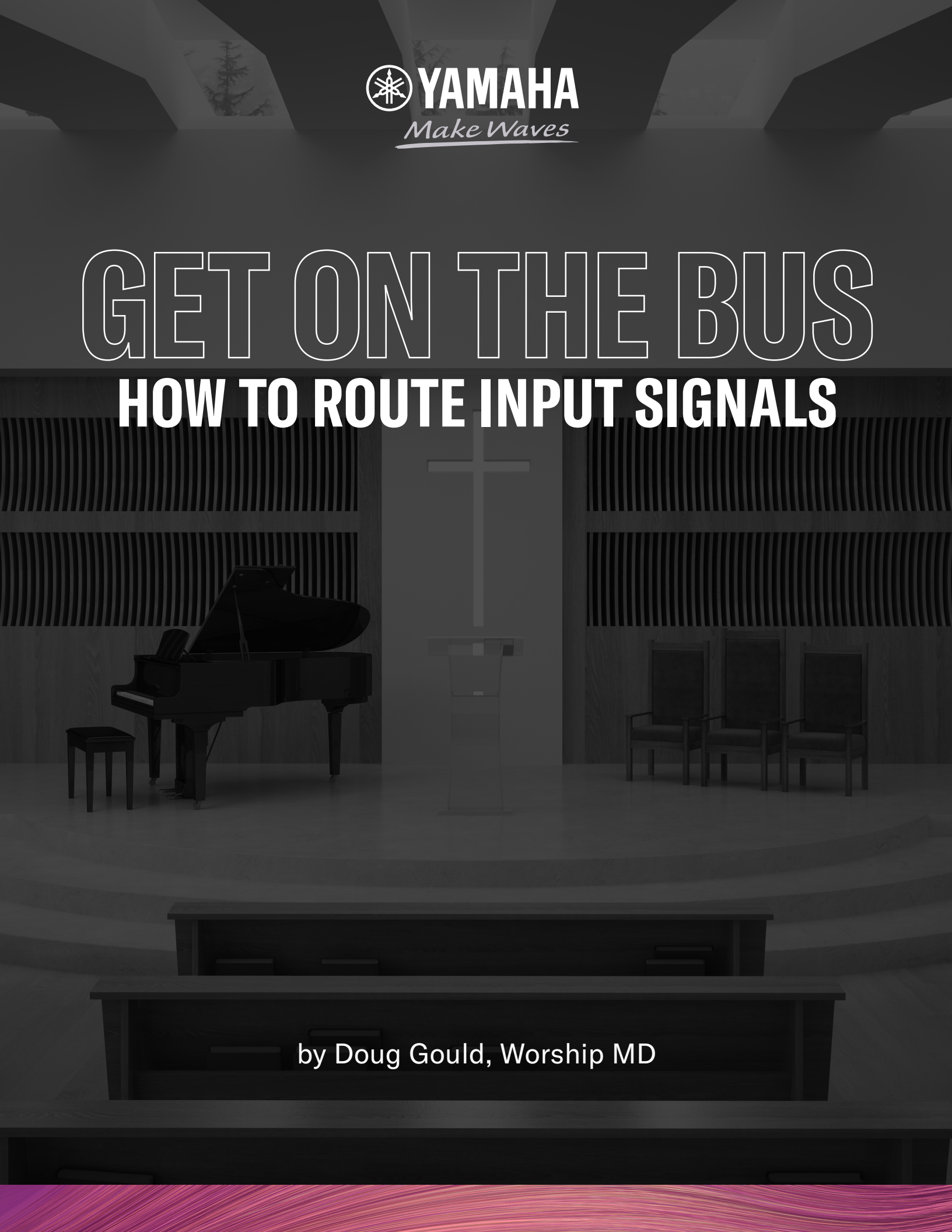
YAMAHA
Make Waves

GET ON THE BUS

HOW TO ROUTE INPUT SIGNALS



by Doug Gould, Worship MD

I WAS RECENTLY ON A TWO-WEEK TRIP TO EUROPE. My wife Sheri and I visited four countries in 12 days. We arrived at Munich International Airport and immediately headed to Salzburg, Austria — Mozart's birthplace. We then visited Vienna and Klagenfurt and eventually arrived in Venice, Italy.

We knew ahead of time we would be restricted from driving a rental car into the old city of Venice so we decided to stay outside the city and use local transportation. After looking at all the options, we opted for the city bus for a few reasons: it was inexpensive, direct, stopped at our hotel and ran every fifteen minutes. The only thing we had to do was figure out which bus to get on. You see, many buses stopped at our hotel, but we needed to take either Bus 5 or 19.

As you read this, I'm sure you're asking yourself if this is a travel review or travel blog post? What's up with the Venetian bus story? I'm glad you asked.

A bus for transportation provides an almost perfect allegory or metaphor for an audio bus on a mixing console. One of the things many volunteer audio techs get confused about is knowing how to route the input signals to the proper bus. Simply stated: "How do I get this signal or group of signals to come out over there?"

So, just as people get to their intended destination by getting on the right bus, routing a signal from a voice, guitar or vocalist group input to its appropriate bus allows those signals to arrive at their proper destinations.

WHAT ARE AUDIO BUSES AND HOW ARE THEY UTILIZED?

In live sound production, the term “bus” is spelled just like the vehicle, “bus.” In this context, a bus typically refers to a pathway or channel through which audio signals are routed within a mixing console or audio interface. Buses are used to group and route signals, allowing for efficient control and manipulation of multiple audio sources. For example, you might have a bus for all the vocals, one for instruments and another for effects, each allowing you to adjust their levels collectively.

MAIN BUS/OUTPUT BUS: This is where the final mix of all audio signals is routed, typically sent to the main speakers or outputs for the audience to hear.

SUBGROUP BUS/GROUP BUS: Subgroup buses are used to group related channels together, such as grouping all drum, vocal or instrument channels. This allows for collective processing and control of those groups.

AUXILIARY BUS/AUX BUS: Auxiliary buses, often called “aux sends” or “auxiliary sends,” are used to send a portion of a channel’s signal to an external processing device or effect (such as reverb, delay or external hardware processors). This is typically sent post-fader. More on the differences between pre and post-fader later.

MONITOR BUS: Monitor buses send specific mixes of audio signals to performers’ monitor speakers or in-ear monitors on stage. Each performer may have a custom mix of signals tailored to their needs, typically a pre-fader send.

MATRIX BUS: Matrix buses allow for the creation of custom mixes that combine multiple input signals in different proportions. These mixes can be sent to various destinations, such as additional speakers or recording devices.

TALKBACK BUS: Talkback buses are used for communication between the engineer and performers on stage or between different parts of a production team. They often include a microphone input and are routed to the performer’s monitor mixes or communication systems.

THE SOLO BUS: Also known as the solo function or solo channel, is an essential feature found on most mixing consoles and audio interfaces. It allows an engineer to isolate and listen to a specific channel or group of channels independently of the main mix. When you solo a channel, it means you’re listening to that channel exclusively, often muting all other channels temporarily. This is useful for several purposes.

These are just a few examples, and the specific buses available may vary depending on the mixing console or audio interface being used. Each type of bus serves a distinct purpose in managing and processing audio signals in live sound production.

MORE ON THE ALLEGORY OF PEOPLE ON A BUS TO A SIGNAL ON AN AUDIO BUS

How about this? Imagine you're on a large tour bus traveling through a city. The bus has multiple compartments, each with its own group of passengers. This is how this scenario relates to audio buses:

MAIN BUS/OUTPUT BUS (THE TOUR BUS): The main bus is like the entire tour bus itself. It represents the destination for all passengers (signals) on the bus. Everything that happens on the bus is ultimately headed to this main destination.

SUBGROUP BUSES (COMPARTMENTS): Subgroup buses are like the different compartments within the tour bus. Each compartment groups together passengers with something in common, like families, friends, shared language or individuals with similar interests. Similarly, subgroup buses group together audio signals that share similar characteristics, like all the drum, vocal or instrument signals.

AUXILIARY BUSES (TOUR GUIDES): Auxiliary buses are like tour guides who take small groups of passengers on specialized excursions. These tour guides (auxiliary buses) lead passengers to specific destinations (external processing or effects) that are independent and separate from the main tour (the main mix).

MONITOR BUSES (HEADPHONES): Monitor buses are like individual headphones or audio devices that passengers use to listen to customized audio feeds. Each passenger (performer) can adjust their headphones to hear a mix tailored to their preferences, allowing them to focus on specific aspects of the journey (performance).

MATRIX BUS (TOUR COORDINATOR): The matrix bus is like the tour coordinator who plans routes and coordinates schedules for various excursions. It takes input from multiple sources (audio channels) and creates custom mixes to send to different destinations (speakers, recording devices or other rooms).

PRE-FADER AND POST-FADER: WHAT'S THE DIFFERENCE?

The difference between pre-fader and post-fader auxiliary buses is when the signal is tapped from the channel and sent to the auxiliary bus in relation to the channel's fader position.

PRE-FADER AUXILIARY BUS

In a pre-fader auxiliary bus, the signal is tapped from the channel before it reaches the channel fader. This means that the level of the signal sent to the auxiliary bus is independent of the position of the channel fader. It's based solely on the level set by the pre-fader controller aux sent on the channel strip.

Pre-fader sends are typically used for stage monitors or recording devices where you need to adjust the level of the signals independently of changes to the channel's level in the main mix.

POST-FADER AUXILIARY BUS

In a post-fader auxiliary bus, the signal is tapped from the channel after it passes through the channel fader. This means that the signal level sent to the auxiliary bus is affected by the position of the channel fader. As you adjust the channel fader, the level of the signal sent to the post-fader auxiliary bus also adjusts.

Post-fader sends are typically used for effects sends like reverb or delay, where you need the effect level to remain consistent and follow the changes to the channel's level in the main mix.

IN SUMMARY:

- Pre-fader auxiliary sends are independent of the channel fader position and are often used for independent mixes: stage monitors and recording sends.
- Post-fader auxiliary sends depend on the channel fader position and are often used for effects like reverb and delay, aux-fed subwoofers, etc.

SUB-GROUPS AND VCAS / DCAS

Sub-groups and VCAs (Voltage Controlled Amplifiers) are tools used in live sound and studio mixing, but they serve slightly different purposes and have different functionalities.

SUB-GROUP

A sub-group is a grouping of multiple audio channels or tracks that are mixed before being sent to the main mix bus.

Sub-groups are typically used to group related instruments or sound sources, such as drums, vocals or guitars, to allow for collective processing and control. By routing multiple channels to a sub-group, you can adjust their overall level, apply processing like EQ or compression collectively and easily control their balance in the overall mix.

Sub-groups often have their own dedicated faders on the mixing console, allowing for independent level adjustments. Utilizing sub-groups in your mixing routine can significantly simplify your mix. It is much easier to operate a console with groups versus multiple inputs. Imagine trying to manipulate eight drum channels in the context of a performance versus using one fader to adjust the relative levels of a drum group.

You can mix an entire worship service with two groups if that is all you have available, breaking them into band and vocal. Now, with two faders, you can adjust the level of the band and the vocal instead of 16, 24, 32 or more individual faders.

VCA (VOLTAGE CONTROLLED AMPLIFIER)

A VCA is a control mechanism used to adjust the level (volume) of multiple channels simultaneously without affecting their relative balance.

VCAs do not actually pass audio signals themselves; instead, they control the level of audio channels by sending control voltages to the faders or gain stages of those channels. Think of the VCA as if it's a remote control. It communicates to the channels assigned to this VCA to level up or down. Unlike sub-groups, VCAs do not sum audio signals together; they simply provide a convenient way to adjust the overall level of multiple channels simultaneously.

VCAs are often used to control large groups of channels, like all the drum channels or all the background vocal channels, allowing for easy adjustment of their overall level without having to adjust each individual fader separately.

VCAs are particularly useful for managing complex mixes with many channels, as they provide a quick and efficient way to adjust overall levels without altering the relative balance between channels.

The bus setup screen on a Yamaha DM7 console.

In summary, use sub-groups to process multiple audio channels together and use VCAs for convenient level control of multiple channels without affecting their balance. Both are valuable tools in mixing, each serving different purposes depending on the mix's requirements and the engineer's preferences.

MY DIGITAL CONSOLE ONLY HAS DCA

VCA (Voltage Controlled Amplifier) and DCA (Digitally Controlled Amplifier) are similar concepts and serve similar functions in the context of audio mixing, but they are not the same.

VCA (VOLTAGE CONTROLLED AMPLIFIER)

VCA is an analog technology that uses control voltages to adjust the level (volume) of audio signals passing through it. In the context of mixing consoles, VCAs are typically used to control the level of multiple channels simultaneously without affecting their relative balance.

DCA (DIGITALLY CONTROLLED AMPLIFIER)

DCA is a digital technology that uses digital control signals to adjust the level of audio channels. Like VCAs, DCAs allow for the simultaneous control of multiple channels' levels, but they use digital control rather than analog control voltages. The primary difference between VCAs and DCAs lies in their underlying technology.

- VCAs are analog and rely on control voltages to adjust levels.
- DCAs are digital and use digital control signals to adjust levels.

In practical terms, however, VCAs and DCAs function similarly in most mixing consoles. They both provide a convenient way to adjust the overall level of multiple channels simultaneously without altering their relative balance.

While the terms VCA and DCA are often used interchangeably in colloquial language, technically, they refer to different underlying technologies. However, DCA is more commonly used in modern digital mixing consoles.

IN SUMMARY

In summary, audio buses serve as pathways or channels within a mixing console, allowing for the grouping, routing and processing of audio signals in live sound production. Various buses, such as main, subgroup, auxiliary, monitor, matrix, and talkback buses, serve distinct purposes in managing and manipulating audio signals. Analogies like comparing people on a tour bus to signals on an audio bus help illustrate these concepts, emphasizing the importance of routing signals to their intended destinations. Additionally, understanding the differences between pre-fader and post-fader auxiliary buses is crucial for effective signal management and processing. Sub-groups and VCAs (or DCAs) offer further tools for grouping and controlling multiple audio channels, contributing to efficient and streamlined mixing processes. Overall, mastering the utilization of audio buses is essential for achieving optimal sound quality and control in live sound production.

ABOUT THE AUTHOR

Doug Gould is the CEO and Founder of Worship MD and has been a veteran of the Pro Audio and Music Technology industry for nearly 30 years, serving in management roles at Shure, Tascam and E-Mu Systems. Doug has served as a worship leader, musician and sound tech at various churches throughout his career.

Over the last 18 years, Doug has been a very effective presenter at hundreds of worship conferences all over North America and beyond, focusing his experience on consulting and teaching.

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