



**RDL**<sup>®</sup>  
Radio Design Labs

**SYSTEMS  
SOLUTIONS**



# House of Worship

Volume 1



RDL Product Applications  
**HOUSE OF WORSHIP - 1**

**Table of Contents**

*Introduction*..... 2

*Wiring*..... 2

*Sanctuary Applications*..... 4

**Mix multiple choir mics for uniform sound pickup in choir loft or platform area** ..... 4

**Prevent overload of power amplifiers when unexpected loud audio bursts occur** ..... 5

**Provide extra mic signals from a single mic jack**..... 6

**Add monitor for organist or pianist**..... 7

**Add congregational singing to recordings of a service** ..... 8

**Boost mic level signals up to line level to reduce hum and noise over long cable runs** ..... 9

**Add Phantom Power to a mic jack**..... 10

**Amplify “front of stage” speakers to “lower” the sound source in front rows** ..... 11

**Equalize choir loft monitor speakers to “tune out” feedback frequencies**..... 12

*Platform/Stage/Presentation Applications*..... 13

**Distribute line-level sources on stage**..... 13

**Isolate ground-loop in balanced line (XLR)** ..... 14

**Remove ground-loop hum from laptop audio output connected to sound system**..... 15

**Automatically regulate audio recording levels**..... 16

**Add metering in booth to monitor specific audio levels (monitors or sanctuary)** ..... 17

**Add specific headphone jack to monitor any source (main mix, recording, etc.)** ..... 19

**Provide an unbalanced recording feed from a balanced mix output** ..... 20

**Distribute an audio signal to multiple destinations: amplifiers, VCR, DVD recorder** ..... 21

**Switch between multiple (NTSC/PAL) video sources: camera, VCR, DVD** ..... 22

**Distribute a video signal to multiple destinations: monitor, VCR, DVD recorder** ..... 23

**Install speakers in remote listening areas: narthex, cry room, bathrooms, classrooms** ..... 24

**Automatically adjust listening levels in remote areas: cry rooms, classrooms** ..... 25

**Provide local volume adjustment in a remote listening area: narthex, cry room, etc.** ..... 26

*Equipment Rack and General Applications*..... 27

**Delay audio to specific speakers: Cluster, balcony, narthex**..... 27

**Remove “ground-loop” hum from permanently installed wiring run**..... 28

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## RDL Product Applications HOUSE OF WORSHIP - 1

### Introduction

RDL products are the core building blocks used by creative system designers. Configuring systems around RDL's application-specific modules provides greater flexibility and higher performance in audio/video systems. This design approach tailors system features to the specific installation yielding a dramatic improvement in system value.

RDL modules also may be added to new or existing system equipment. Because RDL modules are compact, they can be mounted where they are needed. Many systems are designed around rack-mounted modules, but it is often beneficial to mount modules at other locations in the facility. RDL offers a wide array of mounting options including rack adapters and chassis, tabletop chassis, backboard enclosures, DIN rail adapters and countertop enclosures.

With hundreds of products in production, an almost unlimited range of possibilities is available to new users. This introduction to RDL products in Houses of Worship explains some basic RDL product applications that are useful in adding features to a system, enhancing performance and solving problems. Users that become familiar with these applications often discover many other possibilities using RDL products. Product information is available in the annual RDL catalog and at [www.rdl.net.com](http://www.rdl.net.com). RDL also has technical support staff available to answer any technical questions and to help with system design ideas. Visit [www.rdl.net.com](http://www.rdl.net.com) regularly for current news, design tools, installation instructions for all products, and application notes.

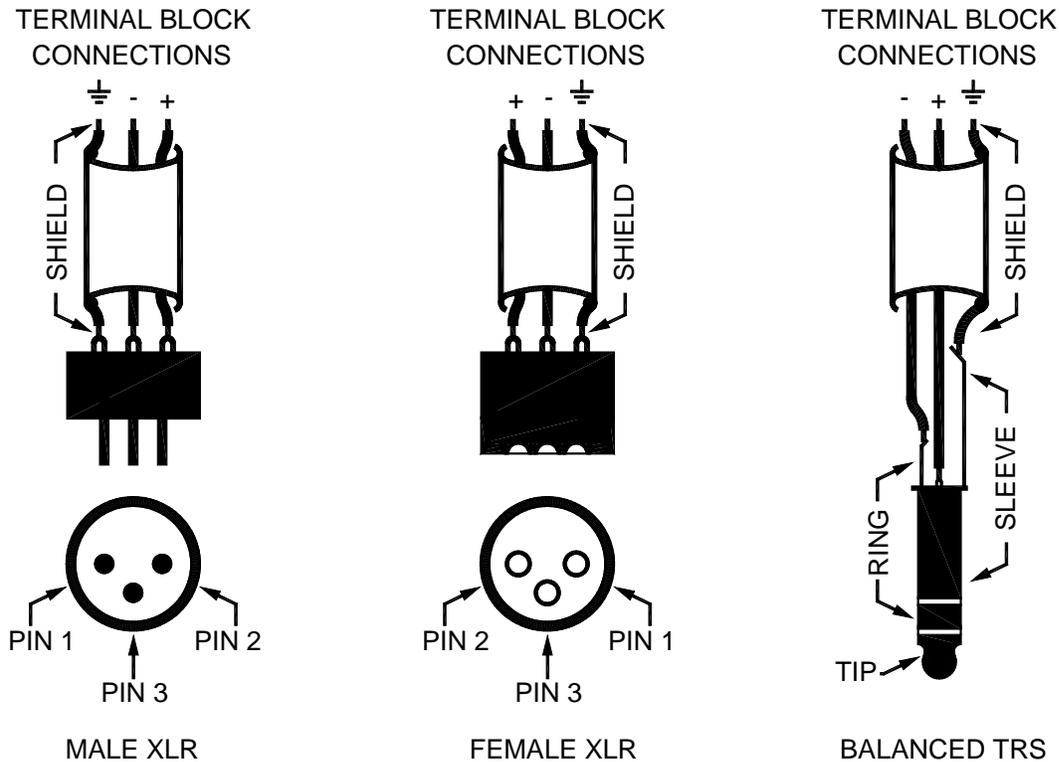
### Wiring

Certain RDL products provide XLR, RCA, or BNC jacks for input/output signals. Compact RDL products intended for one time permanent installation provide signal connections on terminal blocks. Products that are likely to be used in either temporary or permanent configurations provide signal connections on both jacks and terminal blocks.

Balanced audio wiring contains a shield and two signal conductors. Unbalanced wiring contains a shield and one signal conductor. Wherever possible, the best audio performance is achieved using balanced wiring. Balanced audio (also called differential) can travel over long distances with good audio quality and minimal induced hum. Unbalanced wiring must be kept short and should be connected to equipment powered from the same electrical outlets, otherwise hum is likely to be severe. Certain products common to the music industry (and houses of worship) provide balanced audio jacks, but electrically are *not* differential. Such products are commonly called "pseudo-balanced" since they allow use of balanced cables but do not provide the other quality (hum reduction) characteristics of true balanced wiring.

Balanced audio products are either *active balanced* (electrically balanced) or transformer balanced. Most industry products, including powered RDL modules, are *active balanced*. When signals are sent over long distances between equipment not connected to the same electrical outlets, a “ground loop” may form that is severe enough that active balanced products cannot remove all the hum. This is particularly likely when connecting to high-gain products, such as power amplifiers. This “ground-loop” induced hum can be removed by using an isolation transformer at one end of the audio line, typically at the input. RDL offers a full line of broadcast-quality audio isolation transformers for this purpose.

Connections between equipment with jacks and RDL modules with terminal blocks are often made in permanently installed audio/video systems. The association between terminal block labels and standard connectors is shown in the following diagram:



The applications shown in the following pages demonstrate one possible solution for each set of conditions. There are often other RDL products that could be used. For additional options, consult our RDL technical service representatives or the RDL website at:

[www.rdl.net.com](http://www.rdl.net.com)

## Sanctuary Applications

### Application HW1-1

#### **Mix multiple choir mics for uniform sound pickup in choir loft or platform area**

Product(s): FP-MX4 (single or multiple)

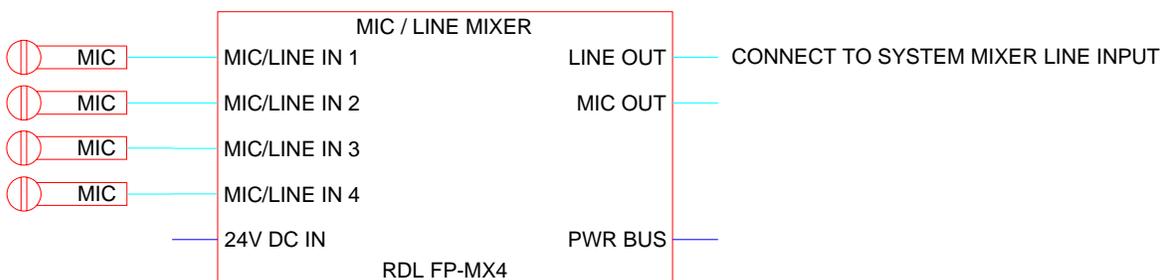
##### Description:

Choir loft or group vocal performance areas typically are large enough that uniform sound pickup is not possible using a single microphone. Several (typically two to four) small condenser microphones are often hung over the choir loft to solve this problem. If each of these microphones is wired directly to the main mixer, several mixer inputs become dedicated for the choir even though they are faded up and down together as a group. Wiring between the mixer and these microphones is often long, increasing the possibility of interference from power wiring, lighting devices and radio sources.

The RDL FP-MX4 Mic/Line Mixer is designed to mount either in an equipment rack or to any flat surface. Overhead beams or sound diffusion panels serve as ideal mounting surfaces to conceal an FP-MX4. Each of the four MIC inputs provides the switch-selectable phantom power required for condenser microphones. The FP-MX4 provides both a MIC and a LINE level output. The best system noise immunity will result from using the LINE output from the FP-MX4 if a line-level input is available on the system main mixer. Only one audio cable is required between the FP-MX4 and the system mixer.

##### Installation and Setup:

Position the microphones for uniform sound pickup and secure them in place. Mount the FP-MX4 in the nearest practical location that power is available. Connect the microphone cables to the FP-MX4, routing them safely away from power wiring and lighting system components. Connect 24 Vdc power to the FP-MX4 and connect either the MIC or LINE output to the system mixer. If condenser mics are being used, set the input switches to MICPH. If dynamic mics are used, set the input switches to MIC. Set the GAIN trimmers to mid position. With the loudest possible source, select the proper MIC GAIN switch setting to produce maximum illumination of the green LEVEL indicator with minimum flashing of the +4 LEVEL indicator on the FP-MX4. (Note: The choir may be the loudest sound source, but in some cases an organ may produce a greater level than the choir! It is best to position the mics to avoid picking up the organ, if possible.) Make fine adjustments to the GAIN trimmers for correct levels on the FP-MX4 dual-LED VU meter. Typically, equal gain on each input will produce good results, but one or more mics may be turned down slightly if mic placement causes one choir section to dominate the mix.



Application HW1-2

**Prevent overload of power amplifiers when unexpected loud audio bursts occur**

Product(s): ST-CL2

Description:

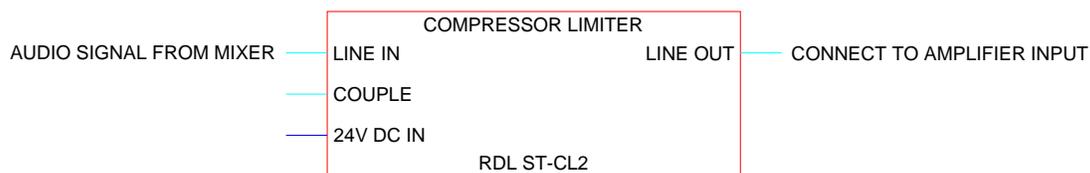
Live sound, and house of worship sound in particular, is subject to large variations in sound levels. Causes include dramatic preaching, inexperienced liturgists, musicians unfamiliar with good mic technique and even microphones kicked over or dropped on the stage or platform. Results may include painfully excessive sound levels, component damage, distortion and even blown fuses or circuit breakers. These conditions can be avoided in advance by installing a compressor/limiter in the audio line feeding the power amplifier(s). A compressor should be chosen that is transparent to normal audio while quickly attacking overload signals. Best protection is afforded by compressors that also include peak limiting. (Note: Experienced installers will calibrate the compressor/limiter output level and amplifier gain such that limiting (infinity to one) occurs below the clipping level of the amplifier output.)

Compressors are available in various formats, both analog and DSP based. Most compressors require considerable adjustment, allowing the installer to tailor it to a specific sound source (voice or music style). Not only is setup of many compressors difficult, the results may not be consistent with differing audio material. Incorrect setup often produces worse sound quality than if no compressor had been installed.

The RDL ST-CL2 Compressor/Limiter is easy to install, sonically transparent, provides effective control, includes a peak limiter and provides fully automatic parameter adjustment based on the program material. The only adjustments required are the INPUT and OUTPUT levels. Very few audio power amplifiers include any audio compression making the ST-CL2 a necessity. Note that certain RDL power amplifiers include the compressor/limiter (for example: FP-PA20 series).

Installation and Setup:

Mount the ST-CL2 near the power amplifier. Remove the line-level cable from the input of the amplifier and connect it to the input of the ST-CL2. Connect an audio cable from the output of the ST-CL2 to the amplifier input. Connect 24 Vdc power to the ST-CL2. The module is supplied from the factory for normal operation with +4 dBu audio signals, therefore it is often not necessary to make any adjustments to the ST-CL2. Feed the ST-CL2 with a normal audio level. The NORMAL compression indicator may flash regularly. If the HEAVY indicator flashes regularly, reduce the gain on the INPUT trimmer. Increase the audio level to the loudest level ever to be encountered. The HEAVY compression indicator should be flashing regularly. If not, increase the INPUT trimmer for consistent flashing of the HEAVY indicator. The OUTPUT trimmer is not normally adjusted because the system level can now be set on the power amplifier.



Application HW1-3

**Provide extra mic signals from a single mic jack**

Product(s): STM-LDA3  
STM-DA3

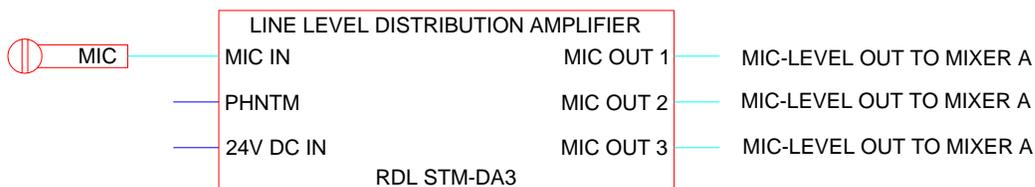
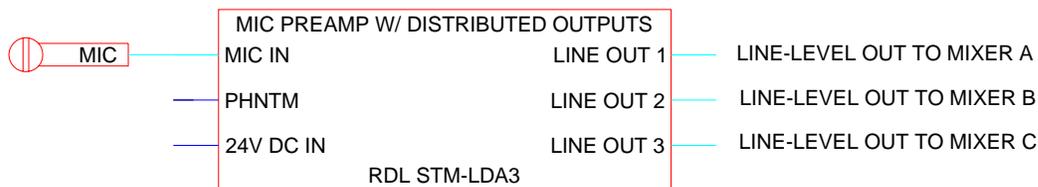
Description:

In the simplest installations, each microphone jack connects to a corresponding input on the system mixer. Often there is a need to split a microphone signal to feed more than one mixer. Additional mixers may be used to provide a dedicated mix of specific microphones. Uses include monitoring by musicians or choir, recording, and hearing-impaired transmitters. In some cases, a mic signal needs to feed the main mixer while also feeding a separate power amplifier.

The STM-DA3 Microphone Distribution Amplifier splits a single microphone signal and provides three separate mic-level signals that can feed separate mixers. This module also provides isolation between the outputs. If a signal is accidentally connected to one output, the module blocks that unwanted signal from the other two outputs. The STM-DA3 can provide phantom power to mic jacks where condenser mics may be used. If line-level outputs are preferred, use the STM-LDA3.

Installation and Setup:

Determine the best mounting location for the STM-DA3 or STM-LDA3 modules. If several modules are being mounted together, an equipment rack near the stage area is ideal. RDL offers several suitable rack and enclosure options. Connect the audio cable from a mic jack to the input of an STM-DA3 (if mic-level outputs are desired) or an STM-LDA3 (if line-level outputs are desired). Connect 24 Vdc to the PWR input of the module. Connect a short jumper from PWR + to PHM (phantom) + if condenser microphones are to be connected to the mic jack. Connect an audio cable from output A to the main system mixer input for this mic. Connect an audio cable from outputs B and C to the input of other mixers. Unused outputs may be left unconnected. Connect a microphone fed with a loud audio level and adjust the module GAIN control for maximum intensity of the green indicator and minimum intensity of the red indicator on the dual-LED VU meter.



Application HW1-4

**Add monitor for organist or pianist**

Product(s): ST-PA6  
TX-70A

Description:

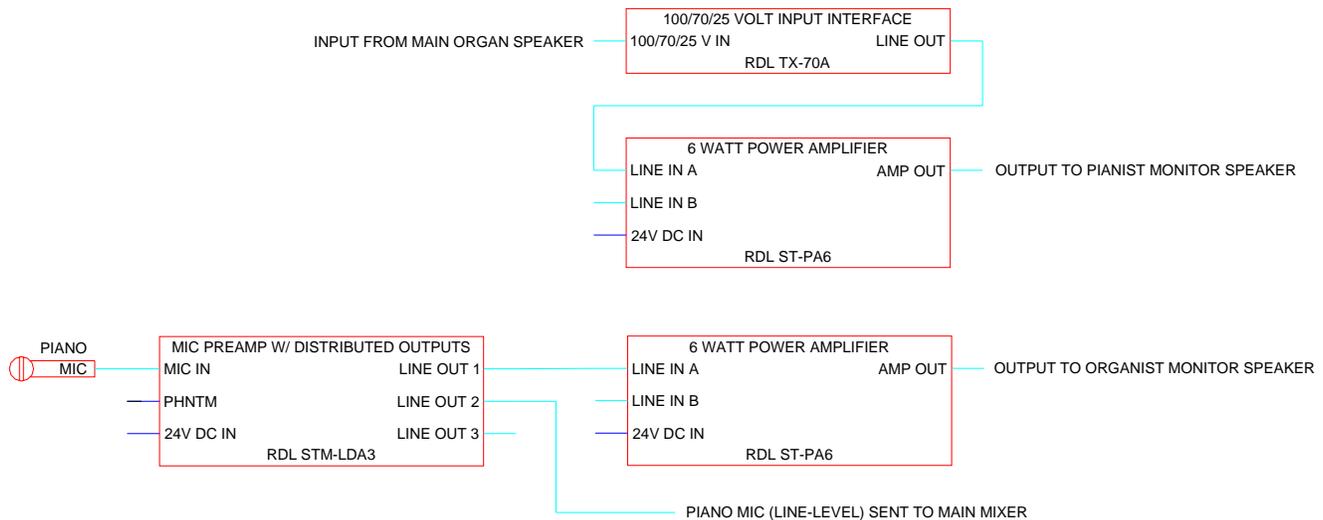
In some churches, the organ or piano may be located where the organist or pianist cannot hear the other instrument or the choir. A worse condition exists if the instrumental musicians predominantly hear reflected sound or delayed amplified sound.

This condition may be corrected by mounting a fixed monitor (or a stand monitor) near the pianist or organist. An RDL ST-PA6 Audio Power Amplifier provides ample power for these small monitors. Typically, the piano will have a dedicated microphone and the choir will have either a microphone or several microphones already mixed together. An electronic organ is not normally amplified through the sound system. An RDL TX-70A module may be used to provide a line-level signal from one of the main organ speakers. A line-level signal from the piano or choir mic may be available from an STM-LDA3 (Application HW1-3). A line-level signal may be available directly from the choir loft mixer (Application HW1-1).

Installation and Setup:

If an electronic organ is to be monitored, connect the two input terminals of an RDL TX-70A directly to the two terminals on one of the main organ speakers (Heavy gauge wire is *not* required for this connection).

Determine the optimum placement of the monitor speaker close to the organist or pianist. It is best if the monitor does not face any part of the congregation. If the speaker is to be stand mounted, a jack is usually installed to feed the speaker. Mount the ST-PA6. Connect 24 Vdc power. Connect an audio cable from the audio source (choir mixer output, preamplified piano mic) to INPUT A on the ST-PA6. Connect the output of the module to the monitor speaker or to the jack that will feed the monitor speaker. Adjust the GAIN trimmer on the ST-PA6 for the desired level from the monitor speaker.



Application HW1-5

**Add congregational singing to recordings of a service**

Product(s): FP-MX4

Description:

Audio recordings of worship services or the sound track of video recordings often originate from the main mix that feeds the sanctuary speakers. This mix does not include congregation microphones since feedback would result. Crowd noise is a familiar sound in sports broadcasts. Separate microphones are placed to pick up crowd responses, giving the listener a feeling of attending the event rather than simply hearing about it. Similarly, adding congregation mics gives worship service recordings a “live” feeling. One or two microphones suspended above the congregation enhance the recordings with congregational singing, room acoustics and aural continuity during times that no other microphones are turned on.

Installation and Setup:

Position the microphone(s) for general sound pickup and secure them in position. Mount the RDL FP-MX4 and connect 24 Vdc power. Connect the line output of the main system mixer (or a line output from the distribution amplifier fed from the main mixer) to one line input of the FP-MX4 and set the associated input selector to LINE. Connect the congregation mic(s) to the remaining FP-MX4 inputs and set those input switches to MICPH for condenser mics or to MIC for dynamic mics. Connect the output of the FP-MX4 to the input of the recorder and connect headphones to the headphone monitor jack on the recorder. Feed audio through the main system mixer at the normal operating level. Adjust the line input MIX trimmer for proper indication on the FP-MX4 dual-LED VU meter (maximum intensity of the green indicator; minimal flashing of the red indicator).

Normally, the congregation mics are mixed in at a lower level than the main mix since the object is to enhance the recording rather than to serve as the primary sound pickup. The correct GAIN switch setting for each mic will depend on both the position and sensitivity of the mics. While listening on headphones, set the GAIN switch for each congregation mic to the lowest setting for the approximate desired audible level with the associated MIX trimmers set midscale. Adjust the MIX trimmers for the correct level.



Application HW1-6

**Boost mic level signals up to line level to reduce hum and noise over long cable runs**

Product(s): STM-LDA3  
FP-MP1

Description:

Mic jacks are usually located a long distance from the sound/video booth. These distances and the high gain required for microphone signals increase the susceptibility of the mic cables to interference from power wiring, lighting devices and radio transmissions. The optimum solution to this potential interference is to boost microphone level signals up to line level for long distance transmission. The inputs on most system mixers can be set to line level, allowing microphone pre-amplification at or near the stage or platform.

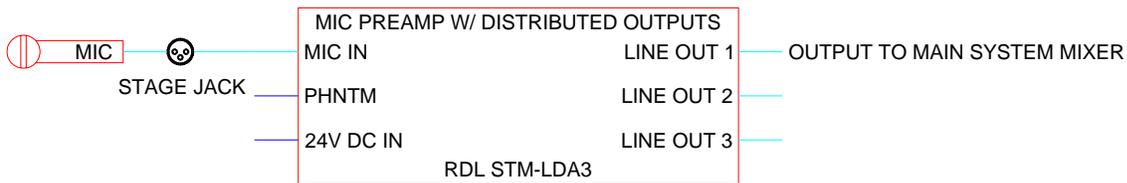
An additional and often unforeseen advantage of this application is a reduction in system background noise. The microphone preamplifiers commonly found in house-of-worship mixers are not typically as quiet as studio-quality mixer preamplifiers. RDL STM-LDA3 or FP-MP1 Microphone Preamplifiers offer studio-quality performance and selectable phantom power for jacks intended for condenser microphones. If multiple feeds from each stage jack are desired, the STM-LDA3 is the ideal choice. If backboard mounting or XLR connectors are preferred, the FP-MP1 is preferred.

Installation and Setup:

Determine the best mounting location for the STM-DA3 or FP-MP1 modules. If several modules are being mounted together, an equipment rack near the stage area is ideal. RDL offers several suitable rack and enclosure options. Connect the audio cable from a mic jack to the input of the RDL preamplifier. Connect 24 Vdc to the PWR input of the module.

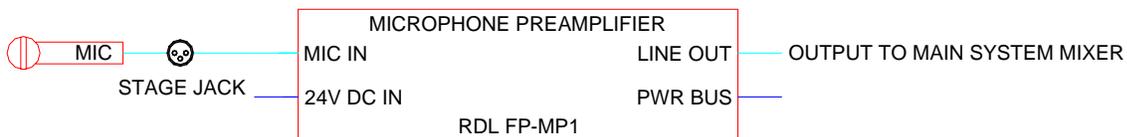
Using the STM-LDA3:

Connect a short jumper from PWR + to PHM (phantom) + if condenser microphones are to be connected to the mic jack. Connect an audio cable from output A to the main system mixer input for this mic. Unused outputs may be left unconnected. Connect a microphone fed with a loud audio level and adjust the module GAIN control for maximum intensity of the green indicator and minimum intensity of the red indicator on the dual-LED VU meter.



Using the FP-MP1:

Set the input phantom switch to 24V if condenser microphones are to be connected to the mic jack. If dynamic mics are to be used, set the phantom switch OFF. Set the GAIN TRIM to mid position. Connect a microphone fed with a loud audio level and select the proper MIC GAIN switch setting to produce maximum illumination of the green LEVEL indicator with minimum flashing of the +4 LEVEL indicator on the dual-LED VU meter. Fine tune the level using the GAIN TRIM control.



Application HW1-7

**Add Phantom Power to a mic jack**

Product(s): ST-MPA2  
FP-MPA2

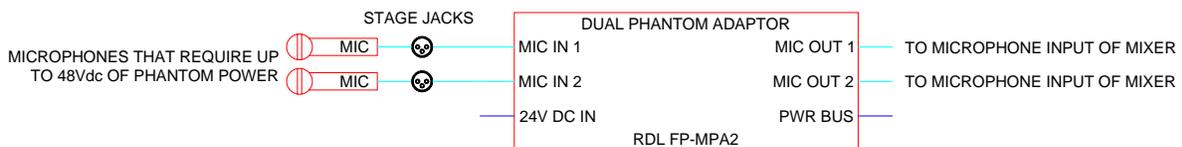
Description:

Some mixer microphone inputs do not provide phantom power. Certain other large mixing consoles do not have a provision to activate phantom voltage *only* on selected jacks. Connection of condenser microphones to specific stage jacks requires phantom power on those jacks. If RDL preamplifiers are installed for those jacks (Applications HW1-3 and HW1-6), phantom power may be individually selected.

RDL ST-MPA2 and FP-MPA2 phantom adapters allow phantom voltage to be added to two microphone jacks. The ST-MPA2 is a compact module in the Stick-On Series that produces up to 24 V phantom voltage when the module is operated from a 24 Vdc power supply. The FP-MPA2 can provide 12 V, 24 V or 48 V phantom voltage. Most microphones operate from 24 V phantom voltage, but a few cannot be operated above 12 V. Either RDL adapter may be used with such mics. A very small number of studio microphones require 48 V phantom voltage which is provided only by the FP-MPA2. The ST-MPA2 connections are on a terminal block for permanent wiring into the system. The FP-MPA2 connections are all on XLR connectors which may be quicker to wire if XLR wiring snakes are used.

Installation and Setup:

Each channel of either model phantom adapter is identical. Connect or wire the MIC input to the stage or platform jack. Connect or wire the OUTPUT to the microphone input of the mixer. Connect 24 Vdc to the module. If using the FP-MPA2, set the POWER switch to NORMAL and the voltage switch to 24 V (unless a specific mic is to be used requiring either 12 V or 48 V).



Application HW1-8

**Amplify “front of stage” speakers to “lower” the sound source in front rows**

Product(s): ST-PA6  
FP-PA20A

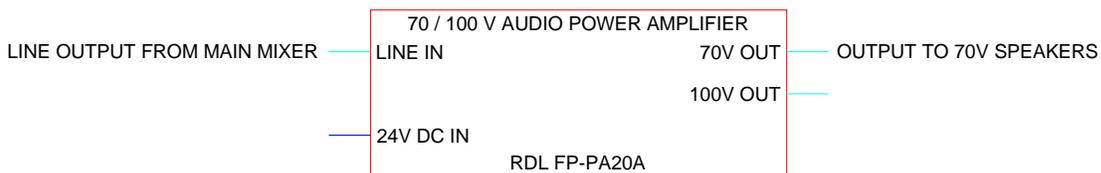
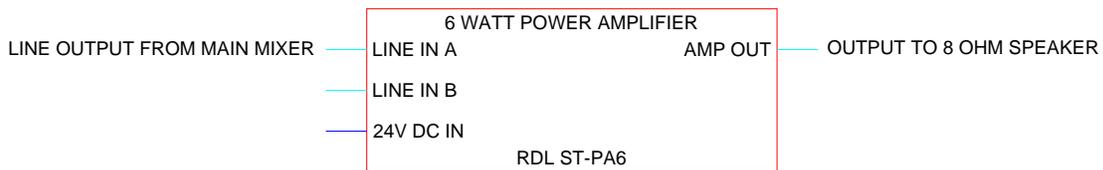
Description:

Architectural design in many sanctuaries requires placement of speakers clusters relatively high above the front few rows. Congregation members sitting in the front areas may be watching someone a few degrees above eye level while hearing their voice nearly overhead. This unnatural condition can be distracting and may detract from the intended worship experience. Installation of small speakers in the front of the stage or platform steps equally spaced across the width of the sanctuary can create the impression of lowering the apparent amplified sound source. The audio level into these stage speakers should not be any louder than necessary to overcome the overhead pinpoint sound source in those front rows. One or two watts of continuous power are normally sufficient.

If 8 ohm speakers are used, an RDL ST-PA6 can be installed to power each speaker. If 70 V speakers are used, all the speakers may be driven by a single amplifier. The RDL FP-PA20A amplifier is ideal for this purpose, and this amplifier also contains a calibrated compressor to prevent output transformer saturation and distortion.

Installation and Setup:

Determine the best mounting location for the ST-PA6 or FP-PA20A modules. If several ST-PA6 modules are being mounted together, an equipment rack near the stage area is ideal. RDL offers several suitable rack and enclosure options (see RDL SR-4 mounting rack for localized stage mounting). Connect the line output of the main system mixer (or a line output from the distribution amplifier fed from the main mixer) to one line input of the ST-PA6 or to the line input of the FP-PA20A. Connect 24 Vdc to the PWR input of the module. Operate the system at a normal audio level. From various listening positions in the front two or three rows, adjust the GAIN of the amplifier(s) until the audio from the stage front speakers just becomes noticeable.



Application HW1-9

**Equalize choir loft monitor speakers to “tune out” feedback frequencies**

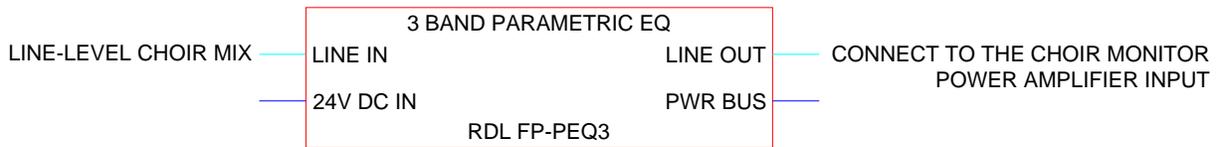
Product(s): FP-PEQ3

Description:

Choir lofts typically have one or more monitor speakers installed so the choir members can hear sound from the fixed and wireless mics. These monitors can be critical to the experience of the choir members. Care must be exercised to keep the sound level high enough for all levels of hearing acuity without approaching the possibility of feedback. Two or three principal resonant frequencies will restrict the possible volume level before feedback. Often it is necessary to tune out these frequencies. It is critical to remove only the resonances while leaving all other frequencies present. This requires tunable notch filters that are most effectively adjusted by experienced personnel.

Installation and Setup:

Connect the line-level choir monitor mix to the input of the FP-PEQ3. Connect the output of the FP-PEQ3 to the power amplifier for the choir monitor speaker(s). (Note: The RDL FP-PA20 or FP-PA20A are ideally suited to drive choir monitors. These models contain an integral calibrated compressor.) Locate a sensitive microphone in the fringe area of the choir loft, as close as a microphone is normally operated to the choir. Follow the step-by-step instructions provided with the FP-PEQ3: ADJUSTMENT TO REDUCE ACOUSTIC FEEDBACK IF A REAL TIME ANALYZER IS UNAVAILABLE.



## Platform/Stage/Presentation Applications

### Application HW1-10

### **Distribute line-level sources on stage**

Product(s): AV-DC4

#### Description:

Special performance setups may require the distribution of a line-level audio signal to multiple amplifiers. When a signal is split and sent to different amplifiers or mixers that have different ground potentials, a ground hum is likely to result.

The RDL AV-DC4 Audio Divider/Combiner is a heavy duty stage box that can split an audio input to three outputs. Each output is transformer isolated from each other. If a ground hum is present, a switch can be activated to ground-isolate each of the outputs independently. This provides a quick, real-time solution to hum problems while splitting a signal out to as many as three outputs.

#### Installation and Setup:

Connect the line-level source to the channel 1 female XLR connector. Connect up to three outputs to channels 2 through 4 male XLR outputs. If ground hum is present, switch in the ground-lift switches, one at a time, until the hum disappears. (Note: Unused outputs may remain disconnected.)



Application HW1-11

**Isolate ground-loop in balanced line (XLR)**

Product(s): AV-HK1X

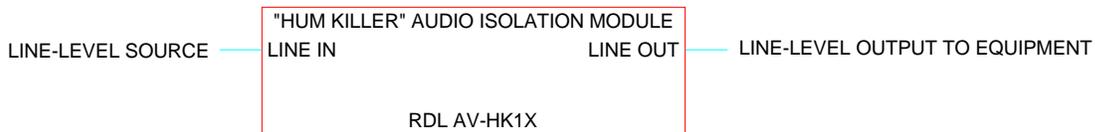
Description:

When a signal is sent to an amplifier or mixer with a different ground potential from the source equipment, a ground hum is likely to result.

The RDL AV-HK1X Hum Killer is a heavy duty stage box that provides transformer isolation and lifts the ground connection in an audio line.

Installation and Setup:

Connect the line-level source to the INPUT XLR connector. Connect the OUTPUT to the equipment input. The AV-HK1X will remove hum induced by a “ground loop” while continuing to provide a ground path for potential radio transmission interference. (Note: If installation of the AV-HK1X does not remove the hum but unplugging the modules stops the hum, then the hum is already present in a *prior* audio stage.)



Application HW1-12

**Remove ground-loop hum from laptop audio output connected to sound system**

Product(s): AV-HK1

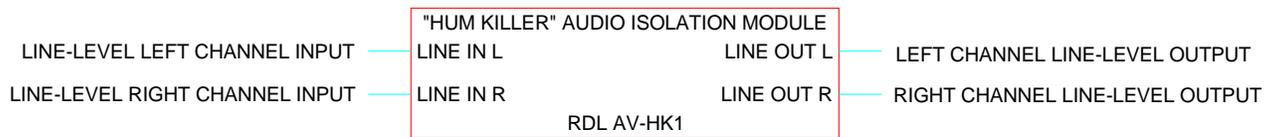
Description:

Special presentations may include playback of sound from a laptop computer or other consumer device with RCA jack outputs. When such components are powered, a ground hum is likely to be induced in the audio system.

The RDL AV-HK1 Hum Killer is a heavy duty stage box that provides transformer isolation and lifts the ground connection in a high-impedance stereo audio line. It is a useful tool to be carried by the presenter or to be available from the house of worship. (Note: If connections are to be made regularly, an RDL RCX-J2 Transformer-isolated Input Panel or TX-J2 Unbalanced Input Transformer should be permanently installed.)

Installation and Setup:

Connect the AV-HK1 in line between the computer output and the sound system input.



## Sound/video Booth Applications

### Application HW1-13

### **Automatically regulate audio recording levels**

Product(s): FP-ALC1, FP-ALC2

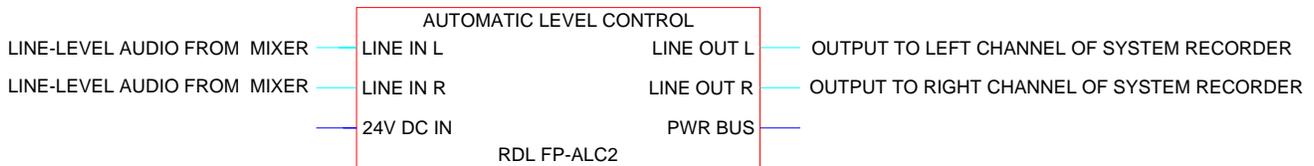
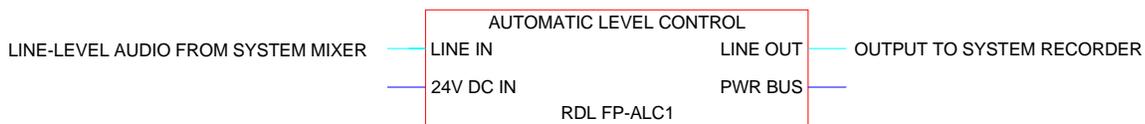
#### Description:

Worship service audio recording levels naturally vary due to the wide dynamic content. This may result in difficulty hearing and understanding the recording, particularly if the listener has any hearing impairment.

The RDL FP-ALC1 and FP-ALC2 Automatic Gain Control (AGC) Amplifiers solve this problem by bringing up low levels and reducing excessive audio levels entering the recording machine. The FP-ALC1 is mono and is optimized for standard balanced +4 dBu levels. The FP-ALC2 is stereo and is optimized for standard unbalanced -10 dBV audio levels.

#### Installation and Setup:

Connect the recording output from the system mixer (or from a special mixer as described in Application HW1-5) to the input of the AGC amplifier module. Connect the output of the AGC module to the input of the recording deck. Connect 24 Vdc to the module. Feed the highest normally expected level through the sound system. Adjust the GAIN trimmer on the module until the INPUT OVERLOAD indicator just lights. (Note: Due to the low operating levels common to many mixers, it is not abnormal for the GAIN control to be set fully clockwise.)



**Add metering in booth to monitor specific audio levels (monitors or sanctuary)**

Product(s): RU-SM16  
TX-70A

*Description:*

Most house of worship systems have limited or nonexistent metering of critical audio levels. In particular, two conditions are often present. First, normal operating levels at the main mixing console output are often set up to be low, making the mixer metering read too low to be useful. Second, volunteers that operate equipment during some or all services have different perceptions of audio levels causing them to make subjective adjustments that are not consistent from service to service. In addition, there are various levels that are useful to monitor in the booth. Some examples of particularly helpful additional metering are:

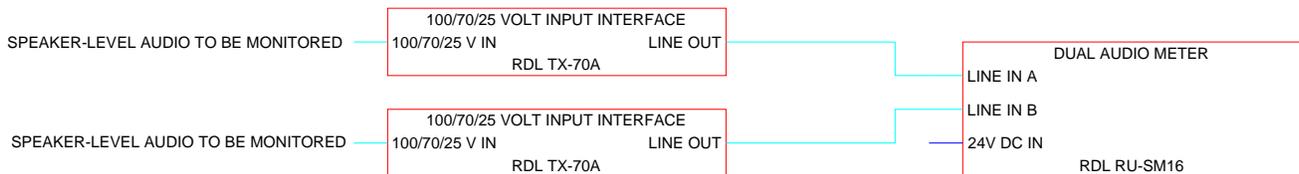
- Sanctuary: A meter that indicates the level of audio feeding directly into the main speaker cluster allows consistent worship sound levels to be maintained with a variety of operators in the booth. Another method of monitoring the sanctuary sound level is to meter the output of the congregation mic mixer, if one is used (Application HW1-5).
- Choir monitors: A meter connected to the output of the amplifier feeding the choir monitor assures that the operator will maintain a level that allows all choir members to hear clearly.
- Stage monitors: Houses of worship that use a group of musicians usually have one or two monitor amplifiers for stage monitor speakers, allowing musicians to hear each other, or allowing vocalists to hear accompaniments. Metering the amplified signals feeding the monitor jacks allows the booth operator to send intelligible levels to the monitor speakers.
- Wireless receivers: Metering that shows the audio level at the output of each wireless receiver may allow the operator to quickly identify which mic is in use. It is also useful to determine if a particular wireless mic has been accidentally left on.
- Hearing impaired: Many houses of worship have a system to distribute audio to personal listening devices for people with hearing impairment. The booth operator usually does not know if the transmitter is receiving audio and is working. A single receiving device, powered by a "battery eliminator" power supply, can have its output connected to a meter in the booth, allowing the operator to know the system is functional at all times.
- Recording level: It is often helpful to monitor the level feeding recording or broadcast equipment. This alerts the operator to any level problems so they may be corrected quickly without losing a complete recording.
- Distributed sound: Many houses of worship have one or more distributed sound systems with speakers located in the narthex, offices, restrooms, choir

room, etc. Because the mix to these areas is secondary to running the mix in the sanctuary, levels to the distributed sound amplifiers may have been turned down or off on the main mixer. Monitoring these amplifiers in the booth allows the operator to see an improper condition and correct it.

The RDL RU-SM16 is a compact two-channel meter with a bright LED display. Mounting options are available to secure multiple meters on or under a shelf just above the main mixer, as well as for rack mounting. Meters are typically mounted in an RDL RU-RA3 or RU-RA3HD Rack Adapter. If a shelf is provided above the main mixer, the rack adapter can be mounted above or below the shelf using an RDL MBR-1U Mounting Kit. A single meter can be mounted using an RDL RU-BR1. Each meter channel has a multi-turn trimmer allowing the displayed level to be calibrated. Therefore, each meter can be set to display identical levels when the signal it is monitoring is correct. These meters have line-level inputs. Speaker lines may be monitored by connecting an RDL TX-70A between the speaker line and the input to the meter.

Installation and Setup:

Determine the number of meters desired and the preferred mounting location where the mixer operator can clearly see them. Select the appropriate RDL mounting accessories. Run the wiring to be monitored to the vicinity of the meters, keeping any speaker-level wires away from microphone cabling. Connect the speaker level signals to an RDL TX-70A to provide a line-level signal to feed the meter. Connect all the line-level sources to their corresponding meter inputs. Connect 24 Vdc power to each meter and mount the meters. Operate every part of the audio system at ideal normal operating levels. Adjust the CAL trimmer on each meter for a correct normal indication on the meter. (Note: Very high, full-scale, levels that may occasionally occur will not damage the RU-SM16.) It is recommended that the meters be operated in the VU (average) mode.



Application HW1-15

**Add specific headphone jack to monitor any source (main mix, recording, etc.)**

Product(s): RU-SH1  
AF-SH1  
AFM-A1 or AFM-DC1

Description:

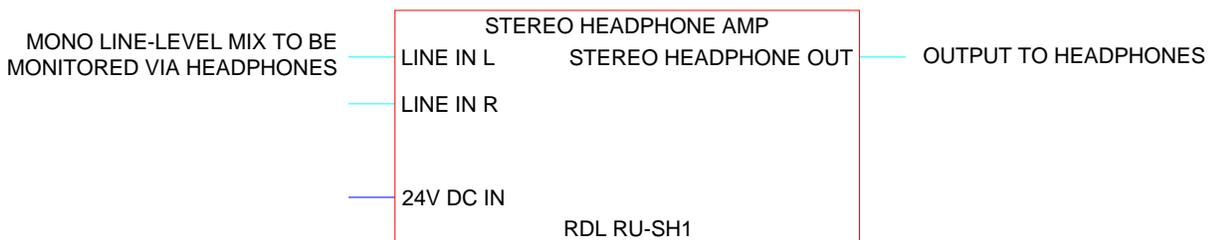
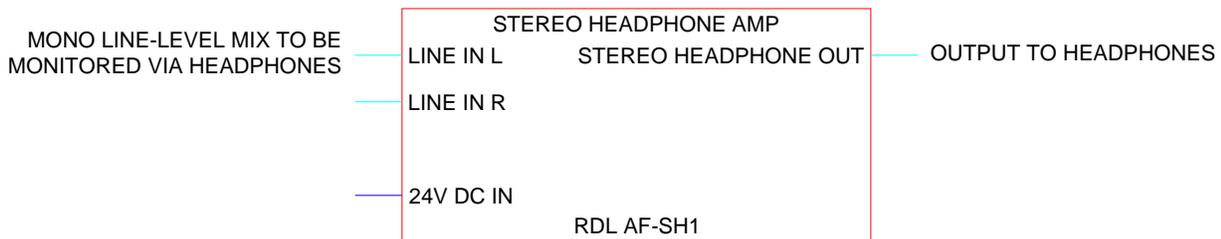
It is often convenient to provide an individual headphone jack to monitor the main mix, recording input or other signal. Examples of locations for headphone amps include:

- In the booth so personnel can hear the main mix or signal feeding the recorder
- At an announce station in the booth for narrations or announcements
- In the choir room for the director to hear what is going on in the sanctuary
- At any location for hearing impaired people

RDL offers two headphone amplifiers suited to these applications. The RU-SH1 mounts in an equipment rack in any RDL RACK-UP series rack mount. These may be convenient if the booth contains an equipment rack. The RDL AF-SH1 mounts either on a countertop (using the AFM-DC1 enclosure) or in a wall (using the AFM-A1 mounting plate).

Installation and Setup:

Connect the line-level audio signal to be monitored to INPUT L on the headphone amplifier and set the MODE switch to MONO. (If a stereo source is to be monitored, connect both inputs and set the mode to stereo.) For normal +4 dBu line-level sources, set the INPUT SENSITIVITY switch to LO. Connect 24 Vdc power and mount the module.



Application HW1-16

**Provide an unbalanced recording feed from a balanced mix output**

Product(s): FP-BUC2

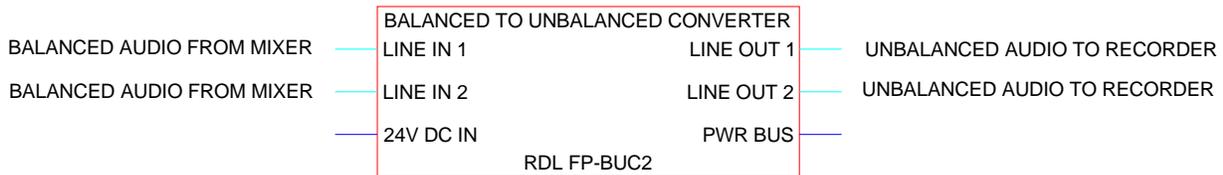
Description:

Most professional mixers have balanced audio outputs. Most recording decks have unbalanced inputs. RDL produces numerous interface modules that can make this conversion, including RU-LA2D, STA-1, STA-1M, STA-2A, FP-BUC2.

The FP-BUC2 is often the most convenient to install since it provides XLR connectors for the balanced inputs and RCA jacks for the unbalanced outputs.

Installation and Setup:

Connect the balanced output of the mixer, or the output of the distribution amplifier that distributes the mixer output (Application HW1-17), to the input of the FP-BUC2. If the mixer is mono, only one channel will be used. The second channel of the FP-BUC2 may be used to unbalance another mixer output. (The FP-BUC2 does not produce crosstalk between the channels that would make it unsuitable for use as a dual-mono product.) Connect the output(s) to the recording deck input(s). Set the GAIN on the FP-BUC2 to the dot, then adjust as required for correct levels.



Application HW1-17

**Distribute an audio signal to multiple destinations: amplifiers, VCR, DVD recorder**

Product(s): RU-DA4D  
ST-DA3

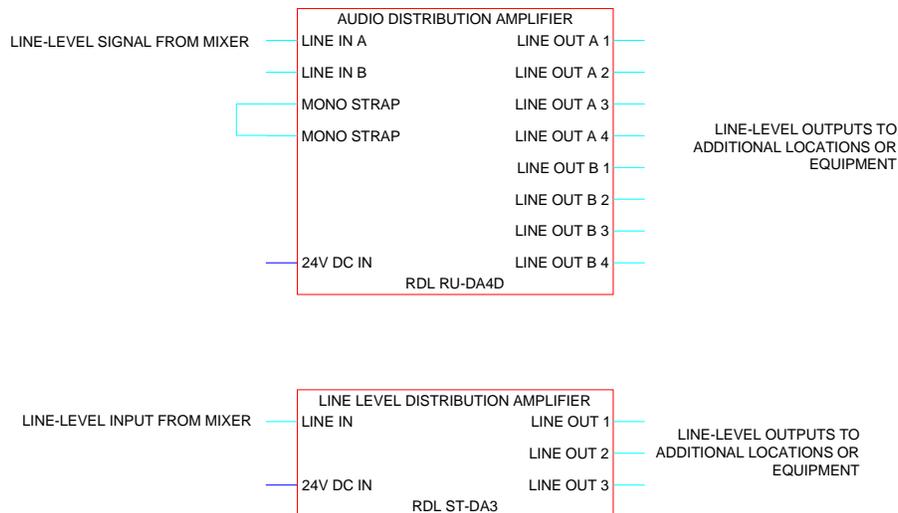
Description:

In most installations, various outputs from the main system mixer need to feed several other products (other mixers, power amplifiers, headphone amplifiers, recorders, computers, press feeds, transmitters). It is good practice to isolate each of these output feeds to avoid interference, hum and excessive loading. For example, if the main house mix is not distributed and there is a disruption to that audio line (accidental short, accidental connection to the output from other equipment, press back-feed, etc.), that interference will be fed to the main house speakers. If the outputs are distributed, a disruption to one output will not be heard in the main system speakers.

RDL produces various distribution modules. Two common models include the ST-DA3 and the RU-DA4D. The ST-DA3 is a compact high quality, low-noise distribution amplifier module that feeds one input to three separate isolated outputs. The module has a single gain adjustment; all three outputs are the same level. The RU-DA4D is a RACK-UP series rack mounted distribution amplifier that can be set to either distribute a stereo signal to 4 stereo outputs, or a mono input to 8 mono outputs. It features individual output level adjustments for each of the 8 outputs. In the stereo mode, the RU-DA4D may also be used to distribute two separate mono sources each to four outputs.

Installation and Setup:

Select the mounting location and method for the module. Connect the mixer output to the module input. (If the RU-DA4D is being used to distribute two separate outputs from the mixer, connect both inputs; if the RU-DA4D is being used to distribute one mixer output to 8 places then install the MONO jumper on the rear of the RU-DA4D.) Connect each distribution amplifier output to the equipment it will be feeding. Connect 24 Vdc power. If balanced +4 dBu signals from the mixer are to be distributed to other equipment with balanced inputs, no level adjustment is normally required. For outputs wired unbalanced, the GAIN on the module will need to be reduced until the connected equipment receives a normal operating level as indicated on its own level metering or on an RDL PT-AMG2 audio test set.



Application HW1-18

**Switch between multiple (NTSC/PAL) video sources: camera, VCR, DVD**

Product(s): RU-VSX4

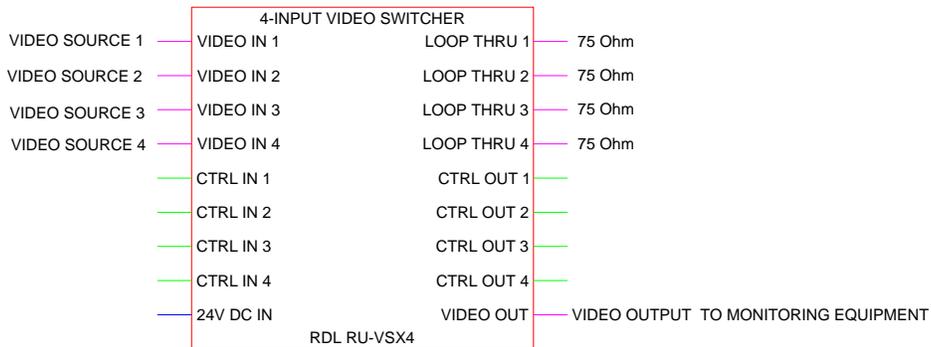
Description:

Multiple video sources are often used in houses of worship. A professional video switcher that provides vertical interval (to avoid screen roll) switching is preferred for switching between these sources. Common video sources may include fixed cameras (example: children’s moment), video tape playback, DVD playback. Some industry switchers that include computer monitor inputs and scaling will include one video input. When multiple video inputs are used, a separate video switcher is needed.

The RDL RU-VSX4 Video Switcher is a broadcast-quality professional switcher that provides long-life keyboard-style pushbuttons on its front panel to select from up to 4 video sources.

Installation and Setup:

Mount the RU-VSX4 in a rack or use available RDL cabinet mounting adapters so that the booth operator can conveniently access the buttons. Connect up to 4 video sources using 75 Ohm coaxial cable with BNC connectors. Attach the included 75 Ohm loads to the four LOOP THRU jacks. Adapters from BNC to RCA may be needed for consumer type video source equipment that provide outputs on RCA connectors. Connect the output of the RU-VSX4 to the video input of the monitoring equipment in the system. Connect 24 Vdc to the PWR input of the switching module.



Application HW1-19

**Distribute a video signal to multiple destinations: monitor, VCR, DVD recorder**

Product(s): RU-VDA4  
FP-VDA4

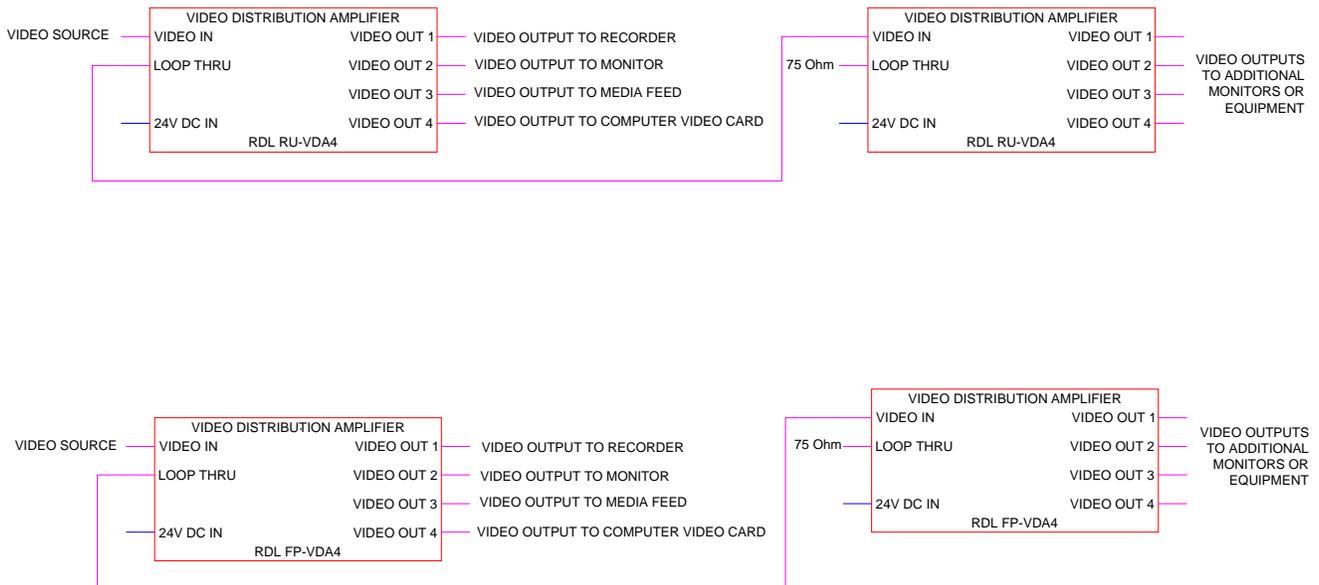
Description:

Video distribution requirements may be found in sanctuary systems and in classroom installations. For example, a video playback deck (tape or DVD) may need to be distributed to several monitors or projectors. A fixed camera that views the worship platform may need to be fed to the system video switcher for children's moments or baptisms while also being fed to an office or cry-room video monitor. Cameras that may be used to record a service may need their outputs fed to a recorder, switcher, media feed or computer video card.

The RDL RU-VDA4 is a RACK-UP series professional broadcast-quality video distribution amplifier. It is intended for rack mounting. The RDL FP-VDA4 provides the same features in a backboard mounted FLAT-PAK series product.

Installation and Setup:

Mount the video distribution amplifier module. Connect the video source to the INPUT of the module and connect the included 75 Ohm load to the LOOP OUT jack. (Note: If more than four outputs are required, a second module may be connected. The LOOP OUT from the first module must be connected to the INPUT of the second module and the 75 Ohm load is then only connected to the LOOP OUT jack of the second module. This provides eight video outputs.) Connect up to four cables to the outputs to feed video to other equipment. Unused outputs may be left unconnected. Connect 24 Vdc power to the module(s).



## Remote Listening Area Applications

### Application HW1-20

#### **Install speakers in remote listening areas: narthex, cry room, bathrooms, classrooms**

Product(s): FP-PA20  
FP-PA20A  
FP-PA20B

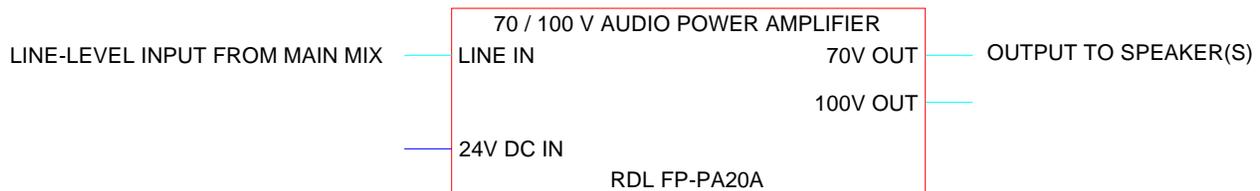
#### Description:

Worship service sound usually needs to be distributed to speakers in various remote locations including the lobby/narthex, cry room, bathrooms, offices, classrooms and outdoor open areas. The power level required per speaker in these applications is typically very low, one or two watts each. Frequently, there are a number of speakers that need audio. One solution is to install constant-voltage speakers (typically 70V in the U.S. or 100V in other countries). If four or fewer speakers are to be installed, 8 Ohms speakers may be used, although the wiring is slightly more complicated.

RDL offers three 20 Watt (RMS) Audio Power Amplifiers that are used for stage and remote monitoring. The FP-PA20 is the 8 Ohm model. The FP-PA20A is the 70/100 V output model. The FP-PA20B is the 25 V output model. These amplifiers feature a balanced mono input and a calibrated anti-saturation compressor that allows the amplifiers to run at high levels without distortion. These models are often used in place of a conventional 50 Watt amplifier. Local level adjustment is possible using other RDL modules (Application HW1-22).

#### Installation and Setup:

Connect the main mix output (or other mixer output, or the distribution amplifier output that provides signal from the mixer) from the system mixer to the audio input of the FP-PA20 type amplifier. Connect the speakers to the amplifier output according to the installation instructions. Connect 24 Vdc power (1000 mA or 2000 mA). Adjust the GAIN trimmer for the correct operating level with normal audio at the system mixer.



Application HW1-21

**Automatically adjust listening levels in remote areas: cry rooms, classrooms**

Product(s): FP-ALC1

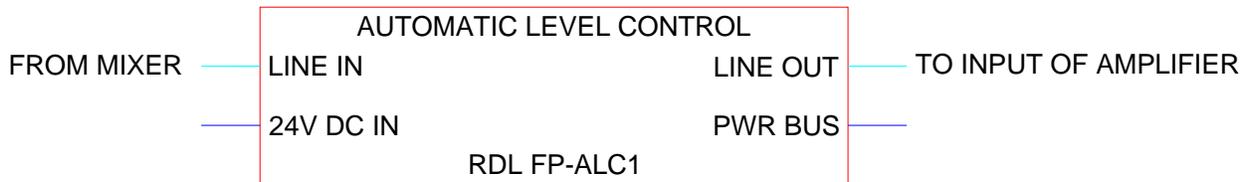
Description:

The usual wide dynamic range of live sound can cause the audio level to drop down to a low level making it difficult to understand spoken words. The ambient sound levels present in certain remote locations (cry rooms, classrooms, bathrooms) can easily mask the distributed sound. An automatic gain control amplifier installed prior to the distributed sound audio power amplifier cures this problem.

The RDL FP-ALC1 is a mono automatic gain control amplifier that is very effective in leveling the sound and is easy to install.

Installation and Setup:

Mount the FP-ALC1 at the location of the monitor amplifier (Application HW1-21). Connect the output from the mixer (or from the distribution amplifier that provides the signals from the mixer). Connect 24 Vdc power to the module. Connect the output of the FP-ALC1 to the input of the audio power amplifier. Operate the system mixer at the highest expected audio level and adjust the GAIN control on the FP-ALC1 until the INPUT OVERLOAD indicator just illuminates. Local level adjustment is possible using other RDL modules (Application HW1-22).



Application HW1-22

**Provide local volume adjustment in a remote listening area: narthex, cry room, etc.**

Product(s): ST-VCA2  
RLC3

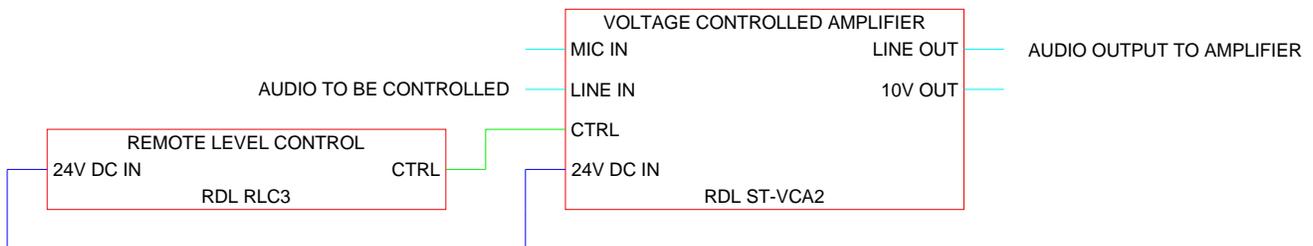
Description:

It is often beneficial to provide for localized volume adjustment in a given remote listening zone. This is done by adding a VCA module (voltage controlled amplifier) ahead of the audio power amplifier for that zone. If the remote listening areas are to be divided into small zones with only one to three speakers per zone, an RDL ST-PA6 6 Watt RMS 8 Ohm audio power amplifier is usually more than sufficient for the speakers in that small zone. For example, instead of installing distributed speakers from a 20 Watt amplifier in 3 zones, it may be preferable to install a 6 Watt amplifier to feed the speakers in each of the 3 zones. A line-level VCA module can be installed prior to the 6 Watt amplifier. The VCA module can be remote controlled. RDL offers several types of remote controls. It is often preferable to give the people in the zone certain, fixed audio levels to select. RDL offers a remote control that allows the installer to pre-select 3 or 4 audio levels that the users can chose from.

The ST-VCA2 Voltage Controlled Amplifier is an audio level control module that adjusts the line-level signal feeding an audio power amplifier. The RDL RLC3 remote control may be wall mounted (using available RDL wall box or a standard US electrical box, and available RDL metal trim plates). It provides 4 buttons for users to select the listening level in their zone. The bottom button may be set by the installer to OFF or to a low listening level. The installer determines the other available levels using trimmer controls on the side of the RLC3. These trimmers are concealed when the control is installed.

Installation and Setup:

Install the ST-VCA2 together with the audio power amplifier for the zone. Connect the audio source to the input of the ST-VCA2. Connect the output of the ST-VCA2 to the input of the power amplifier. Connect the RLC3 to the ST-VCA2 according to the instructions for the product. Connect 24 Vdc power to the ST-VCA2. The RLC3 receives power from the same power supply. Adjust the trimmers on the RLC3 according to its installation instruction prior to mounting the control.



## Equipment Rack and General Applications

### Application HW1-23

### **Delay audio to specific speakers: Cluster, balcony, narthex**

Product(s): RU-ADL2

#### Description:

The distance between the main sanctuary speaker cluster and any other sanctuary or monitor speakers requires time alignment. The audio signal feeding distant speakers needs to be delayed so the sound from both sets of speakers reaches each member of the congregation at the same time. Common examples of required time delay include balcony speakers and narthex speakers (often audible from rear seating rows when lobby doors are open).

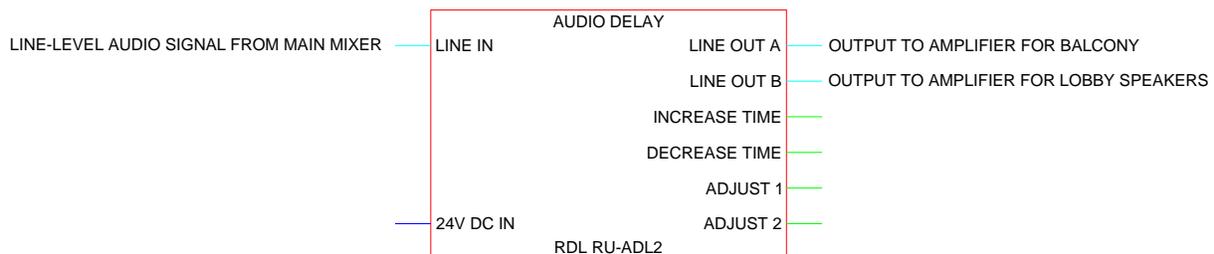
The RDL RU-ADL2 is a DSP (digital signal processor) based broadcast-quality professional audio delay. It features two separate delayed outputs from a single mono input. Each of the two outputs can be set to a different amount of time delay, so one output could feed the balcony speakers while the second output could feed lobby speakers or choir monitors.

#### Installation and Setup:

Connect the output of the main system mixer (or distribution amplifier providing the mixer output signal) to the input of the RU-ADL2. Connect each output to the appropriate power amplifier input. Connect 24 Vdc power to the RU-ADL2. With normal audio levels present in the system, adjust the input GAIN control for proper operating levels as indicated on the dual-LED VU meter on the RU-ADL2 front panel.

Set the display switch to the output to be adjusted. Experienced sound technicians may adjust the time delay to a calculated value based on the distance between main and remote speakers. The delay may be fine tuned by applying clicking sounds through the sound system and adjusting the time until the click is heard at the same time from both sets of speakers when monitored from a location where both the main and remote speakers are heard simultaneously.

Once correct time adjustment is completed, install the included jumper on the rear terminals to prevent front-panel adjustment of the time delay.



Application HW1-24

**Remove “ground-loop” hum from permanently installed wiring run**

Product(s): TX-AT1

Description:

If “ground loop” hum is being induced in an audio line, it can be removed by inserting an isolation transformer at either end of the line. The RDL TX-AT1 is a studio quality transformer of the highest audio performance level. Connections are made on a terminal block. In areas with severe electrical static discharge, the RDL TX-AT1S is preferred. The TX-AT1S includes transient suppression to protect equipment inputs or outputs, and it must be connected to a good earth ground. The TX-AT1 type transformers must not be installed in the vicinity of strong magnetic fields, such as those produced by power transformers in high power amplifiers.

Installation and Setup:

Connect the balanced audio source to the INPUT terminals. Connect the balanced audio destination wiring to the OUTPUT terminals.

