Sound System Design and Installation

by

Lorne Atkins and Gregg Weisbrod

© 2008 Alectro Systems Inc.

Alectro Systems Inc.
2861 Sherwood Hts. Dr. - Unit 24
Oakville, Ont. L6J 7K1
Canada

Phone: 905-829-1117

www.alectrosystems.com

Contents

Page

7 **Introduction**

8 **Part 1 - Sound System Design**

8 **1.1 Speaker selection and placement**
8 1.1.1 Professional Sound Reinforcement Speakers
8 1.1.2 Speaker Position - Ceiling versus wall mount
10 1.1.3 Speaker Characteristics
10 1.1.3.1 Dispersion Angles
10 1.1.3.2 Constant Directivity
10 1.1.3.3 Power Handling and Efficiency
10 1.1.3.4 Speaker Components
11 1.1.4 Smaller Rectangular rooms
12 1.1.5 Larger Rectangular rooms
13 1.1.6 Balcony Coverage
16 1.1.7 "T" shaped rooms
17 1.1.8 Wide rooms
18 1.1.9 Corner Platforms and Fan shaped rooms
19 1.1.10 Round & oval rooms

20 **1.2 Mixer selection and location**
20 1.2.1 Basic "speech only" system
20 1.2.2 Small "limited music" system
20 1.2.3 Mid size "live music" system
21 1.2.4 Larger "live music" system
21 1.2.5 Location, location, location

23 **1.3 Monitor System**
23 1.3.1 Wall mounted "platform" monitors
23 1.3.2 Floor monitor speakers
24 1.3.3 In-ear & headphone wired or wireless monitors
24 1.3.4 Personal monitor system

25 **1.4 Power Amplifiers, Processing and Control Electronics**
25 1.4.1 Power Amplifiers
25 1.4.2 Equalizer
26 1.4.3 Feedback Suppressor
26 1.4.4 Compressor / Limiter
27 1.4.5 Digital Delay
27 1.4.6 System Processor
28 1.4.7 Effects Processor

© 2008 Alectro Systems Inc.

29 **1.5 Microphones**
29 1.5.1 Choir Microphones
30 1.5.2 Podium, Pulpit microphone
30 1.5.3 Communion Table, Altar Microphones
31 1.5.4 Head, Lapel microphones
31 1.5.5 Vocal microphones
32 1.5.6 Instrument Microphones & DI Boxes

33 **1.6 Microphone and Monitor Jacks**
33 1.6.1 Distributed jacks
34 1.6.2 Jack Clusters

35 **1.7 Hearing Assistance**
35 1.7.1 Types of systems
36 1.7.2 Selecting the right equipment

37 **1.8 Sound Distribution**
37 1.8.1 Choosing the right type of system
37 1.8.2 Designing a low impedance system
38 1.8.3 Designing a 70 volt system
39 1.8.4 Linking to another Sound System

40 **1.9 Audio Recording**
40 1.9.1 Selecting the right type of recording systems
40 1.9.2 Direct to CD recording
41 1.9.3 Direct to Digital recording
41 1.9.4 Direct to Computer recording
41 1.9.5 Multi-track recording

42 **1.10 Typical Configurations**
42 1.10.1 Basic Mixer / Amplifier System
43 1.10.2 Mid size system
44 1.10.3 Larger System

© 2008 Alectro Systems Inc.

46 **Part 2 - Sound System Installation**

46 **2.1 Basic Required Skills**
46 2.1.1 Mechanical skills
47 2.1.2 Electrical and electronic skills

48 **2.2 Wiring**
48 2.2.1 Types of wire
49 2.2.2 Running Wires
51 2.2.3 Installing Jacks
53 2.2.4 Making Connections
53 2.2.4.1 Types of Plugs
54 2.2.4.2 Relating wire types to Jacks
55 2.2.4.3 Wiring a Double Microphone Jack
56 2.2.4.4 Wiring a Single Microphone Jack
56 2.2.4.5 Wiring a Double 1/4" Phone Jack
57 2.2.4.6 Wiring a Double Speakon Jack
57 2.2.4.7 Wiring Double Microphone Plugs
58 2.2.4.8 Wiring Single Microphone Plugs
59 2.2.4.9 Wiring 1/4" Phone Plugs
59 2.2.4.10 Wiring Speakon Plugs
59 2.2.2.11 Labeling Jacks
60 2.2.2.12 Ringing out the wiring and labeling the plugs

63 **2.3 Main & Fill-in Speakers**
63 2.3.1 Installing the main speakers
63 2.3.1.1 Side Mounted Speakers
66 2.3.1.2 Ceiling Mounted Speakers
68 2.3.2 Aiming the main speakers
71 2.3.3 Installing and Aiming Fill-in speakers

75 **2.4 Monitor Speakers**
75 2.4.1 Floor Monitors
76 2.4.2 Platform Monitors

77 **2.5 Distribution Speakers**
77 2.5.1 Installing Ceiling Speakers
79 2.5.2 Installing Wall Speakers
79 2.5.3 Installing Attenuators (volume controls)
79 2.5.4 Wiring a 70 volt Speaker System

© 2008 Alectro Systems Inc. www.alectrosystems.com

82 **2.6 Electronics Installation**
82 2.6.1 Basic “speech only” system
83 2.6.2 Mid size “live music” system
84 2.6.3 Larger “live music” system
87 2.6.4 Speaker wiring details
87 2.6.4.1 Stereo Speaker Connections
88 2.6.4.2 Mono Speaker Connections

89 **Part 3 Tuning and Balancing the system**

89 **3.1 Tuning the system**
89 3.1.1 Using a Spectrum Analyzer
91 3.1.2 Tuning By “ear”

91 **3.2 Balancing the system**
91 3.2.1 Balancing the Electronics Levels
92 3.2.2 Balancing Speakers with a Spectrum Analyzer
94 3.2.3 Balancing Speakers by Ear

94 **3.3 System Processor Setup**
95 Part A Input Configuration
100 Part B Output Configuration
106 Part C Programming the Driverack 260
118 Part D Storing the Program

© 2008 Alectro Systems Inc. www.alectrosystems.com

Introduction

Over the past 25+ years, Alectro Systems has installed sound and video systems in about 500 churches. Often we have replaced equipment which the church tried to install themselves. Unfortunately, in the vast majority of these cases, the job was done very poorly. Although it is great to have a church community which is willing to commit their time and effort to projects like this, it does take a considerable amount of experience to get the job done right.

Sometimes these projects are headed up by someone who thinks they know “all about sound” and sometimes, they do know a lot. Although this knowledge is definitely helpful, particularly in operating the system, there is a lot more to designing and installing a church sound system properly than most people realize.

This book compiles 25 years of Church Sound System Design and Installation experience into a form which is easy to understand and apply. It covers all aspects of the design and installation using a number of different room configuration and equipment examples. The intention is to give you the information you need to do it right the first time.

These pages will take you from choosing the right equipment for your application through finding the right locations to install it, installation techniques, interconnection and tuning and balancing of the system.

Once you have installed your system, you will need to learn to operate it properly. An instrument is only as good as its musician. To complete your job, we have produced the Sound Operator’s Handbook - Tricks of the Trade. This provides you with the knowledge to obtain the best performance out of your sound system.

The Sound Operator’s Handbook also provides you with a great deal of mixer operation and microphone application information which helps you select the right equipment. It complements, and is often referred to in this Design and Installation book.

So let’s get started...

© 2008 Alectro Systems Inc.