

Audio System
Description and Operation

Revision 0.5

Grace Lutheran Church

Seguin, Texas

A Member Church of the The Lutheran Church -- Missouri Synod

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Overview

This document covers the description and operation of the audio system in the sanctuary at Grace Lutheran Church in Seguin, Texas.

Background

Pastor Ed Giesse came to Grace Lutheran and did some fantastic work. Following are some of his contributions we are continuing to improve with this effort:

- Started the “Praise Band”
- Re-engineered the acoustic production in the sanctuary
- Introduced modern commercial amplifiers
- Built and integrated a computer for digital recording/reproduction
- Reverse-engineered electronic feed from Allen Organ
- Setup the original dual-mixer configuration

As Pastor Ed put many hours into these and other projects, he gave us an excellent system that has provided years of service. However, there did remain some areas that could be improved.

This document details the original system configuration, as well as the improvements for this “tweak”. Yes, this is only a “tweak”. Another configuration should be coming that will incorporate video into this system.

The Mixers

There are currently 2 mixers used in the audio system. The Samson MPL1401 is a 12-channel (analog) mixer. The Tascam TM-D1000 is a 16-channel (digital) mixer. Using his experience with live music sound production, Pastor Rob Sandley suggested these 2 mixers be traded for a single mixer. A single mixer would be simpler to configure and operate. However, it was agreed to “make do” with these 2 mixers for this “tweak” of the audio system. The next configuration change can be used to simplify this equipment arrangement.

Features

The Samson MPL1401 is the main mixer. It drives that main sound production for the sanctuary, the nursery, the multi-purpose room, and the wireless headphones. It also

drives signal for analog (cassette tape), digital (computer/CD) recording, and praise band monitoring. While the sanctuary, the nursery, and the multi-purpose room share the same mix, separate mixes are available for the wireless headphones, each type of recording, and the praise band monitoring. Analog (cassette tape) and the digital (computer/CD) recordings from the Samson are “dual-mono” mode to allow the highest level of redundancy and simplicity of recording and playback. The Samson has 2 unused channels remaining for expansion.

The Tascam TM-D1000 is a sub-mixer to the Samson. It provides a single monaural signal to a channel on the Samson. (The Samson returns a single monaural signal to the Tascam for praise band monitoring.) The Tascam provides a stereo signal to a set of headphone amplifiers for headphone monitoring by the praise band. (Each musician has a dedicated headphone monitor mix.) The Tascam also provides a separate SPDIF (digital) signal to the computer for digital (computer/CD) recording. The Tascam also has 4 channels of effects (Channel Dynamics) that can be used to modify signals before they are sent to the Samson. The Tascam has 6 unused digital (TDIF) channels remaining for expansion.

Simple operation is a main goal for unattended usage. The ability to simply turn-on the system and confirm it is working is what is intended here.

Warnings

Care must be taken when recording to and playing from the cassette deck and the computer. Each of these devices will reproduce (monitor) the recorded signal back into the mixers. Under certain circumstances, this can produce an infinite gain loop-back (feedback) signal. Any recording and playback planned for a live performance should be practiced (rehearsed) before hand.

Configuration

This section attempts to describe the configuration of the sound system. This section includes details...

Inputs and Outputs Summary

Four tables are presented here, summarizing the inputs and outputs for the Samson Main Mixer and the Tascam Sub-Mixer. Additional detail for each channel is presented in the next section.

Input	Description
Channel 1	DOD Direct Injection (Allen Organ)
Channel 2	DOD Direct Injection (Allen Organ)
Channel 3	Shure Microphone (Piano)
Channel 4	Shure Microphone (Piano)
Channel 5	AKG Microphone (Congregation)
Channel 6	Wireless Microphone (Pastor's)
Channel 7	??? Microphone (Lectern)
Channel 8	Unused
Channel 9	Unused
Channel 10	Tascam Sub-Mixer Feed (Mono)
Channel 11	Tape In L (Stereo Cassette)
Channel 12	Tape In R (Stereo Cassette)
Aux Return 1	BROKEN
Aux Return 2	BROKEN
Aux Return 3	Return from Samson Aux Send 2
Aux Return 4	Return from Samson Aux Send 2

Table 1: Samson Main Mixer Inputs

Output	Description
Aux Send 1	Pre-Fader Tascam Sub-Mixer Feed
Aux Send 2	Post-Fader Feed to Aux Return 3 & 4
Bus Output 1	Unused
Bus Output 2	Realistic Wireless Headphones
Bus Output 3	Stereo Cassette L/R
Bus Output 4	Computer L/R (Aux-in)
Main L	SoundSphere QB Crossover (Brown Speaker)
Main R	Unused
Control Rm L	Onkyo Receiver (Nursery and Multi-Purpose)
Control Rm R	Unused

Table 2: Samson Main Mixer Outputs

Inputs	Description
Channel 1	Lead Vocals Microphone
Channel 2	Guitar
Channel 3	Bass Guitar L
Channel 4	Bass Guitar R
Channel 5	Keyboard L
Channel 6	Keyboard R
Channel 7	Drums L/Mono
Channel 8	Return Feed from Samson Main Mixer
Channel 9	Computer L (SPDIF)
Channel 10	Computer R (SPDIF)
Channel 11	Unused (Digital/TDIF Only)
Channel 12	Unused (Digital/TDIF Only)
Channel 13	Unused (Digital/TDIF Only)
Channel 14	Unused (Digital/TDIF Only)
Channel 15	Unused (Digital/TDIF Only)
Channel 16	Unused (Digital/TDIF Only)
Ext Input L	Unused
Ext Input R	Unused

Table 3: Tascam Sub-Mixer Inputs

Output	Description
Aux Sends 1	Samson Main Mixer (Mono)
Aux Sends 2	Unused
Aux Sends 3	Lead Vocals Monitor
Aux Sends 4	Guitar Monitor
Digital Out A	Computer (SPDIF)
Digital Out B	Unused
Stereo Output L	Headphone Monitor
Stereo Output R	Headphone Monitor
Monitor Output L	Unused
Monitor Output R	Unused

Table 4: Tascam Sub-Mixer Outputs

Samson Main Mixer Configuration

In this section, each input and output of the Tascam Sub-Mixer is described.

Samson 1&2 – Organ

The Allen Organ was not originally designed to provide input to a mixer. This organ came with 2 large internal amplifiers connected to 4 calibrated speakers located above the choir pews. As discussed below, this speaker arrangement never provided balanced sound generation throughout the sanctuary. The inputs to the internal amplifiers were disconnected and fed to a “direct injection” box for conversion to low impedance signal for microphone input on

the Samson. The DOD AC265 direct injection boxes are set with the ground lift to the “left” and the attenuation at 0db.

An un-explained arrangement is required to make the organ’s expression pedal work. The “C” signal is placed in electrical parallel with the “exp” connections that formerly fed the internal amplifier. This arrangement allows the organ’s expression pedal to work. Additionally, there is “Y” input that doesn’t appear to have any signal.

Samson 3&4 - Piano

Located behind the piano, close to the harp, are 2 Shure SM57 microphones. These microphones are intended to pickup only piano sound. However, the nature of a microphone is to get everything, so care must be taken not to over-boost these inputs.

One microphone is located near the upper range of the harp. The EQ on this microphone is boosted in treble and cut in bass. The other microphone is located near the lower range of the harp. The EQ on this other microphone is boosted in bass and cut in treble.

Samson 5 – Omni Microphone

In order to capture the live nature of a worship service, an AKG C2000B microphone is used to record the congregation. This microphone was formerly located in a short microphone stand on top of the organ. When the signal from the microphone was boosted, the short microphone stand caused key-strokes on the organ to be recorded as low frequency “thuds”. As such, this microphone was moved to a tall microphone stand, separate from the organ.

The AKG comes with a bass-cut filter that is useful for close-up voice recording. This filter is not used when recording the congregation. Also, the AKG comes with a –10db pad that is not used for congregational recording.

Samson 6 – Pastor’s Wireless Microphone

Pastor carries an Audio Technica ATW-1451 UniPak Transmitter with clip-on microphone. A half-rack receiver is mounted in the 19” rack. I have not finished adjusting this input.

Samson 7 – Lectern Microphone

This microphone has not yet been installed

Samson 8&9 – Unused

These channels on the Samson mixer are currently unused.

Samson 10 – Tascam Sub-Mixer

Originally, the Tascam Sub-Mixer was input to the AUX Return 1&2. However, a defect in the ¼” stereo plug on the back of the Samson mixer did not allow this arrangement. Additionally, a Direct Injection box is required to match impedance between the 2 mixers. This DI box has not yet been installed.

Samson 11&12 – Tape Deck

The “TAPE” switch, located just above the “CONTROL ROOM” knob, routes the “TAPE IN” RCA jacks to channels 11 and 12. Channel 11 is left and channel 12 is right. This switch should be set to the “in” position, as there are no other inputs on channels 11 and 12. NOTE: the tape output from the Sony TC-K461S Stereo Cassette Deck “repeats” its input signal when recording. Care must be exercised when recording so that an electronic feedback loop is not established through channels 11 and 12. Since the cassette tape is rarely ever used for playback, it is safest to keep the channel 11 and 12 level set to ∞ (infinity).

Samson Aux Return 1&2 – Broken

We have found that Aux return 1 and 2 are broken. We cannot create a reliable connection with the socket for this input. This problem can be felt when plugging and unplugging a lead into this socket.

Samson Aux Return 3&4 – Recording Feed

Aux return 3 and 4 are used to feed signal from Aux Send 2 (post fader). In this way, a recording ready mix can be delivered to bus 3 and 4 from any channel that is feeding bus 1 and 2. This mix is modified by the level setting of each channel (hence it is a post-fader signal). Open microphones, like the piano and wireless mics, can be boosted with Aux Send 2 for clearer recordings. The mono (non-stereo) signal delivered from Aux Send 2 is electrically split equally between bus 3 and 4. In order to ensure the proper routing of signal from Aux Return 3&4, the “MUTE $\frac{3}{4}$ ” switch must be in the “in” position. NOTE: Selecting the “out” position for this switch could result in an electrical feedback loop.

Samson Aux Send 1 – Tascam Return Feed

This output channel on the Samson mixer is a Pre-Fader feed. It is not effected by the fader (Level) changes on each input channel. This output is a return feed to the Tascam Sub-Mixer. On the Tascam, it is mixed with the headphone feed, only. This output may be terminated because it has not proven useful. Before terminating this feed, I should make sure that I can record from the Aux In Analog Feed to the computer.

Samson Aux Send 2 – Recording Feed

This output channel on the Samson mixer is a Post-Fader feed. It is effected by the fader (Level) changes on each input channel. This output is used as a dual-mono loopback feed for recording from bus 3 and 4. Channels that are selected for feed to bus 1 and 2 can also be duplicated on bus 3 and 4 with this loopback.

Bus Output 1 – Unused

This output channel on the Samson mixer is not used because it is selected for use on the Main and Control Room Outputs. There are not other uses for this feed.

Bus Output 2 – Wireless Headsets

This output channel on the Samson mixer is used to feed the Realistic Wireless Headphone Transmitter. The transmitter transmits on a 900 Mhz unlicensed frequency band. The transmitter does not use spread spectrum technology and is prone to interference from other transmitters that implement this technology. However, I have found that strong signal levels can be transmitted reliably within the sanctuary. It is important that a strong signal is transmitted to overcome interference. The bus output 2 levels are balanced (left and right) against the bus 1 output (main and control room). This allows different mix levels from various channels which I have found useful for inputs like Pastor's microphone. Pastor's microphone will feedback quickly over the main PA system, but must be set much higher to get the strong signal levels desired on the bus output 2 (wireless headphones).

Bus Output 3 – Stereo Cassette L/R

This output channel on the Samson mixer provides a dual-mono feed to the Sony TC-K461S Stereo Cassette Deck. While I have successfully tested the ability to record from this feed, I have not yet used it to record a worship service.

Bus Output 4 – Computer L/R (Aux In)

This output channel on the Samson mixer provides a dual-mono feed to the Creative Sound Blaster Audigy Sound Card on the computer. This is an analog feed that the sound card converts to a digital format for recording. I have not yet successfully tested the ability to record from this feed.

Samson Left Main Output – The Brown Speaker

The introduction of the "brown speaker" to the sanctuary was a solution to the problem with sound production from the Allen Organ. This organ came with 2 large internal amplifiers connected to 4 calibrated speakers located above the choir pews. This speaker arrangement never provided balanced sound generation throughout the sanctuary. The orientation of higher frequencies coming straight out from one wall caused these sounds to bounce non-uniformly. A representative of the Allen Organ company suggested the solution was to place quite a few smaller speakers at uniform locations around the sanctuary. Cost and expected undesirable aesthetics resulted in another firm being consulted.

The brown speaker was the result of an engineering study to provide the most cost effective, uniform sound production in the sanctuary. The initial installation of this speaker came with a rack mounted SoundSphere QB Crossover. The sub-bass output from the crossover was fed to the 4 original organ speaker cabinets. This sub-bass output is limited to audio signals of 200Hz and below. The original speakers in the organ cabinets had deteriorated from heat and age. The 12 in. drivers in those cabinets were replaced with speakers from Radio Shack. The cones from the other (non 12 in.) drivers were removed from the magnets to reduce distortion and rattle coming from the deteriorated cones. Power for these speakers comes from a QSC Audio RMX 850 Amplifier. An internal parallel input is strap is used to duplicate the mono (non-stereo) input from Channel A to Channel B within the QSC amplifier. I don't know the power output of this amplifier because I do not know the impedance of the crossovers that are in the organ speaker cabinets. With a full strength (0db) signal input to the QSC amplifier, a gain setting of 28 on channels 1 and 2 appear to drive the organ speaker cabinets to the verge of maximum output. The QSC amplifier has clip limiters available on each channel. However, the QSC User Manual suggest "When driving subwoofers, some users let the amplifier clip without limiting because it gives extra "punch" to kick drums and similar sounds".

The brown speaker itself is driven from the main output produced by the 200Hz rack mounted crossover. Signals above 20 Hz are output through the main to the Furman Model SP-20ABE Half Rack Power Amplifier. The Furman amplifier is setup in a bridged mode where channels A and B are connect in series to obtain a maximum single channel (mono) output power. I don't know the power output of this amplifier because I do not know the impedance of the

brown speaker. With a full strength (0db) signal input to the Furman, a level of 4 will drive the brown speaker as loud as is comfortable.

Samson Right Main Output – Unused

The right main output from the Samson mixer is not used because the main sound production system in the sanctuary is mono (non-stereo) and because bus output 2 is sent directly the wireless headphones.

Samson Left Control Room Output – Nursery and Multi-Purpose

The left control room output from the Samson mixer is sent to a speaker in the nursery and a speaker in the multi-purpose room. The speaker in the multi-purpose room also has a volume control mounted in the wall. These speakers would benefit from the use of a 70 volt step-up transformer because the wiring is a very small gauge and is run a very long way.

Because of a wiring limitation within the building, both speakers are driven from the left output of speaker set A on the Onkyo TX-8511 Audio Video Control Receiver. The left control room output is sent to the left CD input on the Onkyo. The Volume knob on the Onkyo is set to ½ of full level and the control room knob is set at 3 “dots” above infinity (∞) on the Samson. Note that the Samson needs a DI box (used in reverse) to match the unbalanced input on the Onkyo. As of this writing, that DI box is not connected. Also, the same mix sent to the brown speaker is used for this output. There has also been some discussion of adding similar speakers in the restrooms.

Samson Right Control Room Output – Unused

The right control room output from the Samson mixer is not used because the main sound production system in the sanctuary is mono (non-stereo) and because bus output 2 is sent directly the wireless headphones.

Tascam Sub-Mixer Configuration

In this section, each input and output of the Tascam Sub-Mixer is described. Additionally, the Tascam is a digital mixer. As such there are many configurations that are setup in software. Below is a table of the settings revealed in the “Option Monitor”. These settings are default settings for all channels and apply to the entire mixer. Press and hold the SHIFT and MEMO keys to see the Option Monitor. Note that the red LED labeled “MIX” should be lit within the “MODE” box, not the “REC” LED. Also note that the parameters in *italics* are not used, i.e. the settings are irrelevant. Eff Rtn and Aux Rtn should be set to something else because the Digital In A should not show up on L-R through either of these inputs.

Parameter	Value
Mode	ST +4Aux[Mono]
All Channel Aux	Post
Digital Input	A: RCA
Digital Output	A(L-R), B(1-2)
Digital A/B Format	A&B (SPDIF)
Direct Out Mode	<i>Post Input Fader</i>
Eff Rtn Input	<i>Digital in A</i>
Eff Rtn Assign	<i>L-R: On</i>

Aux Rtn Input	<i>Digital In A</i>
Aux Rtn Assign	<i>L-R: On</i>
Ch 7-8 Route1 Target	Analog In
Ch 1 Input	Analog In
Ch 2 Input	Analog In
Ch 3 Input	Analog In
Ch 4 Input	Analog In
Ch 5 Input	Analog In
Ch 6 Input	Analog In
Ch 7 Input	Analog In
Ch 8 Input	Analog In
Ch 9 Input	Digital In A
Ch 10 Input	Digital In A
Ch 11 Input	<i>TDIF-1A</i>
Ch 12 Input	<i>TDIF-1A</i>
Ch 13 Input	<i>TDIF-1A</i>
Ch 14 Input	<i>TDIF-1A</i>
Ch 15 Input	<i>TDIF-1A</i>
Ch 16 Input	<i>TDIF-1A</i>
TDIF-1 A Direct Out	<i>Ch 1-8</i>
Eff Patern	Ch Dynamics
Ch Dynamics Insert	1234
Master Clock Select	Internal [48K]
Direct Recall Defeat	<i>Yes</i>
Remote Control Function	<i>Snapshot Change [up]</i>
TDIF-1 A/B Word Length	A: 24bit
Meter Adjust Release	30ms
Meter Adjust P. Hold	1 sec
Battery Check	3.2V
TM D1000	Ver 1.22

Table 5: Tascam Option Monitor Settings

Tascam 1 – Lead Vocals

Elaine Braune is the lead vocal for the praise band. She uses an Audio-Technica Pro 8Hex Hypercardioid Dynamic Headworn Microphone. This microphone feeds stereo left and right and Aux Output 1. It is also the only feed to Aux Output 3 for headphone monitoring

Tascam 2 – Lead Guitar

Jonathan Bode is the lead guitar player for the praise band. He uses a Gibson Les Paul guitar. His guitar feeds stereo left and right and Aux Output 1. It also feeds Aux Output 4 for headphone monitoring. Note that the guitar needs a DI box to match the balanced input on Tascam channel 2. As of this writing, those DI box is not connected.

Tascam 3&4 – Bass Guitar

Duane Dieterich is the bass guitar player for the praise band. His guitar feeds into a Zoom 506II multi effect processor for bass guitar. The Zoom 506II feeds both channels 3 and 4 on the Tascam. Channel 3 is panned full left and Channel 4 is panned full right. Channels 3 and 4 are also linked in the Tascam, so that all settings (except pan) are duplicated on both channels. These channels feed stereo left and right and Aux Output 1. Note: the signal from both channels of the Zoom 506II is electrically split such that a stereo feed is also sent to the number 1 amplifier in the Behringer PowerPlay HA4400 headphone amplifier system. Note that the 506II needs a DI box to match the balanced input on Tascam channels 3&4. As of this writing, those DI boxes are not connected.

Tascam 5&6 – Keyboard

June Rathgaber is the keyboard player for the praise band. She plays a Yamaha P-60 Electric Piano. This piano has a stereo (headphone) output that feeds channels 5 and 6 on the Tascam. Channel 5 is panned full left and Channel 6 is panned full right. Channels 5 and 6 are also linked in the Tascam, so that all settings (except pan) are duplicated on both channels. These channels feed stereo left and right and Aux Output 1.

Note: the signal from both channels of the Yamaha P-60 is electrically split such that a stereo feed is also sent to the number 3 amplifier in the Behringer PowerPlay Pro HA4400 headphone amplifier system.

Tascam 7 – Drums

Duane Dieterich is also the drummer for the praise band. He plays an electronic drum (trap) set with a Roland TD-6 Percussion Sound Module. The TD-6 has a Left/Mono output and a Right output. Only the Left/Mono output is feed to channel 7 on the Tascam. Note: the signal from the TD-6 is electrically split such that a dual-mono feed is also sent to the number 1 amplifier in the Behringer PowerPlay Pro-XL HA4700 headphone amplifier system.

Tascam 8 – Return from Samson Main Mixer

Channel 8 on the Tascam Sub-Mixer is a return feed from the pre-fader Aux Send 1 output from the Samson Main Mixer. The original intent for this return feed from the main mixer was 2 fold. Primarily, this was used to provide signal to the digital L/R feed to the computer for digital recording. However, an analog feed has also been established to the computer Aux In as a part of this new setup. Secondly, this feed from the main mixer was to be used to return microphone signals, like Pastor's microphone and the congregational microphone, to the headphone monitoring mix. However, this is proven not to be useful. A potential alternative to the main mixer feed would be to connect the Right output from the TD-6 Percussion Sound Module.

Tascam 9&10 – Computer SPDIF Input

Channels 9 and 10 on the Tascam are digital input only. These channels have been dedicated to Digital Input A and configured for SPDIF format. The computer SPDIF output is feed into Digital Input A, which feeds channels 9 and 10. Channel 9 is panned full left and Channel 10 is panned full right. Channels 9 and 10 are also linked in the Tascam, so that all settings (except pan) are duplicated on both channels. These channels feed stereo left and right and Aux Output 1.

Tascam 11-16 – Unused

Channels 11 through 16 are also digital input only. Currently, there is no digital feed for these channels, rendering them unusable.

Tascam Ext Input L&R – Unused

The external inputs (Left and Right) are only routed to monitor outputs. They cannot be used for anything else, rendering them unusable.

Tascam Aux Send 1 – Samson Main Mixer Feed

The Aux Send 1 channel is the main (mono) feed to the Samson main mixer. The fader for this channel is labeled brown speaker because it is used to regulate the volume levels in the sanctuary. All input channels, except the channel 8, are sent post-fader at 100% to this channel. This means that the mix produced with the faders on the input channels is the same mix sent to the Samson mixer. Note that the Tascam needs a DI box to match the balanced input on Samson channel 10. As of this writing, that DI box is not connected.

Tascam Aux Send 2 – Unused

This output channel is unused.

Tascam Aux Send 3 – Lead Vocal Headphone Monitor

The Aux Send 3 channel is dedicated to the lead vocal headphone monitor. The output from this channel is sent as input to the number 2 amplifier in the Behringer PowerPlay Pro HA4400 headphone amplifier system. The channel 1 input is sent pre-fader at 100% to this channel. This means that a full strength signal is always sent to the headphone amplifier from this channel.

Tascam Aux Send 4 – Lead Guitar Headphone Monitor

The Aux Send 4 channel is dedicated to the lead guitar headphone monitor. The output from this channel is sent as input to the number 4 amplifier in the Behringer PowerPlay Pro HA4400 headphone amplifier system. The channel 2 input is sent pre-fader at 100% to this channel. This means that a full strength signal is always sent to the headphone amplifier from this channel.

Tascam Digital Out A – Computer SPDIF Input

The Digital Out A channel is setup how?

Tascam Digital Out B – Unused

The Digital Out B output is not used.

Tascam Stereo Output L&R – Headphone Monitor Mix

The stereo output L&R is sent to the Main In inputs of the Behringer PowerPlay Pro HA4400 headphone amplifier system, which is then duplicated on the Main Out of the Behringer HA4400 to the Behringer PowerPlay Pro-XL HA4700 headphone amplifier system. This feed is used to monitor the band mix using headphones.

Tascam Monitor Output L&R - Unused

These output channels are not used.

Busses, Aux Sends, Aux Returns, and Effects

There are several busses, aux sends, aux returns, and effects (channel dynamics) that are used in this audio system configuration. Explanation of each of these concepts is beyond this document. However, several block diagrams have been provided in Appendix A to show the routing of signal through each mixer. Additionally, wiring diagrams have been provided in Appendix A to graphically display the connections required to complete this audio system configuration.

Operation

This section is intended as a step-by-step guide for using the audio system.

One of the main purposes for this audio system is unattended operation. This means that the system is powered-on, used, and powered-off without any fiddling. Every effort should be taken to ensure that this mode of operation is reliable.

System Power-Up

System power up is accomplished in 3 simple steps.

1. Turn on the Allen Organ
2. Turn on the RackRider
3. Turn on the Furman Amplifier Speaker Switch

The Allen Organ must be powered up first because it sends a huge “POP” to its outputs. All the other equipment needs to be powered off so this POP does not have to be absorbed.

The RackRider is a power conditioner that provides power to all the audio-system components. When this power switch is turned on, all equipment in the racks will power on and begin to function.

The speaker switch on the Furman amplifier is turned on last because the “brown speaker” is sensitive to the audio system startup. So, all the audio components are powered on before the brown speaker is driven. After this switch is turned on, the audio system should be ready for unattended use.

Confirmation of Operation

Before a service begins, it is usually a good idea to confirm operation of the audio system. These items should be tested to confirm they are working.

1. Allen Organ
2. Pastor’s Wireless Microphone

The Allen Organ can be tested by turning on some of the stops and pressing some of the keys. An organist can usually confirm the operation of this instrument.

Pastor’s Microphone should be on standby when the audio system is operating. The wireless microphone should not be turned off. When the wireless is off, the receiver will “hunt” for a signal and can easily pick-up undesirable interference.

System Power-Down

System power-down is done in the reverse order from power-up.

1. Turn off the Furman Amplifier Speaker Switch
2. Turn off the RackRider
3. Turn off the Allen Organ

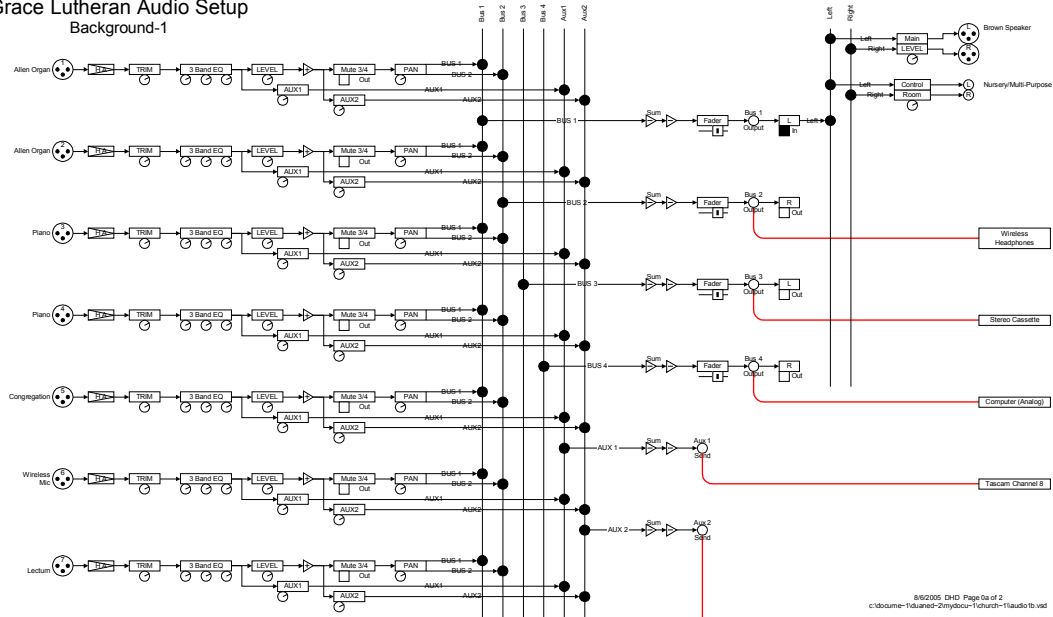
Appendix A: Impedance and Levels

From			Ohms			dBu			To			Ohms			dBu		
Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max	Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max
Audio-Tech Pro 8HE	-	XLR		600		-55			Tascam TM-D1000	Mic 1	XLR		2,200		-65		-15
Gibson Les Paul	-	1/4"							Tascam TM-D1000	Line In 2	1/4"(bal)		10,000		-40		10
Zoom 506 II Bass	Headphone	1/4"		10,000				17	Tascam TM-D1000	Line In 3	1/4"(bal)		10,000		-40		10
Stereo SPLITTER				10,000				17	Tascam TM-D1000	Line In 4	1/4"(bal)		10,000		-40		10
Yamaha P60	Headphone	1/4"							PowerPlay HA4400	Aux In 1	1/4"		25,000				21
Stereo SPLITTER									Tascam TM-D1000	Mic/Line 5	1/4"	1,200		30,000	-50		0
Stereo SPLITTER									Tascam TM-D1000	Mic/Line 6	1/4"	1,200		30,000	-50		0
Roland TD-6	Output L/Mn	1/4"		1,000					PowerPlay HA4400	Aux In 3	1/4"		25,000				21
L/R SPLITTER (Reverse)				1,000					Tascam TM-D1000	Mic/Line 7	1/4"	1,200		30,000	-50		0
Samson MPL 1204	Aux Send 1	1/4"			75		4		PowerPlay HA4700	Aux In 4	1/4"		5,000				22
									Tascam TM-D1000	Mic/Line 8	1/4"	1,200		30,000	-50		0
From			Ohms			dBu			To			Ohms			dBu		
Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max	Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max
Tascam TM-D1000	Aux Send 1	1/4"		100			-2	14	Samson MPL 1204	Line In 10	1/4"(bal)				-30		24
Tascam TM-D1000	Stereo Out L	1/4"(bal)		100			4	20	PowerPlay HA4400	Main Input L	1/4"(bal)		50,000				21
Tascam TM-D1000	Stereo Out R	1/4"(bal)		100			4	20	PowerPlay HA4400	Main Input R	1/4"(bal)		50,000				21
Tascam TM-D1000	Aux Send 3	1/4"		100			-2	14	PowerPlay HA4400	Aux In 2	1/4"		25,000				21
Tascam TM-D1000	Aux Send 4	1/4"		100			-2	14	PowerPlay HA4400	Aux In 4	1/4"		25,000				21
From			Ohms			dBu			To			Ohms			dBu		
Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max	Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max
PowerPlay HA4400	Headphone 1	1/4"		100				8	RadioShack	-	1/4"		100				12
PowerPlay HA4400	Headphone 2	1/4"		100				8	Sony MDR-V600	-	1/4"		45				19
PowerPlay HA4400	Headphone 3	1/4"		100				8	Sony MDR-V600	-	1/4"		45				19
PowerPlay HA4400	Headphone 4	1/4"		100				8	Sony MDR-V600	-	1/4"		45				19
PowerPlay HA4400	Audio Out L	1/4"(bal)						21	PowerPlay HA4700	Main In L	1/4"(bal)		40,000				16
PowerPlay HA4400	Audio Out R	1/4"(bal)						21	PowerPlay HA4700	Main In R	1/4"(bal)		40,000				16
PowerPlay HA4700	Phone Out 4	1/4"		8				2	Sony MDR-V600	-	1/4"		45				19
From			Ohms			dBu			To			Ohms			dBu		
Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max	Device	Port Name	Type	Min	Nom	Max	Min	Nom	Max
Allen Organ ???	???	RCA							DOD 265 DI Box	50K Ohms	1/4"						
Allen Organ ???	???	RCA							DOD 265 DI Box	50K Ohms	1/4"						

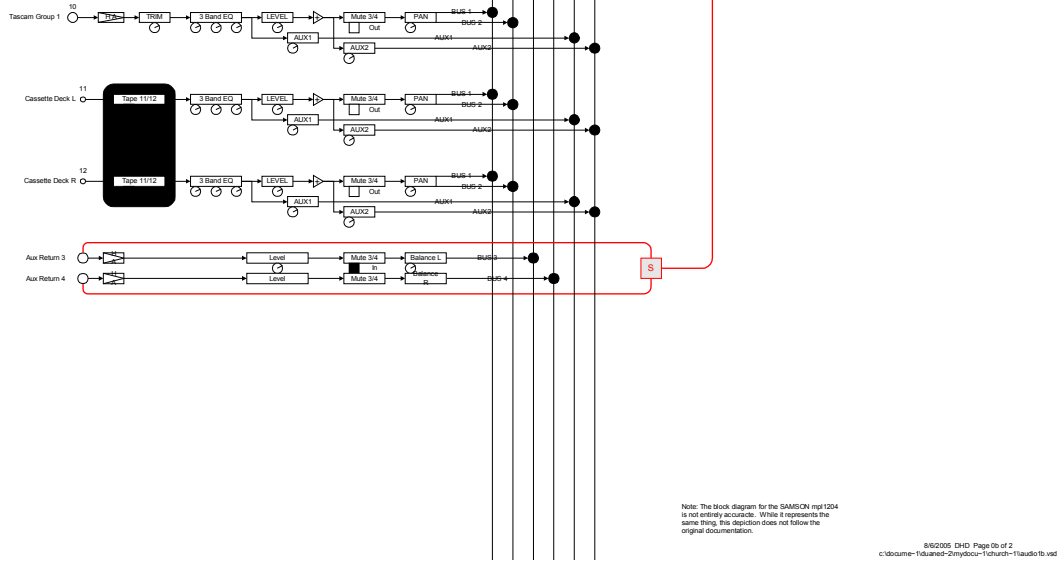
DOD 265 DI Box	600 Ohms	XLR		600					Samson MPL 1204	Mic Input 1	XLR					-50	4
DOD 265 DI Box	600 Ohms	XLR		600					Samson MPL 1204	Mic Input 2	XLR					-50	4
Shure SM57 (Piano)	-	XLR		150					Samson MPL 1204	Mic Input 3	XLR					-50	4
Shure SM57 (Piano)	-	XLR		150					Samson MPL 1204	Mic Input 4	XLR					-50	4
AKG c2000B (Cong.)	-	XLR		200			-32		Samson MPL 1204	Mic Input 5	XLR					-50	4
A-Tech ATW-1451	AF Out	XLR		10,000			-9		Samson MPL 1204	Mic Input 6	XLR					-50	4
Telex FMR-25TD	Output	1/4"		600			-9		Samson MPL 1204	Line In 7	1/4"(bal)					-30	24
Sony TC-K461S	Line Out L	RCA	10,000	47,000			-7		Samson MPL 1204	Tape In L	RCA		10,000			-10	
Sony TC-K461S	Line Out R	RCA	10,000	47,000			-7		Samson MPL 1204	Tape In R	RCA		10,000			-10	
From Device	Port Name	Type	Ohms			dBu			To Device	Port Name	Type	Ohms			dBu		
			Min	Nom	Max	Min	Nom	Max				Min	Nom	Max	Min	Nom	Max
Samson MPL 1204	Aux Send 2	1/4"			75		4		Samson MPL 1204	Aux Return3	1/4"		10,000			4	
L/R SPLITTER (Reverse)					75		4		Samson MPL 1204	Aux Return4	1/4"		10,000			4	
Samson MPL 1204	Main L	XLR			75		4		SoundSphere X-Over	Input	XLR						
Samson MPL 1204	Control Rm L	1/4"(bal)			75		4		Onkyo TX-8511	CD	RCA		50,000		-17		
Samson MPL 1204	Bus Out 2	1/4"			75		4		Wireless Headset	L/AUDIO IN	RCA						
SPLITTER					75		4		Wireless Headset	R/AUDIO IN	RCA						
Samson MPL 1204	Bus Out 3	1/4"			75		4		Sony TC-K461S	Line In L	RCA		47,000		-17		
SPLITTER					75		4		Sony TC-K461S	Line In R	RCA		47,000		-17		
Samson MPL 1204	Bus Out 4	1/4"			75		4		SoundBlaster Audigy	Aux2 -In L	RCA						
SPLITTER					75		4		SoundBlaster Audigy	Aux2 -In R	RCA						
From Device	Port Name	Type	Ohms			dBu			To Device	Port Name	Type	Ohms			dBu		
			Min	Nom	Max	Min	Nom	Max				Min	Nom	Max	Min	Nom	Max
SoundSphere X-Over	Main Out	XLR							Furman SP-20AB	Mono Input	XLR		20,000		-7		
SoundSphere X-Over	Sub-Bass	XLR							QSC RMX 850	CH1	XLR		10,000		3		
Furman SP-20AB	Speakers	Clamps		8?				40W	Brown Speaker	???							
QSC RMX 850	Output 1	Clamps		4?				300W	Allen Speaker 1	???							
SPLITTER				4?				300W	Allen Speaker 2	???							
(Parallel Mode)	Output 2	Clamps		4?				300W	Allen Speaker 3	???							
SPLITTER				4?				300W	Allen Speaker 4	???							
Onkyo TX-8511	SpeakersA L	Clamps		8				100W	Nursery Speaker	???							
SPLITTER				8				100W	Multi-Purpose Spkr	???							
									http://www.analog.com/Analog_Root/static/techSupport/designTools/interactiveTools/dbconvert/dbconvert.html								

Appendix B: Samson Mixer Block Diagram

Grace Lutheran Audio Setup
Background-1



Grace Lutheran Audio Setup
Background-1



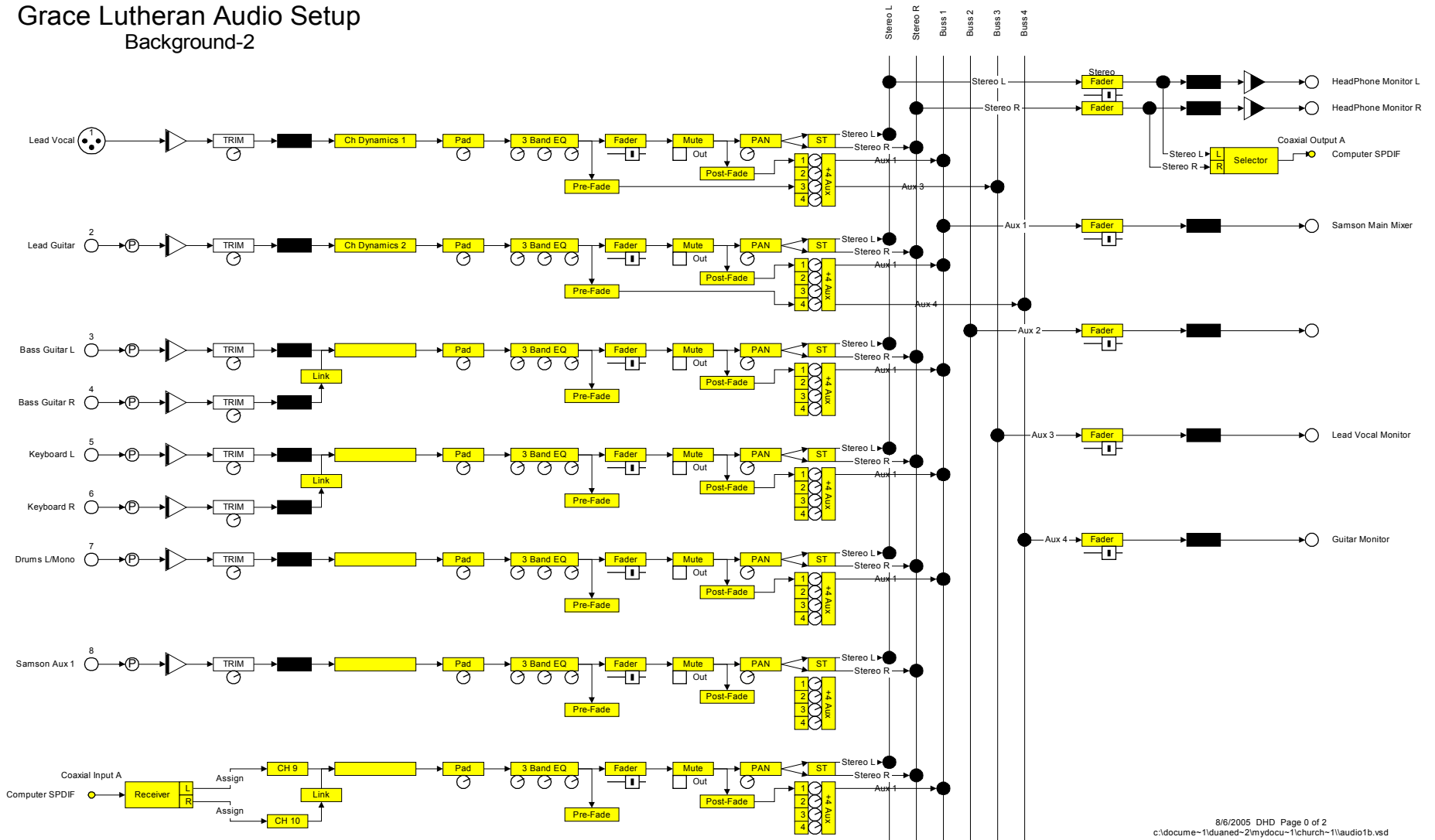
Note: The block diagram for the SAMSON mp1204 is not entirely accurate. While it represents the same thing, this depiction does not follow the original documentation.

8/16/2005 DHD Page 0a of 2
c:\documents-1\duane9-2\mydocu-1\church-1\audio\fb.vsd

8/16/2005 DHD Page 0b of 2
c:\documents-1\duane9-2\mydocu-1\church-1\audio\fb.vsd

Appendix C: Tascam Mixer Block Diagram

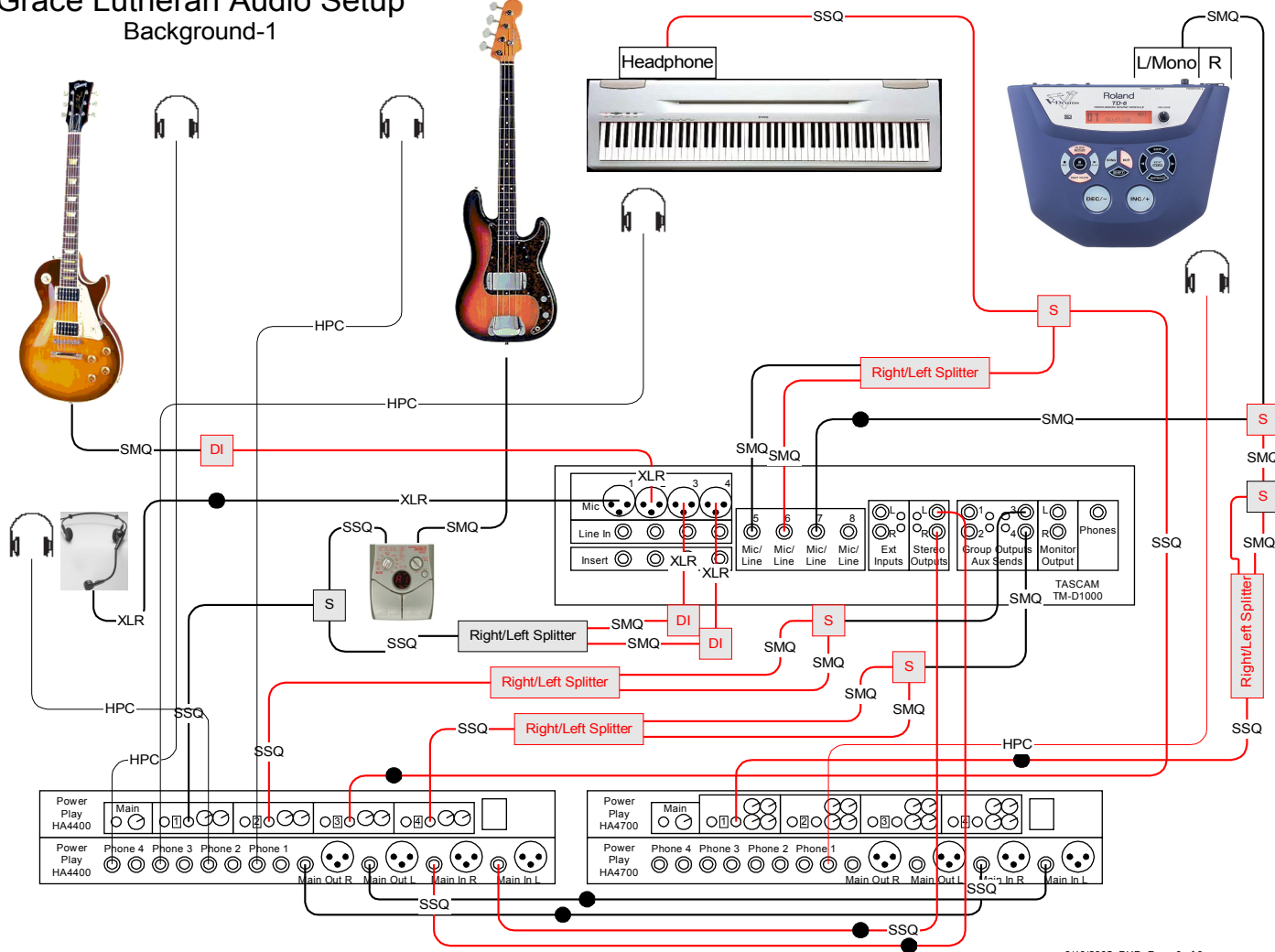
Grace Lutheran Audio Setup Background-2



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c:\docume~1\duaned~2\mydocu~1\church~1\audio1b.vsd

Appendix D: Praise Band Wiring

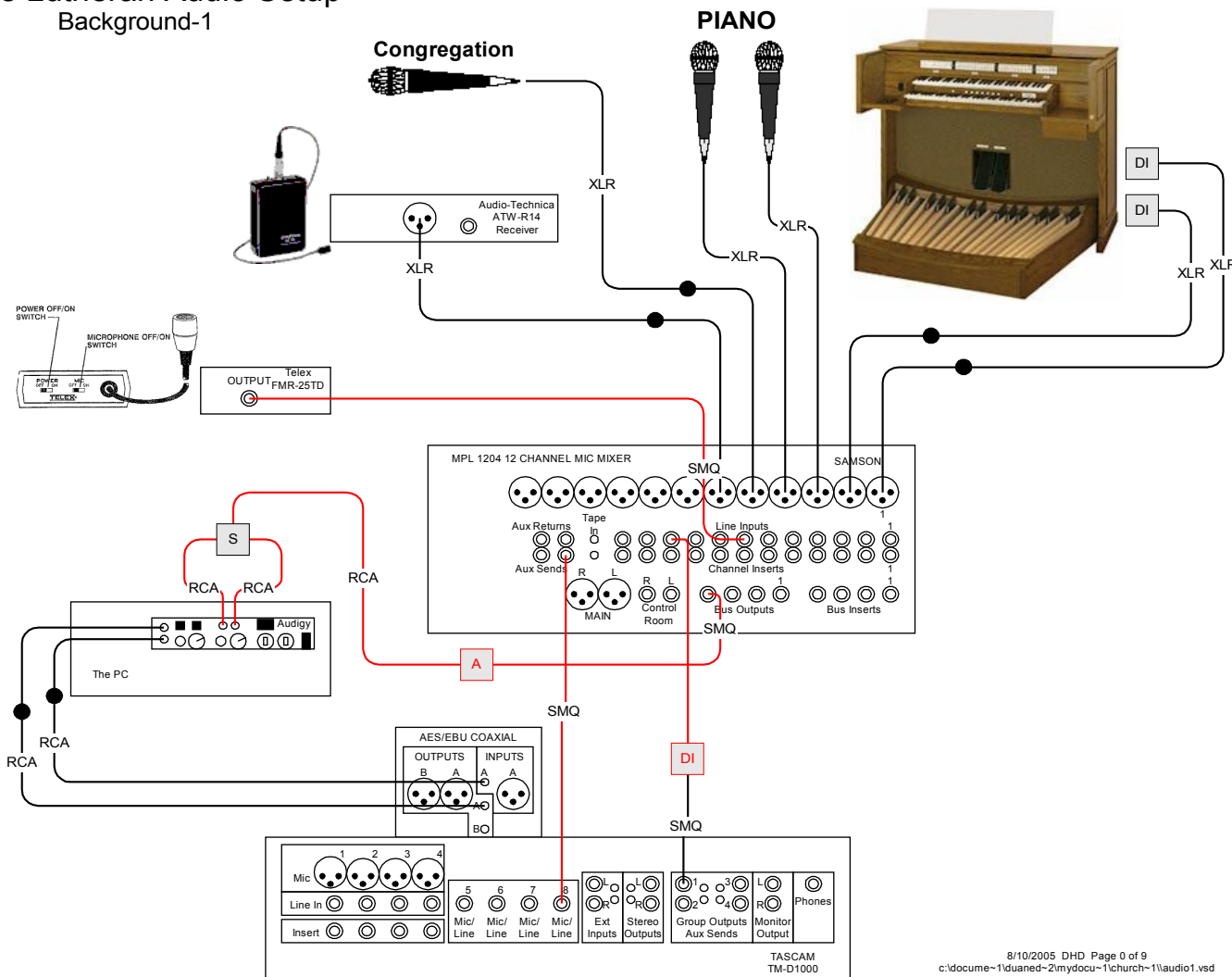
Grace Lutheran Audio Setup Background-1



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c:\docume-1\duaned-2\mydocu-1\church-1\audio1.vsd

Appendix E: Microphone Wiring

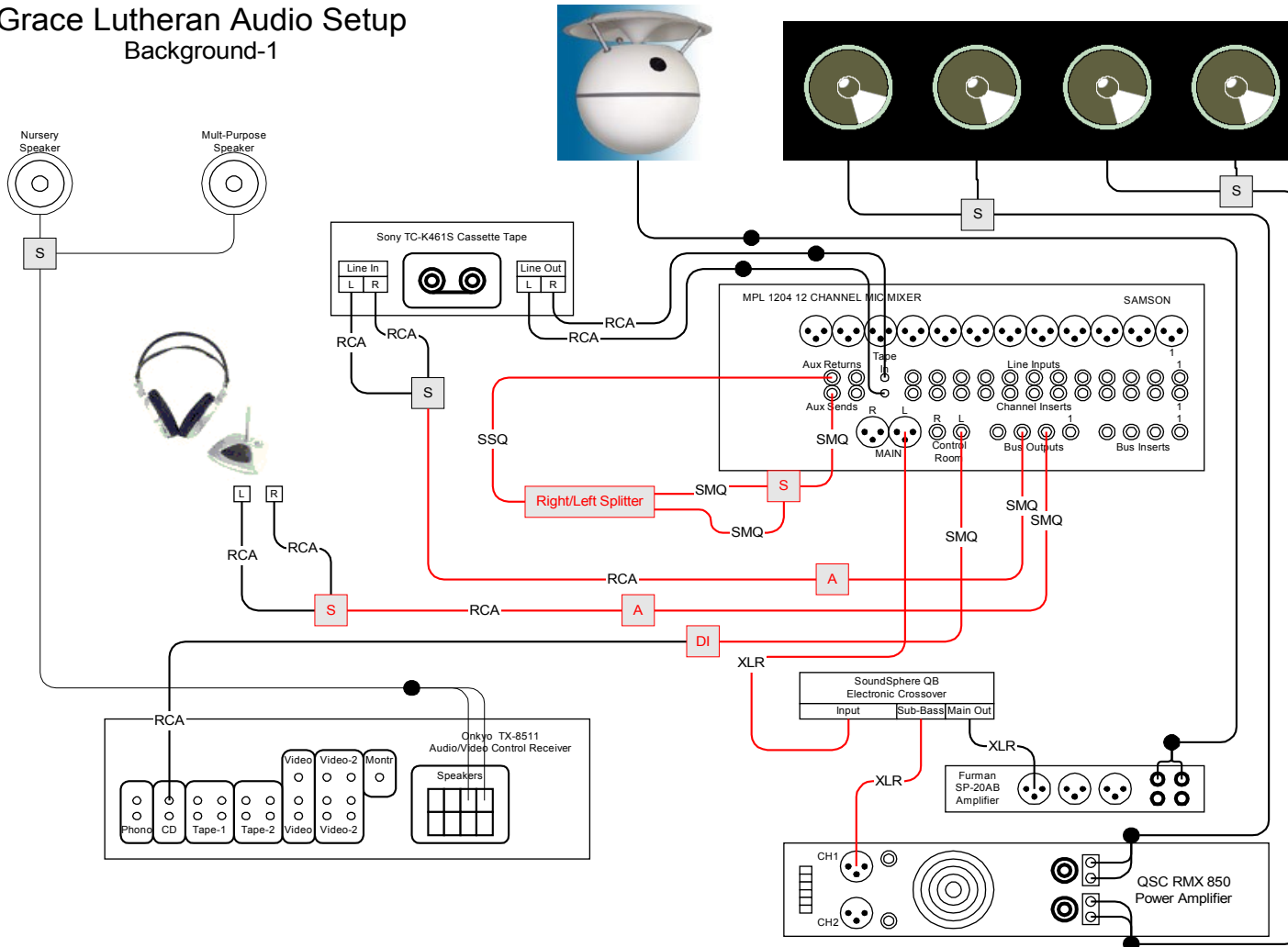
Grace Lutheran Audio Setup Background-1



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Appendix F: PA/Speaker Wiring

Grace Lutheran Audio Setup Background-1

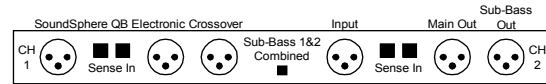


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c:\docume-1\duaned-2\mydocu-1\church-1\audio1.vsd

Appendix G: Wiring Symbols

Grace Lutheran Audio Setup

Background-1

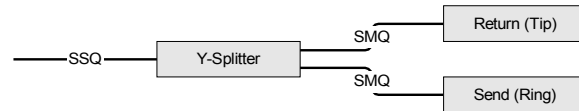
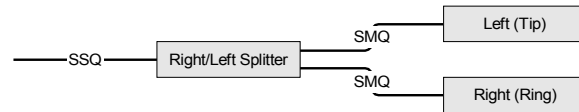


DI Direct Injection Box

A Adapter

S Splitter

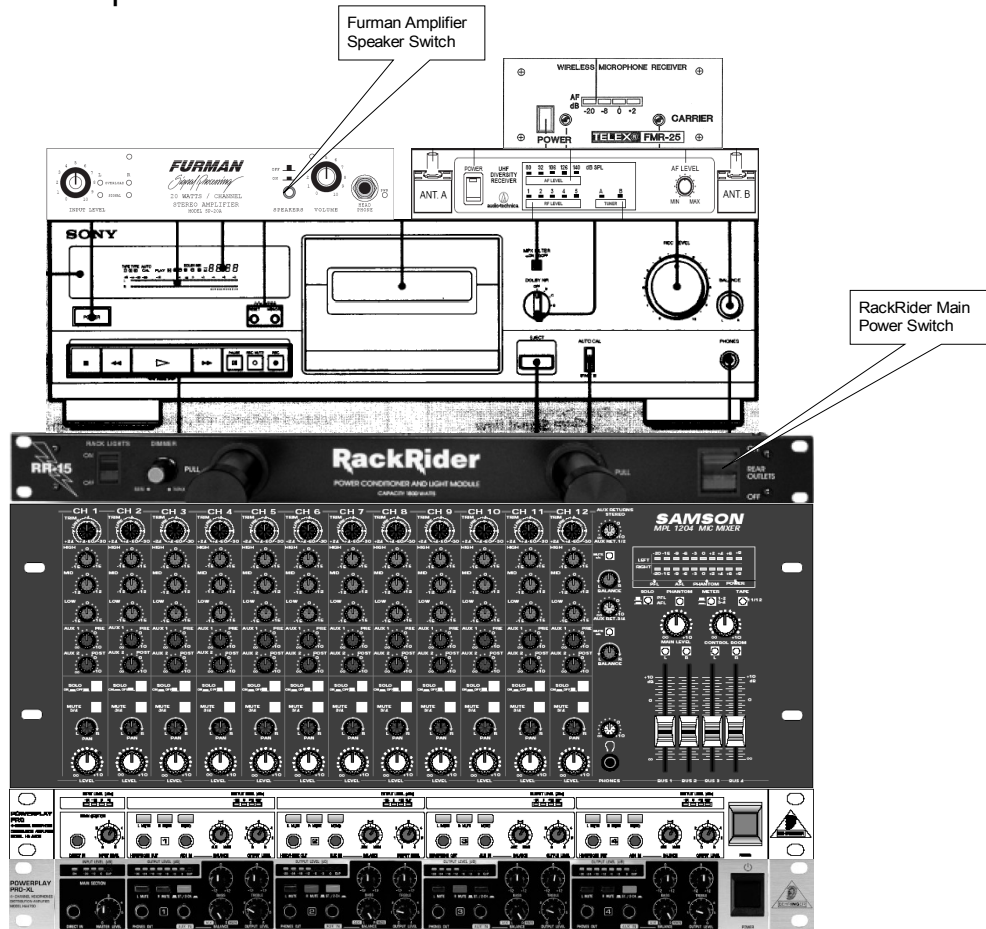
SMQ - Shielded Mono 1/4" Plug
 SSQ - Shielded Stereo 1/4" Plug
 HPC - Headphone Cable (Stereo)



Appendix H: Rack Mounting

Grace Lutheran Audio Setup

Background-1



Appendix I: Mixer Templates

Grace Lutheran Audio Setup Background-1

Created By: _____

Date: _____

	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8	CH 9	CH 10	CH 11	CH 12	SAMSON MPL 1204 MIC MIXER				
	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	TRIM <input type="radio"/>	Aux Returns Stereo <input type="radio"/>				
10 kHz	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	HIGH <input type="radio"/>	Aux Ret. 1/2 <input type="radio"/>				
1 kHz	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MID <input type="radio"/>	MUTE <input type="checkbox"/>				
100 Hz	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	LOW <input type="radio"/>	BALANCE <input type="radio"/>				
	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	AUX1 <input type="radio"/>	Aux Ret. 3/4 <input type="radio"/>				
	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	AUX2 <input type="radio"/>	MUTE <input type="checkbox"/>				
	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	SOLO <input type="checkbox"/>	BALANCE <input type="radio"/>				
	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>	MUTE <input type="checkbox"/>					
	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>	PAN <input type="radio"/>					
	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>	LEVEL <input type="radio"/>					

Ch 1		Ch 2		Ch 3		Ch 4		Ch 5		Ch 6	
Trim:	<input type="radio"/>	Trim:	<input type="radio"/>	Trim:	<input type="radio"/>	Trim:	<input type="radio"/>	Trim:	<input type="radio"/>	Trim:	<input type="radio"/>
Channel Dynamics	Channel Dynamics	Channel Dynamics	Channel Dynamics	Channel Dynamics	Channel Dynamics	Name:		Name:		Name:	
In:		In:		In:		In:		In:		In:	
Eff:		Eff:		Eff:		Eff:		Eff:		Eff:	
Tshd:		Tshd:		Tshd:		Tshd:		Tshd:		Tshd:	
Att-T:		Att-T:		Att-T:		Att-T:		Att-T:		Att-T:	
Rls-T:		Rls-T:		Rls-T:		Rls-T:		Rls-T:		Rls-T:	
Ratio:		Ratio:		Ratio:		Ratio:		Ratio:		Ratio:	
EQ		EQ		EQ		EQ		EQ		EQ	
Pad:		Pad:		Pad:		Pad:		Pad:		Pad:	
Mid-F:		Mid-F:		Mid-F:		Mid-F:		Mid-F:		Mid-F:	
Mid-G:		Mid-G:		Mid-G:		Mid-G:		Mid-G:		Mid-G:	
Mid-Q:		Mid-Q:		Mid-Q:		Mid-Q:		Mid-Q:		Mid-Q:	
Low-F:		Low-F:		Low-F:		Low-F:		Low-F:		Low-F:	
Low-G:		Low-G:		Low-G:		Low-G:		Low-G:		Low-G:	
Hi-F:		Hi-F:		Hi-F:		Hi-F:		Hi-F:		Hi-F:	
Hi G:		Hi G:		Hi G:		Hi G:		Hi G:		Hi G:	
Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>
AUX Levels	AUX Levels	AUX Levels	AUX Levels	AUX Levels	AUX Levels	Aux1:		Aux1:		Aux1:	
Aux2:		Aux2:		Aux2:		Aux2:		Aux2:		Aux2:	
Aux3:		Aux3:		Aux3:		Aux3:		Aux3:		Aux3:	
Aux4:		Aux4:		Aux4:		Aux4:		Aux4:		Aux4:	
10 --		10 --		10 --		10 --		10 --		10 --	
0 --		0 --		0 --		0 --		0 --		0 --	
10 --		10 --		10 --		10 --		10 --		10 --	
20 --		20 --		20 --		20 --		20 --		20 --	
30 --		30 --		30 --		30 --		30 --		30 --	
⊙ --		⊙ --		⊙ --		⊙ --		⊙ --		⊙ --	

Ch 7		Ch 8		Ch 9		Ch 10		Created By:				
Trim:	<input type="radio"/>	Trim:	<input type="radio"/>									
Channel Dynamics	Channel Dynamics	Channel Dynamics	Channel Dynamics	Date:								
In:		In:		Name:		Name:		Name:		Name:		
Eff:		Eff:		In:		In:						
Tshd:		Tshd:		Eff:		Eff:						
Att-T:		Att-T:		Tshd:		Tshd:						
Rls-T:		Rls-T:		Att-T:		Att-T:						
Ratio:		Ratio:		Rls-T:		Rls-T:						
				Ratio:		Ratio:						
EQ		EQ		EQ		EQ						
Pad:		Pad:		Pad:		Pad:						
Mid-F:		Mid-F:		Mid-F:		Mid-F:						
Mid-G:		Mid-G:		Mid-G:		Mid-G:						
Mid-Q:		Mid-Q:		Mid-Q:		Mid-Q:						
Low-F:		Low-F:		Low-F:		Low-F:						
Low-G:		Low-G:		Low-G:		Low-G:		Effect	Aux			
Hi-F:		Hi-F:		Hi-F:		Hi-F:		Return	Return			
Hi G:		Hi G:		Hi G:		Hi G:		Level	Level			
Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	Pan:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
AUX Levels	AUX Levels	AUX Levels	AUX Levels									
Aux2:		Aux2:		Aux1:		Aux1:		Aux1:		Aux1:		
Aux3:		Aux3:		Aux2:		Aux2:						
Aux4:		Aux4:		Aux3:		Aux3:						
				Aux4:		Aux4:		AUX1	AUX2	AUX3	AUX4	L-R
10 --		10 --		10 --		10 --						
0 --		0 --		0 --		0 --						
10 --		10 --		10 --		10 --						
20 --		20 --		20 --		20 --						
30 --		30 --		30 --		30 --						
© --		© --		© --		© --						

