YAMAHA

Empowering Worship

YAMAHA GUIDE TO CHOOSING A SOUND SYSTEM FOR YOUR HOUSE OF WORSHIP

What is the best sound system for your House of Worship? The answer depends on several things, there are no one-size-fits-all formulas. Bundled or packaged solutions can be a starting point, but the best sound system for your application is the one that is designed specifically for your needs.

This guide will give you a good starting point in determining what kind of sound system is right your congregation and needs.

Some Things to Consider

There are several questions that need to be answered when planning out a sound system:

Will your system be portable or permanent?

A church of any type is more than just a building. Congregations can and do meet in many different types of places, community halls, roller rinks, movie theatres, coffee shops, and more. If this describes your situation, you probably need a portable sound system solution. However, if you meet in a dedicated space or established church building, a permanent installed sound system would be the better solution.

What is the shape of your room?

The sound system's job is to direct sound to where the people are in the room, and away from the walls and ceiling. The speakers need to match the size and geometry of the room. By example, a long narrow room with a high ceiling will require a different approach than a short, wide room with a low ceiling.

What is your worship style?

Worship style will often dictate the sound system requirements needed. If you are just amplifying the Pastor as he gives his message, a small system with good vocal intelligibility is all you may need. But, if you are also amplifying a large choir or a full worship team with modern electric instruments, your system will need to be able to reproduce all the instrument and vocal frequencies, clearly and balanced. And if you have multiple worship styles, you will need a scalable solution.

Who is running the system?

In most cases you will have volunteers with different skill levels running sound, so user-friendliness is a necessity. The system should be designed to match the skill level of the team tasked with operating it.

What is in your future?

You should have a plan to future-proof your sound system. When designing a system, keep in mind what your needs may be in one year, two years and even three years. Try and create a system that can grow with your congregation and needs.

Key Components of the Sound System

Your sound system needs to sound great and perform consistently. Regardless of any specific needs, there are key components that are part of every sound system. A good sound system designer can tailor these components exactly to your needs.

Mixer

When you are searching for a sound system, one of the first things you need to look for is a mixer. The first thing to consider is, how many inputs and outputs will you need for all your PA requirements. Take pen and paper and write down "All" of the things that will be going into and out of your sound console. All your worship band requirements, vocals and instruments. Choirs, announcement microphones, speaker microphones, etc. Include audio sends to places like the foyer, cry rooms, hallways, etc., often more than the main sanctuary requires audio of the service. Possible video live stream, video record, etc.

Speakers

The next component of the sound system to look at are the speakers. Quality PA speakers make the difference between a great-sounding system and a system that never seems to sound right. There are a lot of factors that go into choosing the right PA speakers for your application and building space. What will work best for you, powered or passive speakers, portable or permanently installed, ceiling mounted or floor stands. All these choices will be based on your room configuration and size of your congregation.

Microphones

There will be at least one person speaking during any given service, and probably someone singing and playing a musical instrument, that is why you will need microphones. The first decision will be, wired or wireless for the vocals. Additionally, you may require microphones for drums, guitar amps, horns or strings, there are microphones designed specifically for use with musical instruments. Again, the amount of sound reinforcement via microphones will depend on how big your room is, and the size of your congregation.

Stage Monitors

If you have a worship band and vocals, they will need to hear themselves. Stage monitors can be an affordable way to provide a monitoring system for the band. However, if stage noise and stage real estate are a concern, an in-ear monitoring system (IEM) may be the better choice for you and your band. In either case, quality stage monitoring is essential, and should be a conversation between the audio team and the band to determine what will work best physically and budget wise.

## The Audio Mixer

An audio mixer has two primary jobs:

It lets you blend and adjust audio signals coming in from microphones, musical instruments and other audio sources.

It sends those mixed and polished signals to its output jacks, which then connect to amplifiers, loudspeakers or a recording system.

There are three types of audio mixers:

- Analog
- Powered Analog
- Digital

Each type has its pros and cons.
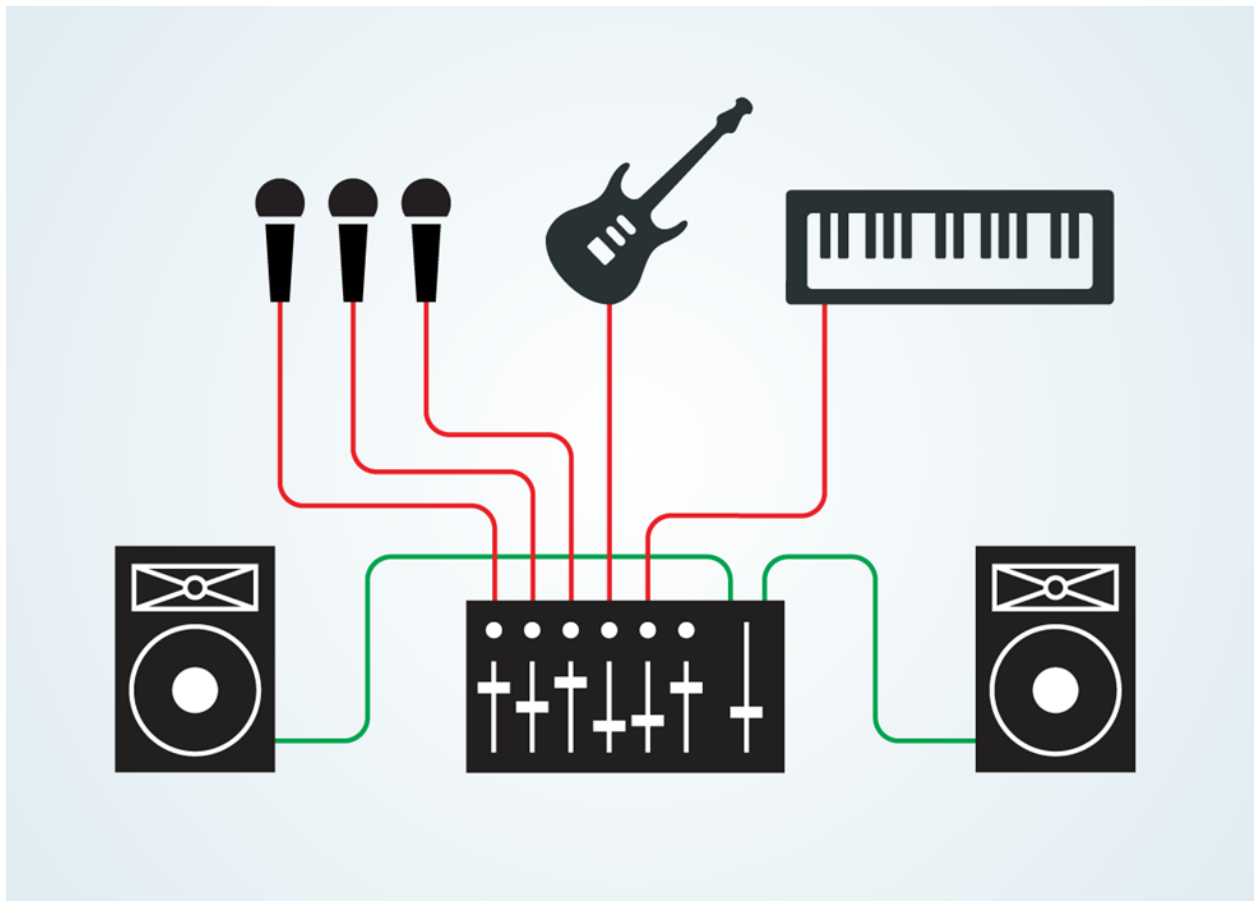
Do You Need a Mixer for a Portable or Permanent System?

If you meet out of doors, inside a temporary location, or you have an on-the-go ministry, then you will most likely require a mixer that can be easily portable. Later in this guide we will discuss self-contained, self-powered, analog and digital systems that are designed for different portable applications. We will also explain and give examples of consoles designed for permanent installation applications from small to large congregations.

What is Your Worship Style?

Ranging from traditional to contemporary, you will have different requirements depending on your worship style. If you are just amplifying the Minister's message with maybe one or two acoustic instruments and a few vocals, a small console may be all you need. But if you have a large choir or a worship team with modern electric instruments, your mixing needs are going to be more complex. If you have multiple worship styles, different campus locations and the need to interconnect them all, a coordinated networked system is going to be required.

Who is Your Tech Staff?

From the beginning it is important to establish the experience level of the people who will be operating the sound system. Houses of Worship tech staff can range from having a few experienced techs who know the system inside and out, to volunteers that may only be capable of moving three faders and nothing more, so experience level is a big part of the decision. The group experience level of your operators will determine what interface will work best: is the console laid out in such a way that it is easy to use, or can be easily learned, and allows for intuitive access to settings? A good mixer is one that allows you to adjust a large quantity of variables and parameters, allows the operator to see what they need to see without getting overloaded, and then can interact quickly with all those parameters.

## How Many Inputs and Outputs Will You Need?

One of the first criteria to establish is the number of inputs and outputs you currently need, and then look at what you may need for the next two to three years. You may only need 16 or 24 channels now, but what if the music ministry expands, requiring more inputs and outputs especially for more monitors. What if your building grows and you need to send more sound feeds to different rooms, or you decide to live stream, all these circumstances will certainly increase your I/O requirements.
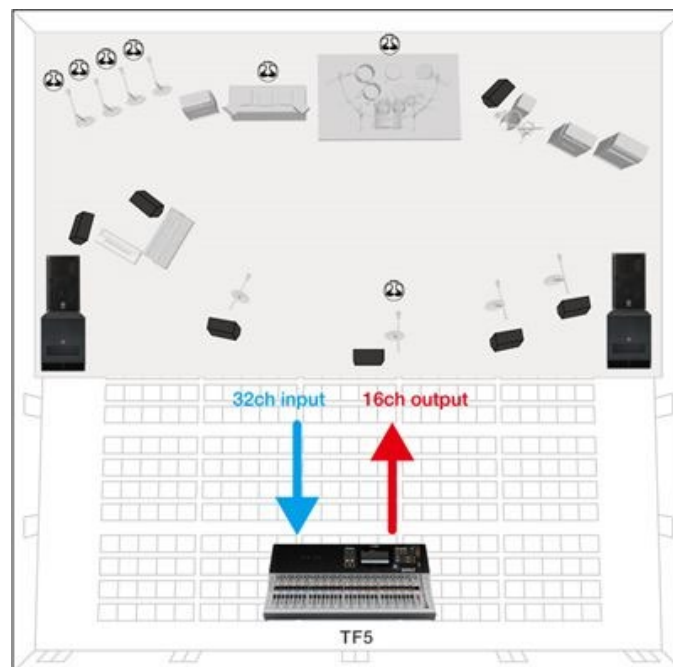
Yamaha TF5 System

Connection Ability

Will the main sound board need to communicate with ancillary consoles? You need to consider how well the console will interface with another mixer whether the same manufacturer or not. If you need additional consoles for broadcast or monitors for example, will you need to purchase the same board as the FOH, or can a smaller, less expensive board work for those positions? As well as considering your I/O needs for the future, it is important to consider the overall possible "Network" expansion of your system. You may eventually get to a place where not everything can be done or accomplished from the FOH board alone and you will need to add additional consoles.
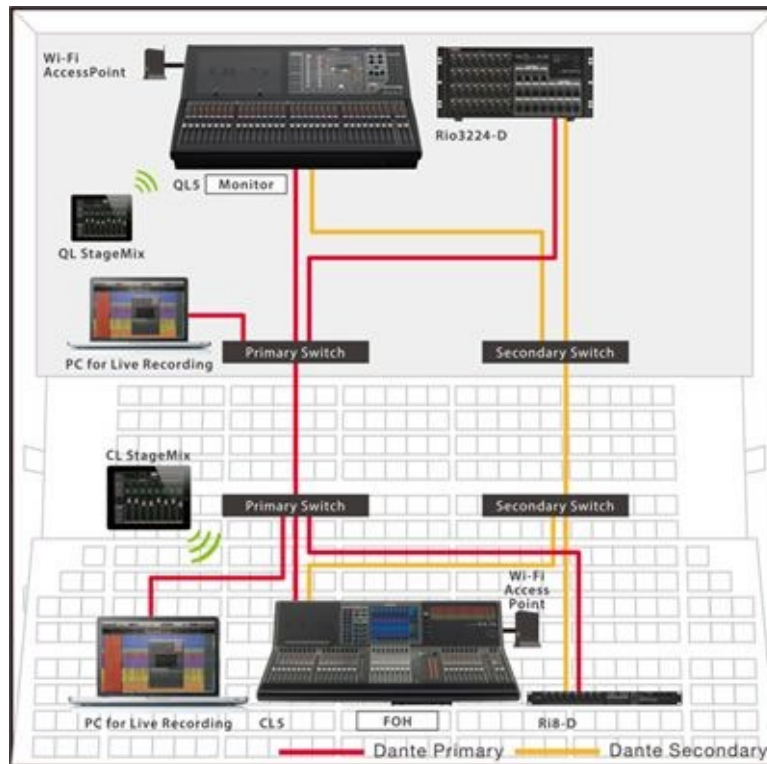
Yamaha CL5/QL5 Star Network

Connecting to the Stage

While an analog snake will work for both an analog and digital board, the digital console should be paired with the digital snake designed for it. Digital snakes utilize CAT5E or CAT6 cable to transmit all the FOH I/O to the stage, or any other networked console or device in the system. The greatest advantage of a digital snake, a single cable replacing the large, heavy and cumbersome analog snake, and the ability to communicate with other devices on your audio network. You are also greatly reducing your chances of having a faulty cable among all those other cables.
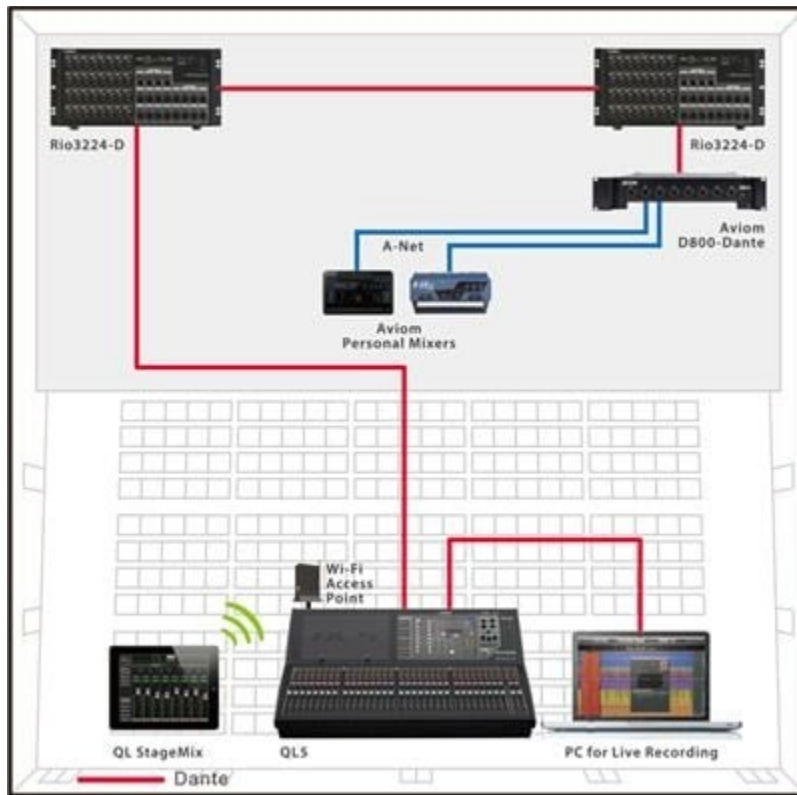
[Yamaha QL5 Daisy-Chained I/O Racks](#)

Single Brand Choice

If growth is in your future, whether that means your worship team and/or your campus will grow, it is important to think about how your tech team will handle rotating from one console to another. Several Houses of Worship have multiple rooms operating at the same time on service days, all in need of sound engineers, and those engineers are often rotated among the rooms. If you have consoles from different manufacturers, that often entails multiple training sessions to make sure the entire staff is competent on the different platforms. Many churches today opt for "Brand Family" consoles so that the training is on same operating platform no matter what the size or model mixer. For example, Yamaha's [QL](#) and [CL](#) mixing consoles use the same workflow, making it easy for a tech to mix on a [CL5](#) this week, and easily mix on a [QL1](#) next week. Brand Family also works great when using a Dante network, all the consoles are using the same protocol and are easily recognized by the network.
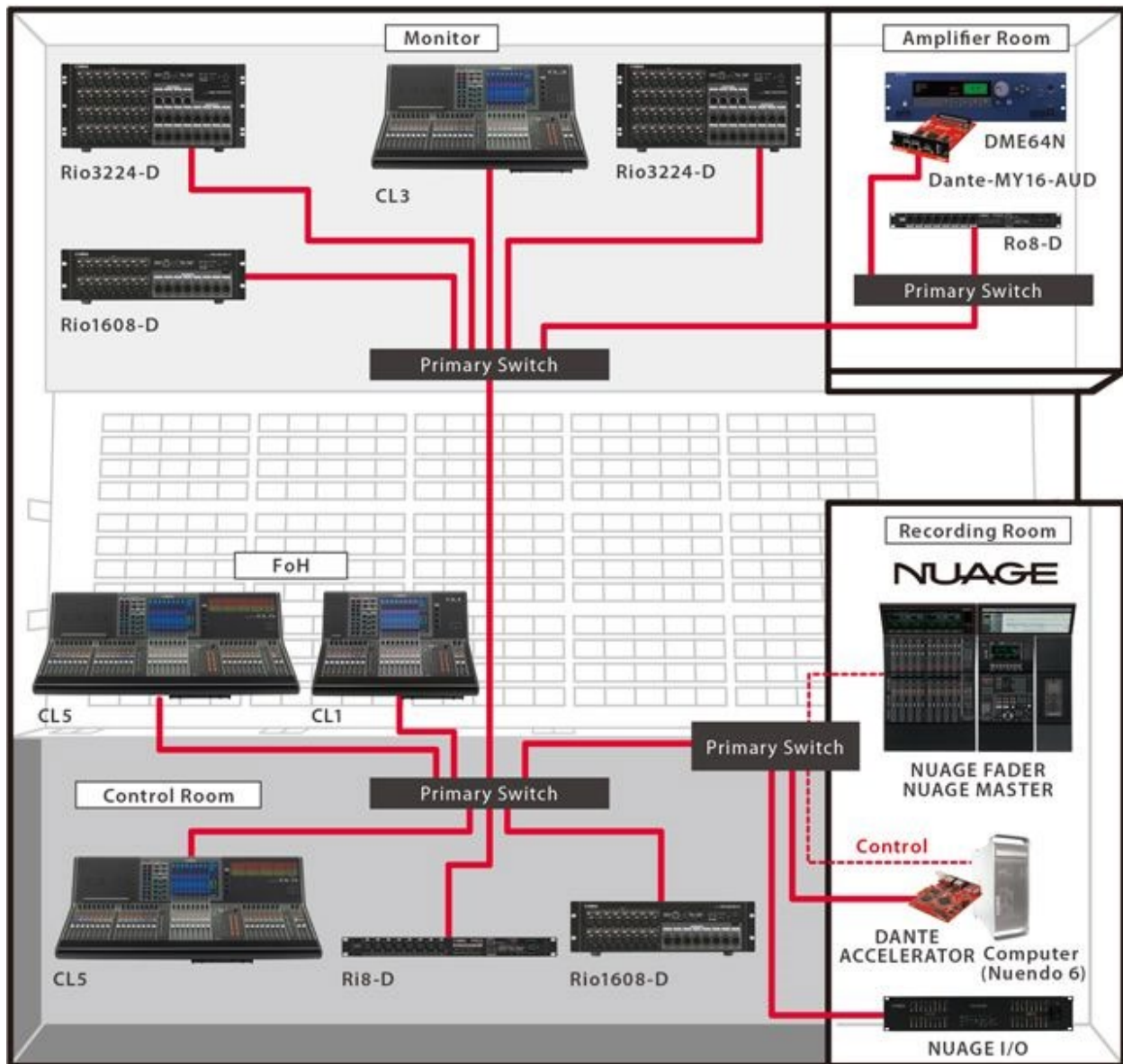
[Yamaha Multi-Console Network](#)

Take Time to Train

Allow plenty of time for the tech team to learn the console before running any services. If you are upgrading your console, set them up side by side, a lot of the preliminary work in setting up the new console can be done with a reference, like laying out and labeling, as well as giving the tech team a chance to get inside the workflow of the new console.

Do not underestimate the amount of time required for the audio techs to learn not only how to use new consoles, but also how to improve their mixing skills on them. Even if the board is considered easy to use, there will still be a learning curve. Each operator needs a reasonable amount of time to push buttons, move faders, and discover what the console is capable of, and then get comfortable with how it works. While there is more capability and flexibility built in, there are going to be many more variables, and parameters they can use.

Analog Mixers

Analog mixers are divided into "Channel Strips" with rotatory knobs that control; gain, EQ, effects, compression and AUX sends and returns. All the controls needed to operate the board are physically located on the mixer. This type of configuration determines what the physical size of an analog console will be. A mixer with 16 channels or less will have a relatively small footprint, but when more channels are required, the footprint will get significantly larger as more channel strips are added.

For the most part, analog mixers usually have a shorter learning curve, and are often a good choice for teams that have limited audio mixing experience.

Many analog consoles will include built-in effects and compression like the Yamaha MGXU and MGP series, these consoles offer 6 to 32 input channels, and for the most part do not require additional external effects generators or compressors. However, you may want to consider an external sound processor to help balance the overall room sound.

If you are budget conscious, analog mixers usually cost less than digital models, but they lack the automation and programmability you might want for more complex setups. While there is no wireless network remote control, some analog consoles like the MGXU series do offer a USB connection for both input and output operations.

While digital mixers offer a great deal more mixing options than analog mixers, analog can be a great choice for those on a small budget, or for those tech teams that have limited audio mixing experience.

Yamaha MG16XU Analog Console

Powered mixers

A powered mixer is an integrated solution that combines power amplifiers with a versatile mixer in a single, compact unit. A powered mixer easily connects to passive speakers, making this type of system literally "plug and play".

Like the Yamaha EMX powered mixer series, they will have two main channel outputs, and depending on the mixer model, will have additional AUX and recording outputs.. AUX channels are line level allowing self-powered monitor speakers to be added to the system if needed.

The EMX series offers many of the same features as the stand-alone analog console; built-in compression, 3 channel semi-parametric EQ, and up to 24 DSP presets for effects, and on the EMX7 model, a 9 band EQ, as well as an onboard feedback suppressor.

Despite their compact construction, only speakers and a microphones are required to configure a fully functioning, extremely portable, and reliable sound system with all the tools needed to mix.

Yamaha EMX7 Powered Mixer

Digital Mixers

Digital mixers offer a wide range of control and recall capabilities. You have the capability to setup "Scenes" on the mixer, then save those scenes into the memory of the mixer, this is very handy when you may have different groups using the mixer for different functions, all with different needs. When you need to restore the board back to your main service setup, a press of a button recalls all your settings. Scene saving is also great for making quick scene-by-scene changes during holiday theatrical productions.

Most digital mixers also allow wireless remote control. Yamaha digital mixers use the remote software StageMix, allowing you to use an iPad to walk around a room while making sure the music sounds good everywhere (different manufacturers will have their own version of remote software).

If your worship band is using In Ear Monitors (IEM's), Yamaha TF, QL, CL and Rivage digital mixers series coupled with MonitorMix, the Yamaha personal monitor mix software, gives each band member the ability to control their personal monitor mix, freeing the FOH engineer to focus on the house mix.

Digital Mixers like the Yamaha TF, QL, CL and Rivage series also come equipped with "Presets", allowing the sound engineer to select specific microphones being used and what they are being used for. What type of instrument input is being used, as well as what type of IEM being used. These presets help the audio engineer "dial-in" the EQ and compression for these channels, making for not only a quicker setup, but a better sounding overall mix.

Digital mixers also offer DSP effects, from reverb to delay, there are several choices to choose from to apply to an input channel.

Another advantage digital mixers have is overall footprint size. Because digital mixers can have multiple "layers" that are accessed by the push of a button, you do not have to have all the individual channels physically installed on the surface. For example, a 48-channel console can have 24 physical input channels DCAs or "Groups" of channels on the board surface, this is "layer 1". By pressing the "layer 2" button, the next group of channels, 25 through 48 now appear. Additionally, there are easy access buttons to view and control the outputs, effects and AUX sends, all on their own layers and instantly accessible.

If recording the service is necessary, most digital consoles come equipped with a USB port that will accommodate a USB memory device. When the record function is engaged, a stereo mix from the mains bus can be recorded as an audio file. If you need to be able to record each independent channel, the software program Nuendo Live from Yamaha/Steinberg installed on a laptop and connected to the console will multitrack record separate channels. This is a great resource if you want to be able to create "Virtual Sound Checks" or be able to do a full mix down of any performance.

A full digital setup also means using a digital cable. An I/O rack like the Yamaha TIO 1608 uses a single CAT 5E or CAT 6 ethernet cable that runs from the console to the I/O (input/output) rack located at the stage. Even systems that require 120 or more Input/Output channels are easily handled on this one cable, eliminating the need for large, heavy and expensive analog snakes. Additionally, the system can be connected to through Dante to other Dante enabled components in the system, this allows streamlining connections, aiding in troubleshooting and routing signal to where you need it to be.

Digital mixers can be flexible for any need or setup.

Yamaha TF5 Digital Mixer

Yamaha QL5 Digital Mixer

[Yamaha CL5 Digital Mixer](#)

Choosing Speakers

Achieving consistent high-quality live sound can be a challenge. Your choice of PA speakers can determine whether you are mixing to make something good sound great or struggling to solve sound-reinforcement problems. There are three basic categories of PA systems:

- Personal PAs
- Medium-sized PAs
- Full-scale PAs

Personal PAs consist of single speakers or mini speaker arrays, which serve as both main speakers and monitors. Medium-sized PAs consist of a pair of speakers on either side of the stage, plus some monitor speakers on the stage. Full-scale PA systems involve multi-speaker line arrays and complex monitoring systems.

Yamaha VS Series   Yamaha CBR Passive Speakers   Yamaha DZR Active Speakers

How Much Power Do I Need?

If you are asking the question, "How much power is required for a PA system?" The real question should be "How loud do you need it to be, for your room?" Power requirements vary according to your unique situation. First, the size and shape of the room is important, then adding in the number of people attending (human bodies make terrific sound absorbers). Are there a lot of windows or hard surfaces that sound can bounce off? What type of flooring do you have, carpet, exposed concrete, etc.? Do you have an open ceiling or a drop-down tile ceiling? How much electrical power is available in the room and where is it located? It is important to have as much of this information ready when you consult with a systems integration company.

While a speaker's wattage will affect its volume, its maximum SPL (Sound Pressure Level) is a better indicator of how loud the speaker can go. Understanding a speaker's coverage angle is also important. A powerful speaker with a narrow coverage angle will reach fewer people than a less powerful one with a broader coverage angle. It is also vital that you consider the speaker's sensitivity, which is a measurement of its ability to effectively convert power into sound. Sensitivity refers to the SPL that a speaker can produce from a 1-watt signal at a distance of 1 meter. The sensitivity spec measures "efficiency" and is a strong indicator of a speaker's loudness, which is why a less efficient 1,000-watt speaker isn't necessarily louder than an efficient 500-watt speaker. In fact, a 500-watt speaker with a sensitivity of 98dB will be the same volume as a 1,000-watt speaker with a sensitivity of 95dB.

Active - Powered Speakers vs. Passive - Unpowered Speakers

If you're not familiar with active PA speakers, the important thing to know is that the power amplifier and crossover are built into the same cabinet as the speakers. The benefit is, all you need are the speaker and a sound source, whether it is a mixer, a music player, or even an instrument in certain circumstances. Powered speakers simplify your PA system and are faster and easier to set up, however, they aren't always the best option when designing complex systems for permanent installation in large auditoriums and halls.

Passive PA speakers require separate power amplifiers and sometimes crossovers, too. For most small- to medium-sized rooms, passive speaker systems may not be the simplest option for a sound system. But, for larger, more complex systems, it can be a huge benefit to have your system components separated. Because of the extreme amount of power required for large systems, utilizing separate amplifiers prevents your speakers from being overheated by the amps; and system maintenance in the long term is much easier when you don't have to climb to the rafters to adjust your amplifier settings.

Because passive speakers don't include power amps, their wattage isn't an indicator of how powerful they are. Rather, it's an indicator of how much power they can handle. You will generally find two values for power handling: their RMS (root mean square) value refers to how much continuous power the speaker can handle, while their peak value refers to the maximum power level that the speaker can handle in short bursts. Thus, if you have a speaker rated at 50 watts RMS and 150 watts peak, then it can handle 50 watts of continuous power with occasional peaks of up to 150 watts.

As you can see, choosing between active and passive PA speakers has more to do with how you're using the system than whether one type is superior to the other. Smaller churches may prefer the simplicity and reliable sound quality of active systems, while large churches will most certainly require the versatility and modular nature of a passive system.

Yamaha TXn Series Amplifier   Yamaha PC-1N Series Amplifiers   Yamaha XP Series Amplifiers

Speaker Driver Configuration

When choosing the right PA speaker for your needs, its driver configuration is another variable to consider. If the speaker only contains a single full-range driver, that driver must cover the entire frequency range. A small speaker that is great for high frequencies won't reproduce low frequencies well, and a large speaker that's good for lows won't reproduce high frequencies well.

What is the solution? Using multiple drivers. Speakers with multiple drivers do a much better job of reproducing the whole frequency spectrum. These types of speakers split the frequency range between

two drivers this is usually a high-frequency driver and a low-frequency driver. By giving each driver a specific frequency to cover, you increase the speaker's output, frequency range, and efficiency.

Understanding Crossovers

A crossover is a device that divides an audio signal into separate frequency ranges that are routed to different drivers (speakers, tweeters, horns, etc.) in an audio system. For example, a 2-way crossover may comprise a lowpass filter that passes a signal with low frequencies to a subwoofer, and a highpass filter that sends appropriate frequencies to the tweeter. Crossovers can have passive or active designs. You do not need to know everything about crossovers to set up a good system but knowing where the crossover points lie in the sonic spectrum can help you set up a better mix.

Bi-Amplification

Bi-Amplification is the process of dividing an audio signal into two frequency ranges, which are then sent to two separate amplifiers that, in turn, drive separate loudspeakers. An active crossover network sends low frequencies to the larger driver (woofer) and high frequencies to the smaller driver (tweeter). Bi-Amping also allows the amplifier(s) to be chosen or designed specifically to match your speakers and enclosures. Bi-Amping, Tri-Amping, and beyond have been used in sound-reinforcement systems for years and have become quite common in active studio monitors, as well.

An All-in-one PA Solution

For small churches or "On-the-go" ministries, a portable all-in-one solution may be the optimum solution. Systems like the Yamaha Stagepas series integrate a mixer with a built-in amplifier, passive speakers, signal processing, and even effects into a simple, compact design. These PA systems can save you money, time, and space and are easy to setup and operate.

Yamaha Stagepas Series Portable PA System

Intelligent Speaker Systems

There are now speaker systems that can automatically recognize what you're plugging into them and will optimize their sound accordingly like the Yamaha PX series amplifiers. Some can recognize whether you've arranged them vertically on speaker stands or horizontally on the stage as floor monitors and will automatically optimize their sound for that orientation. Other built-in intelligent features can include

automatic feedback suppression, networking capability, and remote control. How you plan on using your system on a regular basis determines which of these advanced features, if any, will ultimately benefit you.

Yamaha PX Series Intelligent Processing Amplifier

Subwoofers

Subwoofers are speakers that are optimized for reproducing just the low bass frequencies. However, just adding a subwoofer will not necessarily make your system louder: when properly implemented, but, they can allow you to run your system at a lower overall volume while still maintaining a full-range punch and impact.

- Active Subwoofers
- Passive Subwoofers

Subwoofers usually focus on the 20Hz to 100Hz frequency spectrum, which can be difficult to reproduce accurately with smaller PA speakers. Larger PA speakers can respectably reproduce low frequencies; but for true full-range sound, you need a dedicated subwoofer.

Subwoofers can also play an important role in filling out the sonic spectrum for any room or worship style. Subs also allow the main speakers to sound better, giving them valuable headroom to better reproduce the dynamics of your instruments and vocals. As with full-range speakers, subwoofers can be either active or passive.

Yamaha SW118V Passive Subwoofer

Yamaha DXSmkll Powered Subwoofer

Monitor Speakers

When the worship band is playing and singing, they need to be able to hear themselves, proper monitoring is crucial to a good performance. There are two types of stage monitors: wedges and sidefills. A wedge is essentially a speaker cabinet with an angled back so it can be placed on the stage floor. Their angled shape allows them to aim sound up toward the performer's ears, while their low profile keeps them from blocking the audience's view of the performers. Sidefills are larger full-range speakers that are placed off to the side of the stage. They enable performers to hear a rough mix of the whole band, while wedges provide individual mixes to each performer.

When it comes to stage monitors, bigger isn't better. Low-frequency buildup onstage is an ongoing issue, and since larger speakers produce more bass, they only contribute to the problem. Monitor speakers with a narrower coverage angle and a pronounced upper midrange will do a better job of penetrating the dense sound onstage. Consequently, it's better to have more focused stage wedges than to have fewer monitors with broader coverage and deeper lows.

Stand-mounted Monitors are smaller, unobtrusive monitor cabinets usually mounted on a mic stand and placed closer to the performer's ear for better intelligibility and less overall sound pressure onstage. Keyboard/synth players might benefit from a stand-mounted monitor to better hear themselves cut through the mix.

Yamaha DBR10 Self-Powered Speaker   Yamaha SM10V Passive Speaker

Speaker Connectors

Normally, the choice of cable connectors is determined by the connection types on the speakers you have chosen. When connecting a mixer's outputs to multiple crossovers, then those to power amplifiers, and then those to speakers, you'll most likely be using at least two different cable connector types. Because some audio equipment does give you a choice of connections, this reference guide should help you determine which cable connector type is best for your situation.

SpeakON is a type (and brand) of multi-pin connector that's commonly found on speakers and amplifiers with high wattage ratings. SpeakON connectors offer an exceptionally reliable connection, and can handle extremely high power, and are durable.

TRS is the abbreviation for "Tip-Ring-Sleeve." This term describes 1/4" (or 1/8") balanced connectors. A TRS plug can be found at the end of most headphone cords if you want to know what one looks like. It looks like a standard 1/4" plug with an extra "ring" on its shaft. TRS connectors are used wherever you need to have two conductors plus a ground (shield) in one plug.

XLR (External Line Return) is a circular 3-pin connector with positive, negative, and ground pins. These are normally used for transmitting balanced mic-level signals to mixers or line-level signals to powered speakers.

TS is the abbreviation for "Tip-Sleeve" and refers to a specific type of 1/4" connector that is set up for 2-conductor, unbalanced operation. The tip is generally considered the "hot," or where the signal is applied, while the sleeve is where the ground or shield is connected.

In-ear Monitoring

The concept of in-ear monitoring is quite simple. Introduce a high-quality signal to the musician's ear that allows them to clearly hear the mix at any chosen volume. In-ear monitoring has been around since the mid-1980s and was originally only used by top touring professionals because of the costs involved. However, technological advances in recent years have put in-ears within reach of musicians on a budget.

The benefits of an in-ear monitor to the musician and engineer are immediately apparent: better sound, improved stereo imaging, less vocal strain, protection against hearing damage, portability, increased gain before feedback, and lowered onstage volume. In-ear monitoring works best with relatively low stage volumes, so it's ideal for acoustic performers and electric ensembles who use low-powered instrument amps. If your sound is reliant on massive guitar amp stacks, in-ear monitoring is probably not the way to go.

In-ear monitoring systems are best known for their ability to reduce stage volume. When each band member hears vocals or instruments through wedges and instrument amplifiers, competitive monitoring (individual band members turning up to hear themselves better) often results in a loud, cacophonous stage. This has the effect of muddying the house mix and causes excessive overall volume as the sound engineer is forced to turn up the mains to compensate for stage levels.

When used in conjunction with personal mixer systems, such as those by Aviom, in-ear monitors give musicians absolute control of their own monitor mix onstage. Artists can have any mix they desire at any volume. Singers can independently increase their voice's volume separate from the band's mix, reducing voice fatigue and the risk of hearing damage. This also gives the engineer better isolation, because loud stage monitors bleed into adjacent microphones, which can muddy the overall mix. For smaller venues and bands without the luxury of a separate monitor engineer and console, it frees up the FOH mixer from having to send several separate cue mixes.

Summing Up

We strongly suggest that if possible, you should consult with a reputable system integrator experienced in designing, installing and servicing PA systems. While this guide only touches on areas you as a consumer need to be aware of, hopefully we have given you enough of a start on your journey to your dream sound system. Armed with that information, you are now better equipped to find the right gear to match your needs and budget.

To request information, please visit our [Contact Us](#) page.

For more product information, please visit our [Website](#).