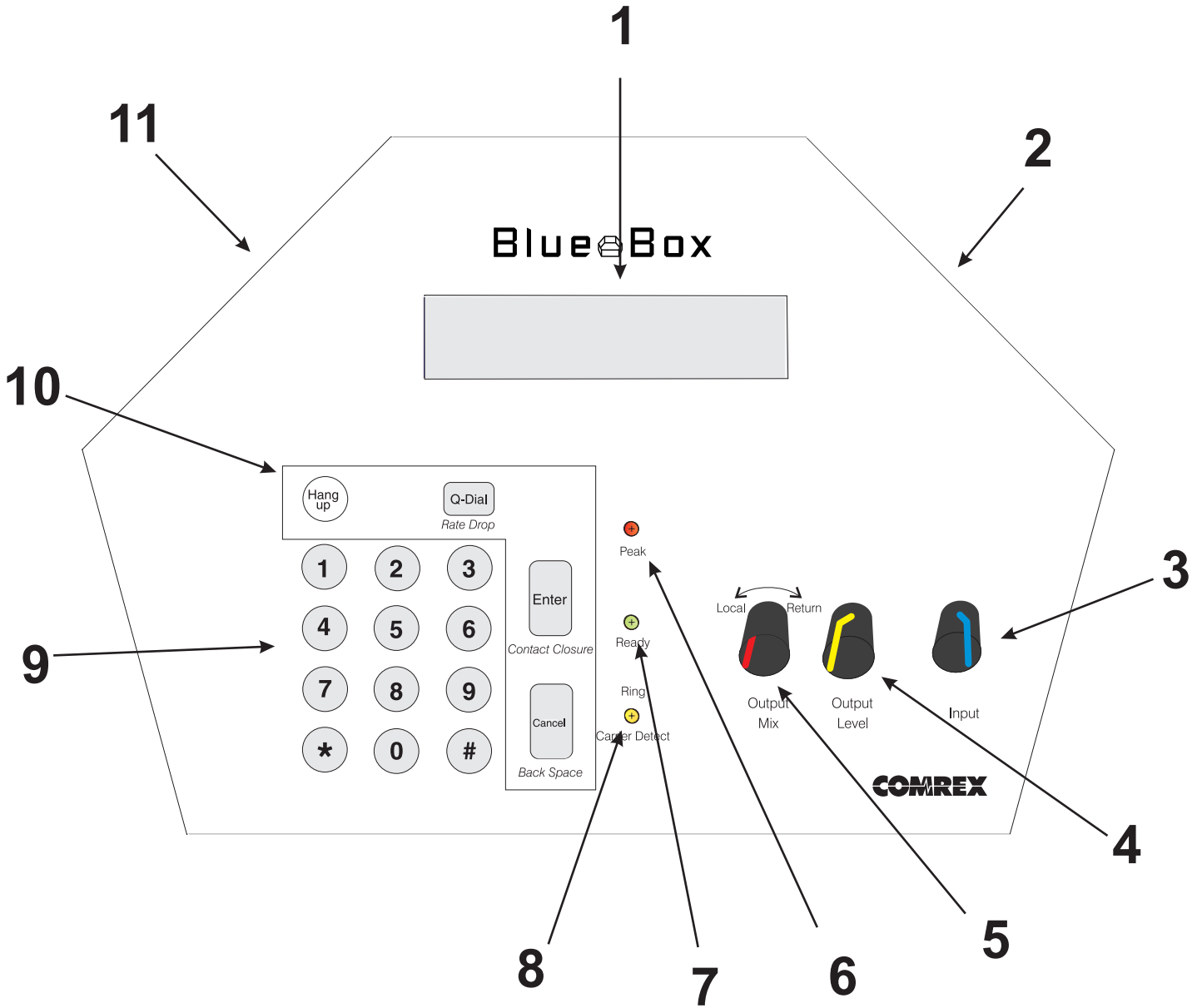
CANCELBacks out of most menus (see *HANGUP*).

Secondary function:

1. Backspaces during entry of dialing strings & programming of *QDIAL* numbers.

SECTION 3. DIAGRAMS AND DESCRIPTIONS OF CONTROLS AND CONNECTORS

TOP SURFACE DIAGRAM

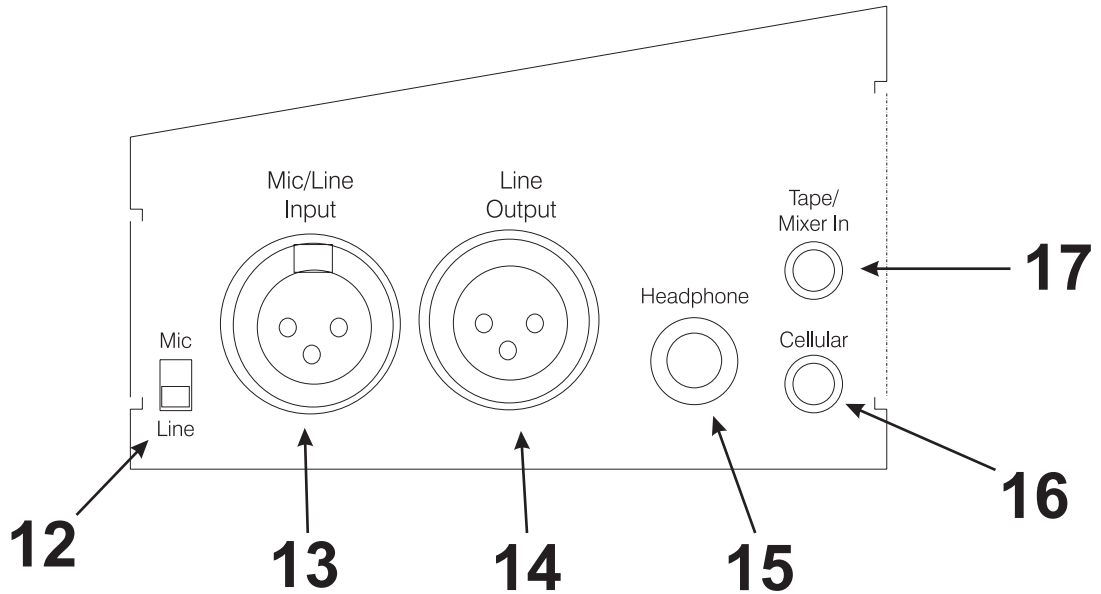


- | | |
|---|--|
| 1) BACKLIT LCD | 7) READY INDICATOR |
| 2) AUDIO REAR PANEL (SEE PAGE 12 FOR DETAILED VIEW) | 8) RING/CARRIER DETECT INDICATOR |
| 3) INPUT LEVEL CONTROL | 9) DIALING KEYPAD |
| 4) OUTPUT LEVEL CONTROL | 10) FUNCTION KEYPAD |
| 5) OUTPUT MIX ADJUSTMENT | 11) POWER REAR PANEL (SEE PAGE 13 FOR DETAILED VIEW) |
| 6) BI-COLOR PEAK INDICATOR | |

DESCRIPTION OF TOP SURFACE

- 1) *BACKLIT LCD* Displays all status and menu options.
- 2) *AUDIO REAR PANEL* Audio connectors are located on the rear panel. (See page 12 for details.)
- 3) *INPUT LEVEL CONTROL* This knob controls the input audio level. Adjust the level using this knob, making sure that the bi-color peak indicator light stays green, with only occasional red showing for program peaks.
- 4) *OUTPUT LEVEL CONTROL* This knob controls the audio present in the headphones and Line Out jack. Adjust this knob until a comfortable listening level is achieved. A ratio of local and return audio levels may be set up using the Output Mix Adjustment. (See #5 below.)
- 5) *OUTPUT MIX ADJUSTMENT* This knob determines the mix/ratio of local versus return audio. Adjust this knob until a comfortable mix of local and return audio is achieved. Turning the knob counterclockwise gives more local audio. Turning the knob clockwise gives more return audio.
- 6) *BI-COLOR PEAK INDICATOR* This LED provides an indication of the audio level being fed into the BlueBox. It doesn't mirror the receive audio in any way. Adjust the input levels so that the green light is illuminated. This LED turns red to indicate when the limiter is engaged on program peaks.
- 7) *READY INDICATOR* This is a signal from the digital audio decoder which signifies it has locked onto the incoming digital audio signal. This will usually light up a few seconds after connection and go out if a retrain is necessary or if the codec "loses sync" for any reason. A contact closure which follows this indication is available on the side panel.
- 8) *RING/CARRIER DETECT INDICATOR* When the BlueBox receives an incoming call, this light will flash to indicate the line is ringing. When the modem inside the BlueBox is connected to another compatible codec, this light will be on steadily.
- 9) *DIALING KEYPAD* Use this keypad to place calls. Numbers may also correspond to menu options (see page 9 for details).
- 10) *FUNCTION KEYPAD* These keys provide "one touch" access for several major functions such as Qdial and hangup. Some of the keys also have secondary functions, noted under the key.
- 11) *POWER REAR PANEL* Power, phone lines and data connections are made on this panel. (See page 13 for details.)

AUDIO REAR PANEL DIAGRAM & DESCRIPTION



12) MIC/LINE SWITCH

This switch determines whether the audio input is configured to receive a microphone level (-70 to -40 dBu) or line level (-10 to +10 dBu) audio input.

13) MIC/LINE INPUT

This 3-pin female XLR connector is designed to accept a balanced, microphone or line level audio feed. This input level is adjustable via the top surface control shown in #3 of the Top Surface diagram. The level is selectable between nominal mic or line level. (See #12 above.)

14) LINE LEVEL OUTPUT

This 3-pin male XLR output provides a configurable mix of codec return and local audio from the BlueBox. Refer to page 15 for configuration instructions. It is a balanced, line level audio feed, adjustable via the *OUTPUT LEVEL* (#4) and *OUTPUT MIX* (#5) knobs on the Top Surface diagram. This output is suitable for connection to a mixer, PA system or additional headphones.

15) HEADPHONE JACK

This is a 3-conductor 1/4 inch headphone jack suitable for most stereo headphones.

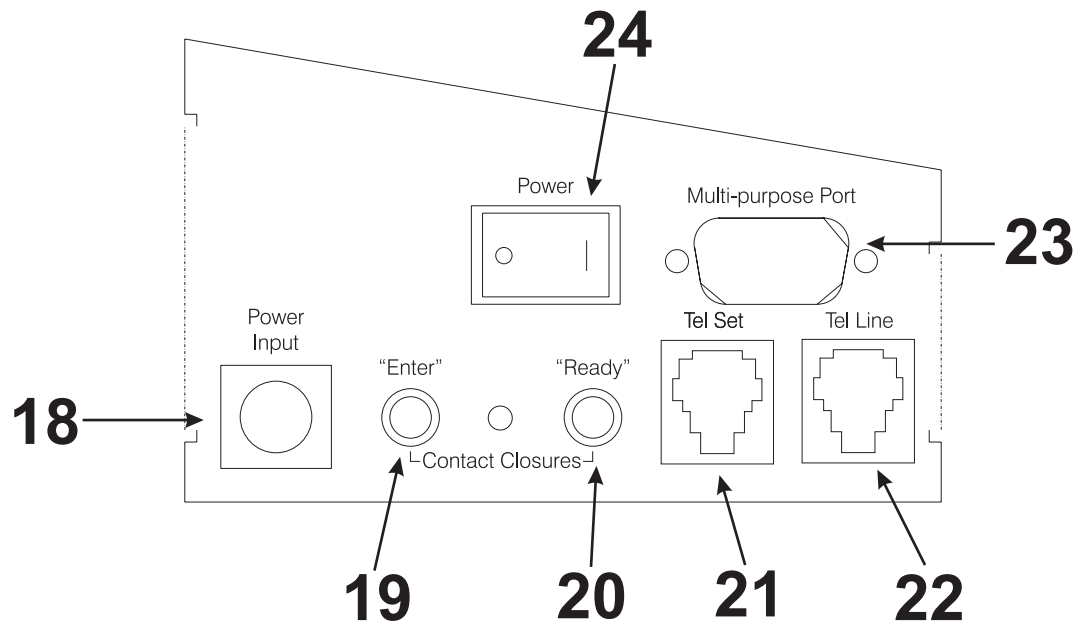
16) CELLULAR HANDS-FREE PORT

This mini-jack provides a connection to the 2.5 mm hands-free port on mobile phones.

17) TAPE/MIXER INPUT

This 1/8 inch mini tape input is designed to accept an unbalanced, -10 dBu fixed audio feed, allowing for easy connection to a minidisc or DAT player.

POWER REAR PANEL DIAGRAM & DESCRIPTION

**18) POWER INPUT**

This is a 5-conductor mini DIN type connector designed to mate with the BlueBox power supply module. Be sure to attach only the power supply provided from Comrex here.

19) ENTER CONTACT CLOSURE

This mini jack provides a momentary dry contact closure which triggers closed when the BlueBox is on-line and the far end sends the "Enter" command via the keypad.

20) READY CONTACT CLOSURE

This mini-jack provides a latching dry contact closure when the digital audio decoder achieves synchronization with an incoming digital audio signal. This contact is closed when the blue *READY* light below the LCD display is illuminated and is released when the *READY* light goes out.

21) TEL SET JACK

This RJ11 jack is for attaching an external telephone to the BlueBox. This can be useful for dialing complicated numbers with lots of pauses and special codes. It can also serve to provide an audible "ring" when an incoming call is received.

22) TEL LINE JACK

This RJ11 jack is for attaching the telephone line from the outside world to the BlueBox. Be careful what you plug into here. Some PABXs provide current which can damage the BlueBox.

23) MULTI-PURPOSE PORT

Female DB-9 connector through which flash upgrades can be performed.

24) POWER ON/OFF

0 = off, 1 = on. These markings are screened on the rocker switch.

SECTION 4. SETTING UP THE BLUEBOX

POWER CONNECTIONS

Attach the external power supply to the connector on the side panel marked “power.” Attach the provided A/C power cord to the power supply, and connect to virtually any A/C power in the world (100 to 240 VAC 50/60 Hz). Turn the BlueBox on using the side panel power switch (0 = off and 1 = on). The BlueBox display should light up. You will then see the introductory screen, followed shortly by the *MAIN STATUS DISPLAY*. See “Power Up Sequence” on page 17.

TELEPHONE CONNECTIONS

Attach the supplied telephone (RJ11) cable to the jack on the rear/side panel of the BlueBox labeled *TEL LINE*. Connect the other end of the telephone cable to the telephone jack provided by the phone company. Note: If you plan to use a PABX connection, you may damage the BlueBox by plugging it into the jack. If you’re unsure about this, better to try a cheap telephone first before plugging in the BlueBox. You can also use a small device called a “modem saver” to test the line. These are available through computer supply outlets and catalogs for testing phone lines before plugging in laptop computers. Usually, any jack which will support a fax machine or computer modem can be used with the BlueBox, although use on PABXs often results in less than optimal performance. Under rare circumstances, you may wish to connect a telephone to the jack on the BlueBox labeled *TEL SET*. This will allow you to hear the telephone line ring when an incoming call comes — or just to use the phone line for other purposes when not on-air. Also, an external telephone may be used to dial the BlueBox (useful for very long, complex dialing strings with lots of digits and prompts). But usually you’ll leave this jack unconnected.

AUDIO CONNECTIONS

Mic/Line Input — This 3-pin female XLR input can be switched between microphone or line level. To get started, select whether you will be feeding mic or line level. If you are connecting a microphone, the switch to the left of the input connector must be up. Otherwise, set the switch down and feed a balanced line level into the connector. If your source is unbalanced, read the section on page 16 “About Unbalanced Connections.” Now feed some typical audio, and adjust the level using the *INPUT LEVEL CONTROL* on the front panel. Watch the level indicator for appropriate deflection. The level indicator is a bi-color LED. When a sufficient level of audio is fed to the unit, the LED will be green. The level indicator will turn red to indicate peaks. Adjust the input level so that the LED flashes red only occasionally. If you cannot get the LED to flash green, or if it is steadily on red, check to see that the Mic/Line switch is set correctly.

If you cannot achieve a good input level, make sure that you are feeding the correct level. If that doesn't work, you will need to try a different microphone or cable. These inputs do not support microphones which require phantom power.

Headphone Output — You use stereo headphones with the BlueBox. Plug the headphones into the headphone jack. Feed some audio into the input. Adjust the *OUTPUT LEVEL* knob for a comfortable listening level. The output mix may be adjusted to hear more local audio (audio fed to inputs) or return audio (audio fed from other end). Please refer to “Adjusting the Output Mix” on page 16 for details.

XLR Line Level Output — This output can feed ancillary equipment such as an external mixer, PA system, extra headphones or recording device (DAT or tape recorder). There are four options for controlling the audio sent to the *LINE OUT* jack, and they are selectable from the *LINE OUT* option on the menu. To configure the *LINE OUT* settings:

- A. Press *ENTER* in the *MAIN STATUS DISPLAY*.
- B. Select “4” for *CONFIGURE*.
- C. Now press “4” for *MORE*.
- D. Select “4” for *LINE OUT*.
- E.

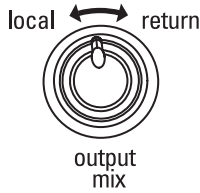
1) Variable — This is the default option. The *OUTPUT LEVEL* and *OUTPUT MIX* controls set the levels for both the headphone jack and the *LINE OUT* jack, as described above. Any adjustment that affects the headphones will also affect the *LINE OUT*. Please refer to “Adjusting the Output Mix” on page 16 for details.

2) Fixed — The mix of audio sent to the *LINE OUT* jack is fixed at 50% local, 50% return. The audio level is fixed at a nominal 0 dBu (depends on the input audio levels on both codecs). This option might be desirable if you connect the *LINE OUT* jack to a recorder or PA amplifier and don't want the level to change with headphone adjustments.

3) Local — Only local audio is sent to the *LINE OUT* jack at a fixed 0 dBu level. You can select this if you would like the headphones to operate normally, but have only local audio fed to a device like a recorder or PA system.

4) Return — Only return audio is sent to the *LINE OUT* jack, again at a fixed 0 dBu level. In this case, the headphones operate normally, but equipment connected to the *LINE OUT* jack will only get return, not local audio.

ADJUSTING THE OUTPUT MIX



The BlueBox outputs (XLR output and headphone output) feed the user a mix of two different audio sources. The *LOCAL* portion contains all the microphones or other sources connected to the BlueBox inputs. The *RETURN* portion contains all the audio sent from the other end of the link. The BlueBox mixes the two sources and feeds the *LINE OUTPUT* XLR and the headphones (both left and right) with the same mix. The ratio of local and return audio may be adjusted using the *OUTPUT MIX* knob. Turning the knob counterclockwise gives more local audio. Turning the knob clockwise gives more return audio. Adjust this knob until the desired mix of local and return audio is achieved.

Note: The above instructions refer to the “Variable” option for the Line Out jack, which is the default setting. Other configurable options for controlling the audio output mix are described on page 15.

ABOUT UNBALANCED CONNECTIONS

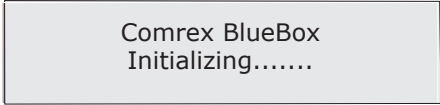
It is best when using professional audio gear to use balanced audio connections. Sometimes, however, it is unavoidable to connect to consumer equipment with unbalanced connections. If you must use unbalanced audio, here’s how to connect to the BlueBox:

BlueBox input — When driving the BlueBox from an unbalanced source, connect pins 1 and 3 together on the BlueBox input XLR. This should connect to the ground signal on your unbalanced device. Connect pin 2 on the BlueBox XLR to the unbalanced device’s audio + connection.

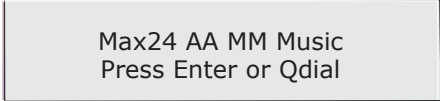
BlueBox output — The BlueBox uses active balanced outputs designed to drive unbalanced sources directly. This means there won’t be any level difference when feeding an unbalanced source. On the BlueBox output XLR, connect pins 1 and 3 together, and tie this to ground on your unbalanced device. Connect pin 2 on the BlueBox XLR to + audio side on the unbalanced device.

SECTION 5.**CONFIGURING THE BLUEBOX***POWER UP SEQUENCE*

When the BlueBox is connected to power and turned on, the initializing menu appears for approximately two seconds. The BlueBox then shows the *MAIN STATUS DISPLAY*. The main setup options are displayed in the top portion of the screen. As shipped from the factory, the BlueBox *MAIN STATUS DISPLAY* will be the same as the screen shown below. Again, these selections will remain in nonvolatile memory until changed.

INITIALIZING SCREENA rectangular box representing a screen display. The text inside is centered and reads: "Comrex BlueBox" on the first line and "Initializing....." on the second line.

Comrex BlueBox
Initializing.....

MAIN STATUS DISPLAYA rectangular box representing a screen display. The text inside is centered and reads: "Max24 AA MM Music" on the first line and "Press Enter or Qdial" on the second line.

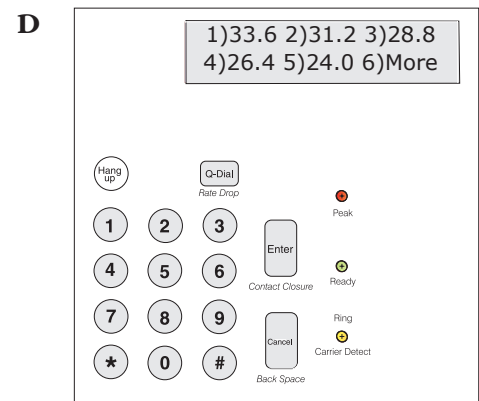
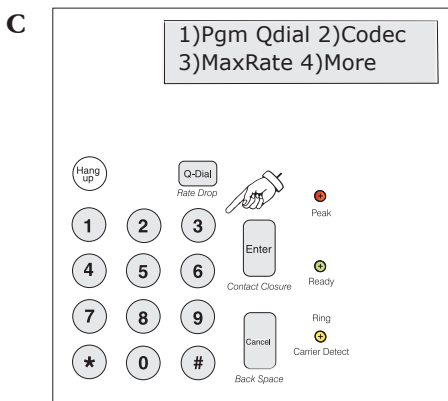
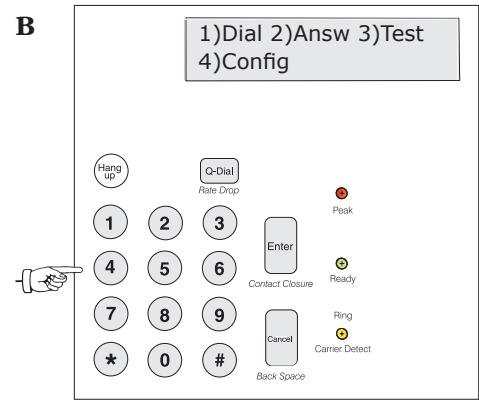
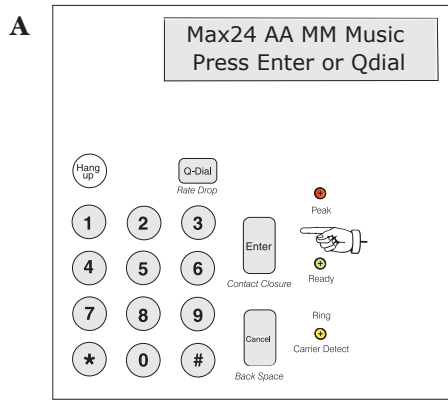
Max24 AA MM Music
Press Enter or Qdial

SETTING THE MAXRATE

The MaxRate option allows you to limit the maximum modem connect rate. The MaxRate factory default setting of a new BlueBox is 24 kb/s. If the BlueBox is allowed to negotiate on an unrestricted basis, it will find the highest possible connect rate. Since telephone line connections can vary over time due to crosstalk, burst errors and other changing parameters, the initial connect rate may not be sustainable. It may help to set a MaxRate at a level or two below the maximum unrestricted rate to provide a “guard band” of sorts against the noise and corruption which may cause errors on the line. The BlueBox (or Vector or HotLine or Matrix) with the lowest MaxRate setting will determine the maximum connect rate.

To set the MaxRate:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Then press “4” for *CONFIGURE*.
- C. Then “3” for *MAXRATE*.
- D. Using the keypad, press the number which corresponds to the MaxRate setting you want.



PROGRAMMING QDIAL

Up to 19 numbers may be pre-programmed into the BlueBox and then recalled by pressing the *QDIAL* button while in the *MAIN STATUS DISPLAY*. Pressing *QDIAL 00* will redial the last number dialed. These numbers will remain in memory even when power is turned off. The number programmed into the *QDIAL 01* location may be used in the STL Backup Mode. (See page 27 for more information on STL Backup Mode.)

To program a Qdial number into memory:

- A. Press *ENTER* in the *MAIN STATUS DISPLAY*.
- B. Then press “4” for *CONFIGURE*.
- C. Then “1” for *PGM QDIAL* (Program Quick Dial).
- D. The screen will display “Enter Qdial #:01-19.” Enter a number from 01 to 19 to correspond to the Qdial position you wish to use.
- E. Then key in the number to dial, including any country, area or other codes you wish (up to 44 digits). To insert a two second pause, press the *QDIAL* key. A comma will appear to indicate the pause. Multiple pauses may be inserted. The *CANCEL* key backspaces for corrections.
- F. When the number is entered correctly, press the *ENTER* key. Pressing the *HANGUP* key will exit this menu without saving your entry.

MODEM MONITOR

You may choose to hear the modems negotiate through the audio port. This option is found in the *CONFIGURE MENU*. The factory default is for the Modem Monitor to be “on,” allowing you to hear the modem “chat” familiar to computer users. This includes dial tone, pulse or tone digits, ringing and all those funny “blurps” that happen at the beginning of a modem connection. Under some circumstances, you may not wish to hear these things. If, for example, the BlueBox in the studio were “on-air” all the time, the listeners would hear these sounds.

To select a modem monitor option:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Then select “4” for *CONFIGURE*.
- C. Now select “4” for *MORE*.
- D. Next press “3” for *MODMON* (Modem Monitor).
- E. Choose “1” for *MODEM MONITOR ON* or “2” for *MODEM MONITOR OFF*.

*AUTO ANSWER***To choose how/if you want the BlueBox to answer incoming calls:**

- A. Press *ENTER* in the *MAIN STATUS DISPLAY*.
- B. Then select “4” for *CONFIGURE*.
- C. Now select “4” for *MORE*.
- D. Next press “1” for *AUTO ANS* (Auto Answer).
- E. Choose “1” for *ON*, “2” for *OFF* OR “3” for *6 RINGS* (The BlueBox will answer after 6 rings.)

TONE/PULSE DIALING

To select tone or pulse dialing:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Then select “4” for *CONFIGURE*.
- C. Now select “4” for *MORE*.
- D. Next press “2” for *DIALING*.
- E. Choose “1” for *TONE DIALING* or “2” for *PULSE DIALING*.

The BlueBox will remember your selection until you change it, even when powered down. The BlueBox factory default setting is for *TONE* dialing.

AUDIO CODING SELECTION

Music Mode — This mode, optimized to give the widest frequency response possible, is the factory default setting. Your BlueBox will automatically operate in this mode unless it calls or is called by a BlueBox, Matrix or Vector set to a less demanding mode or by a HotLine. If connecting to a HotLine, the BlueBox will automatically switch to HotLine Mode. If connecting to a BlueBox, Matrix or Vector set to Voice Mode, the BlueBox will automatically default to the more conservative Voice Mode. If you are having difficulty connecting in Music Mode, double check that both codecs are set to Music Mode.

Voice Mode — Under normal operation, the BlueBox is designed to provide maximum bandwidth based on the connect rate. Some users, however, may prefer to forego very high bandwidth in favor of a more reliable connection as well as to provide an ancillary data channel. Voice Mode locks the highest bandwidth at 7 kHz, and any leftover data rate is used to provide extra error correction, along with a 300 BAUD ancillary data channel. Voice Mode will (within limits) provide for a more reliable audio link. For more on the ancillary data connection, see page 26. If one BlueBox (or Matrix or Vector) is set to Voice Mode and the other is not, the connection will default to Voice Mode in both directions.

GSM Mode — This mode allows for 7 kHz audio transmission over a 9600 baud GSM connection. This mode is only applicable when you are using the BlueBox on a POTS line as the receiving end of a GSM call. The receiving BlueBox cannot automatically adapt between GSM and normal POTS codec, therefore GSM Mode must be enabled for proper GSM operation.

To set the BlueBox for Music, Voice or GSM Mode:

- A. Press the *ENTER* key from the *MAIN STATUS DISPLAY*.
- B. Then select “4” for *CONFIGURE*.
- C. Now select “2” for *CODEC*.
- D. Choose “1” for *VOICE MODE*, “2” for *MUSIC MODE* or “3” for *GSM (POTS SIDE)*.

After a selection is made, the screen will display *ALGORITHM SELECTED*. The BlueBox will remain in this mode until you change it. You can now *CANCEL* back to the *MAIN STATUS DISPLAY*.

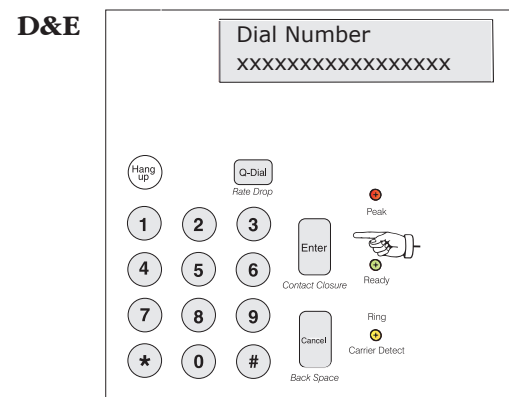
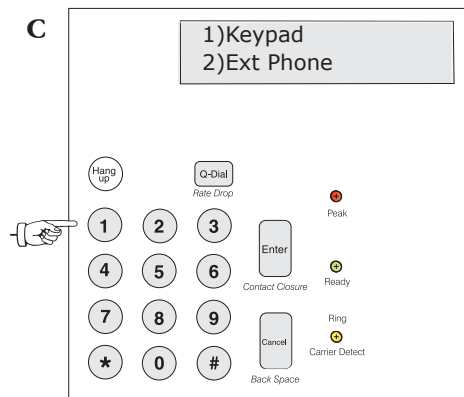
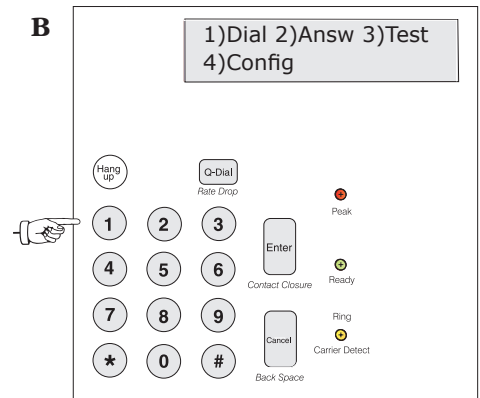
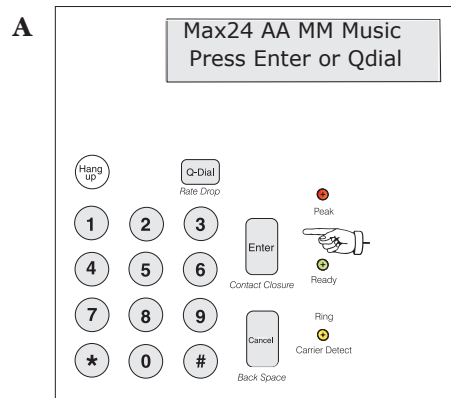
SECTION 6. PLACING A CALL FROM THE BLUEBOX

DIALING FROM THE KEYPAD

So now it's time to use your BlueBox. We will assume that all the proper connections have been made, and you're ready to place a call. There are several ways to dial from the BlueBox. The most common method is to dial from the built-in keypad.

To place a call from the keypad:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Then press "1" for *DIAL*.
- C. Then press "1" for *KEYPAD*.
- D. Now key in the number you wish to dial. The *CANCEL* key will back space, and the *HANGUP* key will take you back to the *MAIN STATUS DISPLAY*. To insert pauses and disable call waiting, see page 22.
- E. Then press *ENTER* to dial the number. (Pressing the *HANGUP* key disconnects the call.)

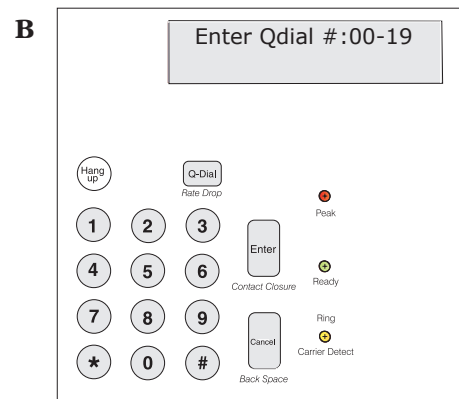
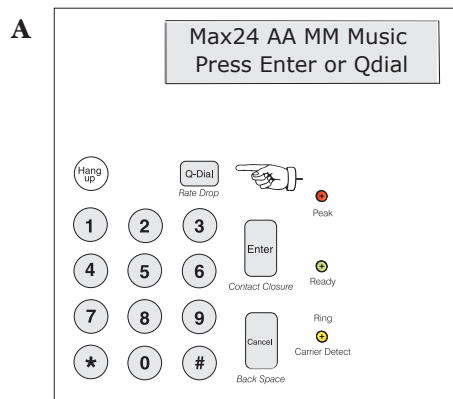


If you wish to use the Comrex BlueBox test line number, call 978-784-1700. You may enter up to 44 digits in a dialing string. A two second pause may be entered anywhere and used multiple times in the dialing sequence by pushing the *QDIAL* softkey. This will insert a comma to indicate the position of the pause. This pause may be needed to dial through certain PABXs or to place credit card calls. Also, you may wish to enter other characters, such as “*70” which is typically used at the beginning of a number to disable call waiting. To dial the number, press *ENTER* after you have keyed in the digits. Note: The phone line doesn’t go “off hook” until the *ENTER* key is pressed (much like a fax machine). The far end unit will either auto answer or will need to be answered manually, depending on its setup. Once the far end has answered, the BlueBoxes will negotiate and a “connect” message will be displayed on both units, including the rate at which the connection was accomplished. Within a second or two, the *READY* light on each BlueBox should illuminate. At this point, you will have wideband audio (response dependent on connect rate and selected mode) in both directions.

DIALING WITH QDIAL

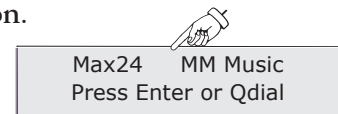
To dial a pre-programmed Qdial number:

- A. Press *QDIAL*.
- B. Then press the two-digit location (01-19) where the number is stored. Pressing *QDIAL 00* will redial the last number dialed. (See page 19 for instructions on programming numbers into Qdial.) All Qdial numbers, including last number redial are stored in non-volatile memory.



*ANSWERING A CALL
MANUALLY*

First, look on the *MAIN STATUS DISPLAY* to make sure auto answer is off. If AA is seen on the display, your auto answer is on.



If you need to reset this, follow the instructions on page 19. You can connect a telephone set to the *TEL SET* jack on the rear panel to hear the line ring. Otherwise, you will need to wait for the yellow *RING/CARRIER DETECT* light on the BlueBox to begin flashing to indicate an incoming call. To answer a call when the line is ringing:

- A. Press the *ENTER* key.
- B. Then press "2" for *ANSW* (Answer Call).

The BlueBox will answer the incoming call and negotiate a connect speed. The call can be disconnected by pressing the *HANGUP* key.

*DIALING FROM AN EXTERNAL
PHONE*

In complex dialing situations, such as when an operator may be involved or when the dialing string is longer than 44 digits, you can dial the BlueBox using an external telephone set. Connect an external single line telephone set to the modular jack on the rear panel of the BlueBox labeled *TEL SET*.

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Then press "1" for *DIAL*.
- C. Then "2" for *EXT PHONE* (External Phone).
- D. Pick up the external telephone handset and listen for a dial tone. Dial the number, and press *ENTER* at the first ring and hangup the telephone handset.

When you press *ENTER*, this engages the modem. You need to hangup the external telephone handset immediately after pressing *ENTER* because the modem negotiation process is most reliably done without an external handset off-hook across the line. Note: When the external telephone option is used, the number you are dialing does not appear on the display. You can disconnect the call normally on either end of the line by pressing the *HANGUP* key.

LAST NUMBER REDIAL

The last number dialed is automatically stored in the *QDIAL 00* location. To redial the last number:

- A. Press the *QDIAL* key from the *MAIN STATUS DISPLAY*.
- B. Press the "0" key two times.

The last number you dialed from the BlueBox will be re-dialed. This number will remain in memory after the BlueBox is powered down. Numbers dialed through an external phone will not be kept in memory.

HANGING UP THE CALL

When you wish to disconnect your call, simply press the *HANGUP* key. After several seconds, the call will be cleared and the *MAIN STATUS DISPLAY* will return. If the other end initiates the disconnect, your unit will also disconnect and revert to the *MAIN STATUS DISPLAY*. Note: It can take about five seconds between the time you terminate the call to the time the BlueBox releases the line for the next call.

DROPPING THE CONNECT RATE DURING A CALL

If a telephone line degrades during a broadcast, it is possible to lower the connect rate on the line without disconnecting the call. The lower connect rate will help to provide a “guard band” against the errors on the line. During the renegotiation period, the audio will be muted for about 2.5 seconds. To lower the connect rate, simply press the *QDIAL* key.

By pressing the *QDIAL* key while on-line, you’re instructing the BlueBox to drop one rate lower than that at which you’re actually connected. This rate is now “locked” as the *MAXRATE* for this call (e.g. if the BlueBox suffers a renegotiation, it won’t choose a connect rate above the one to which you’ve dropped).

Another BlueBox feature is the ability to do a full retrain at will. This is accomplished by pressing the *QDIAL* key twice rather than once (like a “double mouse click”). This will cause the BlueBox to do a full negotiation (as it does at the beginning of the call) on the connection. We highly recommend the use of this feature on prolonged broadcasts (longer than one hour) to “reset” all the parameters of the modem to the changing parameters of the phone line. It’s much more desirable to force the BlueBox to retrain during your program break than to have it trigger its own retrain during your program due to changing phone line conditions. Audio in both directions will be muted for about 10 seconds during the retrain sequence.

On occasion, phone line parameters are such that the modems can’t support the change to a lower rate. This is because, along with changing the data rate, the modem may be required to change filters, symbol rates and other parameters that you don’t see. If the line won’t support the parameters, you may see the unit break into renegotiation, retrain or (on rare occasion) disconnect the call. The fix here is to set the *MAXRATE* setting to the rate at which you need to work and redial the call.

SECTION 7.

CELLULAR HANDS-FREE OPERATION

The BlueBox provides the ability to connect to the hands-free port on many mobile phones. This mode does not enhance the audio quality of the wireless phone call, but can provide a useful way to get microphone and headphone audio to and from the phone for backup purposes.

CONNECTIONS FOR HANDS-FREE CELLPHONE PORTS

To use the *CELLULAR HANDS-FREE* port, you will need a cable with a 1/8" 3-conductor plug on one end, and a 2.5 mm 3-conductor plug on the other (this cable is available from Comrex). The cable is wired "straight through" as follows:

<u>1/8" Plug</u>	<u>2.5mm Plug</u>
Tip	Tip
Ring	Ring
Sleeve	Sleeve

The 2.5 mm plug connects directly with the hands-free port on many Motorola phones. If you have a phone made by a different manufacturer, you will need to perform a modification to the cable and/or purchase an adapter. Please visit our website at www.comrex.com for the engineering note detailing the necessary modifications. CellularAccessory.com provides hands-free audio adapters for a wide range of cellphones that convert a universal 2.5 mm jack to the required cellphone audio connections. The Web address is: www.cellularaccessory.com/audioadapter.html, and the phone number is 1-800-2-BUY-PCS.

OPERATION

CELLULAR HANDS-FREE mode does not require any menu or configuration changes. Simply leave the BlueBox in the *MAIN STATUS DISPLAY* (see below).

Max24 AA MM Music
Press Enter or Qdial

You will place the call using your cellular phone's keypad. When the call is connected, microphone audio from the BlueBox is routed to the cellphone, and return audio from the cellphone is routed to the headphone and line output. When you wish to disconnect your call, hang up the call from the cellular handset.

SECTION 8.**ADDITIONAL FUNCTIONS***TEST*

The *TEST* function allows the user to test the encoder and decoder portion of the BlueBox and to check out audio levels by “looping” the input audio back through to the output. It also gives the user the ability to listen to audio at various data rates. If you are not familiar with the audio connections on the BlueBox, read more about these on pages 14-16 of this manual.

To initiate the *TEST* function, first feed audio into the BlueBox at a typical level, and adjust the *INPUT* control until the BlueBox Level Indicator reads correctly (see pages 14-15). Connect the BlueBox output to your monitoring facility. Turn the *OUTPUT MIX* knob all the way to the right (clockwise) so that no local (input) audio is heard.

To enable the TEST function:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.
- B. Next press “3” for *TEST*.
- C. Select the coding type you wish to use: “1” for Voice, “2” for Music, “3” for HotLine or “4” for GSM.
- D. Select a data rate by pressing the corresponding number on the keypad.
- E. When the *READY* LED comes on, the *OUTPUT* level control until you have a comfortable level in your headphone and/or monitor.
- F. To exit *TEST*, press the *CANCEL* key.

ANCILLARY DATA

The BlueBox provides a 300 bps asynchronous data channel when connected in Voice Mode at a data rate of 16.8 kb/s and above. 300 bps was chosen as the ancillary data rate because it allows us to steal only one byte from each audio frame, having little impact on audio quality. This speed is perfectly adequate for sending and receiving text characters but will prove quite lacking in applications requiring graphics or any other “high-overhead” data transmissions. If your applications require higher data throughput, it may be best to use another telephone connection with a normal modem.

Ancillary data is provided on the BlueBox through the 9-pin “D” connector on the rear panel labeled *MULTI-PURPOSE PORT*. Pinouts for the *MULTI-PURPOSE PORT* are shown in the “Specifications” section on page 47 of this manual and should mate correctly with a 9-pin PC style serial port. Use a “straight through” data cable. A “null modem” cable will not work. More information on setting up an ancillary data connection is outlined in the “About Ancillary Data” on page 43 and “Troubleshooting the Ancillary Data Channel” on page 45.

CONTACT CLOSURES

Two contact closures are available on the BlueBox:

The latching contact closure labeled *READY*, available through the 1/8" mini jack on the rear panel of the BlueBox, will remain closed as long as the blue *READY* light is illuminated on the front panel .. i.e. as long as the call is connected.

There is also a momentary "dry closure" available through the 1/8" mini jack on the rear panel of the BlueBox, marked "Enter." To activate this closure, press the *ENTER* key when two BlueBoxes are on line.

While this key is pressed, two things will occur:

- 1) A contact closure will be made silently across the *ENTER* terminal on the remote end.
- 2) An asterisk will be present on the LCD of the unit on the other end.

Use this feature if you wish to provide an indication to the other BlueBox user at any time during the audio transfer or to activate a device remotely through the far end BlueBox. The contact closures will have no effect on audio quality.

BLUEBOX CONTROL AND DATA SIGNALS

The BlueBox provides contact closures which can be used to trigger automated equipment on the far end of the audio link. This type of signal can be useful to the user but has its limitations. Because of the uncertain nature of telephone lines, it is possible that the contact closures can be corrupted if errors are present on the telephone line. If your requirements are for control over on-air automation systems, this can cause problems. We would recommend under these circumstances that you use a different phone line and attach a normal computer modem, which will provide higher speed as well as a higher probability of an error free link. Another approach would be to use external logic circuitry that requires the closure to present for at least 1 second - something that random errors would be unlikely to create.

STL BACKUP MODE

The BlueBox has a special feature that allows the unit to automatically initiate and maintain a POTS codec call. When engaged, the BlueBox will dial the number stored in *QDIAL 01*, and redial the call should the line drop for any reason. A jumper must be moved on the BlueBox main board and a contact closure must be connected to the *MULTI-PURPOSE* port to utilize STL Backup mode.

Please contact Comrex technical support for additional information or visit our website at www.comrex.com for the engineering note detailing the necessary modifications.

SECTION 9.

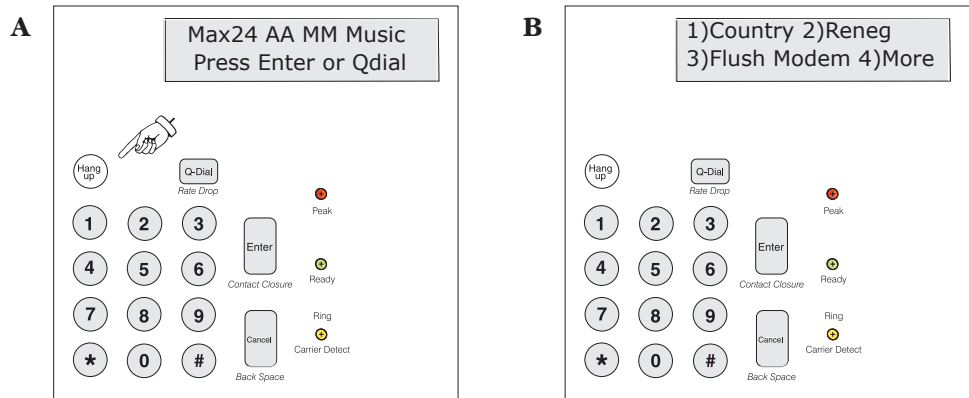
HIDDEN MENU

The BlueBox has several reliability enhancing features built-in. Some of these, such as “Rate Drop,” “Retrain” and “MaxRate,” are designed right into the main configuration and operation menus. Some others are hidden within the “Hidden Menu” to prevent access by casual users. This is because these configurations (in some situations) may cause as many problems as they prevent. But they are included because, in our experience, having access to these modes has saved an occasional remote broadcast.

The important thing to remember about these modes is that once they are selected, they will stay that way until they are reset via the *HIDDEN MENU*, or when a “Modem Flush” is performed. If you ever suspect that the BlueBox has had one of these special modes enabled, it may be valuable to issue a “Modem Flush” to clear out any unwanted configuration information. (See pages 30-31 for details.)

To Access the Hidden Menu:

- A. From the *MAIN STATUS DISPLAY*, press the *HANGUP* key 3 times.
- B. The *HIDDEN MENU* choices appear on the screen.



REVISION INFORMATION

To show the current software version contained in the BlueBox:

- A. Enter the *HIDDEN MENU* (press the *HANGUP* key 3 times).
- B. Select “4” for *More*.
- C. Select “2” for *REVISION*, and the current software version will show on the screen for approximately 4 seconds.

MODEM COUNTRY CODES

00.....	<i>NORTH AMERICA</i>
01.....	<i>AUSTRIA</i>
02.....	<i>BELGIUM</i>
03.....	<i>DENMARK</i>
04.....	<i>FINLAND</i>
05.....	<i>FRANCE</i>
06.....	<i>GERMANY</i>
07.....	<i>IRELAND</i>
08.....	<i>ITALY</i>
09.....	<i>SINGAPORE</i>
10.....	<i>NETHERLANDS</i>
11.....	<i>NORWAY</i>
12.....	<i>PORTUGAL</i>
13.....	<i>SPAIN</i>
14.....	<i>SWEDEN</i>
15.....	<i>SWITZERLAND</i>
16.....	<i>UK</i>
17.....	<i>GREECE</i>
18.....	<i>AUSTRALIA</i>
19.....	<i>JAPAN</i>
20.....	<i>CTR21</i>

RENEGOTIATION & RETRAIN OPTIONS

The BlueBox's modem can be user configured for operation in twenty different countries. Once configured, the BlueBox will remain in this setting until the country parameter is changed. Country configuration is confirmed after selecting *COUNTRY* from the *HIDDEN MENU*, where the BlueBox's display will show the current configuration (*CONFIGURED FOR NORTH AMERICA*, etc.). Country configurations change dialing parameters, such as DTMF level and pulse and ring cadence, as well as call progress tone detection, including dial and busy tones. The factory default setting is for North America.

To change the country configuration:

- A. Enter the *HIDDEN MENU* (press the *HANGUP* key 3 times).
- B. Select "1" for *COUNTRY*. Current country configuration will appear momentarily.
- C. Enter the appropriate two digit number from the chart on the left. The BlueBox will go through an initializing process and confirm the country selection on the display screen before returning to the *MAIN STATUS DISPLAY*.

Note: The country parameter only needs to be changed when dialing from a country, not to it. Some experimentation may yield a listed code which works well in countries not listed here. Also, dialing from an external phone is a good method to avoid issues with international phone systems altogether.

In most cases, these options will only be used at the field end. We have found some locations (sports venues in particular) are quite unkind to modem data. Often, EMI will affect the venue phone lines, and cause POTS codecs to renegotiate or retrain at particularly inconvenient times. Renegotiation and retrain are two tools the BlueBox uses to evaluate telephone line conditions. When the BlueBox renegotiates, it's quickly determining whether a lower data rate is necessary due to short burst of noise or errors on the phone line. Retrain is a "full negotiation sequence" of the connection, resetting and adapting the phone line parameters of the modem to the changing conditions on the phone line. There are three options for controlling the renegotiation and retrain functions:

- 1) *RENEG/RETRAIN ON* — This is the factory default option, allowing for the BlueBox to monitor the telephone line quality and renegotiate or retrain should the telephone line degrade. To minimize the number of errors during an audio feed, the user can set a *MAXRATE* and/or force a *RATE DROP* (For more on *RENEG/RETRAIN*, *MAXRATE* and *RATE DROP* see page 24 & 35-36).

RENEGOTIATION & RETRAIN
(CONT.)

2) *RETRAIN ON* — By selecting this option, you’re instructing the BlueBox to “reset” all the phone line modem parameters automatically when it senses lots of errors on the telephone line. Again, please refer to page 24 & 35-36 for further details.

3) *NONE* — This option instructs the BlueBox not to renegotiate or retrain automatically when errors occur on the telephone line. The result will be that the return audio coming back from the studio may become unusable, but in one-way program transmission applications it doesn’t make sense to renegotiate or retrain on errors in the direction you’re not using. Note that if errors are prolonged and substantial, the BlueBox will probably drop the line eventually due to insufficient carrier between the modems. But we have found, particularly in sports venues, that short bursts of telephone line noise are present when the game gets exciting, due to PA, lights and scoreboard changes. In this circumstance, the “Disable Renegotiations & Retrains” setting may improve things. This setting is particularly dangerous to leave engaged for the poor sucker on the next remote. For this reason you will see an asterisk (*) after the codec mode on the *MAIN STATUS DISPLAY*, if it is engaged.

To Select Renegotiation and Retrain Options:

- A. Enter the *HIDDEN MENU* (press the *HANGUP* key 3 times).
- B. Select “2” for *RENEG* (Renegotiation Menu).
- C. Enter “1” for *RENEG/RETRAIN ON* or “2” for *RETRAIN ON* or “3” for *NONE*.

FLUSH MODEM

Flushing the modem resets the BlueBox to factory default mode. It clears out the BlueBox NV Ram, which deletes all configuration settings, including *MAXRATE* and *QDIAL* entries. It’s like getting the BlueBox new out of the box. To flush your modem, access the *HIDDEN MENU* by pressing the *HANGUP* key three times. Then select *FLUSH MODEM*, and press *ENTER* to confirm your selection. After a few seconds, you will see the normal menu screen. **The BlueBox must be powered off for a few seconds after the modem flush.** When you turn it back on, the BlueBox will be “factory fresh.”

***Note: After a modem flush, it is important to re-enter your country modem code via the hidden menu (see “Modem Country Codes” on page 29). This is because the modem maintains the old country settings during a modem flush, but the NV Ram in the BlueBox has been wiped out, which contains the info as to what country to display at power up. So to synchronize the two, re-enter your country information after the modem flush.*

*FLUSH MODEM (CONT)***To Reset the Modem:**

- A. Enter the *HIDDEN MENU* (press the *HANGUP* key 3 times).
- B. Select “3” for *FLUSH MODEM*.
- C. The screen will say “Erase All Settings? Enter = Continue.”
- D. Press *ENTER* to flush the modem. The screen will look like the one below for a few seconds and then return to the previous menu.

Erase All Settings?
Initializing

STL BACKUP

Please refer to “STL Backup Mode” on page 27 for more information.

DIAL TONE

Usually, it is advantageous to have the BlueBox wait to sense dial tone on the line before initiating a call. This means if your line is unplugged or out of service, you’ll know pretty quickly. Also, some phone lines have delayed dial tone and won’t accept dialing digits until a few seconds after the line is picked up. But you may find yourself on a phone line that delivers dial tone that isn’t sensed by the BlueBox. This may happen in countries that aren’t provided for in the BlueBox country code options or when used in conjunction with some PBXs (yes, we know, we told you not to use them). So make this setting change if you encounter these lines, but be sure to change it back before moving the BlueBox to another location.

To Require or Ignore Dial Tone:

- A. Enter the *HIDDEN MENU* as described at the beginning of this section.
- B. Select “4” for *MORE*.
- C. Select “5” for *DT* (Dial Tone).
- D. Select either “1” to *REQUIRE DIAL TONE* or “2” to *IGNORE DIAL TONE*.

GSM14

This option is for use outside of North America. Certain European Networks support 14.4 kb/s GSM data transmission. Both codecs must have this option enabled for proper operation.

GSMEXT

This option provides the ability for the BlueBox to operate with external GSM phones. For further details, please refer to “GSM Wireless Operation” in Appendix D on page 59.

SYMBOL RATE

The telephone line interface in the BlueBox is via a V.34 (33.6 kb/s) modem. V.34 is a very complex modem specification but in a nutshell, provides for negotiation, equalization and rate selection between compatible equipment. One of the parameters chosen during the negotiation phase is one of five possible carrier "symbol rates." Note that this choice is related to, but not the same as, the data rate chosen. We have found that on some phone lines, especially when connecting to older POTS codecs like the Vector and Hotline (which use a different but compatible modem), it is helpful to disable the ability to connect at the highest symbol rate (we call this Symbol Rate A). So the BlueBox disables this symbol rate by default. If you are using BlueBox in pairs, and not mixing other Comrex codecs in, you may find higher data rate connections by re-enabling Symbol Rate A via the *HIDDEN MENU*. Another option exists in the menu to disable the two highest symbol rates (A & B). This may help on particularly unusual telephone connections, but should be done on both codecs to connect reliably.

To Disable or Enable Symbol Rates:

- A. Enter the *HIDDEN MENU* (press the *HANGUP* key 3 times).
- B. Select "4" for *More*.
- C. Select "4" for *SRATE* (Symbol Rate).
- D. Select either "1" to *DISABLE A* (the top symbol rate) or "2" to *DISABLE A&B* (The top two symbol rates) or "3" to *ENABLE ALL RATES*.

SECTION 10.**UPGRADING THE BLUEBOX***HOW TO UPGRADE THE
BLUEBOX CONTROL
PROCESSOR*

Upgrades may become available for the BlueBox as new features are added or new software is written. A list of available upgrades can be obtained from Comrex Tech Support or our website at www.comrex.com.

The BlueBox gives the user the ability to update the firmware that drives the main control processor. This procedure, also known as “flashing” the BlueBox, requires that you have access to:

- 1) A PC running a terminal emulation program capable of Xmodem uploading. (Windows 98 Hyperterminal and Procomm 95 have been tested.)
- 2) A 9-pin male to 9-pin female straight through serial cable or a 25-pin female to 9-pin male “modem” cable with the pin-outs on page 47.
- 3) A BlueBox control upgrade file (BlueXXX.bin where XXX is a three digit number). This file can be downloaded from the Comrex website or can also be emailed to you by our tech support staff.

Note: Once the Flash memory in the BlueBox is erased, you won't be able to use the BlueBox until the upgrade procedure is complete. Therefore, don't go past step 6 if you're unsure of either your upgrade file or your terminal software.

To Flash Upgrade the BlueBox:

- 1) Run the emulation program, and set it to communicate directly to the desired serial port (usually com1 or com2).
- 2) Set the serial port parameters as follows:
Baud Rate – 57600 (57.6 Kbaud)
No parity, 8 data bits, 1 Stop bit (n,8,1)
No handshake required (Software handshake MUST be off; hardware handshake shouldn't matter.)
- 3) If your emulation software has an option to preset the file transfer protocol, select Xmodem.
- 4) Connect the serial cable to the BlueBox *MULTI-PURPOSE* port. Connect the other end the to the proper serial port on your computer.
- 5) Turn on the BlueBox. Quickly, while the “Initializing” display is on, press the *HANGUP* key 3 times. The display will then say “Flash Upgrade Mode.”

- 6) In about 5 seconds, the following words should appear on your computer display:

*COMREX BLUEBOX
FLASH UPGRADE MODE
ALL CONTROL SOFTWARE WILL BE DESTROYED
ARE YOU SURE? (Y/N)*

If these words don't appear, try pressing the *ENTER* key on the computer. If you still don't see the text, turn off the BlueBox and recheck all connections and settings. No change has been made to the BlueBox firmware at this point.

- 7) If you are certain you have the correct upgrade file, and you are certain your program supports Xmodem, press the Y key on your computer. You will then see:

ERASING...

And then:

BEGIN XMODEM TRANSFER

- 8) Using your terminal software, send (or upload) the file using the Xmodem protocol. Don't use Xmodem-CRC or Xmodem-1K, simply Xmodem. There's no rush to do this, as the BlueBox will wait until you begin sending the file. Also, there may be a ten second delay before the file transfer actually starts. If there is an error or power failure during this process, simply reboot the BlueBox and enter flash upgrade mode again. Your BlueBox will still be able to enter flash upgrade mode, but it won't work in its regular mode until the upgrade procedure is completed successfully.

When the upgrade has successfully been completed, the following message will be displayed on your computer monitor:

UPGRADE COMPLETE!

On completion, the BlueBox will resume normal operation, showing the *MAIN STATUS DISPLAY*.

SECTION 11. HOW TO ACHIEVE OPTIMUM BLUEBOX PERFORMANCE

For those who have used digital telephone technology (like ISDN), good data performance is taken for granted. This is because the information transmitted is kept in digital form from end to end and is, therefore, somewhat impervious to the nasty effects of telephone carriers. When using analog modems, however (as in the BlueBox), data is converted to analog tones which are sent through the telephone channel. These tones are much more likely to be affected by the limitations of the telephone channel.

Moving high speed data along analog telephone lines can best be described as a “balancing act.” It requires sophisticated modem technology which senses the quality of each telephone connection and then dynamically adapts all kinds of parameters in short order to “clean up” the connection. These parameters are set and locked during the “negotiation sequence” which takes place shortly after the BlueBoxes are connected together. This is the hash sound you hear when the modem monitor is enabled. During this sequence, the modems also measure bandwidth and noise level on the phone connection to determine the highest data rate which may be supported.

This adaptation is usually done quite well, and the modems can usually be trusted to optimize for a reliable data rate and a solid connection. If the adaptation to the phone call is less than perfect, errors will result. Errors manifest themselves in the BlueBox audio as occasional clicks, dropouts or frame repeats (almost like a “cd skipping” sound). Errors may occur more on long distance calls than local ones and are often a problem when connected to in-house phone systems (another reason to bypass them). A much more detailed discussion of issues encountered on telephone line modem connections is found in Appendix A, “Modem Line Check List,” on pages 51-55.

To address this potential problem, the BlueBox has features which allow the user to minimize the number of errors during an audio feed. Each has its advantages and often can be used in conjunction with each other to fix any error problems which might occur. Either forcing a Rate Drop, or full renegotiation of the connection data rate are the first and most obvious steps to take when experiencing errors during program transmission (see page 24). We also recommend that you look at the actual line you will be using and set a MaxRate, particularly if the connection is to be made regularly.

The best maximum rate setting can be determined by dialing the connection with no MaxRate selected and seeing the rate at which the modem negotiates. If the connection appears to be error free, you may wish to select the next rate down as a MaxRate just to provide some insurance. If you experience errors, it may be best to set it a couple of notches below the unrestricted connect rate. (See pages 17-18 for further details on setting the MaxRate.)

The BlueBox has built-in error correction in Voice Mode. Since the audio bandwidth in Voice Mode is limited to 7 kHz, we have been able to use the leftover data rate for error correction. If errors become objectionable in Music Mode, you may wish to sacrifice some audio bandwidth in favor of a more reliable connection. (See “Audio Coding Selection” on page 20 for instructions on how to select Voice Mode.)

Note: Under most circumstances, the options described above should normally not be necessary. The BlueBox contains the most sophisticated modem technology available and will negotiate the highest reliable speed. No modem can, however, predict what will happen to a telephone connection in the future. Rate Drop, MaxRate and Voice Mode settings are provided as tools to enhance the reliability of the phone network. Please understand that POTS coding has its inherent limitations and risks, and that the BlueBox was designed specifically to minimize these problems. These problems exist in the phone network, however, not in the BlueBox.

SECTION 12. SOME OPERATING TIPS - (STUFF YOU REALLY NEED TO KNOW!)

1. Use direct, outside telephone lines for best performance.
2. A line used by a fax machine usually provides this direct access.
(Be sure to disconnect the fax machine before connecting the BlueBox!)
3. Check to see that there are no extensions or modems on the line you are using — or at least arrange that no one uses these during your broadcast.
4. If there is call-waiting on your line, disable it by entering “*70” in front of the number you are dialing.
5. If possible, try the BlueBox out at the remote site before your actual broadcast, at about the same time of day that you plan to use it. This will give you a good idea of expected connect rates and possible line problems.
6. At minimum, connect a few minutes before airtime to assess the connection quality. Setting a MaxRate based on your findings is highly recommended (see pages 17-18 & 35-36 for more information).
7. Make sure that a “mix-minus” feed is available from the studio to the remote site so that the remote talent will not hear themselves “echoed back.” See Appendix B on pages 56-57 for more information on mix-minus.
8. If operation starts to degrade after a long period of connection, it may be that the phone line parameters have changed over time, and modems should be given the opportunity to renegotiate for these new parameters. The easiest way to do this is by pressing the *QDIAL* key twice. This triggers the full modem handshake process, without disconnecting the line. Audio will be muted for approximately 10 seconds during this process. You can also disconnect the call and redial. It is not a bad idea to have the modems re-handshake every hour or so, during program breaks. This will provide the BlueBox with a “fresh start” on negotiating the best connection, since the line evaluation only occurs during the initial handshake.

OPERATING TIPS (CONT.)

If you experience low connection rates or errors, try the following:

Low Connection Rate (or no connection at all):

- A. Try redialing. If a good connection is found, keep that line up.
- B. Dial from the other end.
- C. If the call is long distance, try forcing to another carrier.
(See next section.)
- D. Verify that you have a direct, outside connection and that there is nothing else connected to that line.

Errors:

- A. Set a MaxRate before your feed. (See pages 17-18 & 35-36.)
- B. Renegotiate to a lower connect rate with *DROP RATE*.
(See page 24 & 35.)
- C. Change to Voice Mode for additional error correction.
(See pages 20 & 36.)
- D. Refer to the "Modem Line Check List" in Appendix A.
(See pages 51-55.)

*USING LONG DISTANCE
ACCESS CODES*

In our field tests with the BlueBox, Matrix, Vector and HotLine POTS codecs, we have seen a wide variety in the quality of connections, particularly in long distance calls. This makes sense, because there is no way of predicting how a call will be routed by the telephone companies involved. We looked for meaningful statistical results from our trials which would show an advantage in using a particular long distance carrier and did not come up with anything concrete. What we did find, however, is that it may help to be able to force a different routing, if your particular connection is not good. To find out which long distance access has been selected for a given line, dial 0-0. The above said, we have found, in general, that you "get what you pay for." We have seen some highly discounted long distance consolidators that seem to provide consistently low data connections. If your station is using "Joe's Long Distance Phone Service" you may well find much better connect rates with a mainstream carrier.

Here is a list of some commonly used long distance carriers and their access codes. To force a particular long distance carrier, simply dial the access code number, followed by the telephone number you would normally dial. For example, to dial Comrex Corporation's main number (978 784-1776) via AT&T, you would enter 101028819787841776.

AT&T	1010288	Sprint	1010333
MCI	1010222	Frontier	1010444

*INTERNATIONAL AC POWER
CORDS AND TELEPHONE
CONNECTORS*

AC adapter cords are available which will connect the standard IEC 320 Inlet on the in-line BlueBox switching supply to a wide range of international power receptacles. These may be purchased from:

Panel Components Corp.	Tel:	800-662-2290 (USA)
P.O. Box 115		641-673-5000 (INT)
Oskaloosa, IA 52577-0115	Fax:	800-645-5360 (USA)
		641-673-5100 (INT)

One solution for international telephone connections — look for the fax machine. Fax machines provide direct line connections and use standard RJ11 modular jacks, so you can simply unplug the fax machine and plug into the BlueBox. It may be necessary to change the modem country code (see below).

*DIALING THE BLUEBOX
INTERNATIONALLY*

MODEM COUNTRY CODES

00.....NORTH AMERICA
01.....AUSTRIA
02.....BELGIUM
03.....DENMARK
04.....FINLAND
05.....FRANCE
06.....GERMANY
07.....IRELAND
08.....ITALY
09.....SINGAPORE
10.....NETHERLANDS
11.....NORWAY
12.....PORTUGAL
13.....SPAIN
14.....SWEDEN
15.....SWITZERLAND
16.....UK
17.....GREECE
18.....AUSTRALIA
19.....JAPAN
20.....CTR21

The BlueBox's modem can be user configured for operation in twenty different countries. Once configured, the BlueBox will remain in this setting until the country parameter is changed. Country configuration is confirmed after selecting *COUNTRY* from the *HIDDEN MENU*, where the BlueBox's display will show the current configuration (*CONFIGURED FOR NORTH AMERICA*, etc.). Country configurations change dialing parameters, such as DTMF level and pulse and ring cadence, as well as call progress tone detection, including dial and busy tones. The factory default setting is for North America. The country parameter only needs to be changed when dialing from a country, not to it. Some experimentation may yield a listed code which works well in countries not listed here. Also, dialing from an external phone is a good method to avoid issues with international phone systems altogether.

To change the country configuration:

- A. Enter the *HIDDEN MENU*, press the *HANGUP* key three times.
- B. Select "1" for *COUNTRY*. Current country configuration will appear momentarily.
- C. Enter the appropriate two digit number from the chart on the left. The BlueBox will go through an initializing process and confirm the country selection on the display screen before returning to the *MAIN STATUS DISPLAY*.

Never heard of a country called CTR21? Neither have we. Actually it's a modem specification designed to work ubiquitously in many European countries. Go ahead and try it in Europe, and if it doesn't work, curse those European standards bodies (like we often do) and then go back to the correct country setting. The term "European Standard" is still held by many to be an oxymoron.

*COMPUTER MODEMS VS.
BLUEBOX MODEM*

Some users attempt to compare the connect rate message they receive when using their computer modem to that which is produced by the BlueBox. Often, they find the BlueBox message reports a dramatically lower connect rate than their computer. This is because most computer modems default to reporting the speed between the computer and the modem, rather than the actual speed between the modems. Most computer modems can be programmed to report the actual connect speed using the following procedure:

Using Procomm™, Windows™ terminal, or some other communications program, get the attention of your modem:

Type:

AT

The modem will respond:

OK

Now Type:

ATW1

The modem should again respond:

OK

If you want to make your modem always work this way type:

AT&W

And the modem will respond:

OK

Now the modem should report the actual connect speed, which is more likely to compare to BlueBox speeds on similar circuits. Note: The initialization strings of some programs (like internet access or on-line service programs) may delete these settings. You may need to edit the initialization string in your program by removing any reference to Wx in the string, where x is any number. Don't remove it if the W is preceded by a symbol (such as & or !).

SECTION 13.**TECHNICAL DETAILS***TROUBLESHOOTING THE
BLUEBOX*

Because of the delicate nature of moving audio data over telephone lines, it is likely that you will experience problems at some point with establishing a reliable connection using the BlueBox. There are dozens of factors that can affect the success or failure of a POTS codec call, some within the user's control and some not. Comrex has support personnel to help troubleshoot problems which may occur, but please use this section first to "run down" the most common issues when using the BlueBox.

1) Are you on an in-house phone system?

There are only so many times we can say this... an in house phone system is almost always a bad idea with the BlueBox. If at all humanly possible, use the BlueBox on a direct telephone company line. If you call for support, and you are using an in-house phone system, the first request you are likely to receive is to move the BlueBox to a direct, "Ma Bell" line.

2) Have you checked your audio quality going into the BlueBox?

Often problems with noise or distortion in audio are added before the BlueBox, but since the BlueBox is the most mysterious link in the chain, it is assumed to fail first.

Check your audio in and out of the BlueBox locally, by listening to the "local" program output. Any noise or distortion present in the BlueBox audio input will be present on this output. Next, enter the *TEST* Mode (see page 26), and then select a loopback rate similar to the rate at which you have been able to establish a connection. This will allow you to monitor audio after it has gone through the encoder and decoder section. Turn the *OUTPUT MIX* knob clockwise as far as it can go, so that no local audio is heard. Due to the extremely high compression and coding of the BlueBox, some artifacts are unavoidable, and these artifacts seem more apparent listening through headphones than through a studio monitor. Also, check that your input level is correct (the level indicator should be green, flashing red on program peaks only). You may also wish to experiment between the Music and Voice Modes (see page 20), as some audio material may sound better in one mode than the other.

3) Have you disconnected all other devices from your lines?

Be absolutely certain that other equipment, such as fax machines, modems, etc. are removed from your telephone line on each end, not simply disabled. Even "on-hook," some devices can affect the BlueBox performance. Also, their removal will prevent anyone from inadvertently "picking up" the line during audio transfer and causing the BlueBox to drop out.

4) Have you tried redialing and/or changing lines or carriers?

Some telephone connections simply won't support the movement of data at the rates required by the BlueBox. If you have trouble establishing a reliable connection even with a rate drop, try redialing several times.

The telephone systems often route calls differently each time, and you may pick up a cleaner circuit on a different call. The problem may also be that your local loop runs a very long distance, is subject to crosstalk, or is "loaded" by the phone company, causing the modem in the BlueBox (or any modems, for that matter) to perform poorly. If possible, try a different line. Finally, we find a change in long distance carriers (assuming you are dialing long distance) can make a world of difference. Try dialing the access code of a different carrier if you have difficulty. See page 38 for some access codes. In general, we find better connections with the larger carriers (avoid "Joe's phone company" if possible).

Phone line performance can be affected by factors such as time of day, weather and geographic location. Once you have used the BlueBox, you will probably gain a better understanding of how it works on different lines and what can go wrong.

5) Using the BlueBox with a Comrex HotLine or Vector:

Current information on achieving the best performance when connecting to our other POTS codecs may be found in Appendix C on page 58.

6) Have you read the following?:

Section 11 - How to Achieve Optimum BlueBox Performance
(pages 35-36)

Section 12 - Some Operating Tips (pages 37-40)

Appendix A - Modem Line Checklist (pages 51-55)

The information contained on these pages is CRITICAL for successful use of a POTS Codec.

If you call Comrex for support, we will likely attempt to connect to each of your BlueBoxes from our office. This way, by connecting from a known good line and carrier, we can often at least isolate which end of the connection is causing the difficulty. To save your time and ours, please be sure you have run through the above checklist before calling for support.

ABOUT ANCILLARY DATA

The BlueBox provides an ancillary data channel, when set in Voice Mode, to send low speed data along the same digital telephone channel used for the BlueBox audio. The vital information you need to know is that this channel has the following parameters:

300 Baud; 8 bits; no parity; 1 stop bit

Now, we will describe a few concepts:

The BlueBox ancillary data channel is asynchronous. This is the most common format for information exchange between computers. An asynchronous data link simply provides a “pipe” which passes bits back and forth between the devices. What you do with this data is dependent completely on the computers and software used in the connection.

It is the nature of asynchronous data that we define a “baud rate.” This is the rate at which individual bits run along the asynchronous link. In some asynchronous systems, however, a continuous stream of data at the specified baud rate will overload the system. This is because the baud rate specifies only the speed on the pipe feeding into the system. Further down, the pipe may narrow and less throughput is possible. Asynchronous communication allows flow control where the sending device will be triggered by the network when enough capacity is available to send more information. In the BlueBox, the “pipe” has the same throughput all the way across, and flow control is not necessary.

Flow control works because asynchronous links do not need to send information at all times. When there are no characters for a computer to send to a modem, for example, the asynchronous link is idle. When the computer has information to send, it will usually format this information into one or more bytes, attach a start and stop bit, (so the receiving system knows where the byte begins and ends) send it off and again make the line idle. In the most common application for ancillary data (two terminals with operators sending text characters back and forth), the asynchronous link is active only a small fraction of the time. During a file download, however, the link will most likely be constantly active, with one byte being sent immediately after the next (unless flow control is active).

Here is a description of a typical ancillary data hookup:

At least one BlueBox must be configured for Voice Mode, and the connect rate on the line must be at least 16.8 kb/s. Each operator will attach a PC com port to the ancillary data connector on the BlueBox (via a straight-through 9-pin cable) and load a terminal emulation program such as Windows™ terminal or Procomm™. Each will set the correct com port in software and the communications parameters to 300 baud, 8 bits, no parity, 1 stop bit. Flow control should be turned off.

In most ways, the link will resemble a normal modem connection. When a key is typed on one terminal, the ASCII byte corresponding to that character will be sent out the computer com port to the BlueBox. The BlueBox will embed this character into the data it is sending, and the BlueBox on the far end will extract this character from the incoming data. It will then send the character to the other computer com port, and it will appear on the other display. Of course, since the channel is full duplex, this exchange may be happening in both directions simultaneously.

A few common options in terminal programs will ease communication:

a) Local echo — Engage this if you wish to see what you are typing on your own display. The BlueBox cannot echo the characters you send back to your display, only send them to the other end. You must configure your communications program to do this.

b) Cr-> CR-LF — When you type a carriage return (enter key), the CR character is all that is usually sent through the BlueBox data link. Your program will likely interpret this correctly and send the cursor back to the beginning of the same line. Your program can probably be set to interpret the CR character as both a CR and LF (line feed) sending the cursor to the beginning of the next line. Your program can also usually be altered to send both characters when the “enter” key is pressed. Usually only one of the above options is required.

c) Other options — The software setup of your communications program may require additional parameters. Keep in mind that the BlueBox data channel is simply a “pipe.” What bytes are sent and how they are interpreted is completely dependent on the software being used and how that software is configured.

Note: The ancillary data functions on both the BlueBox, Matrix and Vector are identical, and these units will inter-operate in this mode. Also, because of the uncertain nature of telephone lines, it is possible that the ancillary data can be corrupted if errors are present on the telephone line. If your requirements are for control over on-air automation systems, this can cause problems. We would recommend under these circumstances that you use a different phone line and attach a normal computer modem, which will provide higher speed as well as a higher probability of an error free link.

*TROUBLESHOOTING THE
ANCILLARY DATA CHANNEL*

The loopback testing facility in the BlueBox can aid in troubleshooting ancillary data connections. It is often difficult to find a fault in a problem like this, since the trouble could be at either end of the link. By loopback testing the ancillary data channel on each end, at least you can easily find which end has the trouble. To loopback test ancillary data:

- 1) Connect a computer serial port to the BlueBox.
- 2) Run a program on the computer with basic serial communications functions, such as Procomm™, Windows Terminal™ or Win95 Hyperterminal™.
- 3) Set the communications parameters as follows:
 - 300 baud
 - 8 bits
 - no parity
 - 1 stop bit
 - echo off (half-duplex mode in Hyperterminal)
- 4) Make sure the software has the serial port chosen which is connected to the BlueBox.
- 5) Verify that your BlueBox has been set to Voice Mode.
- 6) Type some characters on your computer, and verify that you do NOT see them on your screen.
- 7) Go into the *TEST* menu on the BlueBox (see page 26), and select a loopback rate of 16.8 kb/s or higher. The *READY* light should come on.
- 8) Type on your computer keyboard. You should see your characters echoed back to you on the screen.

If this test is successful, you have sent data down the cable to the BlueBox, into the encoder, looped through to the decoder and back to your computer screen.

If not successful, try the following:

- 1) Type "AT" (Enter). If you get a response "OK" then you are probably talking to a modem inside your computer, configured for the chosen com setting. Try a different configuration.
- 2) Try a different com port. Sometimes these ports "burn out," if connected wrong previously.
- 3) Remove any adapters, "dongles" or other connectors on the port.
- 4) Make sure you are using a "straight through" 9-pin to 9-pin cable. Do not use a null modem cable.

SECTION 14. SPECIFICATIONS

CONNECTIONS

Mic/Line Input: 3-pin XLR female
Tape/Mixer In: 1/8" 3-conductor mini-jack
Hands-Free Cellular: 1/8" 3-conductor mini-jack
Line Output: 3-pin XLR male
Headphone: 1/4" stereo phone jack
Tel Line & Tel Set: 6-pin RJ11C modular jacks
Contact Closures (Ready & Enter): 1/8" 2-conductor mini-jacks
Multi-purpose Port: 9-pin "D" type connector

LEVELS

Audio Input
Mic Input Levels: -70 to -40 dBu @ 2K ohms
Line Input Levels: -10 to +10 dBu @ 20K ohms
Tape Input: -10 dBu (fixed) @ 10 K ohms
Audio Output
Line Level Out: +12 dBu max @ 100 ohms
Headphone Out: .5 watt @ 100 ohms
Telephone Line Out: -9 dBm @ 600 ohms
Power: External supply; 15V, 20 Watts, 2 Amp; 100 to 240 VAC 50/60 Hz
Power Connection: 5-pin mini DIN Connector
Size: 9.5" W x 6.5" D x 2.75" H
Weight: Net: 1.5 lbs; Shipping: 5 lbs
Nominal Coding Delay: 100 mS

AUDIO FREQUENCY RESPONSE

At all connect rates and in all modes, the low frequency response is 20 Hz. The high end response is listed below.

<u>Connect rate</u>	<u>Music Mode</u>	<u>Voice Mode</u>	<u>HotLine Mode</u>
9.6 kb/s	4.7 kHz	4.7 kHz	n/a
12 kb/s	6 kHz	6 kHz	4.5 kHz
14.4 kb/s	7 kHz	7 kHz	5.4 kHz
16.8 kb/s	7 kHz	7 kHz	5.6 kHz
19.2 kb/s	11.2 kHz	7 kHz	5.8 kHz
21.6 kb/s	12.7 kHz	7 kHz	6.5 kHz
24 kb/s	14 kHz	7 kHz	7 kHz
26.4 kb/s	14 kHz	7 kHz	8 kHz
28.8 kb/s	14 kHz	7 kHz	8.6 kHz
31.2 kb/s	14 kHz	7 kHz	9.3 kHz
33.6 kb/s	14 kHz	7 kHz	10 kHz

PINOUTS

Tel Line/Tel Set:

- Pin 3: Tip
- Pin 4: Ring

Mic/Line Input:

- Pin 1: Ground
- Pin 2: + Audio In
- Pin 3: - Audio In

Line Output:

- Pin 1: Ground
- Pin 2: + Audio Out
- Pin 3: - Audio Out

Headphone:

- Tip: L Audio Out +
- Ring: R Audio Out +
- Sleeve: Ground

Tape/Mixer In:

- Tip: Tape In
- Ring: Return audio out to external mixer
- Sleeve: Ground

Hands-Free Cellular:

- Tip: Transmit audio to cell phone
- Ring: Receive audio from cell phone
- Sleeve: Ground

Contact Closures:

- Contact closures are floating
- Input controls have sleeve connected to Ground

Power:

- Pins 3,5: +15V
- Pins 2,4: Ground

Multi-purpose Port:

Pin#	Function	Direction
1	CD	From BlueBox
2	RXD	From BlueBox
3	TXD	To BlueBox
4	DTR	
5	GND	
6	DSR	From BlueBox
7	RTS	From BlueBox
8	CTS	To BlueBox
9	RI	No Connection

FCC REQUIREMENTS

1) This equipment complies with Part 68 of the FCC rules. On the bottom of the BlueBox is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. The USOC jack required is an RJ11C. If requested, this information must be provided to the telephone company.

2) The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN's should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total REN's, contact the telephone company to determine the maximum REN for the calling area.

3) If the BlueBox caused harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your rights to file a complaint with the FCC if you believe it is necessary.

4) The telephone company may make changes in its facilities, equipment, operation or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

5) If trouble is experienced with the BlueBox, please contact Comrex Corporation at the address below for repair and warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.

Comrex Corporation
19 Pine Road
Devens, MA 01434
Tel: 978-784-1776

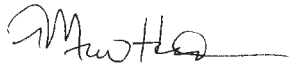
6) The BlueBox cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

*SUPPLIERS' DECLARATION
OF CONFORMITY*

Place of Issue: Devens, Massachusetts

Date of Issue: February 8, 2002

Comrex Corporation, located at 19 Pine Road, Devens, MA 01434 in the United States of America hereby certifies that the Comrex BlueBox bearing identification number US:DXDMD01BBX complies with the Federal Communications Commission's ("FCC") Rules and Regulations 47 CFR Part 68, and the Administrative Council on Terminal Attachments ("ACTA")-adopted technical criteria TIA/EIA/IS-968, Telecommunications – Telephone Terminal Equipment – Technical Requirements for Connection of Terminal Equipment To the Telephone Network, July 2001.



Thomas O. Hartnett, Vice President, Comrex Corporation

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

*EC DECLARATION OF
CONFORMITY FOR
R&TTE DIRECTIVE*

We:

Manufacturer's Name: Comrex Corporation

Manufacturer's Address: 19 Pine Road
Devens, MA 01434

hereby declare on our sole responsibility that the product:

**Comrex BlueBox
Digital Audio Codec**

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC). This product is compliant with the following standards and other normative documents:

European EMC Directive (89/336/EEC)
EN 55022, Class A
EN55024: 1998 (Immunity, ITE Equipment)
Low Voltage Directive (72/23/EEC)
EN 60950: 1992

Information regarding configuration of this equipment for operation on the telephone networks of the EC countries may be found in the BlueBox product manual.

Contact person: Thomas O. Hartnett, V.P., Engineering

Signed:  _____

Date: March 29, 2002

APPENDIX A**MODEM LINE CHECK LIST**

This Comrex Engineering Note discusses problems (and possible solutions) encountered in using modems on dial telephone lines. Such circuits are sometimes called POTS (plain old telephone service) or PSTN (public switched telephone network) lines. It is not applicable to ISDN, SW-56, DDS lines or to equalized program circuits.

A LITTLE BACKGROUND...

The Comrex POTS codecs use internal high-speed modems to send audio in digital format over POTS lines. These modems follow the international V.34+ standard and are very similar to modems used in personal computers. Some of you may remember when 300 bps and 1200 bps modems were considered very fast. Modern V.34+ modems communicate at rates up to 33,600 bps on high quality phone lines. The faster rate is made possible by having the modems make a detailed analysis of technical parameters like frequency response, noise and time delay at the beginning of the call and at any time they are required to renegotiate the connection. The beeps and “hash” you hear at the beginning of the modem call take about 10 seconds and are used to set the connect speed and a number of internal parameters.

If the telephone line is fairly “quiet,” the negotiation at the start of the call may be all you need to insure reliable operation for the duration of a broadcast. You should realize, though, that the digital data moving between BlueBoxes, Matrixes, Vectors or HotLines must be very error-free, because the audio is being decoded in real time. If much of the data is damaged in transit, you will have gaps or strange noises in the audio. You can eliminate small problems with error correction (standard with the BlueBox, Vector, Matrix and selectable on the HotLine), but there is no time to fix large errors by re-sending data that was missed. The usual remedy is to lower the data rate, as the slower speeds are more tolerant of errors. On the other hand, you would prefer to have the data rate set as high as practical, as this gives better audio quality. The battle between these approaches starts many users thinking about the “health” of their phone lines.

In most cases, you will have better results with a direct line to the telephone company than through a business phone system. Modems work best if the call is converted once to digital form and once back to analog. You may get additional analog to digital conversions by running the call through your phone system. This will limit the maximum speed that the modems can achieve. The major exception to the direct line “rule” is in truly large business phone systems where the call is sent to the phone company digitally over a high-capacity trunk like a T1 system.

One more note on in-house telephone systems: Modular jacks are used on all kinds of phone systems. If you see multi-line phones with lots of lights and buttons, be very cautious about plugging a HotLine, Vector, Matrix or BlueBox into that jack!

The voltages and currents present may “fry” your modem. If you need to borrow a line from a business, try to use a fax or modem line. You might want to bring along a simple tester like the IBM “Modem Saver” or even a cheap phone. It is a lot cheaper to blow up a hardware store phone than a POTS codec!

CHECKLIST

If you are having trouble getting good modem connections, we strongly suggest you start your troubleshooting at the studio end. If you have a problem there, it will affect all of your POTS codec broadcasts.

☐ Make a test call to the Comrex POTS codec test number: 978-784-1700. Note the modem connect speed. Listen to the audio for 5-10 minutes. If you notice errors, try using the *DROP RATE* key to step down one speed at a time until the audio is stable. You may want to try more than one call, and see if there is any difference. If you are happy with the performance, your problems may be at the other end of your broadcasts. Try the same test there.

☐ If your POTS codecs work fine on long-distance calls, but have problems on calls within your area code, the real culprit may be the manner in which the phone company routes calls between those offices. You may be “getting stuck” with older microwave circuits, or extra analog/digital conversions at the boundaries of different phone companies. Your ability to solve this problem is limited. It is worth complaining about, but there may be no practical solution. In any case, if you are happy with long distance calls from a particular site, the local part of your telephone circuit is OK! The rest of the information in this checklist may help, but your real problems are elsewhere.

☐ Since natural events (like thunderstorms) and unnatural events (like interns who plug your expensive POTS codec into electronic key phone systems) can damage the modem or interface circuitry in your BlueBox, you should try to weed out a bad unit. Make calls from each codec to our test number, using the same phone line, if possible. If one unit behaves oddly, call Comrex Tech Support.

☐ Start at the back of the codec. Try another modular phone cord, even if you have been using the one we supplied. You might also look at the telephone wall jack to see if the pins are straight and the cable connections are OK. You’ll feel mighty foolish if you spend lots of time with the phone company, only to find that this is the problem!

☐ Next, plug a phone into the line jack, and make a call to a cooperative person on another (hopefully clean) line. Listen carefully for hum, buzz, clicks or crosstalk from other phone lines. Try to do this at a time of day when other phones at that site are in frequent use. If you can hear such noises, you will have a target to aim for. Then try the same call with the phone connected at the demarcation point where the phone lines are terminated by the phone company. Be sure that your other internal wiring is disconnected when you

make the call. If the line is clean, the trouble may be in your inside wiring. If the line is still noisy, the problem is either with the phone company or the phone wiring at the other end.

☐ Check out your inside wiring. How does the line get from the telephone company demarc point to your codec? You may want to route a separate line away from other lines or electrical circuits. Make sure there are no cable staples that go through the cable! What kind of wire is used? We strongly suggest twisted pair phone cables — if you are using “quad wire,” you may be picking up extra noise. If you are buying cable, consider using Category 3 (or higher) computer network cable.

☐ Are there other phones, modems, fax machines or devices on your line? We suggest that your POTS codec be the only thing on the line. Even if the other equipment is turned off, the extra circuitry on the line may limit your modem performance. If you need to share the line with other equipment, consider putting in a simple switch to isolate the codec.

☐ Are you located at an AM transmitter site? If so, we strongly suggest using a telephone line RF filter with good attenuation in the AM broadcast frequency range. In really stubborn cases, you may need to filter the line at the telephone company demarc point and at the back of the codec.

☐ Assuming that the inside wiring checks out OK at each end, it probably is time to start talking with the phone company. Just a caution, though — they are now being deluged with calls from Internet users who feel that their modem performance is being affected by their phone lines. It is probably not in your best interest to stress the word modem in your conversations with the telephone company. They will probably just give you a terse dissertation on how they are not required to support modems above the 2400 bps level.

☐ If there is audible noise on the outside line, go right ahead and report it. If the problem is weather related (such as with rainy weather), make the call when the line is actually acting up. They will do an initial test through their computer system. If they see something wrong, they will dispatch a repair person to deal with it. The problem will likely be some imbalance between the line and ground, may be due to a bad cable or a bad line protection device. If they don't see a significant problem by looking through their computer system, you may have to do some talking to get them to dispatch someone. Be persuasive, but don't try to dazzle them with your technical competence or assertiveness training.

□ If a repair person visits you, make the most of the situation. Don't just send them to the closet at the end of the hall. Clean it out in advance so they can get in there without danger. Stay with them. Gently explain your problem. Offer coffee. Even if they don't find the problem, you may wind up with a better friend the next time. Try to get them to check the line for "balance," even if you are a little shaky as to what that means. See if you can find out how the line gets to you from the telephone company office. In order for this conversation to make sense, we suggest that you read the following:

PHONE LINE 101

The simplest phone line is just a pair of copper wires running from the telephone company office to your location. Part of the line may run above ground suspended on phone poles, and part may be underground, either directly buried or in conduit pipes. Both are subject to weather-related problems. Water can enter improperly sealed cables and cause partial connections between your wires and ground or other wires in the cable. Small animals can chew at cables and damage the insulation on the wires, with the same result. Lightning strikes can damage protective devices on the lines, resulting in partial connections from the wires to ground.

Even the simple phone line is actually fairly complicated. If the line is over 3 miles in length, the phone company will insert "loading coils" which help equalize the frequency response of the line. These loading coils don't introduce any extra noise, but they will limit modem performance to 21,600 bps or so. A nastier thing is the addition of "bridge taps" on the line. These are simply other pairs of wires connected across your line. They may run down other streets and end on poles, in manholes or inside other buildings. Nothing is connected at the other end, but the extra capacitance of that cable will cause peaks and valleys in the frequency response of your line. Bridge taps may also introduce extra noise or crosstalk as well. A "worst case" scenario would be for you to be assigned a cable pair that was previously used at another location and still has inside wiring connected in that building.

As telephone use has expanded, phone companies have found it impractical to keep running more copper lines, particularly in urban and large suburban areas. This has led to the increased use of "SLIC" (Subscriber Line Interface Concentrator) cabinets connected by conventional copper wire to homes and businesses in a neighborhood. You have seen these cabinets (usually green or gray) at street corners. The equipment in the cabinet converts the local call into digital format so that individual pairs are not necessary all the way back to the telephone company office.

There are two basic types of SLICs: integrated and nonintegrated. An integrated SLIC is connected by fiber-optic cable or copper wire to the telephone office. It is a high capacity digital device that is actually part of the phone company switching equipment. Your call undergoes an analog to digital conversion in the cabinet, and stays in that form all the way through the telco switch. An integrated SLIC is very modem-friendly, as it shortens that analog part of your phone line, avoiding loading coils and extra bridge taps. A nonintegrated SLIC is not tied directly to the switch, but requires a companion unit at the telco office that will introduce another set of digital/analog conversions, and that will limit modem performance. It may be better than an excessively long copper line, but it will not be as good as an integrated SLIC ... AND NOW BACK TO THE CHECKLIST!

☐ If the phone company believes that you have a bad cable pair, they will probably switch you to another pair. This is a good opportunity to request (don't demand) the shortest possible routing for the line, hopefully without loading coils and with a minimum number of bridge taps. You can also plead not to be put on a nonintegrated SLIC, as that may worsen the situation.

☐ If the phone company thinks your line is OK, you may want to try an "end run" around the regular people. The telco folks have higher-level customer service people who can advocate for you within the company. If your monthly bills are substantial enough, you can request that such a person be assigned to your account. If that fails, you might contact the person in charge of media relations in your area. They want to stay friendly with radio and TV stations, and may be able to connect you with an influential "inside person." As always, be friendly and diplomatic. Mugs and T-shirts might be an idea for people who seem to be working on your behalf. It wouldn't hurt to have your call letters on their desk!

☐ Attention "tech types": If you used to order equalized phone lines for remotes, and you still remember which cable pairs the telephone company used for the lines to your studio, you might try requesting one of those pairs for your POTS codec line. Equalized lines are usually free of loading coils and bridge taps and are tested more rigorously for noise and balance.

☐ If you are absolutely stuck with a lousy phone line to your studio, you might want to try creating a "perfect" phone line from an ISDN line (assuming that is available). All you will need is a computer-type external terminal adapter with at least one POTS port. That port will have ringing and dial tone just like a regular phone line and will be all-digital to the phone company. You will need to program the TA with a computer, entering switch type, SPIDs and LDNs. After that, no computer connection is necessary.

APPENDIX B

ABOUT MIX-MINUS

Even the simplest remotes are a two-way process. The remote site must send its audio to the studio and receive a return feed to monitor the programming. This return feed may be done over a radio station's regular transmitter (with an AM or FM radio at the remote), a special radio link or a telephone circuit. This feed may just go to headphones at the remote and also be put on speakers for the local audience.

The problem comes when there is a time delay in getting audio to and/or from the studio. In this case, the remote talent hears a delayed version of their voice in the headphones and may find this very distracting. Even a remote done with simple equipment or a frequency extender on plain phone lines may have this problem on a long-distance call. All remotes using ISDN, Switched-56 and POTS codecs will have delays each way as signals are processed from analog to digital, compressed, uncompressed and converted back to analog audio. Some digital compression schemes, such as G.722, result in shorter delay times, but there will still be a "reverb" effect in headphones at the remote site, if their audio is sent back from the studio. In any of these cases, it may not be possible for the remote people to listen to an off-air or program channel feed.

The solution is **mix-minus**. A mix-minus feed has a mix of all of the programming on the radio station (or network) **minus** the audio from the remote. In other words, the station or network doesn't send the remote audio back to the remote. At the remote end, this mix-minus feed is converted back to an "air monitor" by mixing in the local audio from the remote. This is easily done on the BlueBox, with the *OUTPUT MIX* knob.

For radio stations, in addition to fixing the time delay problem, using a mix-minus feed has two other advantages. First, if the station uses a 6-7 second delay to allow editing of phone calls, pre-delay audio can be sent to the remote site. Second, if there is a PA system at the remote, they will be able to run the speaker levels higher with the mix-minus audio. This is because the remote microphone audio is not running through the station's audio processing, and the levels stay under the control of the remote operator.

The simplest way to do one mix-minus feed in a typical radio studio is to use the Audition or second program channel. On many audio consoles, each fader's output may be sent to both Program and Audition. If your board will allow those feeds simultaneously, just set all of the modules to Program and Audition, **with the exception of the one carrying the remote audio. Set that one to Program only.** The Audition channel will then be a mix of everything on the console except the remote. That will be your mix-minus, and it should be sent to the remote site. One caution — make sure that audio is being sent to and from any telephone modules you may have in the console. They may have been designed to work with only one channel at a time — either Program or Audition, but not both. If so, you will have to check with your "tech guy" or the board

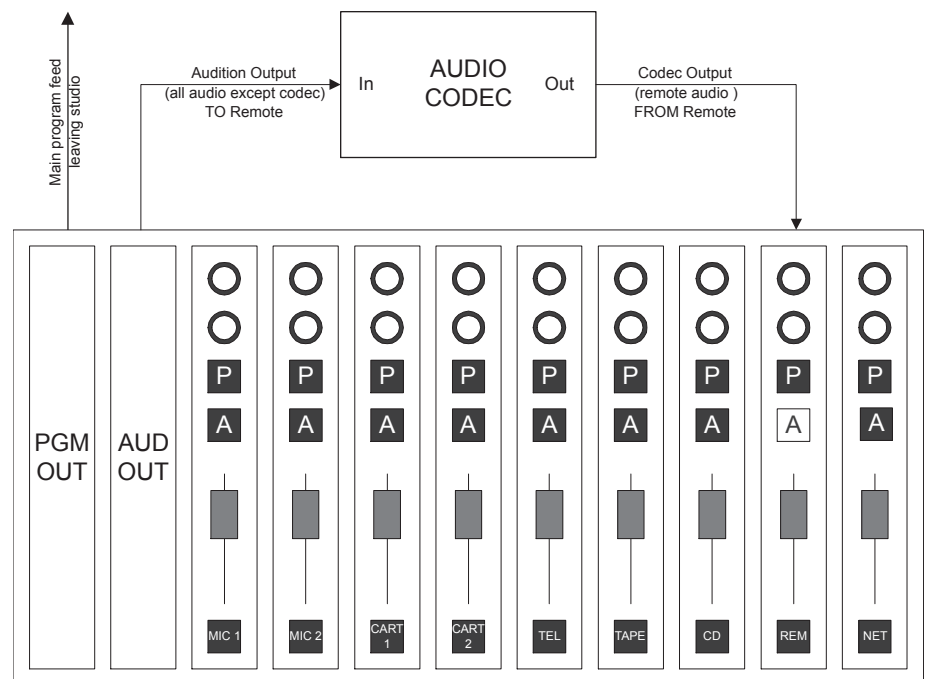
manufacturer for advice. If you use multiple audio codecs, you should investigate the Comrex Mix-Minus Bridge. This will allow you to expand one Program/Audition setup to handle five codecs or other remote audio devices. It also provides IFB (talkback) to remote sites.

If you are using a BlueBox at the studio, check the *OUTPUT MIX* knob. Turn this knob all the way to the right (clockwise) so that no local (input) audio is heard. Local audio from the studio board will be sent back to the board, and funny effects will result.

“I’M USING MIX-MINUS AND I STILL HEAR AN ECHO!”

If you are doing a call-in talk show on the road, the remote people may complain of hearing an echo when a caller is put on the air. With the telephone pot down, everything is OK. The culprit is the telephone hybrid being used to put callers on the air. Some of the remote audio is “leaking” through the hybrid and mixing with the caller audio. Modern digital hybrids do a much better job of preventing this than the older units that had to be manually “tweaked” for each call. If you are using a digital hybrid and having this problem, dig out the manual and redo the hybrid’s initial setup.

Some stations do not feed regular audio back to the remote, particularly for sports broadcasts. Instead, they send a continuous feed of the board operator’s microphone out to the game. In this case, the board op must remember to wear headphones and keep the studio speakers *off*. His microphone would pick up the remote audio from the speakers, and the crew at the game would hear themselves in delayed form.



APPENDIX C

USING THE COMREX BLUEBOX WITH A HOTLINE OR VECTOR

The BlueBox is compatible with the Comrex HotLine and the Vector, automatically sensing which algorithm is in use.

Throughout the extensive field testing we did during the development of the BlueBox, we found issues on some phone calls at higher than average connect speeds to or from a HotLine or Vector. Typically, the modems would continue to negotiate at the start of the call. While redialing the connection frequently cured this; we found that the better approach was to upgrade the software in the HotLine and Vector to help match the newer modem in the BlueBox.

This new control software is identified as Revision J for the HotLine and Revision 7 for the Vector. If you will be using the BlueBox with these codecs, you will get the best performance if their software is updated. Recent HotLine and Vector software shows its version on the screen:

HotLine — Watch the screen during boot-up. If the software is Rev. F or higher, you will see the information just before the *MAIN MENU* appears.

Vector — From the *STATUS DISPLAY*, press the *MENU* key. If the software is Rev. 6 or higher, you will see the information in the lower left corner of the *MAIN MENU*.

In both cases, if you do not see an indication of the version, the unit has older software.

The HotLine and Vector upgrades can be done in the field or here at Comrex. For a field upgrade, you only need the new chips, some simple tools, our instructions and a “PLCC Extractor,” available at Radio Shack or similar electronic suppliers.

For more information on the upgrades, call us at 978-784-1776, and we’ll be happy to help you.

Also, for the present, we recommend that you turn off Error Correction on a HotLine being used with a BlueBox.

APPENDIX D**GSM WIRELESS OPERATION**

We include the capability for the BlueBox to operate with external GSM phones as a legacy function. Only a small number of GSM phones were capable of interfacing to the BlueBox, with custom software required for each. Unfortunately, the models of these mobile phones changed constantly and most are now obsolete.

Because of this and other operational concerns, we refocused our development efforts and integrated the mobile phone directly into the Matrix codec. This has resulted in a far superior solution, providing much more stable connections, better sounding audio and much greater ease of use. The modular capability of the Matrix, along with its inherently greater processing capability, allowed us to create a highly functional GSM package.

While it is still technically possible to connect an external phone to the BlueBox and while there are still a few phones available that can be used in this manner, our strong recommendation is that the Matrix GSM package be used in the field. The BlueBox is a good solution for the studio end since its modem is capable of handshaking with an incoming GSM call and it can also support the algorithm used for GSM. For further information on the Matrix and GSM, please go to www.comrex.com and search on GSM.

ABOUT WIRELESS OPERATION

Wireless operation has its uses but also its limitations. In areas of low wireless signal strength, operation can be unstable and subject to drop-outs. Different wireless networks perform differently also. We highly recommend that you test a potential installation before you invest in expensive phones and service contracts to make sure wireless operation will suit your needs in terms of stability and quality.

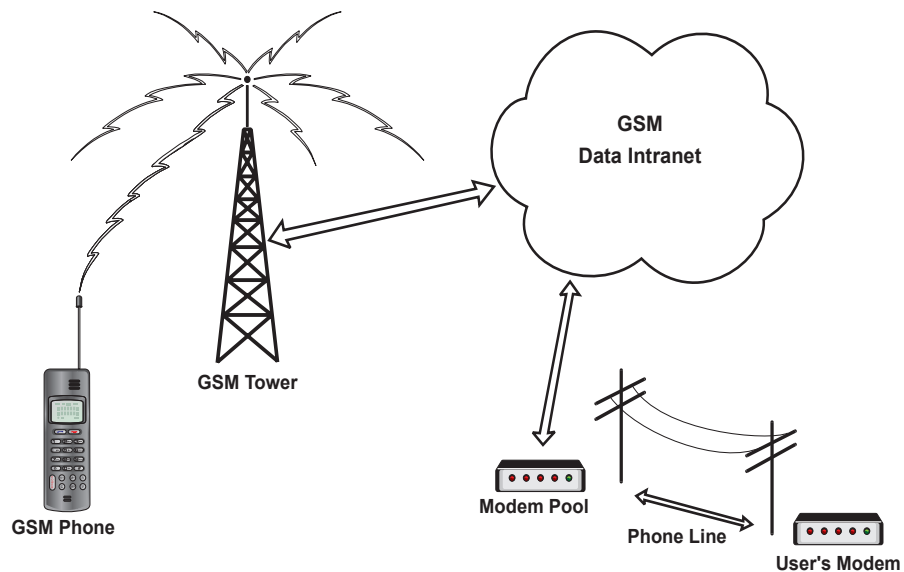
Wireless operation is a complex issue. An important point in this discussion concerns the link between the studio BlueBox and the mobile phone network. It's important to know that your mobile phone does not contain a modem that interfaces directly with the modem in the studio BlueBox. Several protocol conversions happen, and a modem link is actually established between the studio BlueBox and a modem located in a "modem pool" somewhere within the wireless network. For this reason, the studio BlueBox (or Matrix) cannot be set for normal POTS codec operation. Before a call is completed, the studio BlueBox (or Matrix) must be set to interwork with this "network modem pool." For this reason, you must set both the field BlueBox and the studio BlueBox (or Matrix) to work in wireless mode and also configure a few other parameters before you can operate wirelessly. If a properly configured field BlueBox attempts to dial via mobile phone into a studio BlueBox (or Matrix) that is not prepared to receive a wireless call, no connection can be made. Also, a studio BlueBox (or Matrix) configured to receive a wireless call cannot accept a normal POTS codec mode call until it is reconfigured.

ABOUT GSM

Second generation digital cellular networks come in several flavors. The most common network available internationally is known as GSM (Global System for Mobile Communication). There is also a large deployment of AMPS (analog), TDMA, and CDMA networks, especially in North America. Our testing has determined GSM to be the best network for transmission of real-time audio from both a data availability and stability standpoint. GSM also has the advantage of subscription via Smart Card (SIM) so a GSM account can easily be moved from phone to phone (or phone to codec).

ABOUT GSM DATA

When you use the BlueBox with a GSM phone, you are actually “piggybacking” on the digital stream normally used for wireless voice calls. The difference is that instead of converting the wireless data to analog and routing it down a POTS line, the GSM network is feeding this data into a normal analog modem. This modem resides somewhere in the GSM network, possibly thousands of miles away from both ends of the link. The modem then places a call to the destination and negotiates a data link over the phone line. As shown below, there are actually three “daisy chained” digital links: The first is the wireless link between the GSM phone and the tower, the second is the circuit from the digital tower to the network modem pool, and the last is the normal modem connection between the modem pool and the POTS side of the call.



This type of connection is called Circuit Switched Data (CSD), because an actual physical circuit is established and kept open throughout the call, much like a normal phone call is.

*OTHER TYPES OF WIRELESS
DATA*

GSM (and most other types of digital wireless service) have newer generations of data offerings. In the GSM world, the most common is known as GPRS (usually some spiffy marketing name is applied to it). GPRS boasts data speeds much higher than those available via CSD. But GPRS, being designed primarily for web traffic, has serious deficiencies where real-time audio is desired. GPRS is a web-based connection, meaning that rather than dialing a remote point; you are connected directly to the carrier's web server. Any connections to remote locations must be virtual and packet-based along the public Internet, with all the congestion and delays associated with that. Also, deployed GPRS systems typically provide a wider download speed than upload, and remote broadcasting relies on the upload path in a wireless environment. So for now, "state of the art" wireless broadcasting will rely on the older, thinner, circuit switched data connections provided by GSM. The same limitations apply to high-speed offerings by CDMA systems, typically known as "1X" networks.

*CONNECTING TO A WIRELESS
PHONE*

A mobile phone can be connected to the BlueBox via the 9-pin *MULTI-PURPOSE PORT* on the side panel of the BlueBox. You will need to obtain the serial data cable available for your phone in order to connect this way. During setup, you will be asked what phone you are connecting to the BlueBox, phones designated in the menu have been tested and are known to work correctly. Because the *MULTI-PURPOSE* port is configured as a DTE (female gender) connector, you will probably need a null modem adapter to connect the data cable to the BlueBox. Note this is not a straight-through gender changer, but an adapter that crosses certain pins. This adapter is available free from Comrex on request. The pinout of the null modem adapter is:

<u>DB-9M</u>	<u>DB-9M</u>
1,6	4
2	3
3	2
4	1,6
5	5
7	8
8	7
Pin 9 N/C	Pin 9 N/C

*SETUP FOR USE ON WIRELESS
PHONE (FIELD BLUEBOX)*

It is assumed that the “field BlueBox” is the unit that will actually be connected to a mobile phone, and the “studio BlueBox” (or Matrix) will be connected to a phone line. Before the setup procedure for the field BlueBox is started, the phone should be connected to the *MULTI-PURPOSE* port on the BlueBox and powered up. You can set up the BlueBox without connecting a mobile phone, and you will get a short error message when the BlueBox tries to communicate with the phone, but your settings will be saved. The BlueBox wireless menu will need to be enabled and pre-configured for the specific wireless phone you are using. This is done as follows:

To enable the wireless menu:

- A. Access the *HIDDEN MENU* by pressing the *HANGUP* key 3 times from the *MAIN STATUS DISPLAY*.
- B. Select “4” for *MORE*.
- C. Next, select “3” for *GSMEXT*.
- D. Select “1” for *ENA (enable) GSM EXT PHONE*. *GSM PHONE* will now appear as option “5” in the main menu until disabled. To disable the wireless menu select “2” for *DIS GSM EXT PHONE*.

To pre-configure for a specific phone:

- A. Press *ENTER* from the *MAIN STATUS DISPLAY*.

Max24 AA MM Music
Press Enter or Qdial

- B. Select “5” for *GSM PHONE*.

1)Dial 2)Answ 3)Test
4)Config 5)GSM Phone

- C. Press *ENTER* from the *GSM STATUS DISPLAY*.

<phone> GSM 9.6
Press Enter or Qdial

- D. Next, select “2” for *SETUP*.

1)Dial 2)Setup
3)Exit GSM Mode

- E. Choose which phone you have connected to the *MULTI-PURPOSE* port. “*SELECTION STORED*” will appear momentarily after you have made your selection.

1)6310 2)7190
3)Q/N105 4)T39/T68

THE BLUEBOX CURRENTLY SUPPORTS THE FOLLOWING TYPES OF MOBILE PHONES.

1) NOKIA 7190 – WORKS ONLY IN NORTH AMERICA. THIS PHONE WORKS WELL WITH THE BLUEBOX. HOWEVER, IT'S BEEN OBSOLETE BY NOKIA BUT IS STILL AVAILABLE FROM SOME RETAILERS. REQUIRES THE DLR-3P CABLE.

2) SAMSUNG SGH-Q105 OR N105 – WORKS WORLDWIDE. AVAILABLE IN THE UNITED STATES THROUGH MAJOR GSM CARRIERS LIKE T-MOBILE. REQUIRES THE RS-232C CABLE.

3) ERICSSON T39 OR T68 – WORKS WORLDWIDE AND HAS LONG BATTERY LIFE. REQUIRES THE DRS10 DATA CABLE (NOT INCLUDED). HSCSD IS SUPPORTED BUT IS THE INCORRECT "TYPE" FOR USE WITH THE BLUEBOX.

4) NOKIA 6310 – FOR USE ONLY OUTSIDE NORTH AMERICA, THIS PHONE SUPPORTS HSCSD OPERATION. REQUIRES THE DLR-3P DATA CABLE (NOT INCLUDED).

Once the phone is selected, the BlueBox will attempt to communicate with your mobile phone via the data cable. If it cannot communicate correctly, the following error message will appear for several seconds:

Communication Error!
Check Phone Cable

If the phone does respond to the BlueBox, but can't support the selected mode, the following message will appear:

Communication Error!
Check Phone Setup

If no error message appears, the BlueBox has successfully communicated with the phone. Press the *CANCEL* key to return to the *GSM PHONE DISPLAY*.

Note: Your BlueBox will not operate as a normal POTS codec until you manually exit this mode. The field BlueBox (as well as your studio BlueBox or Matrix) must be manually set for GSM Mode in order for the wireless function to operate, since a studio BlueBox or Matrix cannot automatically detect whether a call is a normal POTS codec call or a wireless call.

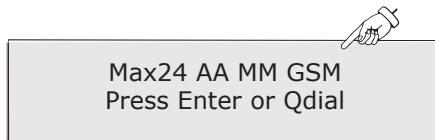
To exit *GSM PHONE MODE*, press the *ENTER* key to get to the *GSM MAIN MENU*.

1)Dial 2)Setup
3)Exit GSM Mode

Select "3" to *EXIT GSM MODE*, the BlueBox will return to normal POTS codec operation. This is the only way to exit *GSM PHONE MODE*, since the BlueBox will revert to GSM if powered off in this mode.

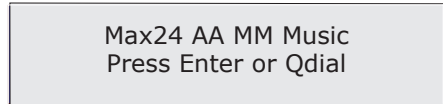
SETUP FOR USE ON
NORMAL PHONE LINE
(STUDIO BLUEBOX OR
MATRIX)

A BlueBox (or Matrix) is required at the other end of the connection to “receive” a call from the GSM phone attached to the BlueBox. To prepare the BlueBox (or Matrix) for GSM operation, simply attach a POTS (Plain Old Telephone Service) line to the jack labeled “Tel Line” and apply power to the unit. After the “Initialzing” screen, make sure the display has “GSM” in the upper right hand corner:

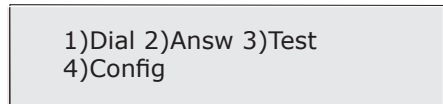


If the display does not indicate “GSM” change it using the following steps:

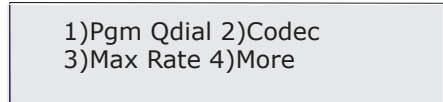
1. Press *ENTER* from the *MAIN STATUS DISPLAY*.



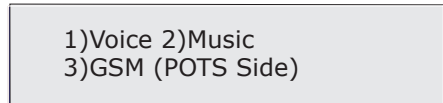
2. Then select “4” for *CONFIG*.



3. Next, press “2” for *CODEC*.



4. Select “3” for *GSM (POTS SIDE)*. Press the *CANCEL* key twice to return to the *GSM STATUS DISPLAY*. It should now indicate “GSM” in the upper right hand corner of the display.



The BlueBox (or Matrix) cannot automatically adapt between GSM Mode and normal POTS codec mode. To return to normal POTS operation, follow the above steps but select either “1” for *VOICE* or “2” for *MUSIC* (depending on which POTS coding algorithm you prefer).

GSM DIALING PROCEDURES

In GSM Mode, a call may typically be dialed and answered from either end of the link. Most users will place the call from the field unit and answer it in the studio unit. Note that most digital wireless carriers have separate phone numbers for incoming voice and data calls, so if you plan to dial into the mobile phone from the studio, you'll need to know what this number is.

The dialing procedure is the same whether you dial from the field or studio unit. If the BlueBox is set to use a GSM phone, the dial command will be sent to the phone and the phone will place the call automatically. If the BlueBox is set for GSM (POTS Side), the call will be placed over a normal dial line.

TO DIAL USING QDIAL

A. Press the *QDIAL* key from the *GSM STATUS DISPLAY*.

<phone> GSM 9.6
Press Enter or Qdial

B. Input the two digit index (01-19) of the programmed number you wish to dial. (See page 19 for instructions to program these numbers. Qdial numbers are shared with POTS codec mode.)

Enter Qdial #:00-19

C. The unit will automatically dial the programmed number and connect.

Dialing
XXXXXXXXXXXXXXXX

TO DIAL MANUALLY, USING THE BLUEBOX KEYPAD

A. Press the *ENTER* key from the *GSM STATUS DISPLAY*.

<phone> GSM 9.6
Press Enter or Qdial

B. Select *1)DIAL* from the *GSM MAIN MENU*.

1)Dial 2)Setup
3)Exit GSM Mode

C. Enter the number you wish to dial, using the keypad. The *CANCEL* key backs over any errors, and the *HANGUP* key aborts the call. Press *ENTER* when ready to dial.

Dial Number:

D. The unit will dial the call and connect.

Dialing
XXXXXXXXXXXXXXXX

*OPERATIONAL ISSUES AND
TROUBLESHOOTING*

Because wireless operation is dependent both on the quality of the phone line and the quality of the wireless link, it can experience significant operational problems. Some of them are:

- 1) Failure to connect
- 2) Connection without audio
- 3) Excessive delay
- 4) Stability problems

We'll address these separately below.

FAILURE TO CONNECT

If your wireless BlueBox system can't complete a call, it may be that data services aren't supported on your wireless account, or that circuits are too busy to allow a wireless data call at this time. The best test is to connect your mobile phone to a computer with a spare serial port. Using a terminal emulation program, set the serial port to 115.2 kb/s (19.2 kb/s if you are using the Nokia 7190) no parity, 8 bits, 1 stop bit.

Type the following into the terminal program:

```
AT<Enter>
The phone should respond
OK
```

Now try to dial the studio BlueBox from the computer.

Type: ATDXXXXX, where XXXXX is the number of the studio BlueBox.

The studio BlueBox should eventually answer, and you should get a connect message, followed by some lines of random characters on the terminal. You can disconnect the call on the mobile phone or via the studio BlueBox (or Matrix). If you cannot complete a call this way, you'll need to contact your wireless provider to troubleshoot their data service. If the call completes as described, contact Comrex for further troubleshooting help.

*CONNECTION WITHOUT
AUDIO*

Typically, this means the *READY* light on the BlueBox has failed to light in one or both directions of the call. If you are using normal GSM service, make sure you are set to 9.6 kb/s operation on both ends of the connection. If you are using GSM14, make sure both ends are configured for 14.4 kb/s.

A good test to check that your units are operating properly in wireless mode is to complete a call over normal telephone lines using the wireless protocol. To do this, set the field BlueBox to the same parameters as the studio BlueBox (or Matrix), using the *GSM (POTS SIDE)* selection (see page 20). Attach a real phone line to the field unit, and place a call between the two. If you cannot achieve an audio link in this mode, contact Comrex support.

EXCESSIVE DELAY

The BlueBox only adds a small fraction of a second of delay to the audio it's processing. If you are finding time delays over the system to be excessive, try redialing the call to see if it is reduced. Time delays differ between carriers, and the BlueBox has no control over the amount of delay introduced by the wireless system. In our experience, delays of up to a half second are common and unavoidable.

INSTABILITY

Instability of wireless calls will typically take the form of audio drop-outs or a "skipping" sound as encoded audio frames get repeated. This typically indicates a halt in data getting to the decoder, caused by one of the following factors:

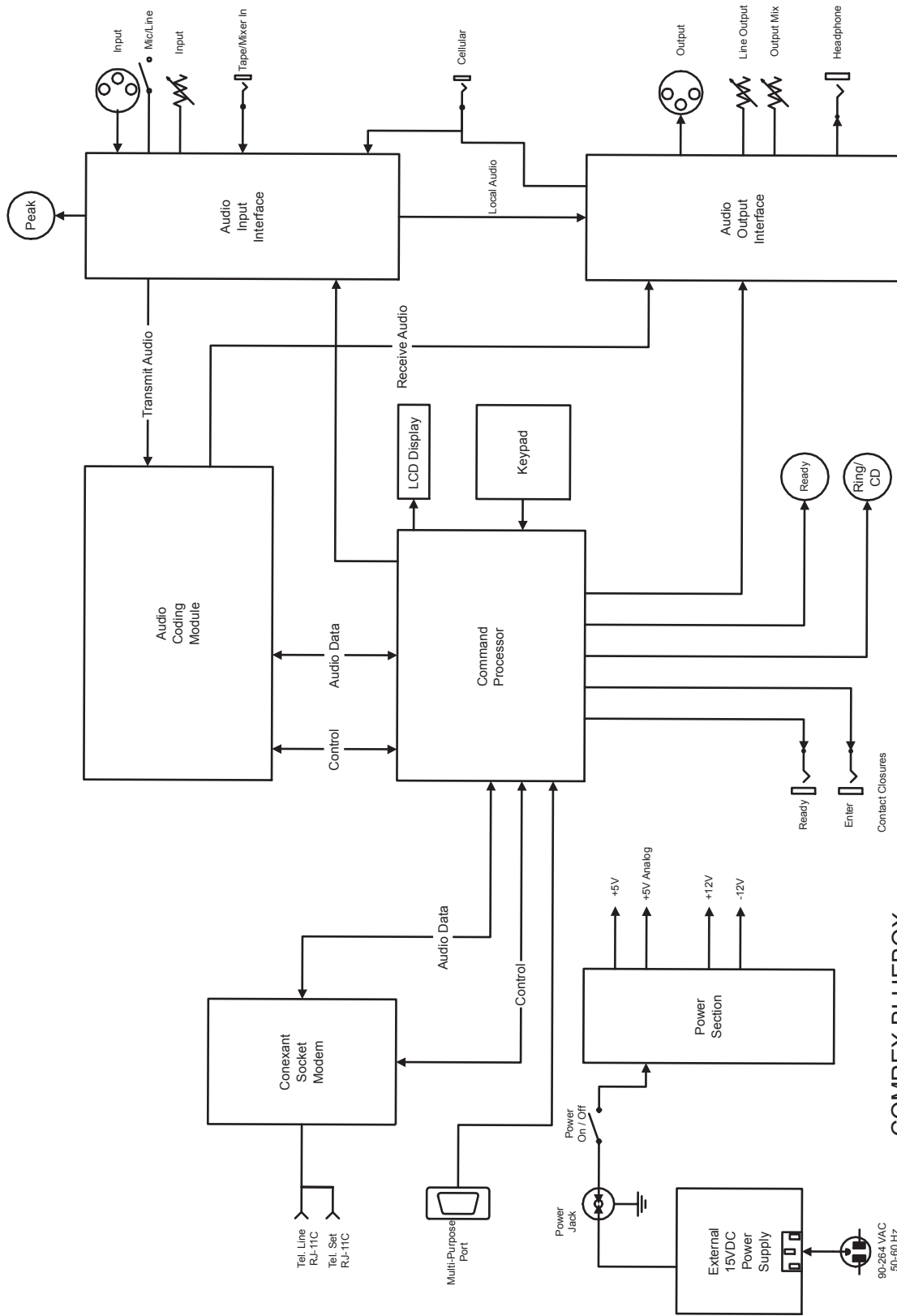
A) Low RF signal strength between the phone and the local mobile phone cell has caused data errors. In this case you should attempt to find a location with higher signal strength. Most mobile phones show some indication of strength. Sometimes movement of several feet can make a large difference in signal strength. In our experience, wireless broadcasts should not be attempted in "fringe areas" with low-to-moderate signal strength.

B) Change in channel/site – Mobile phones by their nature can change radio channels and even base stations during a call, even if the phone is not actually moving. To some extent this cannot be avoided, but a high signal strength will improve your odds.

C) Noise in telephone channels – This is less likely than issues with the radio link but phone line problems can cause stability issues. Make sure the lines in your studio are the best you can get.

If you regularly experience stability problems with your mobile phone, it might be worth trying an external antenna. Many phones have an external antenna jack available that can be adapted to work with a car-type "mag-mount" antenna. Even if it doesn't significantly increase signal strength, an external antenna can more easily be placed above areas of interference from computers and other phones, as well as people moving and affecting radio performance.

APPENDIX E BLOCK DIAGRAM & SCHEMATICS



COMREX BLUEBOX
BLOCK DIAGRAM