



## Studio Audio

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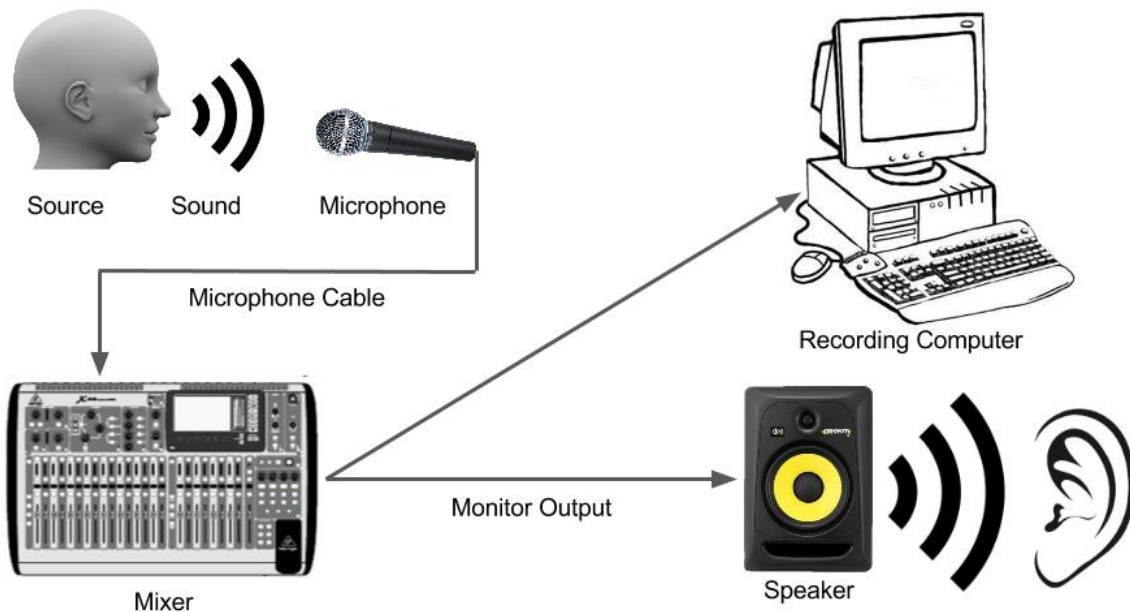
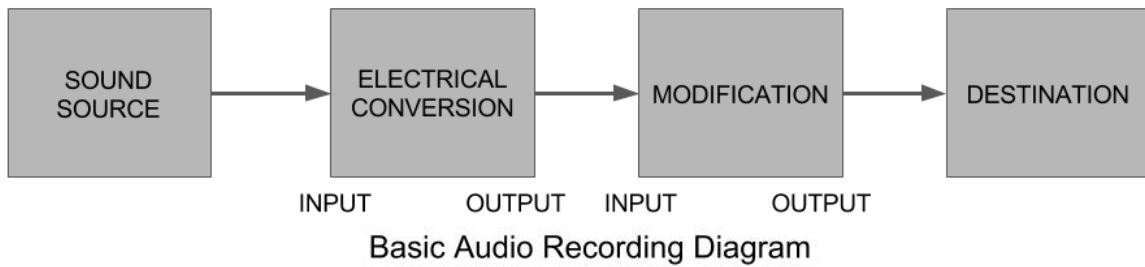


Welcome to the Studio Audio Operation class! In this class you will learn how to operate the studio audio equipment. This will include hands-on training with the mixing board, setting up microphones, and proper audio equipment management and maintenance. In order to pass this class you must complete the instructor-led, hands-on training and score at least 70% on a proficiency test.

**The Role of the Audio Operator:**

The audio operator is responsible for setting up and testing all microphones, music and sound effects before the production. During the production, the job of the audio operator is to monitor and maintain proper audio levels, making adjustments when needed. After each production, the job of the audio operator is to check each microphone and cable to make sure they are undamaged and return them to the correct storage location.

**BASICS OF SIGNAL FLOW:**



In the diagram above, sound is produced by a person speaking. This soundwave is converted to an electrical signal by the microphone. The signal is carried by a microphone cable from the output of the microphone to the input of the mixer. The mixer modifies the volume and tone of the sound, where it can be combined with other source signals. This modified signal is passed from the mixer's output to the speaker, where the signal is converted back to a soundwave for your listening pleasure.

**Microphones:**

Microphones and cables are located in the audio equipment cabinet. The microphones are in individual black bags. In each bag you will find the microphone itself and a microphone clip.

There are three types of microphones available at FPTV: Lavalier, Shotgun, and Handheld.

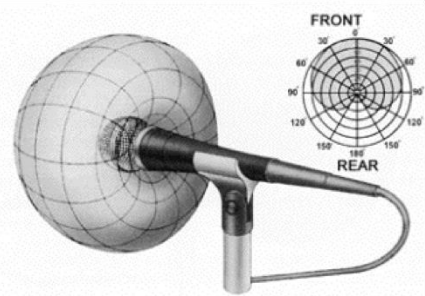
Lavalier (or lapel) microphones are compact microphones that get attached to a person's clothing in order to pick up their speaking voice.



A shotgun microphone is a long, cylindrical microphone designed to pick up sounds in front of it, while rejecting sounds to the sides and rear. Shotguns are designed to have a narrower focus than an average microphone and are most commonly used when you cannot position a mic directly in front of a sound source. For example, if someone is speaking in front of a camera and using a handheld microphone or lavalier is not desirable, having an off-screen shotgun microphone is another option.



Handheld microphones are used mainly for singing or speech. They have a cardioid pickup pattern which isolates the main sound source while minimizing unwanted background noise. The Shure SM58 is a great option when recording singing in a studio production.



Cardioid (Unidirectional) Microphone

**Connecting Microphones:**

Once you have selected the proper microphone, it's time to connect it to the audio system. Connect the female end of the microphone cable into the microphone and the male end of the same cable into an input on the audio patch panel. Make sure you have a microphone cable that is long enough to reach from the set to the audio patch panel located on the wall next to the glass doors. You can connect multiple microphone cables together to achieve the desired length. The patch panel is labeled with the corresponding input on the console.



**XLR MICROPHONE CABLE**



**STUDIO PATCH PANEL**

All the microphone cables at the Television Center use XLR3 connectors. They provide connection for balanced audio signals. For productions wherein multiple audio sources are located far from the audio patch panel we have an audio snake available. The audio snake has six inputs that can be plugged into the audio patch panel and run across the studio. Once the audio snake has been run across the studio, you can then connect up to six audio sources. This is very useful when recording a band in the studio. It can also help minimize the number of visible microphone cables.



**6 CHANNEL AUDIO SNAKE**

### **Lavalier Microphone Placement on Talent:**

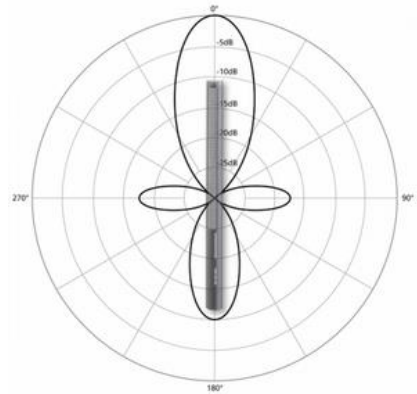
When assisting talent with their microphones, be sure that as much of the cable as possible is out of view.

This can be solved in most cases by running the microphone under the talent's clothing. Clip the microphone onto the lapel or shirt at mid-chest point on the talent, roughly 6-8 inches below their chin. You can also clip it onto the neck or center of the shirt if there is no lapel. The head of the microphone should be facing the direction of the talent's mouth. Make sure there is nothing touching the microphone and that there is no loud jewelry that may bump into the microphone during the production. The microphone pack can be hooked to the back of the pants or skirt.



### **Shotgun Microphone Placement:**

When placing a shotgun microphone be aware that it requires precision placement to ensure the talent does not leave the pick up area of the microphone. If there is more than one general area you are trying to cover you may need to use more than one shotgun microphone.

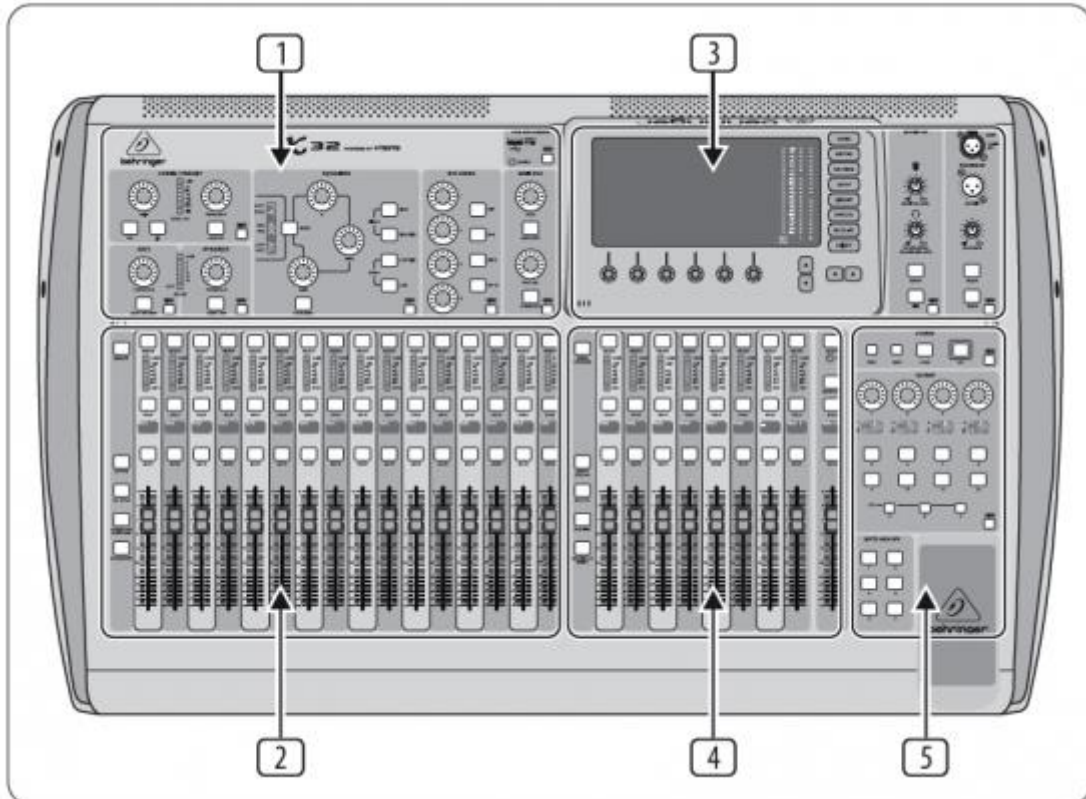


### **Instrument Microphone Placement:**

Recording instruments is a complicated marriage between science and art, but there are some general guidelines that can inform your decisions on where to place the microphone. The closer to the instrument, the more you will emphasize the sound of that part. When recording an acoustic guitar, placing the mic close to the sound hole will result in a boomy sound, while placing it close to the strings will result in a more bright or jangly sound. Moving the microphone further from the guitar will produce a more balanced sound, but will simultaneously capture more of the sound bouncing around the room. The best technique is to place the mic, and listen in the control room while the musician plays. If it sounds good, then no adjustment needs to be made. If you think it sounds wrong, move the microphone to a different location and listen again.

## The Audio Console:

The audio console is located in the studio control room. Sometimes called a “mixing console”, “sound board”, or “mixer”. This is an electronic device for combining, routing and changing levels, tone and/or dynamics of audio signals. All of the adjustments or modifications to the sound will be passed to the recorder.



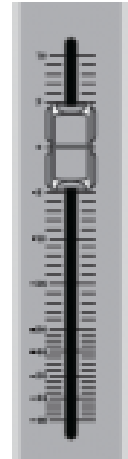
The X32 user interface is divided into five major sections:

- 1. Channel Strip**
- 2. Input Channels**
- 3. Display and Monitoring**
- 4. Group/Bus/Main Channels**
- 5. Scenes/Assign/Mute Groups**

For more info, refer to the “X32 AUDIO CONSOLE ADDENDUM at the end of this handout.

## POWERING ON THE AUDIO CONSOLE:

Locate the power switch on the rear right just above the power cable. Flip the switch, and the console will begin its boot sequence.



## BASIC SETUP

For this example, we'll connect one microphone to Channel 1 on the studio patch panel (which is in turn connected to Input 1 on the mixer.) Next, raise the Main fader to the "0" position, approximately 80% of the way to maximum. Leave the Channel 1 fader all the way down.

## SET THE GAIN:

Input sources like microphones must have their signal amplified to be in the ideal range for the audio console. We do this by adjusting the **gain knob** in the upper left hand corner of the console. Press the select button for Channel 1. Have your talent begin performing or speaking. Slowly turn up the gain knob until the meter reaches "-18dB to -12dB". If you turn the gain too high, you will overload the amplifier. The red **clip light** will illuminate, and the sound signal will distort in an unpleasant manner. You NEVER want your inputs to clip.





Too much gain, clipping the signal.



Correct gain setting

## GAIN VS. VOLUME

Gain is used to set the signal level at the input, while the channel fader is used to set the signal level of the output (volume). Once you've set the gain appropriately, you can begin raising the Channel 1 fader until the volume is at the appropriate loudness level.

## Main Mix:

The main mix is a master control for the summed signal of all of the audio inputs coming into the mixer. All audio can be brought up or down using this one fader. Typically the audio operator will set the main mix slider on the "0" mark. Adjustments to the relative audio levels will be made on the individual channel's audio input faders. When the audio operator wants to fade out all of these inputs at once they can simply take the main mix fader all the way down.

## LOW CUT

Most input signal types don't produce a usable low frequency signal. Including these frequencies often results in unwanted boominess, and can exacerbate plosive sounds (B's, P's, T's, etc). We can eliminate these frequencies by engaging a **low cut** (or high pass) filter. Sources like keyboards, bass guitars, or very low-pitched voices WILL have some low frequency information, and do not require a low cut. Press the "select" button for the channel you want to adjust. Press the "low cut" button next to the gain adjustment. You can adjust the frequency knob immediately above this button to determine at which frequency this filter begins modifying the signal. Most spoken word can be safely low cut between 100-150Hz.

## Equalizer

The equalizer section (EQ) of the mixer allows you to adjust certain frequencies on each channel, effectively changing the tone or timbre of each source so that it fits better in the overall mix. The audio console has 4 EQ “bands” of frequencies labeled “**Low**”, “**Low-Mid**”, “**High-Mid**” and “**High**”. These bands can in turn be adjusted to behave as a “**Low Shelf**”, “**Low Cut**”, “**PEQ**” (Parametric), “**VEQ**” (Vintage), “**High Shelf**” or “**High Cut**” using the “**MODE**” button.

## Equalizer Section

### Variable EQ :

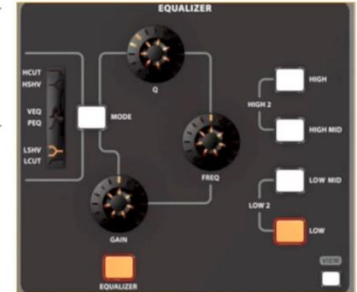
Tighter “Q” width than a Parametric EQ

### “Q” :

set the width of the frequency band you would like to adjust

### Sweepable EQ

- 4-band sweepable parametric EQ
- Low - Low Mid - High Mid - High
- Parametric EQ & Variable EQ



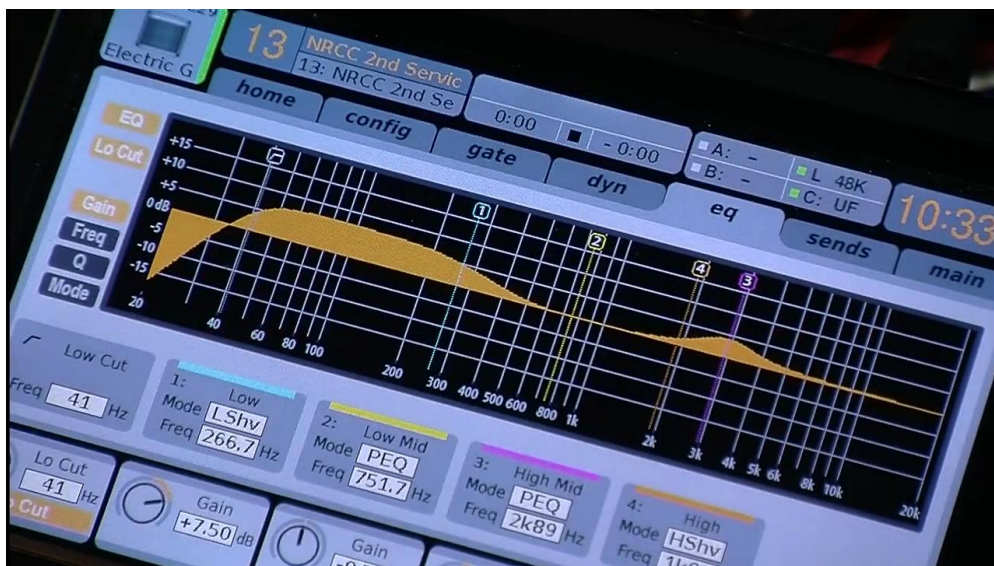
- **Low Cut & Low-Shelf**
- **High Cut & High-SHelf**



To select a particular EQ band, press the associated button on the right of the Equalizer Section. The “Gain” knob will boost or cut the signal level of the corresponding band. The “FREQ” knob allows you to select the frequency you want that band to affect. The “Q” knob allows you to adjust the width of the frequency band modifying the source signal.

The goal is to eliminate overpowering frequencies, enhance needed frequencies, and make the final sound as natural as possible. Without practice, it is exceedingly difficult to identify sounds by their numerical frequency value. To help identify a problem frequency by ear, select one of the mid bands, turn up the gain knob to “+12dB”, turn the Q knob to narrow the curve of that band, and turn the FREQ knob left or right to “sweep” until you hear the sound that you want to boost or cut.

### EQUALIZER EXAMPLE



This screen shows the EQ curves modifying an electric guitar signal. Frequency is on the X axis, while amplitude is on the Y axis. Notice that the center line is labeled “0dB”, meaning that no modification is being made. Frequency boosts are shown on the “+” side, while cuts would be on the “-” side of the graph. In this example, the Low Cut is engaged at 41Hz. EQ band Low is set to a shelf, boosting 7.5dB for all frequencies below 266Hz. The High Mid band is boosting 4dB at 2890 Hz (2.89kHz). The Low Mid and High bands are not actively modifying the signal.

When a channel has signal, the EQ screen will show a graphic representation of a Real Time Analyzer (RTA) in blue bars. The height of these bars shows the amplitude or loudness of that particular frequency. This helps you monitor your source in a visual way, and can guide your EQ decisions.



### SOLOING A CHANNEL

Sometimes during a production, you'll want to listen to just one source at a time without modifying the master output being recorded. Press the "SOLO" button on the desired channel to hear it in the control room monitors without disrupting the recording. The button will illuminate when active. Press the button again to turn solo off, and return to monitoring the Main Output. You can solo as many channels as you'd like at one time. Make sure to turn the solo buttons off when you are done soloing the channel(s). There is also a "CLEAR SOLO" button above the Main Fader which will turn off all active "SOLO" buttons.

### Auxiliary Send for Studio Monitor

Often the talent will require a performance monitor to be able to hear their proximity to the microphone. To accommodate this we have a powered monitor in the studio that can be connected to "Output 1" on the studio patch panel with an XLR cable.



The monitor will need power provided by an extension cord. Once the power and signal cables are connected to the monitor, it can be powered on. Return to the control room to adjust the mixer to send signal to the monitor.

On the console press the "Bus 1-8" button, just to the left of the output faders. Raise the fader for "Bus 1" to the "0" position. Assuming you've already set your gain and EQ for that channel, have the talent start performing at the microphone. Press the "Select" button for the appropriate channel. Locate the Bus Sends to the left of the Main Screen. Make sure the "1-8" button is illuminated. Gradually turn up the "1" knob until the the monitor outputs the desired signal level.



### PRO TIPS:

- Make sure that the monitor level is only as loud as it needs to be. Excessive monitor levels can lead to feedback and audible delay in the audio.
- **Make sure your microphones are always pointed away from the monitor.**

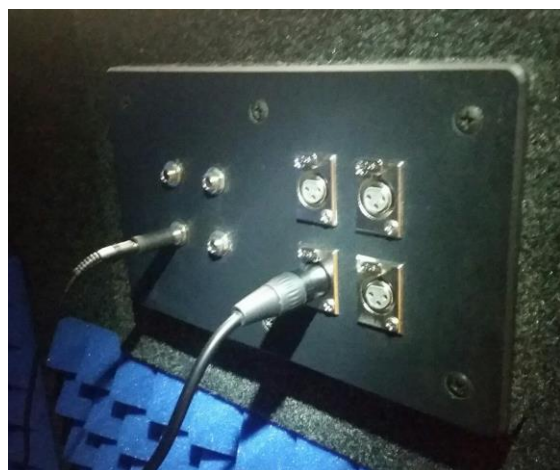
### Audio Equipment Care:

After each production, it is the audio operator's responsibility to check each microphone and cable to make sure they are undamaged and properly stored in the correct location. All microphone cables should be neatly coiled "over-under", tied, and replaced in the audio equipment cabinet in the back of the studio. The "over-under" name refers to the practice of twisting the cable in one direction to make the first coil, and un-twisting it to make the next, and repeating this until all the cable is neatly coiled. Keep each end on its proper side of the roll when uncoiling otherwise a knot will appear with every other loop. Connecting the ends on the outside of the loops, or tying them in that position, ensures that the ends don't pass through the loops in storage so there are no knots when the cable is laid out. All lavalier microphones should be inspected for any damage, then neatly coiled and placed back in the audio equipment cabinet. Any microphones or cables found to be damaged should be immediately given to a member of the staff for inspection and repair. All microphones other than the studio lavalier microphones should also be given back to staff to be properly stored.

## ISOLATION BOOTH



There is a vocal isolation booth available for recording voiceover dialog for your projects. Ask a staff member for the key to unlock it. The booth has a condenser microphone and headphones installed. The booth is patched into the control room. Alternatively, you can connect to an external recording device (laptop or camera) via the patch panel shown below. We'll cover more on this in the advanced audio courses.



# X32 AUDIO CONSOLE ADDENDUM

## View buttons rule

Throughout the top panel of the console, you will find small buttons labeled “**View**”. Press these buttons to immediately switch the console’s large color display (known as the Main Display) to show information related to the section whose View button you have just pressed.

For example, if you are editing the equalizer and feel like seeing a large display of the EQ frequency response curve or corresponding EQ parameter value, simply press the adjacent View button in the EQ section. If you need to check where the talkback signal is being routed, simply press the View button next to the Talk button and the main display will show the details. With the View button approach of the X32 console, there is almost never a need to drill down through multiple menu pages, since the View buttons will always take you directly to the relevant screen.

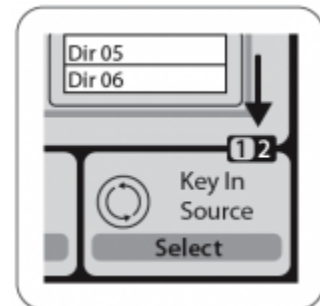
## Customizing the X32 through the Utilities page

Press the Utility button, located to the right of the main display, to bring up useful functions in a “context-sensitive” manner. For example:

- When you are adjusting the equalizer of a console channel, pressing the Utility button will offer copying, pasting, loading or saving of equalizer settings
- Pressing the Utility button while editing a channel’s Preamp/Configuration screen will present a naming screen where you can customize the channel’s appearance on both the main display as well as the small channel display
- On the Routing pages, pressing the Utility button will offer loading or saving different presets of routing scenarios
- In the Scenes menu, pressing the Utility button offers copying, loading, saving or naming console scenes

## Sometimes there is more to say

Some of the individual pages on the main display contain more adjustable parameters than can be controlled by the 6 rotary push encoders (knobs) located beneath it. In these cases there is a small page number indication, e.g. “1/2”. Simply press the Layer Up/Down buttons to switch between layers.



## **Channel Strip**

The X32's channel strip offers dedicated controls for the most important processing parameters of the currently selected channel. To adjust controls for a given channel strip, simply press the Select button on the desired input or output channel.

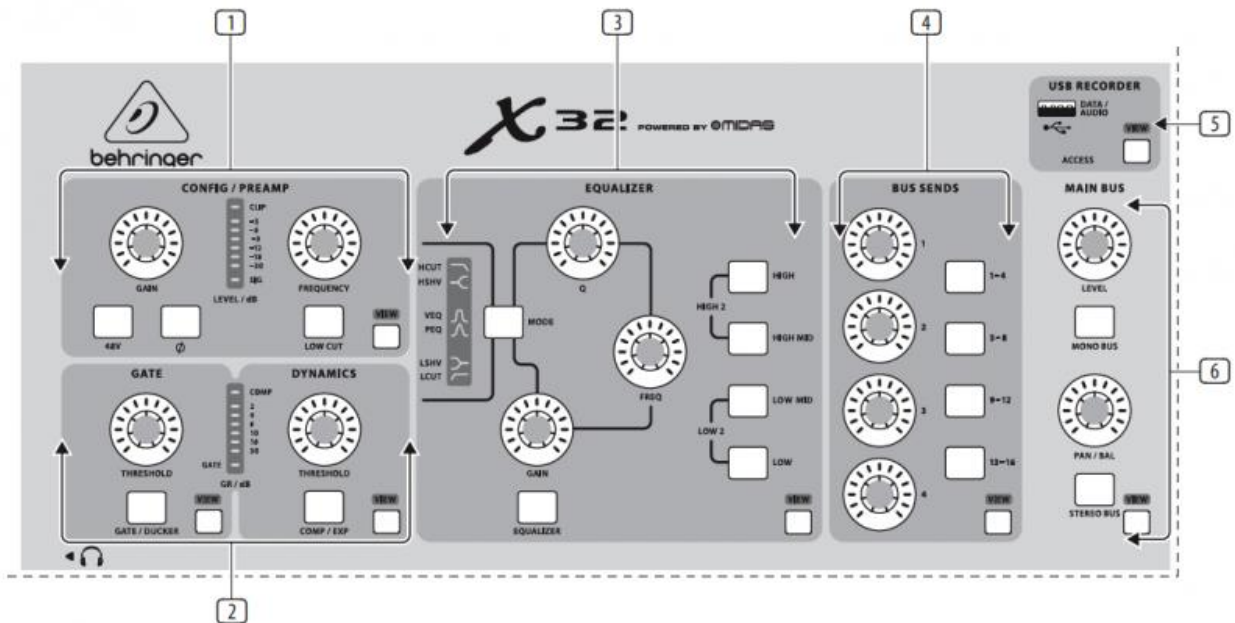
Certain sections of the channel strip (such as the low cut filter, noise gate, EQ and compressor) contain a respectively labeled button that can be pressed to switch the specific effect on and off. The button illuminates to show the effect is active, and goes dark when bypassed.

Within the channel strip, the rotary control knobs are surrounded by an amber LED collar that indicates the parameter's value. Whenever this backlit knob is turned off, it indicates that this specific control/parameter is not available for the selected channel type. For example, if an output bus is currently selected, the LED collar on the gain knob is turned off, because there is no input gain to be controlled on an output bus.

The channel strip consists of the following sub-sections:

- Config/Preamp
- Gate, Dynamics
- Equalizer
- Bus Sends, Main Bus

Each of these subsections correspond to the processing steps of the currently selected channel, and they each have their own View button that, when pressed, switches the Main Display to a page displaying all related parameters for that subsection.



1. **Preamp** – Adjust the preamp gain for the selected channel with the Gain knob. Press the 48V button to apply phantom power for use with condenser microphones and press the button to reverse the channel’s phase. The meter displays the selected channel’s level. Press the Low Cut button and select the desired high-pass frequency to remove unwanted lows. Press the View button to access more detailed parameters on the Main Display.
2. **Gate/Dynamics** – Press the Gate/Ducker button to engage the noise gate and adjust the threshold accordingly. Press the Comp/Exp button to engage the compressor and adjust the threshold accordingly. When the signal level in the meter drops below the selected Gate threshold, the noise gate will silence the channel. When the signal level reaches the selected Dynamics threshold, the peaks will be compressed. Press the View buttons to access more parameters on the Main Display.
3. **Equalizer** – Press the Equalizer button to engage this section. Select one of the 4 frequency bands with the High, High Mid, Low Mid, and Low knobs. Press the Mode button to cycle through the types of EQ available. Select the specific frequency to be adjusted with the Freq knob, and adjust the bandwidth of the EQ with the Q knob. Finally, boost or cut the selected frequency with the Gain knob. Press the View button for more editing options.
4. **Bus Sends** – Quickly adjust the bus sends by selecting one of the 4 banks, followed by one of the 4 knobs. Press the View button for more detailed editing and routing.
5. **USB Recorder** – Connect a thumb drive to install firmware updates and to record performances. See the Topic Guide section for details.
6. **Main Bus** – Press the Mono Bus button or Stereo Bus button to assign the channel to the main mono or stereo bus. When Stereo Bus is selected, the Pan/Bal adjusts the left-to-right positioning. Adjust the overall send level to the Mono Bus with the Level knob. Press the View button for more editing options.

## Input Channel Banks



The Input Channels section of the console is located on the lefthand side, and offers 16 separate input channel strips. These 16 channel strips represent three separate layers of inputs for the console, including:

- Input Channels 1-16
- Input Channels 17-32
- Auxiliary Inputs 1-6/USB playback/FX Returns 1L-4R

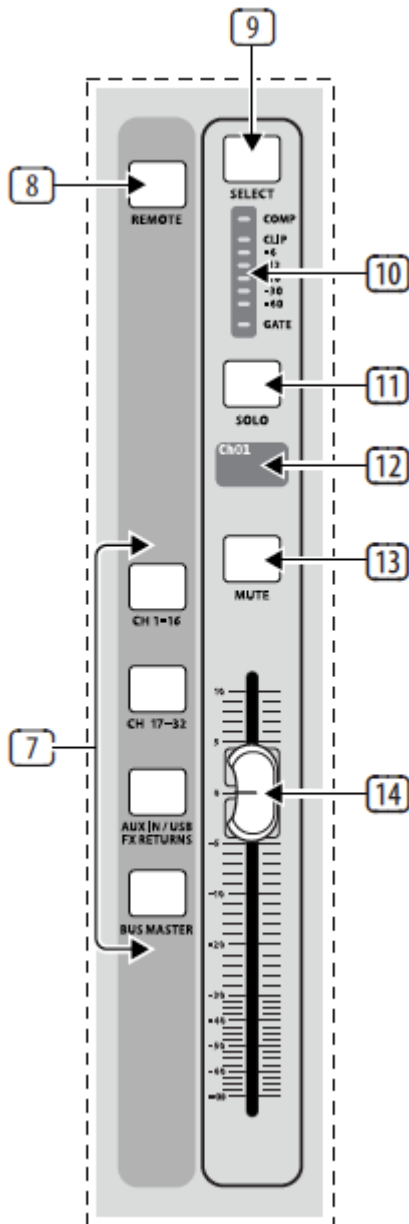
You will find a “Select” button on top of every channel. These are used to direct the control focus of the user interface, including all channel-related parameters (channel strip and main display), to that channel. Please note that at any time, there is exactly one channel selected (either Input Ch 1-32, Aux 1-8, FX Returns 1L-4R, Mix Bus 1-16, Main LR/C, or Matrix 1-6). DCA Groups (digitally controlled amplifier) cannot be selected because they control a number of assigned channels rather than one specific channel.

Press any of the correspondingly labeled layer buttons on the left side of the console to switch the input channel bank to any of the three layers listed above. The button will illuminate, reminding you which layer is active.

A fourth layer “Bus Masters” is also offered, allowing you to adjust the levels of the 16 Mix Bus Masters, which is useful when you wish to include Bus Masters into DCA Group assignments. On each fader strip you will find a motorized 100mm level fader, Mute and Solo buttons, a Gate indicator, an input level meter, Compressor indicator, and the channel select button.

Each of the 16 input channels has an individual (and customizable) color LCD screen that can display a channel number, nickname, and even a graphical channel icon. In the event that a channel’s input source has been changed to an input signal that differs from the default setup, the LCD display will also indicate the name of the actual input source.

Example: Channel 01 has the nickname Soundcard and is fed from Aux input 5.



**7. Layer Select** – Select either the channels 1-16, channels 17-32, Aux In/USB/FX Returns, or Bus Masters layer with these 4 buttons. The currently active layer will light.

**8. DAW Remote** – Press this to enable DAW remote control.

**9. Select** – Press this button to select an input or bus (depending which layer is active) and allow it to be edited by the Channel Strip and Main Display.

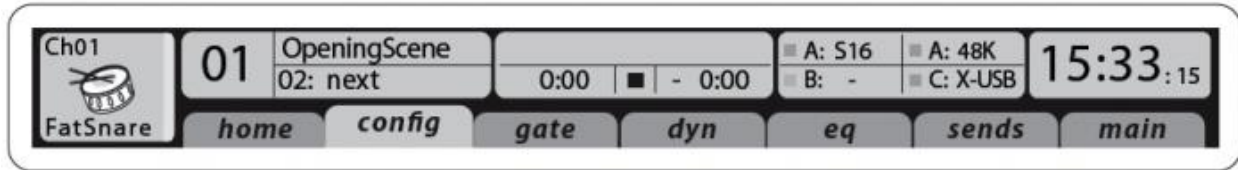
**10. Channel Meter** – This displays the signal level of the input or bus (depending which layer is active). The Gate and Comp LEDs light to indicate that noise gate and/or compression are active.

**11. Solo** – Press this button to send the channel to the Solo Bus.

**12. Mini Display** – Information such as channel number, nickname, input source and graphical icon are displayed on this color LCD screen. (Also called “Scribble Strip”)

**13. Mute** – Press this button to mute the channel.

**14. Fader** – Use this to adjust the channel volume or bus send in ‘Sends on Faders’ mode. The faders will automatically display the current status as layers and functions are changed.



## Main Display Area

The main color display presents information about various sections of the console. It can be switched to different screens using the console's View buttons, as well as any of the 8 buttons on the right side of the display.

The top section of the main display shows useful status information. The top left corner displays the selected channel number, its nickname and the selected icon. The next block shows the current scene number and name in amber, as well as the next upcoming scene. The center section displays the playback file name along with elapsed and remaining time and a recorder status icon. The next block to the right has 4 segments to show the status of AES50 ports A and B, the Card slot and the audio clock synchronization source and sample rate (top right). Small green square indicators show proper connectivity. The right-most block shows the console time that can be set under Setup/Config.

When working with any given screen, press the Page keys located on the display bezel to switch to different screen pages.

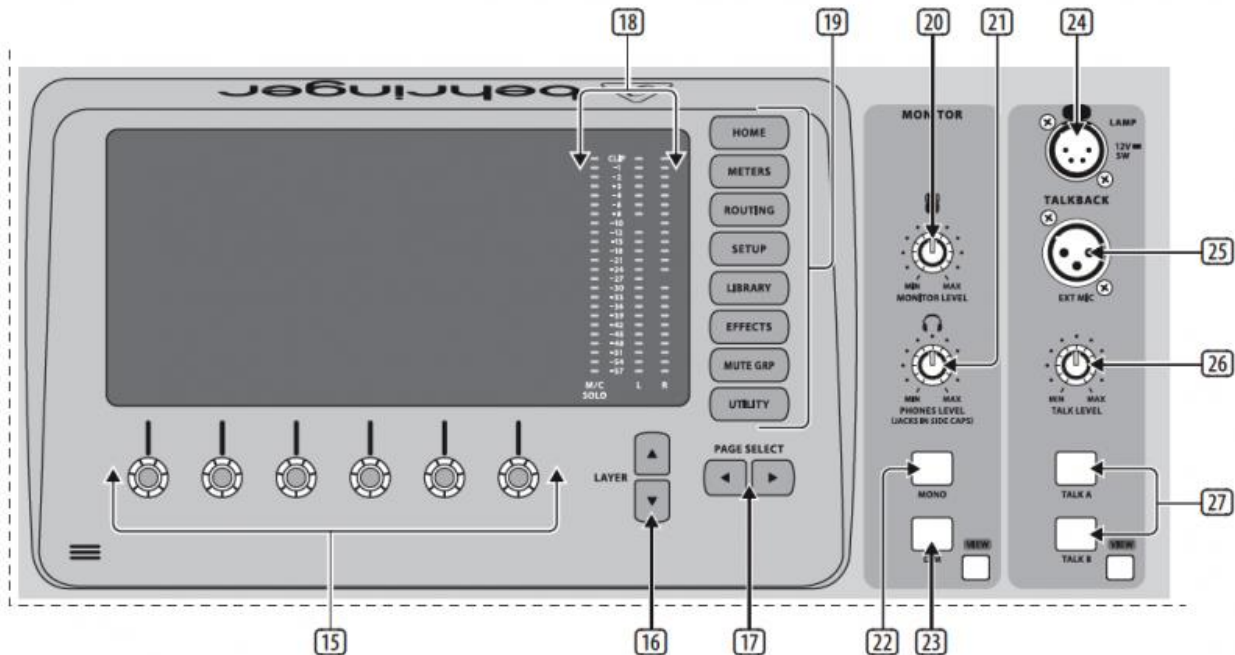
Editing parameters or settings on each of the screens is done using the 6 associated push encoders (knob) along the bottom edge of the display.

- Whenever there is a continuous control or list entry, you can turn the corresponding knob for editing, which is indicated by various circular icons
- When there is a switch or toggle function on one of these knobs, you will see a broad rectangular button along the lower edge of the field. Pressing the encoder (knob) changes the on/off state of the corresponding function. When the rectangular button in the display is dark grey, the corresponding function is off/inactive; when it is amber, the function is on/active

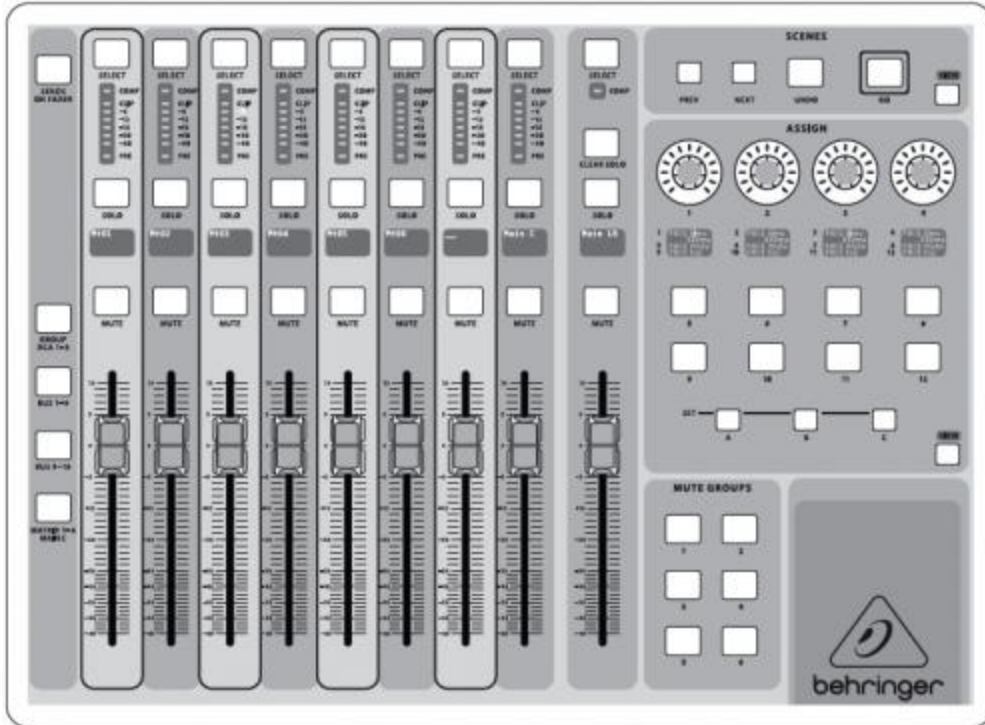
## Monitoring and Talkback

There are two separate Level controls in this section, one for the headphone outputs located on either side of the console, and a second one for the monitor outputs located on the rear panel. Press the section's View button to edit various monitoring preferences, such as the input source for the phones bus and the monitor outputs.

This section also contains independent Talkback buttons (A and B). Press the View button to edit the Talkback preferences for the Talkback A path and Talkback B path separately. This screen also contains settings for the optional goose-neck lamp and the console's internal test-tone generator.



- 15. Push Encoders** – These 6 knobs adjust the parameters presented at the bottom of the Main Display. The editable function will show a circular icon in the display when continuous control is available. The function will show a broad rectangular icon to indicate that a switch or toggle can be accessed by pushing the encoder (knob).
- 16. Layer Buttons** – Some screens in the Main Display have more than 6 editable parameters which can be accessed by pressing the Layer Up or Down buttons.
- 17. Page Select Buttons** – Use these to scroll through the available screens or to confirm/decline certain actions.
- 18. Main/Solo Meters** – The main stereo output level is displayed here along with the solo level of all channels whose Solo button is active.
- 19. Category Select Buttons** – Press one of these buttons to jump directly to the subject you wish to edit or configure.
- 20. Monitor Level** – Adjust the level of the Monitor outputs with this knob.
- 21. Phones Level** – Adjust the volume of the headphone outputs, located inside the left and right side caps.
- 22. Monitor Mono** – Press this button to monitor the audio in mono.
- 23. Dim** – Press this button to reduce the monitor volume. Press the View button to adjust the amount of attenuation along with all other monitoring-related functions.
- 24. Lamp Input** – Connect a standard 12 V, 5 Watt gooseneck lamp here.
- 25. Talkback Input** – Connect a talkback mic via standard XLR cable to this input.
- 26. Talk Level** – Adjust the level of the talkback mic with this knob.
- 27. Talk A/B** – Select the destination for the talkback mic signal with these buttons. Press the View button to edit the talkback routing for A and B.



### Group/Bus Channel Banks

This section of the console offers eight channel strips, divided into the following layers:

- Eight DCA (digitally controlled amplifier) groups
- Mix Bus masters 1-8
- Mix Bus masters 9-16
- Matrix Outputs 1-6, and the main center bus

This section also contains a main LR output fader, which is independent and always available no matter which channel bank or layer is active.

When using the DCA Groups layer, the DCA Groups can be soloed and muted, but they cannot be selected. To edit the DCA group names, icons and colors, navigate to the Setup/DCA Groups page on the main display.

When using any of the output bus layers, note that the bottom LEDs on the meters in this section illuminate when the respective bus is fed from pre-fader sources of the selected channel.