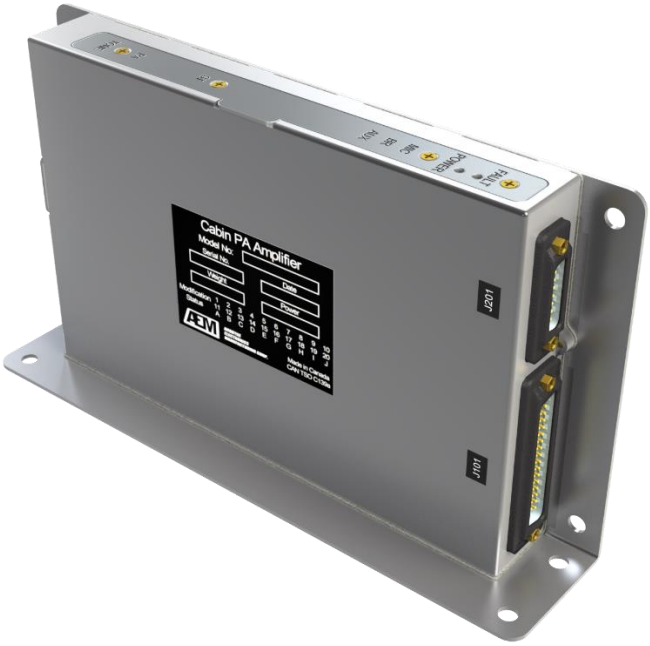
ASM-LSA100-100

LSA100-100
Cabin PA Amplifier



INSTALLATION AND OPERATION MANUAL

REV 1.00 Date October 15, 2018

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AEM MANUAL REVISIONS

Section	Revision Number	Revision Description	Date
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Table of Contents

Section	Title	Page
1.0	**Description**	
1.1	Introduction	1-1
1.2	Product Description	1-1
1.2.1	Product Identifier Description	1-2
1.3	Design Features	1-2
1.3.1	Annunciators	1-2
1.3.2	Tone Generators	1-3
1.4	Specifications	1-3
1.4.1	Electrical Specifications	1-3
1.4.2	Physical Specifications	1-7
1.4.3	Environmental Specifications	1-8
1.4.4	Product Approval/Certification	1-8
1.5	Product Limitations	1-8
1.5.1	Speaker Configuration and Cable Limitations	1-8
1.5.2	Waterproofness Limitations	1-9
1.5.3	Installation Procedures and Limitations	1-9
1.6	Additional Requirements	1-9
2.0	**Installation**	
2.1	Introduction	2-1
2.2	Unpacking and Inspection	2-1
2.2.1	Warranty	2-1
2.3	Installation Procedures	2-1
2.3.1	Warnings	2-1
2.3.2	Cautions	2-1
2.3.3	Cabling and Wiring	2-2
2.3.4	Post-Installation Checks	2-2
2.4	Adjustments and Connections	2-3
2.4.1	Mic, Briefer & Aux Inputs	2-4
2.4.2	Tone Level	2-4
2.4.3	Sidetone, PA & Speaker Output	2-4
2.4.4	Level Adjustments	2-4
2.5	Accessories Required But Not Supplied	2-6
2.6	Continued Airworthiness	2-6
2.7	Installation Drawings	2-6
3.0	**Operation**	
3.1	Introduction	3-1
3.2	General	3-1
3.3	Controls and Indicators	3-1
3.3.1	FAULT Indicator	3-1
3.3.2	POWER Indicator	3-2
3.4	System Interfaces	3-2
3.4.1	Inputs	3-2
3.4.2	Outputs	3-2
3.5	System Operations	3-3

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Section 1.0 Description

1.1 Introduction

Information in this section consists of product description, design features and specifications for the LSA100-100 Cabin PA Amplifier. All derivative product information will be contained in the applicable manual supplement, which may be obtained from AEM as required.

Review all notes, warnings and cautions.

1.2 Product Description

The LSA100-100 Cabin PA Amplifier is a compact, remote mount, lightweight, multi-output, medium-power audio amplifier for use with a network of appropriately rated and configured cabin speakers.

Utilizing a network of Class-D amplifiers, the speaker outputs are low-noise and high-efficiency. Each speaker output is individually controlled by a discrete input to allow for muting of specific speakers. Each muting input has a corresponding discrete output to indicate the speaker output has been muted.

The various inputs and outputs allow the LSA100-100 unit to be interfaced with the cockpit audio system, the cabin briefer and the inflight entertainment system (IFE).

The LSA100-100 generates advisory tones to annunciate various activities, including ‘Fasten Seat Belt’, ‘No Smoking’, ‘Oxygen Fail’, ‘Baggage Ready For Loading’, and ‘Attendant Call’. A logic network addresses the tone control and priority requirements.

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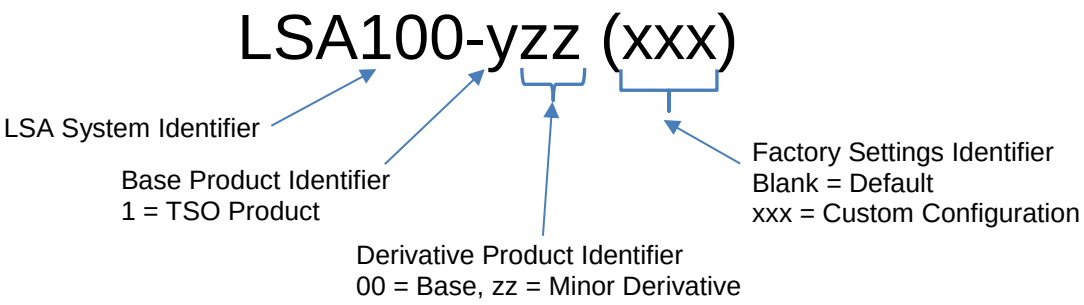
1.2.1 Product Identifier Description



1.3 Design Features

The LSA100-100 has three audio inputs consisting of one single ended Microphone input, one differential Briefer input and one single ended Auxiliary input. Each input has a field adjustable level setting to optimize various input signal levels. Inputs and outputs provide interface control with various related systems, including the cockpit audio system, the IFE and the Cabin Briefer.

The LSA100-100 has six 20W speaker outputs. Each speaker output can be turned on/off via a discrete input and has a field adjustable level setting. The on/off control circuit provides a discrete output to confirm the speaker output has been turned off. The LSA100-100 amplifier also has two low level audio outputs to provide Sidetone audio to the cockpit audio system and Cabin PA audio to the IFE.

The integrated tone generator circuit and associated priority control logic provide the advisory tones to indicate ‘Fasten Seat Belt’, ‘No Smoking’, ‘Oxygen Fail’, ‘Attendant Call’ and ‘Baggage Ready’ activities.

The Class D amplifier stages have integrated protection circuitry that provide a ‘fault output’ which is monitored and used to provide a discrete output to indicate a Cabin PA fault condition.

The LSA100-100 includes a power management monitor that selects and gain scales (-3dB from rated) the speaker’s audio output to protect the unit from excessive power consumption when the input power supply drops below 20.5 Vdc.

1.3.1 Annunciators

All amplifier status conditions detected by the LSA100-100 are indicated by the illumination of annunciator’s visible external to the enclosure.

The LSA100-100 has one red annunciator, to indicate a fault condition. The annunciation will not be cleared until the fault condition has been removed or corrected. See Section 3 for more detail.

The LSA100-100 has one green annunciator, to indicate that the amplifier is powered on.

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1.3.2 Tone Generators

The LSA100-100 generates four distinct tones:

Tone	Corresponding Function
1	Fasten Seat Belt / No Smoking / Oxygen Fail
2	Cabin PA / Briefer announcements
3	Baggage Ready
4	Attendant Call

Tone 1 is a dual tone chime which is generated once upon activation and once upon the subsequent deactivation of the applicable input key. Each tone frequency, duration, duty cycle, relative level, time on/off and fading parameters are implemented in a custom .wav file.

Tone 2 is a single chime tone generated upon activation of the PA or Briefer Key. Tone frequency, duration, duty cycle, on time and fading parameters are implemented in a custom .wav file.

Tone 3 is a triple-tone chime generated upon activation of the Baggage Ready Input key. Each tone frequency, type, duration, duty cycle, on time and fading parameters are implemented in a custom .wav file.

Tone 4 is a single chime tone generated upon activation of the Attendant Call Input. Tone frequency, type, duration, duty cycle, on time and fading parameters are implemented in a custom .wav file.

The four distinct tones are summed and provided on the PA and Speaker audio outputs. All tones except Briefer Key Chime and Attendant Call Chime will be summed with the PA Mic audio and provided on the Sidetone audio output.

1.4 Specifications

1.4.1 Electrical Specifications

1.4.1.1 Input Operating Voltage

Normal Operating Conditions:

Nominal:	+28.0 Vdc
Maximum:	+30.3 Vdc
Minimum:	+22.0 Vdc
Emergency:	+18.0 Vdc

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Abnormal Operating Conditions:

Nominal:	+28.0 Vdc
Maximum:	+32.2 Vdc
Minimum:	+20.5 Vdc

Input Current:	6.2 A maximum @ 28.0 Vdc <0.25 A idle @ 28.0 Vdc

Protection:

Over-current:	7 A fuse
Reverse Polarity:	Power supply inhibited upon -28 Vdc power applied
Over-voltage:	Power supply inhibited upon ≥ 42 Vdc power applied
Under-voltage:	Power supply inhibited upon ≤ 16 Vdc power applied

1.4.1.2 Input Signals

Microphone Audio	(PA MIC IN)
Quantity:	1
Microphone Type:	amplified dynamic/electret
Circuit Type:	Single-Ended
Rated Level:	250 mVrms ± 10%
Impedance:	150 Ohm ± 10%
Mic Bias:	+12 Vdc min
Adjustment Range:	20 dB

PA Key Input	(PA KEY IN)
Quantity:	1
Rated Level:	Gnd (active low), 1 Vdc maximum
Current In:	≤ 10 mA

Briefer Audio	(BRIEFER AUDIO IN)
Quantity:	1
Circuit Type:	Differential
Rated Level:	(0 dBm) 775 mVrms ± 10%
Impedance:	600 Ohm ± 10%
Adjustment Range:	20 dB

Briefer Control Input	(BRIEFER CONTROL IN)
Quantity:	1
Rated Level:	Gnd (active low), 1 Vdc maximum
Current In:	≤ 10 mA

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Fasten Seat Belt Input	(FASTEN SEAT BELT)
Quantity:	1
Circuit Type:	Edge Triggered, rated level applied to or removed from connector input pin
Rated Level:	28 Vdc (active range 5 to 28 volts)
Current In:	≤ 10 mA
No Smoking Input	(NO SMOKING)
Quantity:	1
Circuit Type:	Edge Triggered, rated level applied to or removed from connector input pin
Rated Level:	28 Vdc (active range 5 to 28 volts)
Current In:	≤ 10 mA
Oxygen Fail Input	(OXYGEN FAIL)
Quantity:	1
Circuit Type:	Edge Triggered, rated level applied to or removed from connector input pin
Rated Level:	28 Vdc (active range 5 to 28 volts)
Current In:	≤ 10 mA
Baggage Ready Input	(BAGGAGE READY)
Quantity:	1
Rated Level:	Gnd (active low), 1 Vdc maximum
Current In:	≤ 10 mA
-3 dB Control Input	(-3DB SELECT)
Quantity:	1
Rated Level:	Gnd (active low), 1 Vdc maximum
Current In:	≤ 10 mA
Auxiliary Audio Input	(AUX HI IN)
Quantity:	1
Circuit Type:	Single-Ended Rated Level: 500 mVrms ± 10%
Impedance:	1 kOhm ± 10%
Adjustment Range:	20 dB
Mute Select Input	(MUTE SELECT)
Quantity:	6
Rated Level:	Gnd (active low), 1 Vdc maximum
Current In:	≤ 10 mA

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Attendant Call Input		(ATTENDANT CALL)
	Quantity:	1
	Rated Level:	Gnd (active low), 1 Vdc maximum
	Current In:	≤ 10 mA

1.4.1.3 Output Signals

Speaker Audio		(SPEAKER)
	Quantity:	6
	Circuit Type:	Differential
	Rated Level:	6x 20 W (120W total) (12.65 Vrms ± 10% into 8 Ohms) (8.95 Vrms ± 10% into 4 Ohms)
	Rated Load Impedance:	4-8 Ohms ± 10%
	Output Impedance:	≤ 2 Ohms
	Frequency Response:	≤ 3 dB from 300 Hz to 6 kHz
	Distortion:	≤ 10% @ rated output (designed for ≤ 1%)
	Audio Noise Level:	≥-60 dB from rated output
	Adjustment Range:	20 dB
	Gain Scaling:	-3 dB from rated power, power supply input < 20.5 Vdc
Sidetone Audio		(SIDETONE AUDIO OUT)
	Quantity:	1
	Circuit Type:	Differential
	Rated Level:	100 mW (7.75 Vrms ± 10%)
	Rated Load Impedance:	600 Ohms ± 10%
	Output Impedance:	≤ 50 Ohms
	Off State Impedance:	< 450 Ohms
	Frequency Response:	≤ 3 dB from 300 Hz to 6 kHz
	Distortion:	≤ 10% @ Rated output (designed for ≤ 1%)
	Audio Noise Level:	≥-60 dB from rated output
	Adjustment Range:	20 dB
PA Audio		(PA AUDIO OUT)
	Quantity:	1
	Circuit Type:	Differential
	Rated Level:	100 mW (7.75 Vrms ± 10%)
	Rated Load Impedance:	600 Ohms ± 10%
	Output Impedance:	≤ 50 Ohms
	Frequency Response:	≤ 3 dB from 300 Hz to 6 kHz
	Distortion:	≤ 10% @ Rated output (designed for ≤ 1%)
	Audio Noise Level:	≥-60 dB from rated output
	Adjustment Range:	20 dB

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IFE Pause Output		(IFE PAUSE OUT)
	Quantity:	1
	Rated Level:	Gnd (active low)
	Output Active:	≤ 1 Vdc
	Sink Current:	250 mA maximum

Cabin PA Fault Output		(CABIN PA FAULT OUT)
	Quantity:	1
	Rated Level:	28 Vdc
	Output Active:	≥ 10 MOhm (External Pull-Up Required)
	Output Inactive:	≤ 3 Ohm
	Sink Current:	250 mA maximum

Note: When a Cabin PA Fault is activated, the associated speaker amplifier enters an automatic recovery mode. Under these conditions the associated speaker amplifier output is disabled for ≥ 1.4 sec and then enabled for 10 msec to determine if the fault condition still exists.

Mute Active Output		(MUTE ACTIVE OUT)
	Quantity:	6
	Rated Level:	Gnd (active low)
	Output Active:	≤ 1 Vdc
	Sink Current:	250 mA maximum

1.4.2 Physical Specifications

Height		5.46” [138.7mm]
Length		9.80” [248.9mm]
Width		2.05” [52.1mm]
Weight		2.0 lb (0.91 kg)
Connectors		1 x 50 pin Male Dmin with jack post locking hardware 1 x 15 pin Male Dmin with jack post locking hardware
Mounting		8 chassis mounting holes (Vertical/Horizontal orientations) 4 Vertical 0.266” diameter mounting holes 4 Horizontal 0.266” diameter mounting holes
Mounting Hardware	Bolt:	AN4 (¼-28) Hex
	Washer:	Flat Washer, 0.25” (0.265” inside Diameter, 0.500” outside Diameter).
	Quantity:	4

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1.4.3 Environmental Specifications

Temperature	-15 to +70°C (operating) -55 to +85°C (survival)
Altitude	15,000 feet max.
Humidity	95% Non-condensing
Operational Shock Crash Safety	6g for 11msec 20g for 11msec (impulse), 3 sec (sustained)
Vibration	Conforms to DO-160G category 'R', waveforms C & C1

Note: Refer to Environmental Qualification Form located in Section 2 of this Manual for complete details of the environmental categories.

1.4.4 Product Approval/Certification

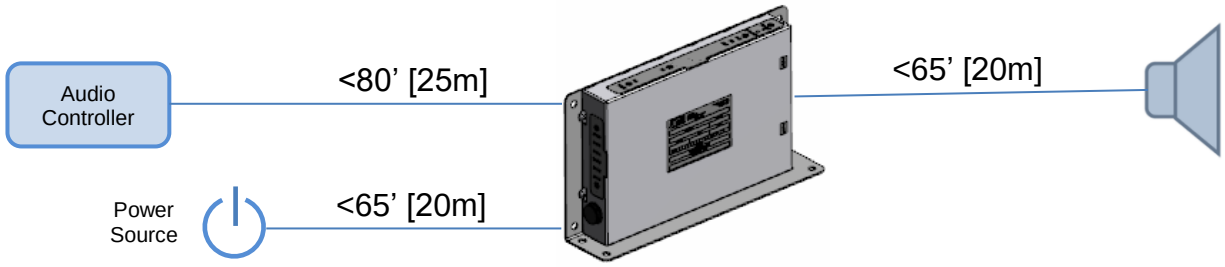
Transport Canada: CAN TSO C139a Aircraft Audio Systems and Equipment

1.5 Product Limitations

1.5.1 Speaker Configuration and Cable Limitations

During installation, depending on the resultant speaker configuration impedance, the LSA100-100 may need to have the SPEAKER outputs adjusted to ensure that 20W rated output is being delivered to the speaker array.

Maximum cable length between LSA100-100 and associated audio controller:	80 ft [25 m]
Maximum power cable length to LSA100-100:	65 ft [20 m]
Maximum cable length to cabin speakers:	65 ft [20 m]



All cable lengths are estimates based on recommended wire size. Speaker cable lengths beyond the specified maximums are achievable with alternate system wiring configurations that satisfy the rated load requirements of the LSA100-100.

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1.5.2 Waterproofness Limitations

Waterproofness Orientation Limitation: Unit can not be mounted with the connectors facing upwards towards a watering source.

1.5.3 Installation Procedures and Limitations

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval.

1.6 Additional Requirements

Dielectric Withstanding Voltage	All 28 Vdc powered components to withstand, without damage, a voltage of 500 Vdc between all terminals and case for 1 minute, without any leakage current in excess of 1.0 mA or evidence of damage due to arcing, flashover or insulation breakdown.
Insulation Resistance	The insulation resistance between all terminals and the case: > 100 MΩ at a voltage of 45 Vdc ±2% > 1 MΩ at a voltage of 100 Vdc ±5%
Bonding	≤10 mΩ

End of Section 1.0

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Section 2.0 Installation

2.1 Introduction

Information in this section consists of: unpacking and inspection procedures, installation procedures, post-installation checks, and installation drawings.

2.2 Unpacking and Inspection

Unpack the equipment carefully. Inspect the unit visually for damage due to shipping and report all such claims immediately to the carrier involved. Note that each unit should have the following:

- LSA100-100
- Acceptance Test Report
- Certificate of Conformity or Release certification

Verify that all items are present before proceeding and report any shortage immediately to your supplier.

2.2.1 Warranty

All Anodyne Electronics Manufacturing Corp. (AEM) products are warranted for 3 years. See the website www.aem-corp.com/warranty for complete details.

2.3 Installation Procedures

2.3.1 Warnings

WARNING:
High volume settings can cause hearing damage. Proper personal protective equipment is required to prevent hearing damage.

2.3.2 Cautions

CAUTION:
The LSA100-100 units identified with a blank factory settings identifier (see Section 1.2.1) are adjusted from factory to achieve 20W rated output into an 8 Ohm load for Channel 1 and into a 4 Ohm load for Channels 2-6. The LSA100-100 units identified with a non-blank factory settings identifier have the inputs and speaker outputs adjusted at the factory to address custom installation requirements. Do not adjust any speaker outputs to exceed 20W.
No LSA100-100 speaker output loads to be less than 4 Ohms.
Speaker output adjustments to achieve clear and comfortable sound pressure levels in the airframe may be required.

Do not remove the sealing gaskets from around J101 and J201 during installation, only remove the inserted dmin dust covers.

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CAUTION:
The interconnecting cable jack screws should be installed using a PosiDriv screwdriver bit PZ1 with 0.25 inch hex shank. Connector alignment may be affected by waterproofing gaskets. To ensure proper connector installation and gasket alignment, tighten jack screws in small, even increments, alternating between the two.

Wrap wire bundles with Silicon Fusion Tape TE 608036-X or equivalent to fill the space between connector backshell portal and wire bundle.

2.3.3 Cabling and Wiring

All wire shall be selected in accordance with the original aircraft manufacturer's Maintenance Instructions or AC43.13-1B Change 1, Paragraphs 11-76 through 11-78. Unshielded wire types shall qualify to MIL-W-22759 as specified in AC43.13-1B Change 1, Paragraphs 11-85, 11-86, and listed in Table 11-11. For shielded wire applications, use Tefzel MIL-C-27500 shielded wire with solder sleeves (for shield terminations) to make the most compact and easily terminated interconnect. Follow the interconnect drawing in Section 2.7 as required.

Allow 3" from the end of the shielded wiring to the shield termination to allow the connector hood to be easily installed. Refer to the interconnect drawing in Section 2.7 for shield termination details. Aircraft harnessing shall permit the unit to be removed for easy access to all adjustments. The interconnecting cable jack screws should be installed using a PosiDriv screwdriver bit PZ1 with 0.25 inch hex shank.

Maintain wire segregation and route wiring in accordance with the original aircraft manufacturers Maintenance Instructions.

Unless otherwise noted, all wiring shall be a minimum of 24 AWG, except speaker lines which shall be 18 AWG and power and ground lines which shall be a minimum of 16 AWG. Reference the Interconnect drawing for additional specifications. Check that the ground connection is clean and well secured, and that it shares no path with any electrically noisy aircraft accessories such as blowers, turn and bank instruments or similar loads. Power to this unit must be supplied from a separate circuit breaker or fuse (fast blow), and not attached to any other circuit breaker without additional protection. Verify that the selected circuit breaker size and wire gauge are adequate for the installation using the techniques specified in AC43.13-1B Change 1, Paragraphs 11-47 through 11-51 and 11-66 through 11-69.

2.3.4 Post-Installation Checks

2.3.4.1 Voltage/Resistance Checks

Do not connect the LSA100-100 to the wiring harness until the following conditions are met.

Referencing the Interconnect drawing from Section 2.7, check the following:

a) Check P201 pins <1, 9> for +28 Vdc relative to ground.
b) Check P201 pins <8, 12, 15> for continuity to ground (less than 0.5Ω).
c) Ensure all remaining wiring connections have been made per the aircraft wiring diagram.
d) Remove dmin dust covers from J101 and J201, DO NOT remove the sealing gaskets.

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2.3.4.2 Power On Checks

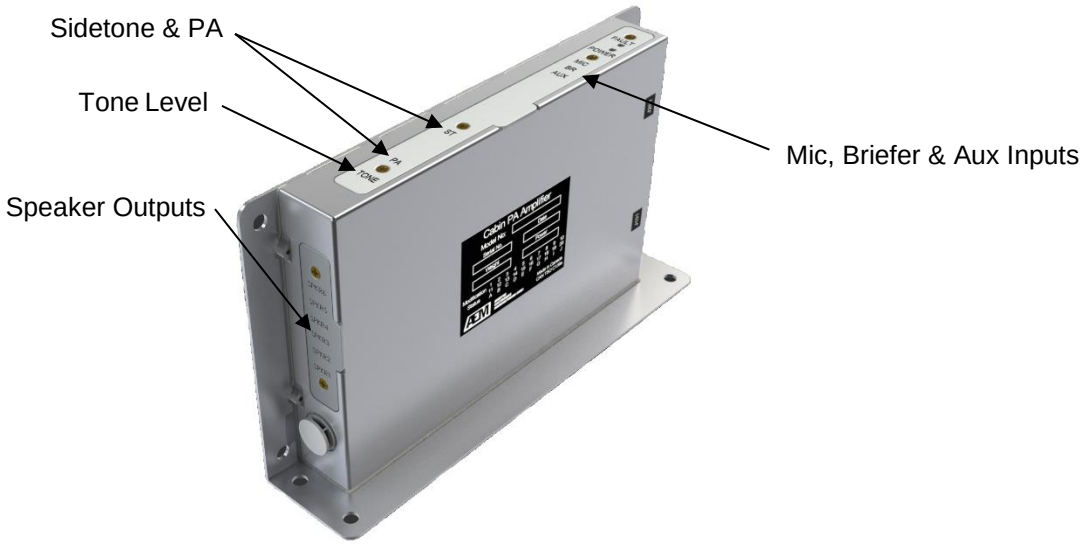
Power up the aircraft's systems and confirm normal operation of all functions of the LSA100-100. Refer to Section 3 (Operation) for specific operational details.

a) Unusual buzzes, hums or other background audio are symptomatic of multiple grounds, or noisy external systems such as blowers or pumps sharing wiring with the audio system.

Upon satisfactory completion of all performance checks, make all required log book entries, electrical load, weight and balance amendments and other documentation as required by your local regulatory agency before releasing the aircraft for service.

2.4 Adjustments and Connections

The unit is shipped from the factory with all adjustments set to the nominal test levels. Once installed in the aircraft, it may be desirable to change some of these settings to best suit the local operating environment. The adjustments are located behind removable cover plates. The cover plates have legends on them that correspond to the adjustment it is covering.



The cover plates can be removed using a #1 Phillips screw driver. If the plates are removed, ensure that the O-ring gaskets remain seated in their associated groves. During re-installation, the screws must be torqued to 4.4 – 5.0 in-lbs.

The accessible adjustments require the use of a Bourns H-90, H-91, H-92 or equivalent adjustment tool.

All adjustments are designed to allow an increase in level with clockwise rotation of the potentiometer.

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2.4.1 Mic, Briefer & Aux Inputs

The Microphone, Briefer, and Auxiliary Audio inputs are adjusted based on their associated rated input level to achieve a specific internal level that is presented to the Sidetone, PA, and Speaker amplifier outputs. Any adjustment of these inputs will have a subsequent effect on all the outputs.

2.4.2 Tone Level

The Tone Level adjustment matches the output from the internal tone generation circuitry to the same internal level as the Microphone, Briefer, and Auxiliary Audio inputs. Any adjustment of Tone level will have a subsequent effect on all the outputs.

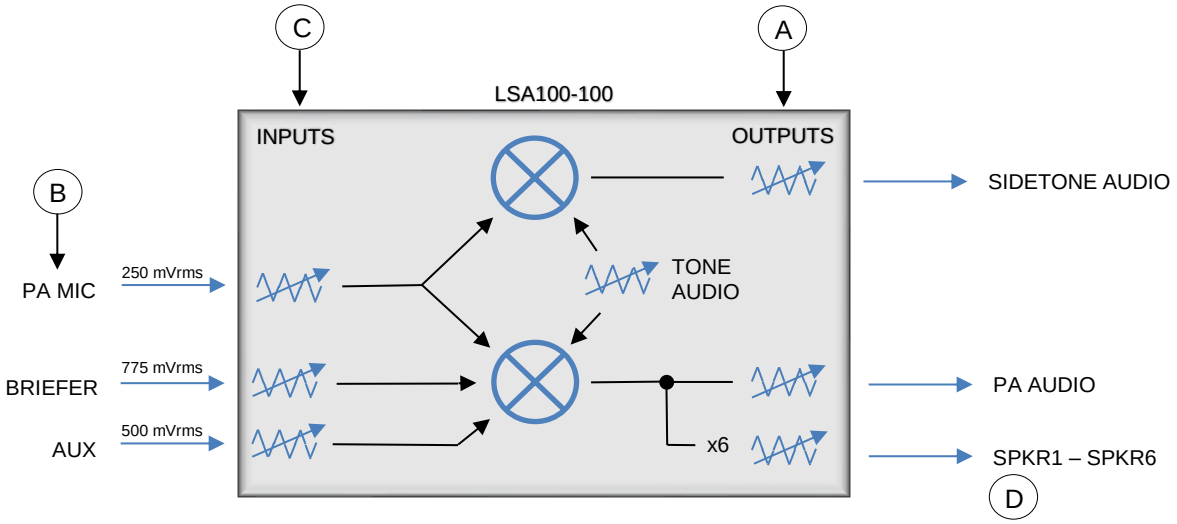
Note: Adjustment of Tone Level should only be made after the Sidetone, PA, and Speaker outputs have been adjusted for each specific cabin audio system installation.

2.4.3 Sidetone, PA & Speaker Outputs

The Sidetone, PA, and Speaker outputs are adjusted to meet the rated output levels and are based on the specific internally adjusted Microphone, Briefer, Aux, and Tone level. These outputs can be adjusted to better suit specific cabin audio system installations.

2.4.4 Level Adjustments

During installation, when setting the cabin speaker levels, it may be necessary to make adjustments to the LSA100-100. Refer to Cautions section above for adjustment limitations. The associated adjustment cover plates must be removed, prior to attempting any adjustments. As well, determination of speaker load and delivered power requirements for the aircraft installation configuration needs to occur prior to speaker level adjustments.



A. The preferred method is to only adjust the SPKR1-SKPR6, PA AUDIO, and SIDETONE AUDIO output potentiometers to achieve the desired level. Rated output is achievable when the inputs are known to be at their rated levels. For detailed speaker adjustment steps, see step D.

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B. Ensure that the PA MIC, BRIEFER, and AUX levels being supplied from the aircraft audio systems are at their rated levels. If the rated input levels can not be met, the LSA100-100 will not be able to meet rated output.

C. The LSA100-100 audio input adjustments are only intended to attenuate known audio levels that are exceeding the rated input levels. Adjustment to any of the LSA100-100 inputs or TONE AUDIO will have an impact on the associated output levels. When adjustments are made, re-check the other output levels supplied by the other inputs.

D. Speaker Level Adjustment Steps:

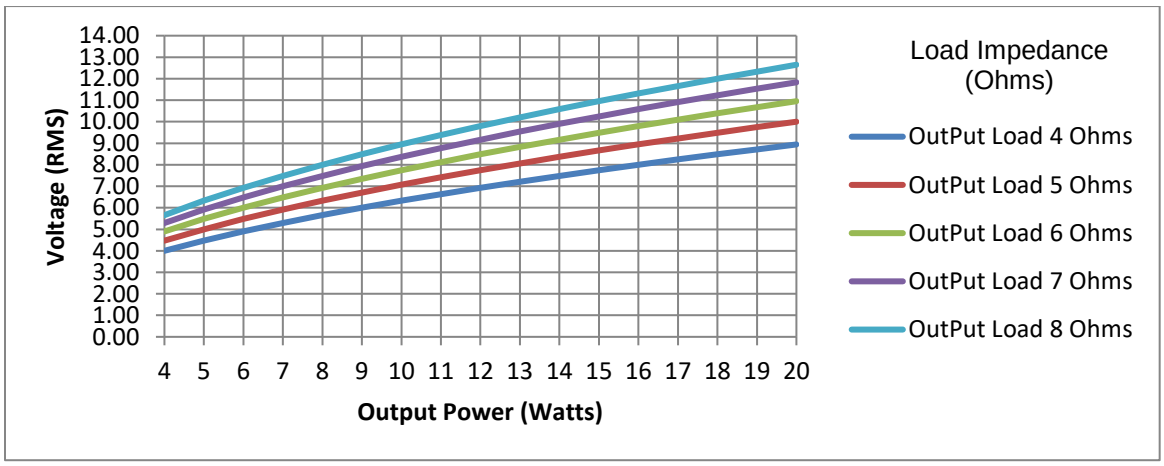
1) Determine each speaker output load impedance (ohms) based on the aircraft installation configuration.

2) Choose a power level (watts) and record the corresponding output voltage based on the individual channel load requirements referencing the tables below.

3) Apply a standard (1kHz) test tone at the rated input level to either the PA MIC, Briefer, or Aux Audio Inputs. With the determined load attached, key the LSA100-100 (if using PA MIC or Briefer inputs) and adjust the speaker level to the desired output level.

Speaker Level (Vrms)

Output Load (Ω) \ Watts (W)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
4	4.00	4.47	4.90	5.29	5.66	6.00	6.32	6.63	6.93	7.21	7.48	7.75	8.00	8.25	8.49	8.72	8.94
5	4.47	5.00	5.48	5.92	6.32	6.71	7.07	7.42	7.75	8.06	8.37	8.66	8.94	9.22	9.49	9.75	10.00
6	4.90	5.48	6.00	6.48	6.93	7.35	7.75	8.12	8.49	8.83	9.17	9.49	9.80	10.10	10.39	10.68	10.95
7	5.29	5.92	6.48	7.00	7.48	7.94	8.37	8.77	9.17	9.54	9.90	10.25	10.58	10.91	11.22	11.53	11.83
8	5.66	6.32	6.93	7.48	8.00	8.49	8.94	9.38	9.80	10.20	10.58	10.95	11.31	11.66	12.00	12.33	12.65



Example 1: For 20W delivered on SPKR 1 to an equivalent speaker load of 8 Ohms, adjust the measured voltage to achieve 12.65 Vrms.

Example 2: For 20W delivered on SPKR 6 to an equivalent speaker load of 4 Ohms, adjust the measured voltage to achieve 8.95 Vrms.

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2.5 Accessories Required But Not Supplied

The accessible adjustments require the use of a Bourns H-90, H-91, H-92 or equivalent adjustment tool.

Installation kit p/n LSA100-IKC (crimp) is required to complete the installation. The kit consists of the following:

Qty	Description	Manufacturer	Mfr Part #	Part #
1	D-Sub, Socket, 15 Crimp Housing	TE Connectivity	MS24308/2-282Z	120-21-002
1	D-Sub, Socket, 50 Crimp Housing	TE Connectivity	MS24308/2-285Z	120-21-003
49	Contact, Socket, Crimp, 20-24 AWG	TE Connectivity	MS39029/63-368	120-26-015
16	Contact, Socket Crimp, 18 AWG	TE Connectivity	1218267-1	120-26-014
1	Hood, Metal, D-Sub 15	Conec	165X11619X	20-28-015
1	Hood, Metal, D-Sub 50	Positronic	D50000GE0	20-28-003

Note: The jack screws on the Dsub hoods should be installed using a PosiDriv screwdriver bit PZ1 with 0.25 inch hex shank.

2.6 Continued Airworthiness

Maintenance of the LSA100-100 Cabin PA Amplifier is ‘on condition’ only. Periodic maintenance of this product is not required.

2.7 Installation Drawings

Use of the "#" symbol in the REV. column indicates that the document is listed elsewhere in the manual. Refer to the applicable AEM Part No. to locate the referenced document.

DOCUMENT	REV	DESCRIPTION	TYPE	SER. NO.
LSA100-100-403-0	1.00	Cabin PA Amplifier	Interconnect	77127+
LSA100-100-405-0	1.00	Cabin PA Amplifier	Connector Map	77127+
LSA100-100-521-0	1.00	Cabin PA Amplifier	Environmental Qualification Form	77127+
LSA100-100-922-0	1.00	Cabin PA Amplifier	Mechanical Installation	77127+

Section 2.0 ends following above documents

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LSA100–100 INSTALLATION NOTES

NOTES:

1. ALL WIRES SHOULD BE 24 AWG UNLESS OTHERWISE SPECIFIED. ALL UNSHIELDED WIRE SHALL BE SELECTED IN ACCORDANCE WITH AC43.13–1B CHANGE 1, PARAGRAPHS 11–76 THROUGH 11–78. WIRE TYPES SHOULD BE TO MIL–W–22759 AS SPECIFIED IN AC43.13–1B CHANGE 1, PARAGRAPHS 11–85, 11–86 AND LISTED IN TABLE 11–11. ALL SHIELDED WIRE/CABLE SHOULD BE IN ACCORDANCE WITH MIL–C–27500.

2. CABLE LENGTH BETWEEN LSA100 AND ASSOCIATED AUDIO CONTROLLER NOT TO EXCEED 80 ft [25 m].
POWER CABLE LENGTH NOT TO EXCEED 65 ft [20 m].
SPEAKER CABLE LENGTH NOT TO EXCEED 65 ft [20 m].
ALL CABLE LENGTHS ARE BASED ON RECOMMENDED WIRE SIZE.
SPEAKER CABLE LENGTHS BEYOND SPECIFIED MAXIMUMS ARE ACHIEVABLE WITH ALTERNATE SYSTEM WIRING CONFIGURATIONS THAT SATISFY THE RATED LOAD REQUIREMENTS OF THE LRU.

3. CABLE LENGTH NOT TO EXCEED 3.3 ft [1.0 m].

4. SYSTEM CROSSTALK MAY BE EFFECTED BY STYLE OF HEADSET AND JACK. CHECK SPECIFICATIONS AND SYSTEM REQUIREMENTS BEFORE SELECTING AND INSTALLING SAME.

5. SHIELDS SHOULD BE GROUNDED TO LOCAL AIRFRAME GROUND, UNLESS OTHERWISE SPECIFIED.

6. SHIELD LENGTH NOT TO EXCEED 1 ft [0.3 m].

7. SPLICE FROM 16 AWG TO TWO 18 AWG WIRES.

8. INTERCONNECT CABLE JACK SCREWS SHOULD BE INSTALLED USING A POSIDRIV SCREWDRIVER BIT PZ1 WITH 0.25 INCH HEX SHANK.

9. CONNECTOR ALIGNMENT MAY BE AFFECTED BY WATERPROOFING GASKETS. TO ENSURE PROPER CONNECTOR INSTALLATION AND GASKET ALIGNMENT, TIGHTEN JACK SCREWS IN SMALL, EVEN INCREMENTS, ALTERNATING BETWEEN THE TWO.

10. WRAP WIRE BUNDLES WITH SILICON FUSION TAPE TE 608036–X OR EQUIVALENT TO FILL THE SPACE BETWEEN CONNECTOR BACKSHELL PORTAL AND WIRE BUNDLE.

11. THE LSA100 INSTALL KIT IS SUPPLIED WITH TWO TYPES OF CRIMP SOCKETS, 18 AWG AND 20–24 AWG. CARE SHOULD BE TAKEN TO USE THE CORRECT SOCKET AND CRIMP TOOLS SETTINGS FOR THE WIRES SPECIFIED IN THE INTERCONNECT DRAWING.

DEFINITIONS:

N/C: NO CONNECTION. THE PIN IS NOT CONNECTED TO ANYTHING INTERNALLY, AND THEREFORE SHALL HAVE NO CONNECTION EXTERNALLY.

N/C SPARE: NO CONNECTION INTERNALLY, BUT A SPARE WIRE SHALL BE INSTALLED IN THE WIRE HARNESS.

RESERVED: MAY BE CONNECTED AND USED IN THE FUTURE.
THE CIRCUITRY MAY BE PRESENT OR ADDED TO ACTIVATE THE FUNCTION.
THE PIN MAY BE USED FOR TEST PURPOSES.
THERE IS NO EXTERNAL CONNECTION.

RESERVED SPARE: (RSV SP) RESERVED, BUT INSTRUCTIONS SHALL BE FOLLOWED TO ACTIVATE THE CIRCUITRY. A SPARE WIRE SHALL BE INSTALLED IN THE WIRE HARNESS.

	NAME	DATE
DRAWN	RB	05-Jun-18
CHECKED	D.H.	Sep 24/18
APPROVED	T.B.	Sep 24/18

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ±0.0625"
ANGULAR ±0.5°
TWO DECIMAL PLACE ±0.010"
THREE DECIMAL PLACE ±0.005"

MATERIAL: N/A

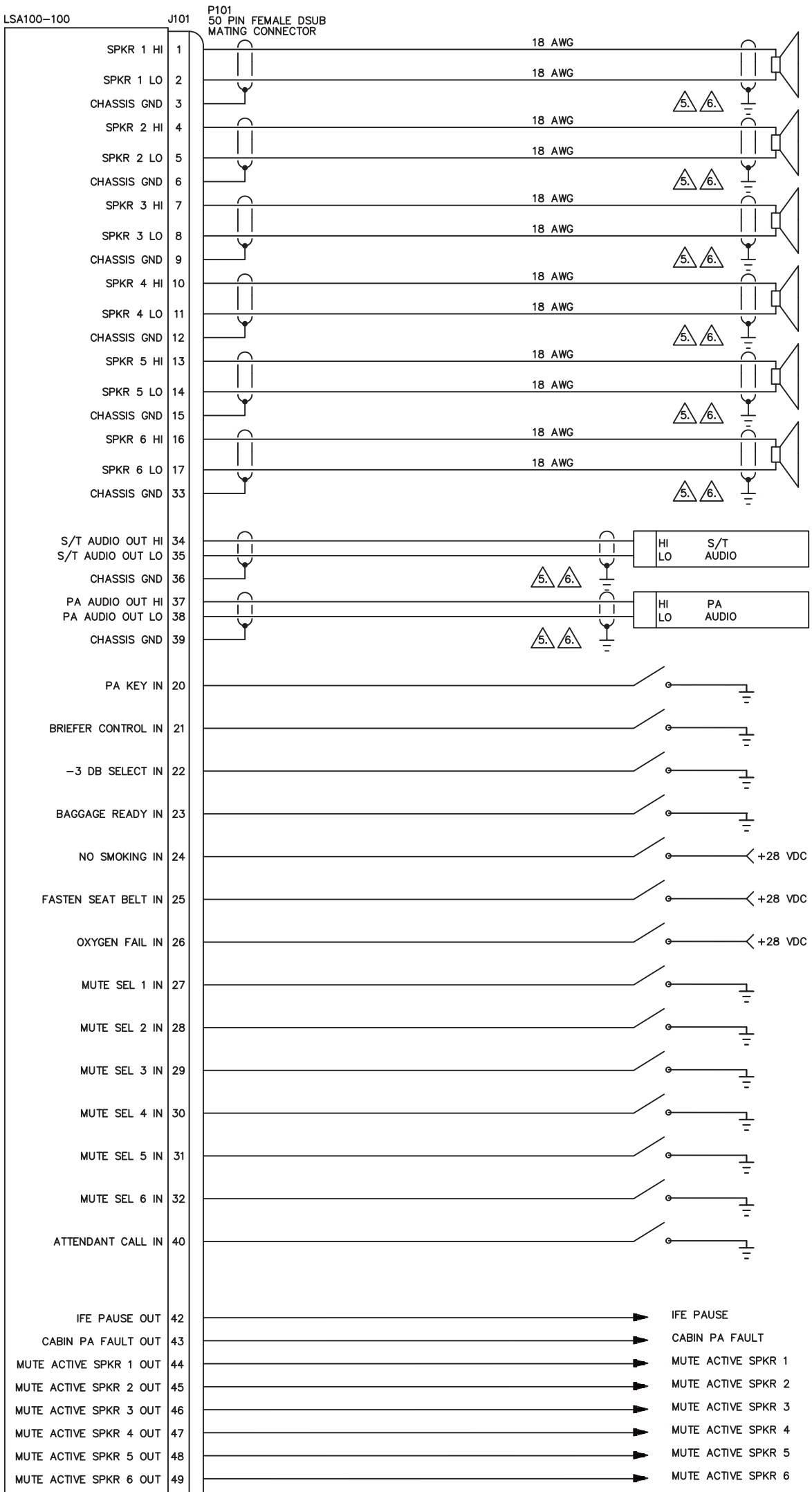
FINISH: N/A

ANODYNE ELECTRONICS MANUFACTURING CORP.
KELOWNA BC CANADA
(250)-763-1088
WWW.AEM-CORP.COM

TITLE:
CABIN PA AMPLIFIER INTERCONNECT

PAPER SIZE:	CAGE CODE	PART No.:	REVISION
A	L9015	LSA100-100	1.00

SCALE:1:1	DO NOT SCALE DRAWING	DRAWING No.: 403-0	SHEET:1 of 3



	NAME	DATE
DRAWN	RB	05-Jun-18
CHECKED	AEM D.H.	Sep 24/18
APPROVED	AEM T.B.	Sep 24/18

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TWO DECIMAL PLACE ±0.010"
THREE DECIMAL PLACE ±0.005"

MATERIAL: N/A

FINISH: N/A

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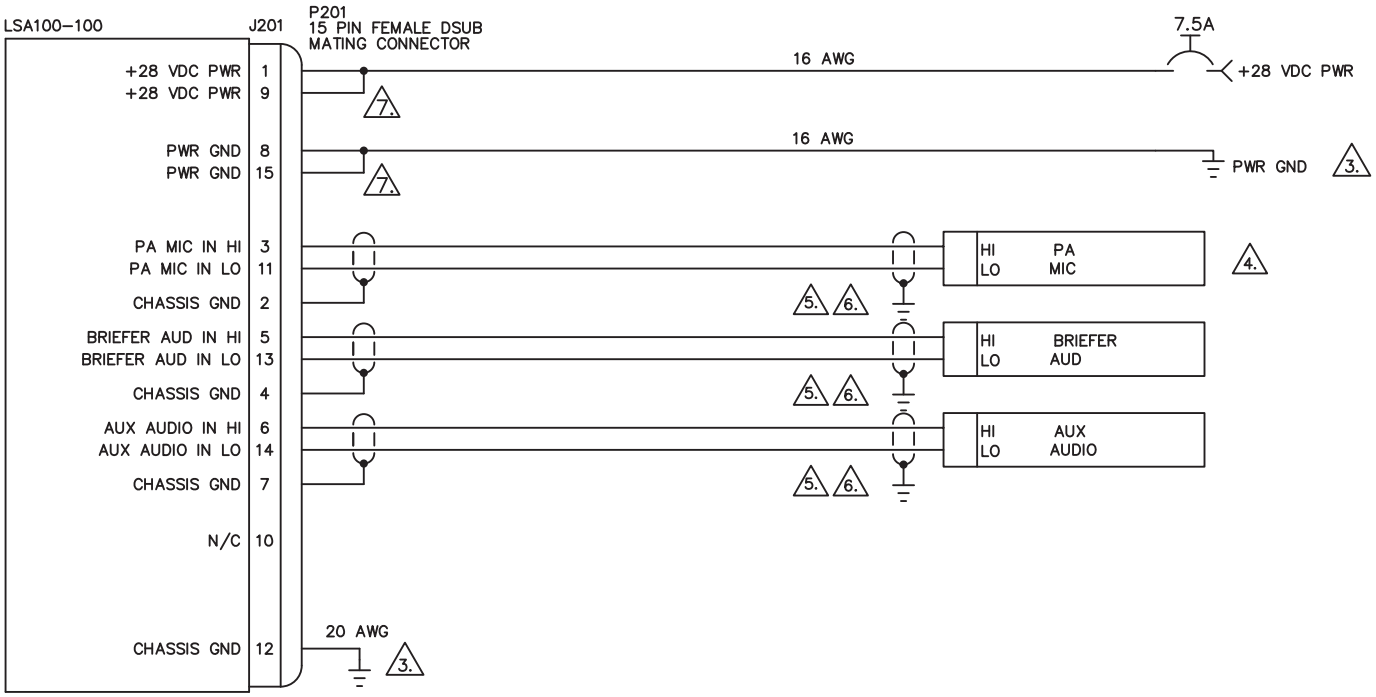
TITLE:
CABIN PA AMPLIFIER INTERCONNECT

PAPER SIZE:	CAGE CODE	PART No.:	REVISION
B	L9015	LSA100-100	1.00

SCALE:1:1	DO NOT SCALE DRAWING	DRAWING No.: 403-0	SHEET:2 of 3



	NAME	DATE
DRAWN	RB	05-Jun-18
CHECKED	D.H.	Sep 24/18
APPROVED	T.B.	Sep 24/18

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TOLERANCES:
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ANGULAR_____ ±0.5°
TWO DECIMAL PLACE___ ±0.010"
THREE DECIMAL PLACE___ ±0.005"

MATERIAL: N/A

FINISH: N/A

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KELOWNA BC CANADA
(250)-763-1088
WWW.AEM-CORP.COM

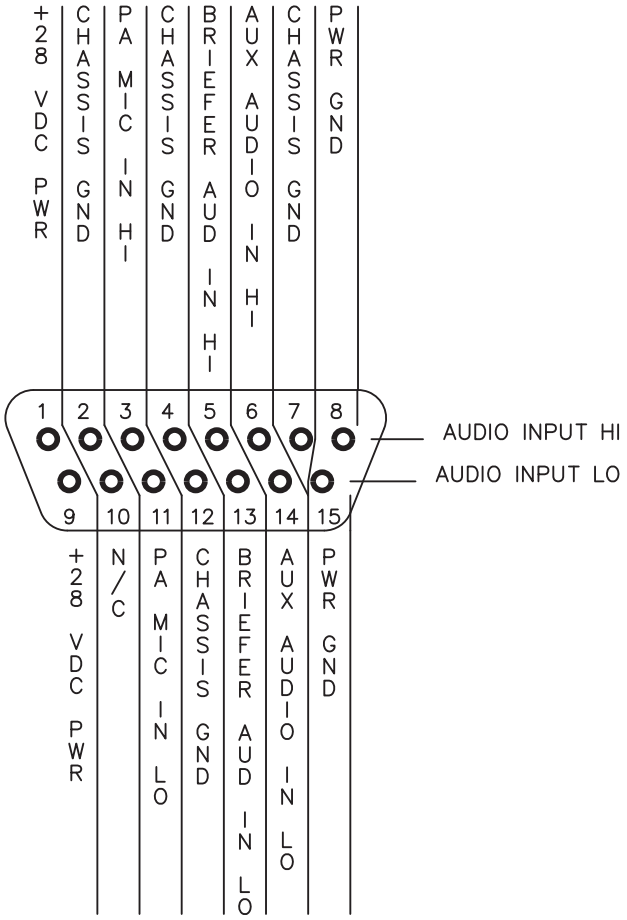
TITLE:
CABIN PA AMPLIFIER INTERCONNECT

PAPER SIZE:	CAGE CODE	PART No.:	REVISION
A	L9015	LSA100-100	1.00

SCALE:1:1	DO NOT SCALE DRAWING	DRAWING No.: 403-0	SHEET:3 of 3

P201

15 PIN FEMALE DMIN
MATING CONNECTOR



VIEW IS FROM REAR OF AIRFRAME CONNECTOR

	NAME	DATE
DRAWN	RB	JUN 05/18
CHECKED	D.H.	Sep 20/18
APPROVED	T.B.	Sep 25/18

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TOLERANCES:
FRACTIONAL_____ ±0.0625"
ANGULAR_____ ±0.5°
TWO DECIMAL PLACE___ ±0.010"
THREE DECIMAL PLACE___ ±0.005"

MATERIAL: -

FINISH: -

ANODYNE ELECTRONICS MANUFACTURING CORP.
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(250)-763-1088
WWW.AEM-CORP.COM

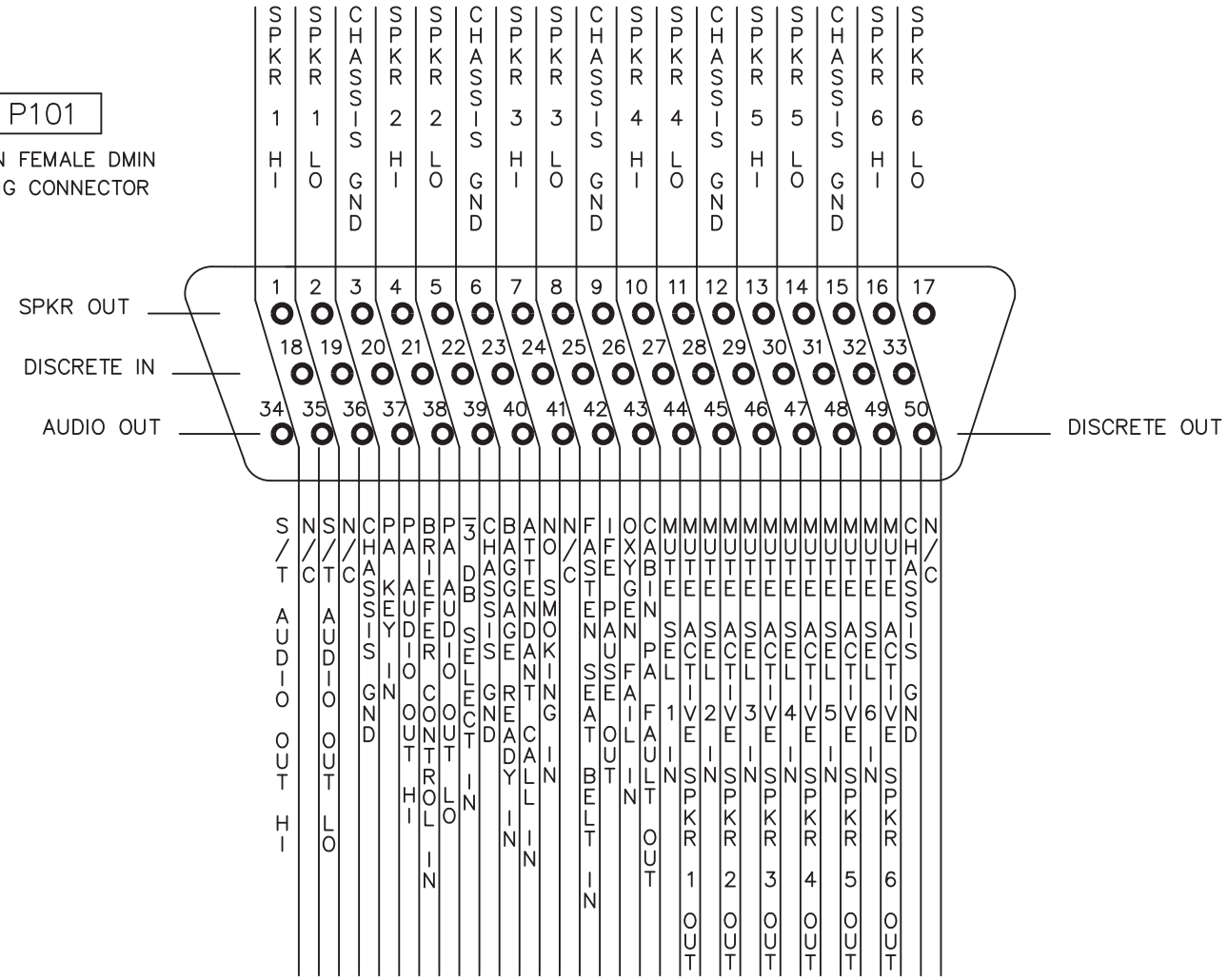
TITLE:
CABIN PA AMPLIFIER CONNECTOR MAP

PAPER SIZE:	CAGE CODE	PART No.:	REVISION
A	L9015	LSA100-100	1.00

SCALE:-	DO NOT SCALE DRAWING	DRAWING No.: 405-0	SHEET:1 of 2

P101

50 PIN FEMALE DMIN
MATING CONNECTOR



VIEW IS FROM REAR OF AIRFRAME CONNECTOR

	NAME	DATE
DRAWN	RB	JUN 05/17
CHECKED	D.H.	Sep 20/18
APPROVED	T.B.	Sep 25/18

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TWO DECIMAL PLACE ±0.010"
THREE DECIMAL PLACE ±0.005"

MATERIAL: -

FINISH: -

ANODYNE ELECTRONICS MANUFACTURING CORP.
KELOWNA BC CANADA
(250)-763-1088
WWW.AEM-CORP.COM

TITLE:
CABIN PA AMPLIFIER CONNECTOR MAP

PAPER SIZE:	CAGE CODE	PART No.:	REVISION
A	L9015	LSA100-100	1.00

SCALE:-	DO NOT SCALE DRAWING	DRAWING No.: 405-0	SHEET:2 of 2

ENVIRONMENTAL QUALIFICATION FORM

Description: **Cabin PA Amplifier** Document: **LSA100-100-521-0100**

Part #: **LSA100-100** TSO #: **CAN TSO C139a**

Manufacturer's Specification and/or Other Applicable Specification:

Manufacturer: **Anodyne Electronics Manufacturing Corp.**

Address: **#15 - 1925 Kirschner Rd., Kelowna, BC, Canada. V1Y 4N7**

DO-160 Rev: **G**

Prepared By:	Checked By:	Approved By:
RB Ron Briggs Designer Sep 19/18	D.K. Steve Kempf Designer Sep 20/18	TB Todd Blackstock R&D Manager Sep 26/18

Conditions	Section	Description of Conducted Tests
Temperature and Altitude	**4.0**	**Equipment tested to Category A2**
Ground Survival Low Temp.	4.5.1	-55 °C
Short-Time Operating Low Temp.	4.5.1	-40 °C
Operating Low Temperature	4.5.2	-15 °C
Ground Survival High Temp.	4.5.3	+85 °C
Short Time Operating High Temp.	4.5.3	+70 °C
Operating High Temp.	4.5.4	+70 °C
In-flight Loss of Cooling	4.5.5	N/A
Altitude	4.6.1	+15,000 ft (+4,572 m)
Decompression	4.6.2	+8,000 ft to +51,000 ft (+2,438 to +15,545 m)
Overpressure	4.6.3	-15,000 ft (-4,572 m)
Temperature Variation	**5.0**	**Equipment tested to Category B** ± 5° C/min.
Humidity	**6.0**	**Equipment tested to Category A** 95% RH for 48 hrs.
Operational Shock and Crash Safety	**7.0**	**Equipment tested to Category B**
Operational Shocks	7.2.2	6g for 11 ms in all axes
Crash Safety (Impulse)	7.3.2	20g for 11 ms in all axes
Crash Safety (Sustained)	7.3.3	20g for 3 s in all axes

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Conditions	Section	Description of Conducted Tests
Vibration	**8.0**	**Equipment tested to Category R** Profiles C and C1
Explosive Atmosphere	9.0	Category X, no test performed.
Waterproofness	**10.0**	**Equipment tested to Category W** (Reference Remarks: Item 4.)
Drip Proof test	10.3.2	140 l/m^2/hr or greater volume of water.
Fluids Susceptibility	11.0	Category X, no test performed.
Sand and Dust	12.0	Category X, no test performed.
Fungus Resistance	**13.0**	**Category F, qualified by analysis**. (Reference Remarks: Item 5.)
Salt Spray	14.0	Category X, no test performed.
Magnetic Effect	**15.0**	**Equipment tested to Category A** Deflection of 1°: 0.3 ≤ D ≤ 1.0 m. (Reference Remarks: Item 6.)
Power input	**16.0**	**Equipment tested to Categories A(XI)** (Reference Remarks: Item 7.)
Voltage (Average Value DC)	16.6.1.1	Maximum Operating Voltage: +30.3 Vdc Nominal Operating Voltage: +28.0 Vdc Minimum Operating Voltage: +22.0 Vdc Emergency Operating Voltage: +18.0 Vdc
Momentary Power Interruptions(DC)	16.6.1.3	50ms, 200ms and 300 ms
Normal Surge Voltage (DC)	16.6.1.4	As per DO-160G
Engine Starting Under Voltage (DC)	16.6.1.5	N/A
Voltage Steady State (DC)	16.6.2.1	Maximum Operating Voltage: +32.2 Vdc Normal Operating Voltage: +28.0 Vdc Minimum Operating Voltage: +20.5 Vdc
Low Voltage Conditions (DC)	16.6.2.2	N/A
Momentary Undervoltage Operation (DC)	16.6.2.3	+12 Vdc for 7 s
Abnormal Surge Voltage (DC)	16.6.2.4	+46.3 Vdc for 100 ms, +37.8 Vdc for 1 s.
In Rush Current Requirements(DC)	16.7.5.2	9x the max steady state load for first 3 ms, 4x the max steady state load up to 500 ms, 2x the max steady state load up to 2s and nominal thereafter.

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Conditions	Section	Description of Conducted Tests
Voltage Spike	**17.0**	**Equipment tested to Category A** 600 Vp for 10 µs Positive and negative spikes
Audio Frequency Susceptibility Ripple Voltage	**18.0**	**Equipment tested to Category R** 0.6 Vpp from 10 to 200 Hz, to 1.6 Vpp from 0.2 to 1 kHz, to 4.0 Vpp from 1 to 15 kHz, to 0.6 Vpp at 15 kHz, to 4.0 mVpp at 150 kHz
Induced Signal Susceptibility Magnetic Fields into Equipment Electric Fields into Equipment Magnetic Fields into Cables Electric Fields into Cables Spikes Induced into Cables	**19.0** 19.3.1 19.3.2 19.3.3 19.3.4 19.3.5	**Equipment tested to Category ZWE** 20 Arms @ 350 and 800 Hz 170 Vrms @ 400 Hz 30 A•m @ 350 to 800 Hz, reducing to 0.8 A•m@ 32 kHz 1800 V•m from 350 to 800 Hz Positive and negative spikes as per DO-160G
Radio Frequency Susceptibility Conducted RF Susceptibility Radiated RF Susceptibility	**20.0** 20.4 20.5	**Equipment tested to Category TR** (Reference Remarks: Item 8.) 0.15 mA @ 10 kHz, to 0.36 mA @ 24 kHz, to 7.5 mA @ 24 kHz, to 7.5 mA @ 400 MHz SW/CW: 20 V/m from 100 to 400 MHz, PM: 150 V/m from 0.4 to 8 GHz
Radio Frequency Emission Conducted RF Emission Radiated RF Emission	**21.0** 21.4 21.5	**Equipment tested to Category M** Power lines: 150 kHz to 152 MHz Interconnecting Cables: 150 kHz to 152 MHz 2 MHz to 6 GHz (Reference Remarks: Item 9)
Lightning Induced Transient Susceptibility	22.0	**Equipment tested to Category XXJ3L3**
Lightning Direct Effects test	23.0	Category X, no test performed.

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Conditions	Section	Description of Conducted Tests
Icing	24.0	Category X, no test performed.
Electrostatic Discharge	**25.0**	**Equipment tested to Category A** 15,000 Vp, 10 positive and negative spikes.
Fire, Flammability	**26.0**	**Category C, qualified by analysis.** Compliant to FAR 25.853(a), Appendix F, Part I, (a)(1)(i) by analysis.

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REMARKS

1. Sections 4 to 8,10,15 to 19, and 25 tests were conducted at Anodyne Electronics Manufacturing Corp (AEM) in Kelowna, BC.

2. Sections 20 and 21 were tested at Electronics Test Center in Kanata, ON. Sections 22 was tested at CKC Laboratories, Inc. in Bothell, WA. U.SA.

3. Sections 13 and 26 are qualified by analysis.

4. Section 10 drip proof tests were not performed in the mounting orientation where the connectors face upward. The unit is compliant with the section requirements in all other mounting orientations.

5. Section 13 tests were performed on printed circuit boards specimens coated with Humiseal 1A33 conformal coat at the Federal Institute for Materials Research and Testing (BAM) in Berlin, Germany.

6. Section 15 measured distances satisfy the requirements of CAT Z (Deflection of 1°: 0m ≤ D ≤ 0.3 m).

7. In Section 16, the equipment was tested to the DO-160G Momentary Power interruptions requirements of 50 and 200 ms, plus an additional customer interrupt requirement at 300 ms. Interruptions that cycle voltages below the Minimum Operating voltage can cause the equipment to behave as if the power has been cycled to the equipment.

8. In Section 20 the equipment was tested with conducted RF Susceptibility levels and frequencies to satisfy the requirements of both DO-160G Sec 20.4 and DO-214A, Sec 2.5.11.

9. In Section 21, the equipment was tested to and met the requirements of Radiated RF emissions requirements of DO-160E Sec 21.4 Cat M. The equipment also satisfies the requirements of DO-160G, Sec 21.5, Cat M.

Installation Notes:

All mounting orientations are allowed except where the external connectors are facing upwards. If the equipment installation does not require compliance to the Waterproofness requirements of DO-160G (Section 10, Cat W), then equipment installation in any mounting orientation is allowed.

End of Environmental Qualification Form

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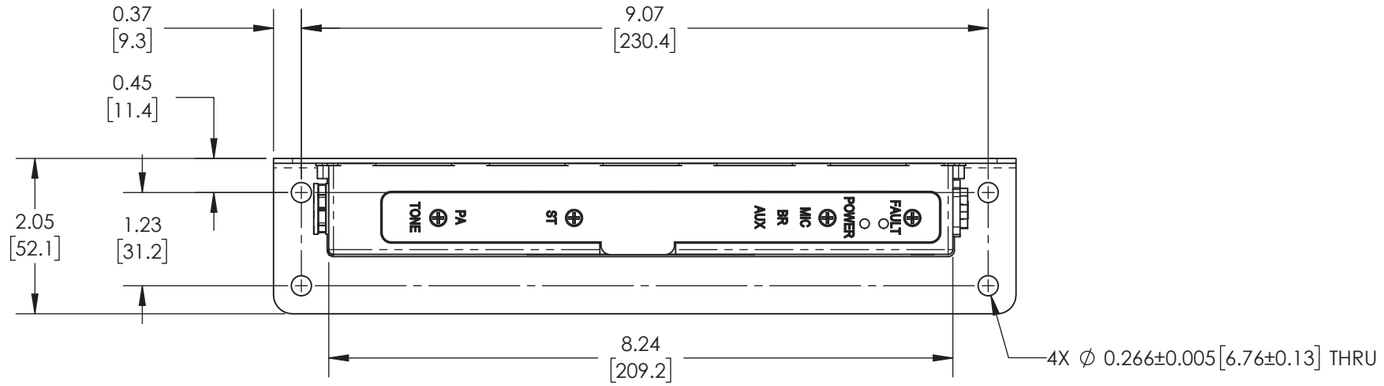

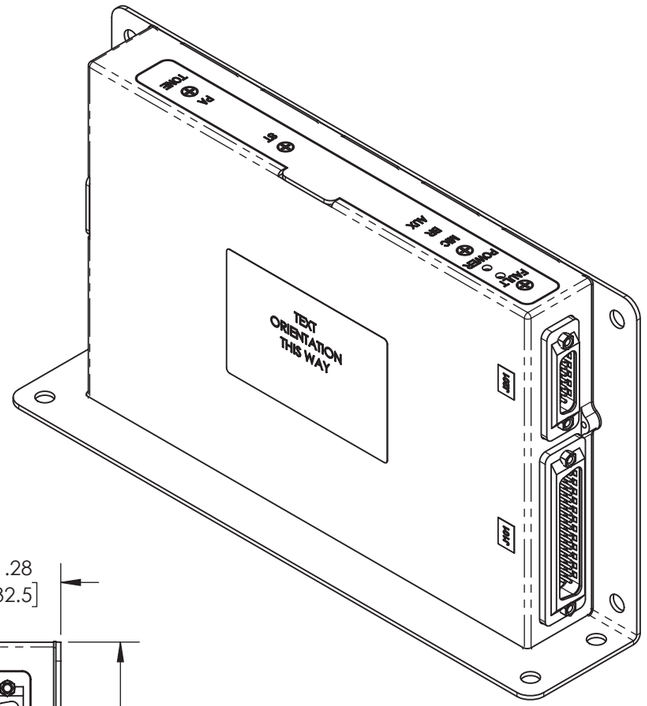

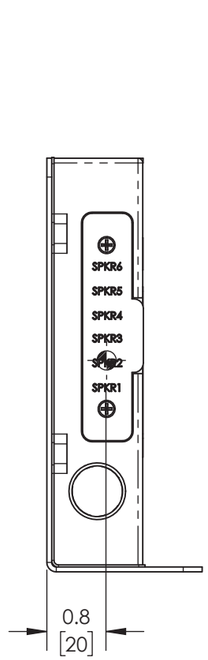

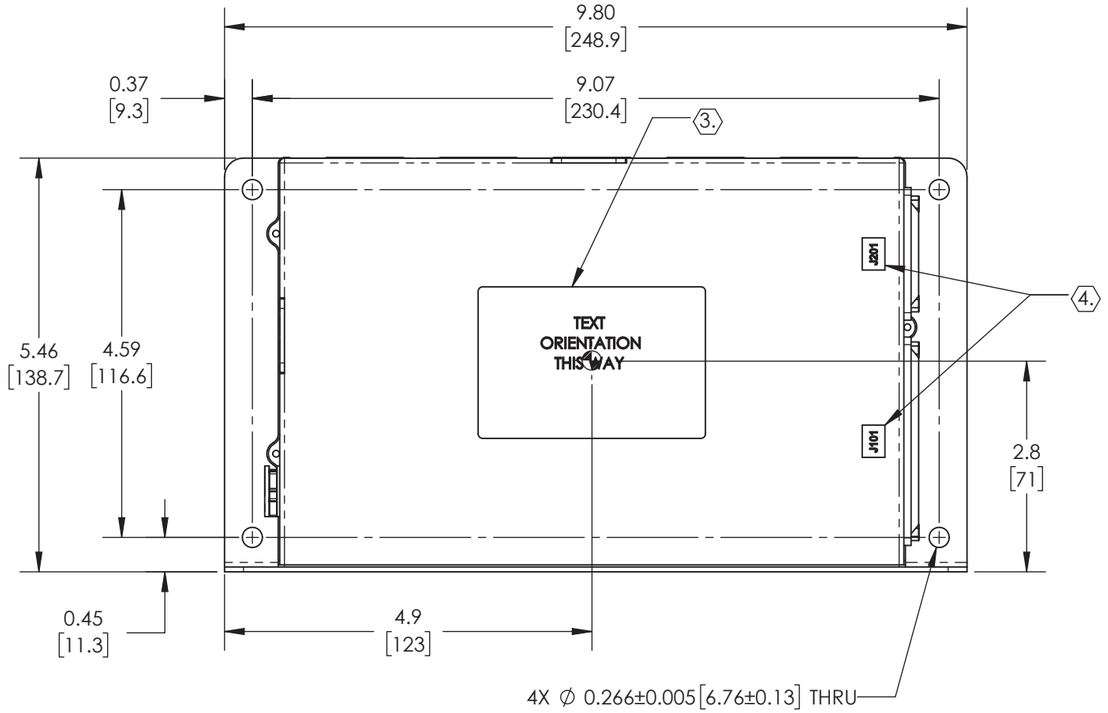

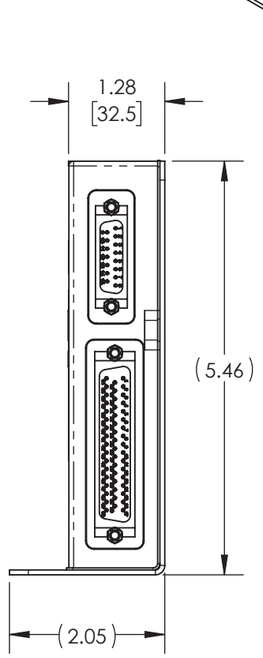

NOTES:

1. MASS: 2.0 lb [0.91 kg] MAX.
2. APPROXIMATE CENTER OF GRAVITY.

3. PRODUCT LABEL.
4. CONNECTOR IDENT LABEL.

	NAME	DATE
DRAWN	LAC	12-Jun-18
CHECKED	AEM RB	Jun 12/18
APPROVED	AEM TB	Sep 25/18

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
ANGULAR _____ ±0.5°
FRACTIONAL _____ ±0.0625"
ONE DECIMAL PLACE _____ ±0.100"
TWO DECIMAL PLACE _____ ±0.030"
THREE DECIMAL PLACE _____ ±0.010"

MATERIAL: N/A

FINISH: N/A
-

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15-1925 KIRSCHNER RD.
KELOWNA BC V1Y 4N7
(250)-763-1088
WWW.AEM-CORP.COM

TITLE:
CABIN PA AMPLIFIER MECHANICAL INSTALLATION

PAPER SIZE:	CAGE CODE	PART No. :	REVISION
B	L9015	LSA100-100	1.00

SCALE: 1:2 | DO NOT SCALE DRAWING | DRAWING No. : 922-0 | SHEET: 1 OF 1

Section 3.0 Operation

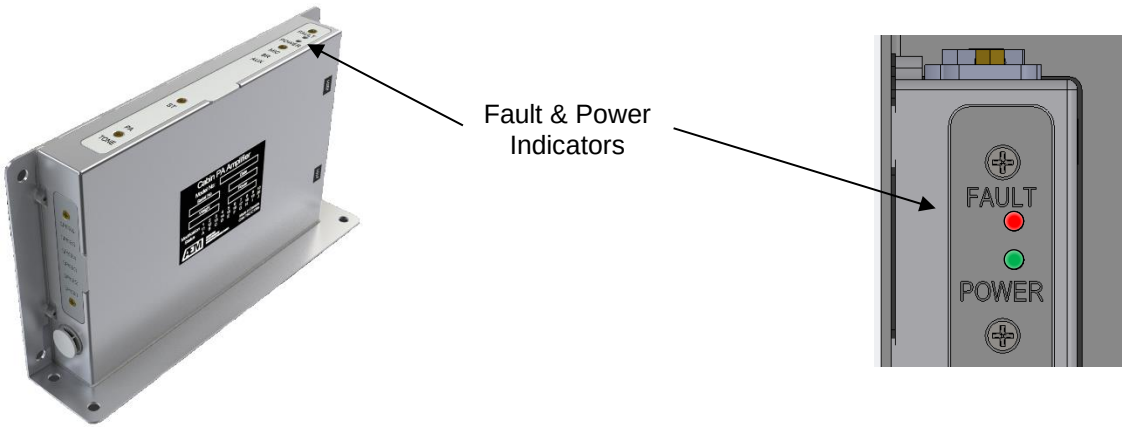
3.1 Introduction

Information in this section consists of functional and operational procedures for the LSA100-100 Cabin PA Amplifier.

3.2 General

The LSA100-100 Cabin PA Amplifier has no operator accessible controls. During installation, it may be determined that level adjustments are required, reference Section 2.4.

3.3 Controls and Indicators



3.3.1 FAULT Indicator

When any one of the six speaker outputs detect a fault condition, the associated speaker amplifier shuts down by changing the state of its output to high impedance. Over Current, Over Temperature, and High DC Offset are faults that are presented both externally as a red FAULT annunciator and as a CABIN PA FAULT discrete output on J101 pin 43.

The following will trigger a fault condition and shut down the associated speaker output until the condition is removed:

FAULT	Condition	External Indication
Over Current	Amplifier output shorted to supply or ground	Yes
Over Temperature	Amplifier die temperature > 150 °C	Yes
High DC Offset	DC at output of amplifier	Yes
Under Voltage	Amplifier Supply < 4.5Vdc	No
Over Voltage	Amplifier Supply > 27Vdc	No

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3.3.2 POWER Indicator

When the LSA100-100 is powered up, indication is presented externally as a green POWER annunciator.

3.4 System Interfaces

3.4.1 Inputs

The following are input interfaces of the LSA100-100, reference Figures 1 and 2 below:

a) PA MIC IN audio input is level adjustable, gated and summed with all other audio inputs.

b) BRIEFER AUD IN is level adjustable, gated and summed with all other audio inputs.

c) AUX AUDIO IN is level adjustable, gated and summed with all other audio inputs. If muted by either the PA or BRIEFER keys, the AUX audio input will fade back in within one second when unmuted.

d) PA KEY IN discrete input that gates the PA MIC IN audio, keys a chime tone generator and controls an IFE PAUSE OUT signal.

e) BRIEFER CONTROL IN gates the BRIEFER AUD IN, keys a chime tone generator, and controls the IFE PAUSE OUT.

f) -3DB SELECT IN decreases the signal level on all speaker outputs by 3dB.

g) BAGGAGE READY IN keys a chime tone generator and controls the IFE PAUSE OUT.

h) NO SMOKING IN keys a chime tone generator and controls the IFE PAUSE OUT.

i) FASTEN SEAT BELT IN keys a chime tone generator and controls the IFE PAUSE OUT.

j) OXYGEN FAIL IN keys a chime tone generator and controls the IFE PAUSE OUT.

k) ATTENDANT CALL IN keys a chime tone generator.

l) Six independent MUTE SEL IN inputs that mute each respective SPKR output.

3.4.2 Outputs

The following are output interfaces of the LSA100-100, reference Figures 1 & 2 below:

a) Six independent SPKR outputs contain audio from all summed inputs.

b) S/T AUDIO OUT contains select audio from the tone generator and PA MIC.

c) PA AUDIO OUT contains audio from all summed inputs.

d) IFE PAUSE OUT is a discrete output controlled by PA KEY IN, BRIEFER CONTROL IN, BAGGAGE READY IN, NO SMOKING IN, FASTEN SEAT BELT IN, and OXYGEN FAIL IN.

e) CABIN PA FAULT OUT indicates a fault in any one of six speaker amplifiers. When active, the Cabin PA Fault discrete output tries to reset the fault condition every 1.4 seconds for a duration of 10 ms until the fault condition is removed.

f) Six independent MUTE ACTIVE SPKR OUT indicate the associated MUTE SEL IN and the SPKR output that is being muted.

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3.5 System Operations

The following are operations of LSA100-100, also reference Figures 1 & 2 below:

a) Upon an active PA KEY IN, the BRIEFER AUD IN and AUX AUDIO IN are muted.

b) Upon an active BRIEFER CONTROL IN, the AUX AUDIO IN is muted.

c) Audio priority:

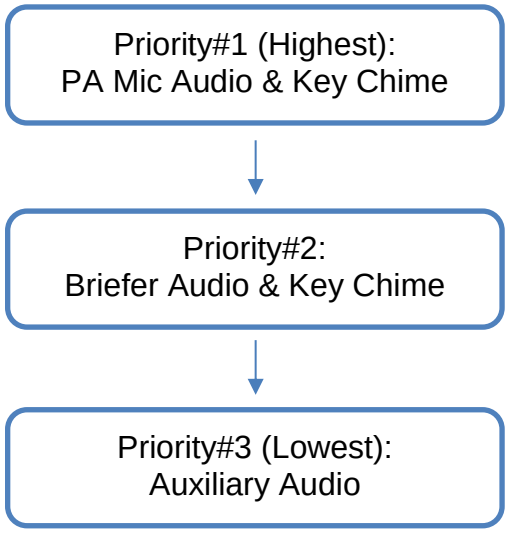

Figure 1. Audio Output Paths

INPUT	CHIME TONE	OUTPUT		
		SPEAKERS	PA	SIDETONE
PA MIC	N/A	√	√	√
BRIEFER	N/A	√	√	X
AUX AUDIO	N/A	√	√	X
PA KEY CHIME	Tone 2	√	√	√
BRIEFER KEY CHIME	Tone 2	√	√	X
FASTEN SEAT BELT CHIME	Tone 1	√	√	√
NO SMOKING CHIME	Tone 1	√	√	√
O2 FAIL CHIME	Tone 1	√	√	√
BAGGAGE READY CHIME	Tone 3	√	√	√
ATTENDANT CALL CHIME	Tone 4	√	√	X

√ = Audio path available
X = Audio path not available

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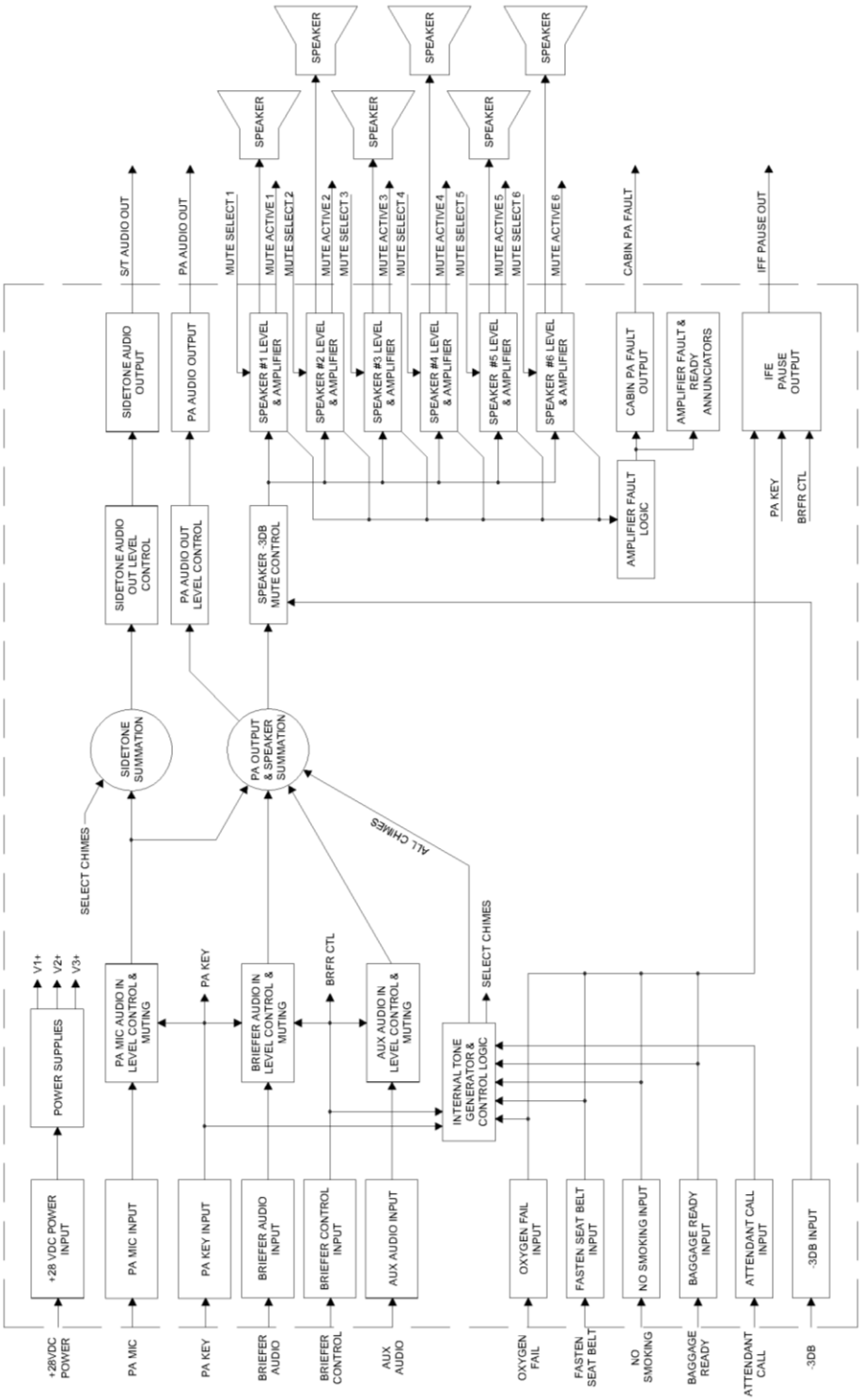
Figure 2. Block Diagram



End of Section 3.0

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