

Lindsey Beane

Lighting/Electrical
Professor Mistrick
Harris Theater for Music and Dance
Chicago, IL

Final Report

Electrical Depth

Introduction

The overall design ideas for the electrical design are to plan an efficient and well organized system. This includes control plans, circuiting and also distribution plans. There are two distinct plans to integrate these three systems. The first is to plan the controls and circuiting to coordinate directly. Then the secondary item is to make the distribution panels feeding these smaller items just as well planned and organized.

The new lighting design requires a level of detail for controlling and circuiting the number of different types of fixtures. This design has changes to the controls for the lobby, offices, and house light. Using Lutron's Grafik Eye system the lighting system is controlled through a number of zones in each larger space. The details to this system are specified in the following pages. There are a few exceptions to this main use for control which is for specific accent lighting that works better with DMX controls. There is an existing DMX control point at the stage area for stage and house lighting combined. So, the lighting system utilizes a few of those existing circuits for halogen fixtures in the theater and a specialty spot light in the entrance area.

Also, there was a potential to reduce the number of electrical distribution panels. There are a total of 13 distribution panels that are sized smaller than what is typical. After reviewing the existing panels, it was determined that two sets of two distribution panels can be consolidated. Each panel is 600A and was consolidated to be (2) 1200A panels instead of (4) 600A panels. This would have saved time for installation and also material costs as seen in the following electrical section of the report.



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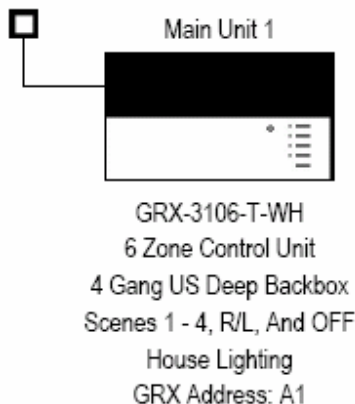
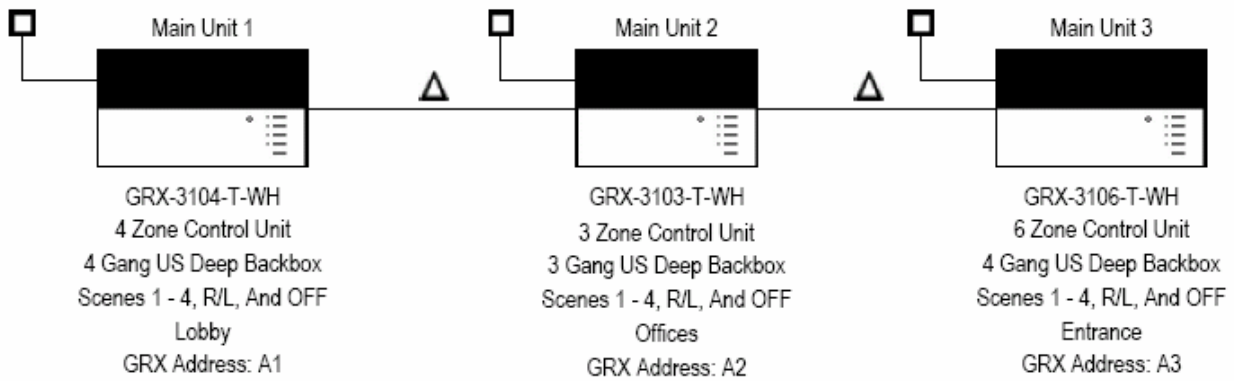


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Lighting Controls Details

The controls for all lighting systems are a combination of Grafik eye controls and a few DMX controls. The details to the DMX controls are not included, because there is an existing system to accommodate those controls. The following pages will include a discussion of the Lutron Grafik Eye controls for all four spaces. The zone analysis for the lighting controls was designed using Lutron's Designer software. This designer software provided control diagrams and a list of the zones required to fit the given design loads.

The diagrams below show the delineation between one set of controls in the entrance, lobby and offices. These systems were designed separately because the group of (3) spaces will be controlled from the main offices while the theater control point will be on the stage. This way the house lighting controls will be next to the house lighting accent and stage lighting controls for use by the director. These two systems will be called front of house and back of house controls. The front of house controls refers to the lobby, offices and entrance system while the back of house controls refers to the theater house lighting controls.



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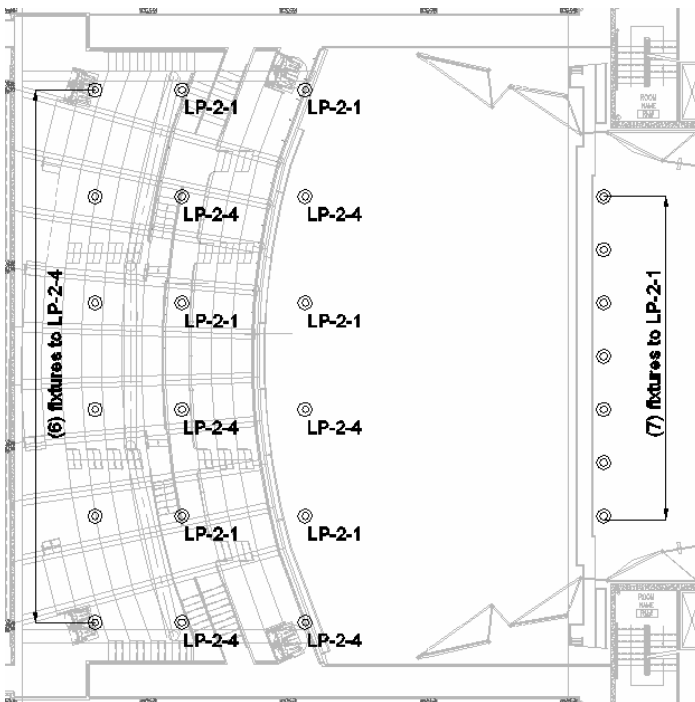
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Control System Details

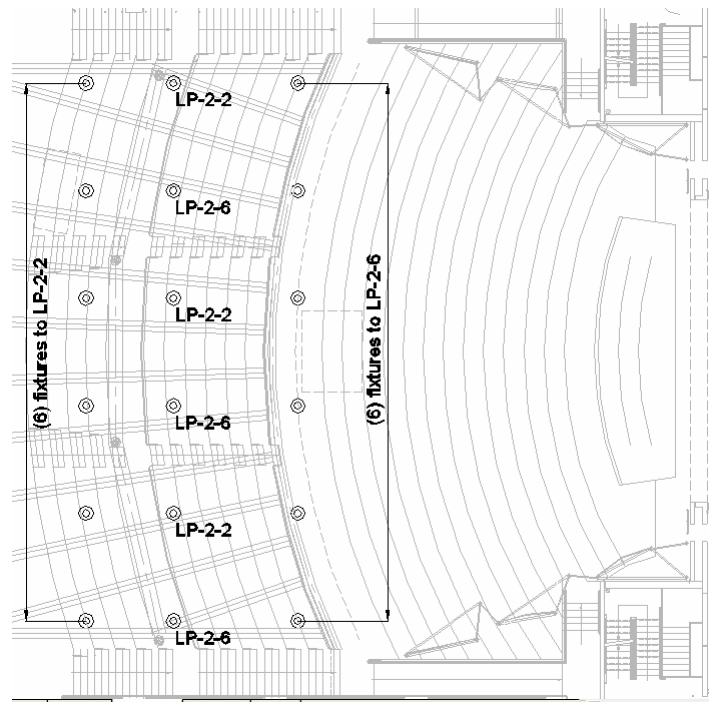
The zones for controls were chosen by circuit. All of the circuiting groups were planned for dimming/switching purposes. This page and the following page show circuiting plans which in effect relate to the listed zones described on the load schedules in Appendix B. There is some redundancy built into this system by overlaying circuits between house lighting rows.



Ceiling Lighting Circuiting Plans



Balcony Ceiling



Parterre Ceiling

Symbol	Type
⊙	K
□	L
—	M
-	N
▬▬▬▬▬	P

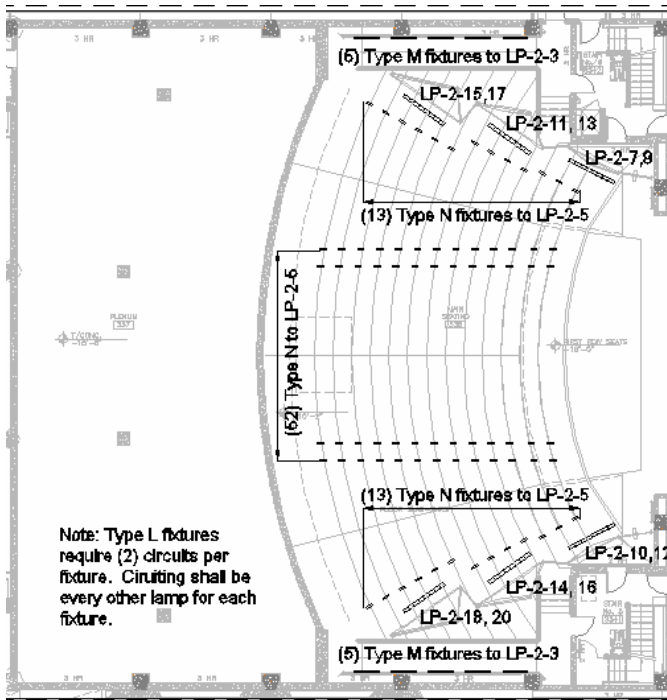
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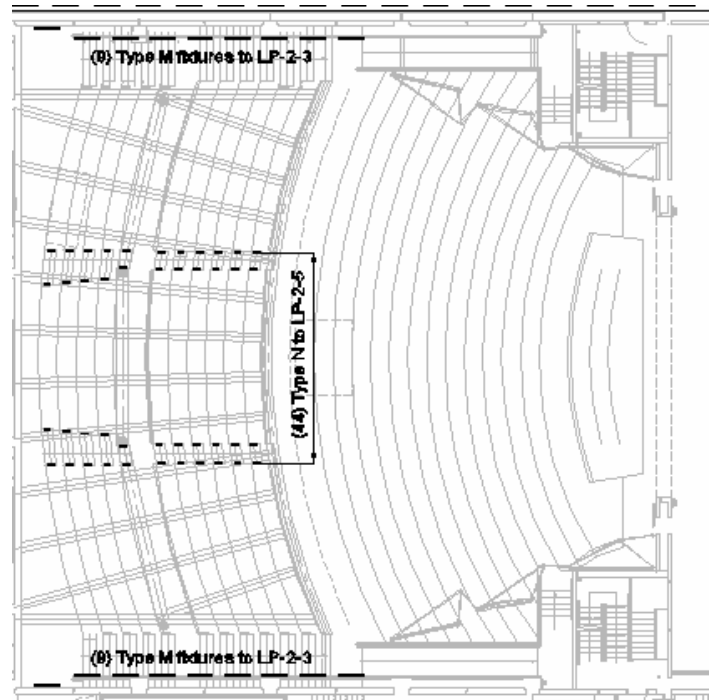
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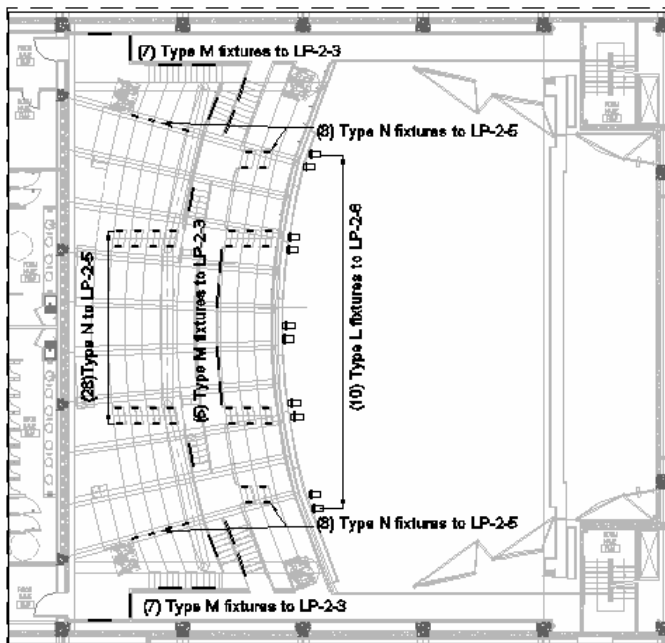
Floor Level Lighting Circuiting Plans



Main Seating Area



Parterre Seating Area



Balcony Seating Area

Symbol	Type
⊙	K
□	L
—	M
-	N
---	P

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Control Load Schedules

To further describe the zones and their purpose please see the load reports below and how they correlate to the load requirements on the given panel boards on the next page. To see how the zones were chosen and grouped please reference these load schedules next to the circuiting plans on the previous two pages or in Appendix A. The first three schedules describe the front of house lighting and the fourth covers the back of house lighting.

Front of House Controls

Entrance GRAFIK Eye 3000 Load Schedule						
Main Control Unit Name: Main Unit 3						
Lutron Model No.: GRX-3106-T-WH						
Control Address / Location: 3 /						
Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A3-1	Accent Flood Lights		5	120V	-	GRX-TVI*
A3-2	Cove Lighting		1	120V	-	GRX-FDBI-16A-120*
A3-3	Cove Lighting -2		2	120V	-	GRX-FDBI-16A-120*
A3-4	Large Pendants		3	120V	-	GRX-FDBI-16A-120*
A3-5	Railing Lights		4	120V	-	GRX-FDBI-16A-120*

Lobby GRAFIK Eye 3000 Load Schedule						
Main Control Unit Name: Main Unit 1						
Lutron Model No.: GRX-3104-T-WH						
Control Address / Location: 1 /						
Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A1-1	Cove Lighting		1	120V	-	GRX-FDBI-16A-120*
A1-2	Cove Lighting -2		2	120V	-	GRX-FDBI-16A-120*
A1-3	Large Pendants		3	120V	-	GRX-FDBI-16A-120*

Offices GRAFIK Eye 3000 Load Schedule						
Main Control Unit Name: Main Unit 2						
Lutron Model No.: GRX-3103-T-WH						
Control Address / Location: 2 /						
Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A2-2	Workstations		1	120V	-	GRX-FDBI-16A-120*
A2-1	Wall Washers		2	120V	-	GRX-FDBI-16A-120*
A2-3	Conference Pendant		3	120V	-	GRX-FDBI-16A-120*

Back of House Controls

House Lighting GRAFIK Eye 3000 Load Schedule						
Main Control Unit Name: Main Unit 1						
Lutron Model No.: GRX-3106-T-WH						
Control Address / Location: 1 /						
Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A1-1	Main - Balcony House Lights	Main Seating area and front of balcony	1	120V	-	GRX-FDBI-16A-120*
A1-2	Railing	All Railing Lights	6	120V	-	GRX-FDBI-16A-120*
A1-3	Balcony House Lights	Rear of balcony	2	120V	-	GRX-FDBI-16A-120*
A1-4	Parterre House Front	Front of parterre	4	120V	-	GRX-FDBI-16A-120*
A1-5	Parterre House Rear	Rear of parterre	3	120V	-	GRX-FDBI-16A-120*
A1-6	Aisle Lights	All aisle lights	5	120V	Incandescent	160

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Circuiting Information

Lighting System Load Requirements

The circuiting information below describes the design loads of the lighting system. The design loads were divided by spaces. As mentioned before there are two separate controls the front of house and back of house. The lobby, offices and entrance were located on LP-1 (referring to front of house) with the exception of the automated fixture (Type J) in the entrance. The automated circuit was separated to the LP-2 (referring to back of house) panel so that it can be located closer to the stage DMX controls which also control this specialty fixture. Panel LP-2 was organized such that the Grafik Eye controlled fixtures are circuits 1-6 and DMX controlled fixtures are circuits 7-18. To see total load information and wire sizes for the panel boards, please reference Appendix B.

Description	LOAD (VA)			Brk. Trip (A)	LP 1			LOAD (VA)			Brk. Trip (A)	Description	
	A	B	C		Cond. Size	Ckt. #	Cond. Size	A	B	C			
Off - Pendants	1048			20	#12	1	2	#12	1254			20	Lby1 - Cove
Off - Wall washer		1245		20	#12	3	4	#12		1320		20	Lby1 - Cove
Lby2 - Cove			1584	20	#12	5	6	#12			1056	20	Lby1 - Lg Pendant.
Lby2 - Cove	1518			20	#12	7	8	#12	636			20	Lby1 - Railing
Lby2 - Lg Pendant		1452		20	#12	9	10	#12		644		20	Ent - Track
Lby2 - Sml Pendant			732	20	#12	11	12	#12			644	20	Ent - Track

Description	LOAD (VA)			Brk. Trip (A)	LP 2			LOAD (VA)			Brk. Trip (A)	Description	
	A	B	C		Cond. Size	Ckt. #	Cond. Size	A	B	C			
HL - CFL Downlight	1607			20	#12	1	2	#12	1113			20	HL - CFL Downlight
HL - Railing		1527		20	#12	3	4	#12		1484		20	HL - CFL Downlight
HL - Aisle			665	20	#12	5	6	#12			1113	20	HL - CFL Downlight
HL - Borderlight Accent	1000			20	#12	7	8	#12	1000			20	HL - Hal Downlight
HL - Borderlight Accent		1000		20	#12	9	10	#12		1000		20	HL - Borderlight Accent
HL - Borderlight Accent			1000	20	#12	11	12	#12			1000	20	HL - Borderlight Accent
HL - Borderlight Accent	1000			20	#12	13	14	#12	1000			20	HL - Borderlight Accent
HL - Borderlight Accent		1000		20	#12	15	16	#12		1000		20	HL - Borderlight Accent
HL - Borderlight Accent			1000	20	#12	17	18	#12			1000	20	HL - Borderlight Accent
Ent - Automated Spot	700			20	#12	19	20	#12	1000			20	HL - Borderlight Accent

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Electrical Distribution Panels

Consolidation

The electrical distribution system is spread over 13 smaller panels with an average size of 600A. To reduce the complexity and material costs of the system the following design has consolidated (4) 600A panels into (2) 1200 A panels. To support that this is a cost-wise decision there is also a cost analysis of materials and installation.

To view the load information for the existing and designed distribution panels please reference Appendix B. The cost information listed below is compiled from Eaton Electrical for materials and RSMMeans for installation and labor information.

RSMeans #	Size	Quantity	Crew	Output	Hours	Unit	Material	Labor	Total
8600270	600 A	4	2 elec	1.2	13.33	ea	\$24,200.00	\$2,180.00	\$26,380.00
86002090	1200 A	2	2 elec	0.92	17.39	ea	\$22,502.00	\$1,420.00	\$23,922.00
Savings									\$2,458.00

Electrical Depth Discussion

Providing a more straightforward approach to the electrical distribution and lighting controls creates a cost saving and efficient building system. An organized and well-sized distribution system makes the design less complicated and easier to install. The design for lighting controls, circuit loads, and distribution panels are also a straightforward and efficient approach to the situation. And organized and well planned electrical system adds to the success of the integrated building systems as well. The efficient electrical design supports a lighting system that follows the same plan for organization. The design plans for these electrical portions of this report meet the plans for an efficient and well organized system.