
Mix-Minus Bridge

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SCHEMATIC

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Our toll free number in North America is 800-237-1776. Product Information, engineering notes and user reports are available at www.comrex.com. Our E-Mail address is info@comrex.com.

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SECTION 1.**INTRODUCTION**

The modern radio studio has many remote audio sources as part of its broadcast day. It is difficult to create a workable environment where outside sources can be put on air quickly and easily, while providing enough flexibility to do unusual types of things on the fly.

It is easy to mix various source material together with a studio console, but sending the correct audio back to the correct user can be challenging. The Mix-Minus Bridge solves this problem by creating five separate and independent audio mixes, each of which intentionally does not include its own remote source. This audio mix is called *mix-minus*, because it is the entire program mix *minus* one of the sources.

MIX-MINUS CONCEPTS

Mix-minus feeds are usually required whenever audio programming originates outside of the studio. Many studios now take programming from ISDN and/or POTS codecs as part of their broadcast day. However, most codecs incur substantial processing delays which preclude off-air monitoring, because the remote talent will not be able to tolerate the delay of their own voice in their ear. The delay is doubled if the codec return channel is used for talent monitoring. The solution is to feed a mix, *minus* the remote talent, back to the remote site.

Also, studio telephone hybrids need a mix-minus feed from the console. This keeps the program audio as clean as possible when a caller is put on the air and prevents the caller from hearing too much of their own voice over the phone. If callers are to be conferenced, or put on air at the same time, each requires a custom mix-minus feed because each caller must hear the other, but not themselves.

MIX-MINUS BRIDGE
FEATURES

It is usually easy to create a mix-minus on a broadcast console because most consoles have an audition or auxiliary bus. An audition or auxiliary bus can create an additional mix of certain console sources, without affecting the main or program mix. If a telephone hybrid is fed this mix, and then a codec feed is required, the console must be reconfigured for each mix-minus. This can be confusing and cause program delay. Also, if the hybrid and codec need to be on-air simultaneously, another mix-minus is required.

With the Mix-Minus Bridge, each remote source has a dedicated, full time mix-minus feed. No configuration is necessary before airing single or multiple remote sources. The Mix-Minus Bridge will still require that you configure an audition or auxiliary bus on your console, but it will remain permanently configured.

Another common requirement for remote broadcasting is the ability to interrupt the feed being sent to the remote talent in order to send cue information or special instructions. This ability is called *interruptible fold back*, or IFB for short. The Mix-Minus Bridge has the ability to send a separate audio signal to all sources receiving mix-minus. Selection of IFB is controlled by pushing a button on the front panel of the Mix-Minus Bridge. Remote control connections are available to control the IFB function and individually select which channels receive IFB. The IFB input to the Mix-Minus Bridge is adjustable as well as switchable between microphone or line level signal.

Because IFB is so useful and most users won't require a full five mix-minus channels, unused mix-minus outputs may be fed into other cueing sources, such as listen line telephone couplers or SCA generators. Although these feeds are not contributing to the mix-minus buses, the program and IFB audio will be available to them.

There may be instances where you will be adding sources to the Mix-Minus Bridge at different times. Perhaps you're conducting a telephone interview, and the remote crew dials in to test the ISDN link for a broadcast later that day. You don't necessarily want audio from the remote crew fed to the telephone caller. So each input to the mix-minus can be selected on or off via front panel buttons. While these buttons control what gets sent into the mix-minus buses, all outputs are always active and everyone still receives audio as soon as they are connected. The input selections have remote control ability.

While the examples that follow in this manual refer to audio codecs, remember that the Mix-Minus Bridge can be used with any devices that would benefit from either IFB or the mix-minus feed.

Note: If you run a PA system at your remotes, you already know how difficult it can be to control feedback from your microphones. If your PA feed comes from an air-monitor receiver, you have been “fighting” the audio processing in your air chain. However, if you use a mix-minus feed (through a codec, a return RPU, a telco coupler, etc.), your PA feed will include unprocessed remote microphone audio. This will make it much easier to control feedback.

SET-UP

The Mix-Minus Bridge will intercept the output of any remote audio device. In other words, any source which requires mix-minus on its *input* will have its *output* routed to the Mix-Minus Bridge **before** it gets to the console. The connection is then made from the Mix-Minus Bridge to the input module on the console.

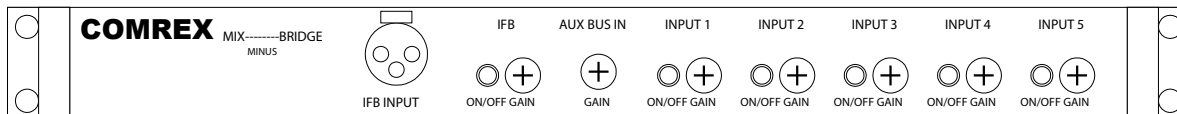
The Mix-Minus Bridge will use the output audio from each device to create its mix-minus buses. The level at which each device gets added to the other devices' mix-minus is controllable via a front panel level control.

In order for your remote guests to hear studio-generated audio, such as the studio mic or cart machines, a single mix-minus will need to be created on your console. This will be a mix of only studio audio, excluding any sources already connected directly to the mix-minus bus. Usually, this will be done via the audition or auxiliary bus on your console, but some consoles may have a dedicated mix-minus feature. This single feed will enter the bridge at the AUX INPUT connector. The level into the mix-minus buses is adjustable.

SECTION 2. FRONT AND REAR PANELS

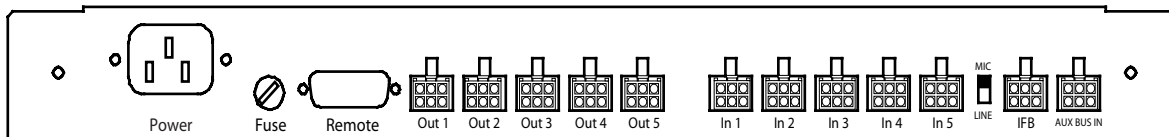
FRONT PANEL

This is a drawing of the front panel of the Comrex Mix-Minus Bridge. The INPUTS 1-5 each have ON/OFF switches and GAIN controls. The ON/OFF switches select which inputs are sent to the other users. The GAIN controls are adjusted to match up levels during the installation process, and can probably be ignored after that. The IFB ON/OFF is a push-to-talk button used to talk to all five codecs simultaneously. The IFB INPUT is an XLR (microphone) connector which can be used for a mic mounted on the front of the rack. The IFB INPUT is also available on the rear panel.



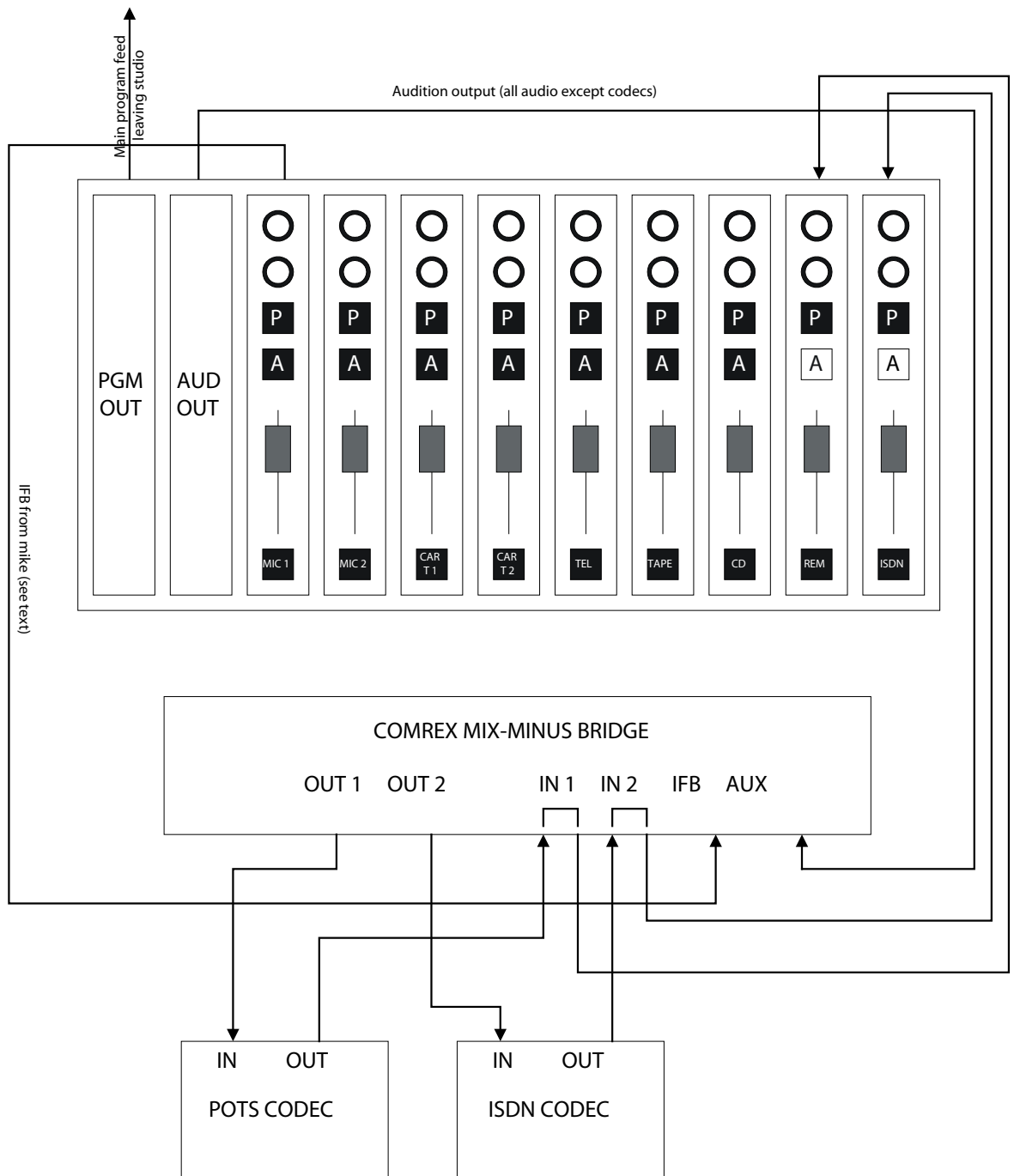
REAR PANEL

The drawing below shows the rear panel of the Comrex Mix-Minus Bridge. IN 1 through IN 5 are the line level inputs to be connected to the outputs of codecs, telephone hybrids, RPU receivers, or other sources to be fed to remote sites. OUT 1 through OUT 5 are the line level outputs going to those devices that return audio to the remote sites. The AUX BUS IN connector takes line level audio from your console's Audition, Auxiliary, or Channel 2 output, and feeds it to all of the remote sites. The IFB input can be switched between microphone and line level, and should be connected to a microphone near the studio operator. The REMOTE connector allows you to control channel ON/OFF selection and IFB operation from external switches or relays.



SECTION 3. STUDIO HOOK-UP

This is a sample studio hookup for two audio codecs, a console and the Comrex Mix-Minus Bridge.



The drawing on the previous page shows a typical on-air audio console at the top, the Mix-Minus Bridge in the middle, and two audio codecs at the bottom. In this example, the POTS codec is wired to the REM module, and the ISDN codec to the ISDN module on the console. The two console mixing channels are labeled program and audition. This may correspond to channel 1 and channel 2 on other commonly available consoles. The program or channel 1 audio would typically leave the studio to feed a radio station's air chain or a network's distribution system. Audio from audition or program 2 is used to form the mix-minus feed to the audio codecs.

Notice that all of the console modules are switched to both audition and program except the two codec modules. They are switched to feed program only. This means that the audition output of the console has all of the audio available, except for the codecs. This audition circuit is then fed to the Comrex Mix-Minus Bridge AUX BUS input, where it is sent to the codec inputs.

The audio from the codecs is then routed to IN 1 and IN 2 on the Bridge. Audio can be fed to the REM and ISDN console modules directly from the codecs, or by use of the loop-through feature of the Bridge connectors. Audio from the Bridge is then fed directly to the codec inputs. Assuming that the INPUT 1 and INPUT 2 ON/OFF button are pressed on the front panel, audio from each codec will be fed to the other, but not to itself.

Note: Your console may have one or two modules dedicated to telephone hybrids, and there may be an additional module to control the internal mix-minus feeds for those hybrids. Make sure that this setup is able to feed the Audition and Program channels simultaneously, while feeding Program audio to the callers. Some of the older console designs may not support this setup, and simple modifications to the console may be required. Check your console manual, or contact the manufacturer.

The wiring of the IFB input must be tailored to the individual studio setup. An XLR connector is provided on the front of the Mix-Minus Bridge. A small dynamic microphone could be plugged into this connector if the operator will be using the IFB button on the Bridge. Another approach would be to use the rear panel IFB connector, wiring directly across the operator's microphone at the console. The impedance of the Bridge's microphone input is high enough not to load the microphone. Also, you could wire the rear panel IFB input to a patch point jack on the console microphone module. Such points are usually unbalanced, and work somewhere between microphone and line level, so plan your wiring accordingly. If there is a microphone processor between the microphone and the console, you may have an unused microphone or line level output from that. A final option would be to mount a gooseneck IFB microphone right at the console, and wire it to the rear panel connector on the Bridge. For all of these options, make sure the MIC/LINE switch is set appropriately.

SECTION 4. TECHNICAL DETAILS

If nothing in this section makes sense to you, don't worry. However, do consider having a genuine "techie type" person do the actual installation.

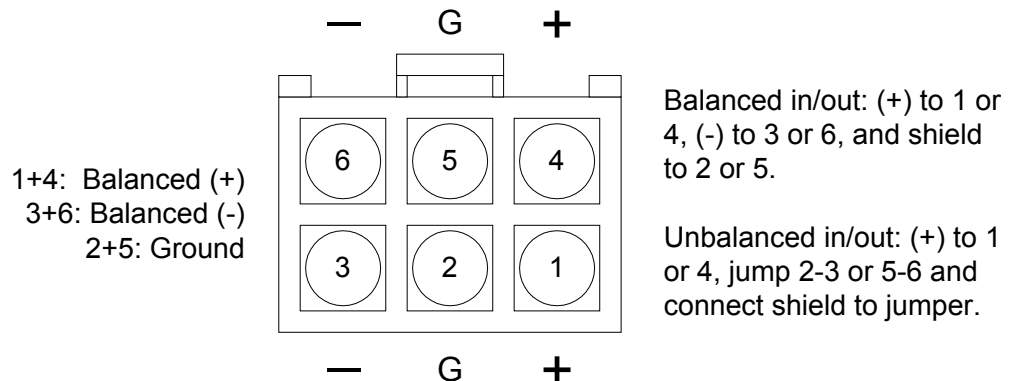
IN/OUT CONNECTORS

The Comrex Mix-Minus Bridge audio connections are made with Molex 5557 6-pin female connectors. Matching plugs and pins are supplied with the unit. If you need to order more from another source, the connectors are Molex 5557-NR (p/n 39-01-2060), and the pins are Molex 5556 (p/n 39-00-0056). Molex recommends their HTR-60622 crimper to attach the pins to the wire. This is a fairly expensive unit, but does an excellent job. The Waldom W-HT-1921 crimper that is used with many audio consoles should also be satisfactory. Comrex stocks these lower price crimpers – please contact us or your dealer for prices.

You should use 18-24 gauge wire with these pins, stripping about 1/8 inch (3 mm) of insulation from the end of each wire. Insert the stripped end into the pin so that the bare wire will be crimped between the forward "ears" and the insulated wire between the larger rear "ears." The Molex HTR-60622 crimper will make both crimps neatly with one squeeze. If you use the Waldom crimper, use the "B" jaws to crimp the stripped end first, and then crimp the insulated wire with the "A" jaws. You may want to get a tighter crimp on the insulation by putting that part in the "B" jaws and squeezing lightly. A few trial runs should get you started.

We chose the six-pin arrangement to allow you more flexibility in connecting to your equipment. Here is the pin layout:

Rear View of Molex In/Out Connectors



Note: The top row and bottom row are connected together. For one audio cable, you may use pins 1-3 or 4-6. You may also want to use the Comrex Mix-Minus Bridge connectors as a distribution point. In other words, run the output of an audio codec to pins 1-3, and then connect pins 4-6 to a console input. Just be aware that the audio connections to the console will be broken if you remove the plugs from the Bridge.

The input and output connections are balanced. We suggest that you maintain a consistent polarity throughout the wiring. Be aware that the ground pins do actually connect to circuit and chassis ground inside the Mix-Minus Bridge. If you have trouble with ground loops, you may want to “float” the shield at one end of your cables.

The active inputs and outputs of the Mix-Minus Bridge permit the use of unbalanced wiring, although this may not be wise in a complicated studio setup. The “hot” or “+” wire should be run to pins 1 or 4. We suggest jumpering either pins 2 to 3 or 5 to 6, and connecting the “cold” or “-” side to those pins. This will tie the unused input pins to ground, lowering noise pickup, and will shift the output amplifiers into unbalanced mode, providing the same voltage output as if they were running in balanced mode.

REMOTE CONTROL WIRING

The 15 pin REMOTE connector on the rear of the Mix-Minus Bridge can be used to remotely control the channel OFF and IFB functions. The connector pin-out is listed on page 15 of this manual. External relays, push-buttons or transistors can be used to pull the remote pins to ground and perform the function. Switching inside the Mix-Minus Bridge is done with 12 VDC relays. Pulling a Channel Off pin to ground (and holding it there) removes that channel from the mix fed to other codecs. If you are going to use this remote channel switching, make sure that the front panel ON/OFF switches are pushed in. Pulling an IFB pin to ground will switch the feed to that codec from the usual audio mix to the output of the IFB mic, allowing the studio operator to talk to an individual remote site without being heard by any others.

ADJUSTMENTS

The ON/OFF push-button for INPUTS 1-5 switch the feeds from each codec to the other codecs. For example, codecs 2-5 will hear codec 1 only if the ON/OFF switch for codec 1 is pushed in. Similarly, codecs 1 and 3-5 will hear codec 2 only if codec 2's switch is depressed. The reason for doing this is simple: If codec 1 is on the air from a remote, and the operator of codec 2 dials in before the remote is done, you do not want the people at the first remote to hear chatter from the second remote until everyone is ready.

The Mix-Minus Bridge is preset for unity gain at the factory. This usually results in the seven GAIN controls being set at 12:00. You may not need to change these settings, particularly if your line level inputs and outputs are standardized within the studio.

Start with the AUX BUS IN, which is probably connected to your Audition or Program 2 channel in the studio. Set up some program audio or tone at normal level on the console. This will be automatically fed to each codec or other device connected to the five OUT jacks on the Bridge. Check the input level to each device, and adjust the input controls on each codec input for proper level. The AUX BUS IN gain control on the Bridge will control the AUX level to **all** codecs. Use it only if you need to scale all of the output levels up or down.

The GAIN controls for INPUTS 1-5 on the Bridge adjust the feed from *that* codec to the *other* codecs. If you feed program audio through codec 1, use the GAIN control for INPUT 1 to set the levels into codecs 2-5. Match the level you previously established for the AUX BUS feed to the codecs. Just make sure the front panel ON/OFF button is pressed in to send that channel to the other codecs.

Press the IFB ON/OFF button on the front panel. This will interrupt all Aux Bus and other feeds to the codecs, and send the IFB microphone audio to each codec. You will probably have to adjust the IFB GAIN control to match this level up with the ones you have previously set. If you have trouble with this, make sure that the MIC/LINE switch on the rear panel is set to the correct position. If the IFB audio is very loud and distorted, the switch should be changed to the LINE setting. On the other hand, if the audio is very weak, try the MIC position.

SECTION 5.**OPERATION***CONSOLE*

Make sure that the console modules carrying codec outputs, etc., are set to program only. There is something about weekend and overnight people that makes them play with buttons on consoles. Some clear labeling will help here. If you use the console's audition or program 2 output for recording or other things, be sure that your operators are aware of the need to put things back to normal.

ON/OFF SWITCHES

The ON/OFF switches on the Bridge control audio being fed to *other* codecs, hybrids or remote sites. For many applications, you may just leave the buttons pushed in, and pay no further attention to them. However, if you have a situation where "closed circuit" audio should not be sent to a remote, these switches will be handy. For example: You are broadcasting a remote via a POTS audio codec. A traffic report via ISDN is scheduled at 8:10 A.M. The traffic person calls in at 8:09, and needs to exchange some information with the board operator at the studio. The operator can have the ISDN feed in cue on the console, and can use an IFB button to chat with the traffic person. However, the audio from the traffic service should not be sent to the POTS remote until they are ready to chat on the air at 8:10. The operator only needs to release the button for the ISDN codec channel, and turn it on again when the report is scheduled to go on the air. We have provided remote connections for this on/off switching (see page 11 for wiring). If you use the remote control feature, just leave the ON/OFF buttons on the Bridge depressed. If your setup allows, you might want to remote the "off" function to follow the OFF button on your console module.

IFB

Pressing the front-panel IFB button momentarily interrupts the audio fed to all codecs or other devices connected to the Mix-Minus Bridge and sends audio from a microphone circuit. We anticipate that users will take advantage of the individual IFB circuits on the remote connector. This allows you to talk to an individual site without disturbing any others. The studio operator should be aware that the remote site will lose its program audio feed when an IFB button is pressed. This could be quite distracting to the people at the remote, and they should work out some rules in advance.

SECTION 6. SPECIFICATIONS

CONNECTIONS

Audio in: Molex 5557 6-pin male
Audio out: Molex 5557 6-pin male

Input connectors allow easy loop-through connection between external devices and console. Mating pins and connectors are supplied with each unit.

IFB in: 3-pin XLR female on front panel; Molex 5557 on rear panel

Remote control: DB15 female

AUDIO INPUTS

IN 1 through IN 5 and AUX BUX are 50K ohm balanced bridging, -10 to +10 dBu, adjustable (unity gain as supplied)

IFB input: Mic level: 15K balanced bridging, -35 to -70 dBu adjustable (-50 as supplied), Line level: 100K balanced bridging, -10 to +10 dBu adjustable (unity as supplied)

AUDIO OUTPUTS

Balanced line level, for 600 ohm or greater load, +4 dBu as supplied, +23 dBu maximum

REMOTE CONTROL

[5] Channel Off pins to remove each channel from the mix remotely (12 ma DC each pin)

[5] IFB pins to talk to each channel individually (12 ma DC each pin)

[5] Common ground pins

Remote control is by an external contact closure or open collector pull-down on a 12 VDC circuit.

POWER

120 VAC/60 Hz or 240 VAC/50 Hz, 12 watts (internally selectable)

SIZE

Net: 19" W x 8" D x 1.75" H; 48 cm x 20 cm x 4.5 cm
Shipping: 22" W x 18" D x 7" H; 56 cm x 46 cm x 18 cm

WEIGHT

Net: 5 lbs; 2 Kg
Shipping: 9 lbs; 4 Kg

SECTION 7. PINOUTS

*IN1 - IN 5, AUX BUS,
REAR PANEL IFB*

Pin 1 +Audio In
 Pin 2 Ground
 Pin 3 -Audio In
 Pin 4 +Audio In (connected to Pin 1)
 Pin 5 Ground
 Pin 6 -Audio In (connected to Pin 3)

IFB FRONT PANEL XLR

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

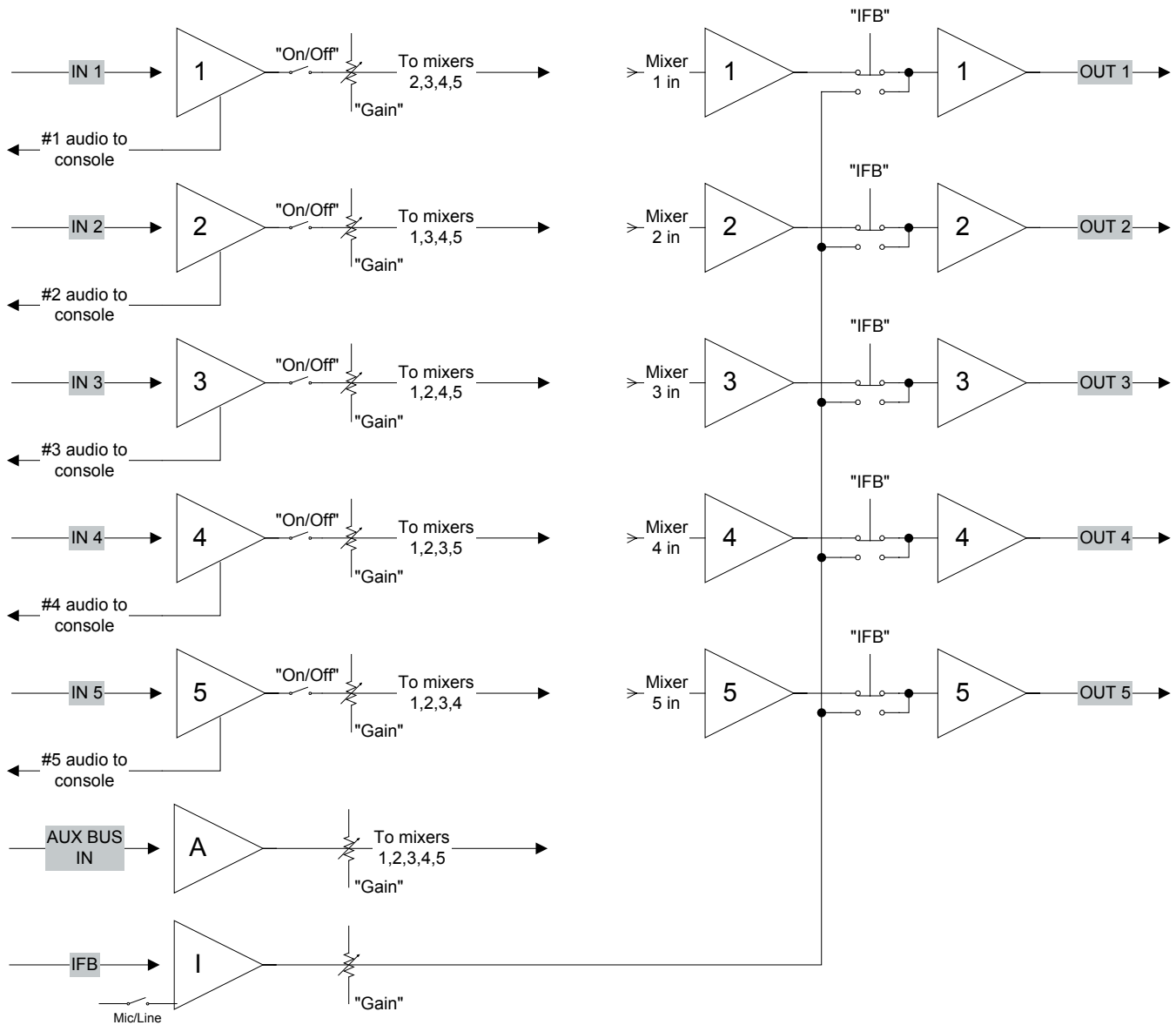
OUT 1 - OUT 5

Pin 1 +Audio Out
 Pin 2 Ground
 Pin 3 -Audio Out
 Pin 4 +Audio Out (connected to Pin 1)
 Pin 5 Ground
 Pin 6 -Audio Out (connected to Pin 3)

REMOTE

Pin 1 Channel 1 Off
 Pin 2 Channel 2 Off
 Pin 3 Channel 3 Off
 Pin 4 Channel 4 Off
 Pin 5 Channel 5 Off
 Pin 6 Channel 1 IFB
 Pin 7 Channel 2 IFB
 Pin 8 Channel 3 IFB
 Pin 9 Channel 4 IFB
 Pin 10 Channel 5 IFB
 Pin 11 Common Ground
 Pin 12 Common Ground
 Pin 13 Common Ground
 Pin 14 Common Ground
 Pin 15 Common Ground

SECTION 8. BLOCK DIAGRAM



- The ON/OFF switches shown above are the front panel switches with relays for remote control. The front panel switch must be depressed if the relays are used to switch channels ON and OFF.

- The IFB switches shown above are relays controlled as a group by the front panel push button, or individually from the remote control jack.