ASL Rack Mount Voice Alarm Systems

VIPEDIA-12-based Voice Alarm System Design Guide

ASL Document Ref.: T-0667-0185.docx
Issue: 5.9 Complete/Approved - Date: 20/03/2023

CE
2831-CPR-F0143

The ASL equipment described in this Design Guide is designed and manufactured to conform to:

Construction Products Regulations:	305/2011 (formerly Construction Products Directive 89/106/EEC)
Applicable Standards:	EN 54-4:1997+A1:2002+A2:2006 Power Supply Equipment for CIE EN 54-16:2008 Voice Alarm control and Indicating equipment
Certificate Number:	**2831-CPR-F0143**
Manufacturer:	Application Solutions (Safety and Security) Limited Unit 17 Cliffe Industrial Estate Lewes East Sussex BN8 6JL UK

A copy of the Declaration of Performance is available on request and is also available for download from the ASL website "downloads" area.

Failure to follow the system design guidance provided by this document may adversely affect the EN 54 compliancy of the overall system.

Application Solutions (Safety and Security) Limited
Unit 17 Cliffe Industrial Estate
Lewes - East Sussex
BN8 6JL - UK
Tel: +44(0)1273 405411 Fax: +44(0)1273 405415

www.asl-control.co.uk

Assessed to ISO 9001

LPCB Cert No: 1043QMS

Document History

Version	Description	Date	Author
1	Initial, for internal use only.	31 Jan 2015	P. Stewart
2	First release after internal ASL review	11 May 2015	P. Stewart
3.0	For EN 54-16 approval submission	8 July 2015	P. Grimwood
3.1	Release after external EN 54-16 approval	19 August 2015	P. Grimwood
3.2	Re-title to VIPEDIA-12 Rack Design Guide	5 Nov 2015	P. Grimwood
3.3	Update for P108666 approval (ASL Secure Loop & Dante). Plus improved rack design notes.	17 Jan 2018	D. Worth / P. Grimwood
4.0	Updates due to UK exit from EU (PAV0001-1418) including changes in Notified Body and EN 54 Certificate references. Updates due to review comments.	21 April 2021	H. Phipps-Jones
5.0	General Update and editorial review to align with the VIPEDIA-12 Package Release V4.2.X.X.	22 October 2021	John Rawlins
5.1	References repaired. Minor editorial changes (e.g. EN54 > EN 54) Updated LPCB Cert Numbers on Pages 2 and 76	28 October 2021	John Rawlins
5.2	Updated following review comments from Zenitel	24 January 2022	John Rawlins
5.3	ASL/Zenitel logos included	01 February 2022	John Rawlins
5.4	Additional recommendation re providing a common 0V interconnection the rack internal PSUs.	26 April 2022	John Rawlins
5.5	Information added re wiring configurations associated with use of Rack Fan Trays.	19 May 2022	John Rawlins
5.6	Release for Publication following internal review	28 June 2022	John Rawlins
5.7	Updated to replace reference to the SDT by HPC	05 January 2023	John Rawlins
5.8	Document History moved to front of the document	09 February 2023	John Rawlins
5.9	7.7.3 Note a) added re non-inclusion of spare amplifiers within a V2000 mainframe. Paragraph added to Section 7.4.1. to warn against storage of combustible materials within a rack assembly	20 March 2023	John Rawlins

Contents

1 Introduction 9
2 CE Certification 10
2.1 ASL Products certified to EN 54-16 11
2.2 ASL PAVA Ancillary Equipment 14
2.2.1 Ancillary Equipment Listing 14
2.2.2 Use of Ancillary Products within an EN 54-16 Compliant System 15
2.3 EN 54 Optional Functions 17
3 Essential Product Documentation 19
4 Key Components of an ASL PAVA System 20
4.1 General Description 20
4.2 VIPEDIA-12 Audio Router 21
4.3 BMB01 GPIO Module 22
4.4 V2000 Amplifier Mainframe 23
4.5 Additional EN 54 PSU Options 24
4.6 Emergency Paging Microphones (MPS/EMS types) 25
5 Examples of PAVA System Architectures 26
5.1 Introduction 26
5.2 Distributed / Networked Systems 29
5.3 PAVA Systems incorporating Dante® 30
5.4 System Configurations incorporating Enhanced Redundancy 31
5.5 Interfacing with Third-Party Control Systems 31
5.5.1 Analogue audio + hardwired control interface 31
5.5.2 Analogue audio + host control interface (hcp) 33
5.5.3 Digital (PMC) audio and SIL/SDK IP interface protocol 33
6 Determination of the System Requirements 34
7 ASL Recommendations for Rack Design Implementation 36
7.1 Introduction 36
7.2 Confirmation of the System Requirements 36
7.3 VIPEDIA-12/V2000 Rack Heat and Power Calculator (HPC) 36
7.4 Additional Rack Design Considerations 37
7.4.1 Electrical Safety Requirements 37
7.4.1.1 Power Supply Isolation 38
7.4.1.2 Earth bonding 38
7.4.2 EN 54 Design Requirements 38
7.5 Cabinet Requirements 41
7.5.1 IP Ratings 41
7.5.1.1 ASL Recommended Racks 41
7.5.1.2 Alternative Rack Types 41
7.5.1.3 Cable Glanding 41
7.6 Implementation of Access Levels 41
7.6.1 General Rules 42
7.6.2 Rack Door Locks 42
7.7 Recommended Equipment Layout within a Rack 44
7.7.1 Equipment Spacing 44
7.7.2 Battery Placement 45
7.7.3 Amplifier Mainframe Placement 45
7.7.4 Audio Router Placement 45
7.8 Power Management 46
7.8.1 Mains Power Distribution 46
7.8.1.1 V2000 Mains Input Connection 46
7.8.2 Battery Power Distribution 47
7.8.2.1 BDIST-V2000 Overview 47
7.8.2.2 BDIST-V2000 Design Rules 48
7.8.3 Battery Charging and Monitoring 48
7.8.3.1 Battery Current when Mains Present 50
7.8.4 Approved Battery Types 50
7.8.5 Power Supplies for Peripherals and Ancillary Equipment 50
7.8.5.1 V2000 Auxiliary Power Output 51
7.8.6 Cabinet Power Distribution Strategy 51

7.8.6.1 Power Supply Strategy for VIPEDIA-12 Audio Routers and Network Switches 52
7.8.6.2 Common 0V Rail 53
7.8.6.3 Provision of Power Indicators (EN 54-16 Clause 5.4) 53
7.8.7 Thermal Management 54
7.8.7.1 General Overview 54
7.8.7.2 Ventilation 55
7.8.7.3 Fan Control 55
7.8.8 Equipment, Terminals and Cable Labelling 57
7.8.8.1 Equipment Labelling 57
7.8.8.2 Cable Labelling 57
7.8.8.3 Fuse Labelling 57
7.8.8.4 Recommended Labelling Implementation 57
8 Additional System Design Guidance 58
8.1 EN 54-16 Emergency Microphones 58
8.1.1 Dual Supplies 58
8.1.2 Maintaining the required EN 54 IP Rating 58
8.1.3 Access Level Compliance 58
8.2 Interfacing with a Fire Alarm Panel 59
8.2.1 Voltage Reversal interface 59
8.2.2 Contact Closure Interface 60
8.3 IP Networking and Switch Configuration 60
9 System Configuration 61
9.1 VIPEDIA-12 and V2000 Static Configuration 61
9.1.1 VIPEDIA-12 Static Configuration for EN 54-16 (standard functions) 61
9.1.1.1 Voice Alarm Zones and Amplification 61
9.1.1.2 Fault Master 61
9.1.1.3 Emergency Microphones (MPS/EMS) 62
9.1.1.4 VA Trigger Inputs from the Fire Alarm Panel (CIE) 63
9.1.1.5 Routing of Background Music or Other Non-Emergency broadcasts 64
9.1.2 VIPEDIA-12 Static Configuration of EN 54-16 (optional functions 64
9.1.2.1 "Alert" Signal 64
9.1.2.2 Manual Silencing of the Voice Alarm Condition 64
9.1.2.3 Manual Reset of the Voice Alarm Condition 64
9.1.2.4 VA Condition Output 64
9.1.2.5 Indication of Faults Related to the Transmission Path with the CIE 64
9.1.2.6 Indication of faults related to Voice Alarm Zones 64
9.1.2.7 VA Manual Control 64
9.1.2.8 Emergency Microphones 65
9.1.2.9 Microphone Priority 65
9.1.2.10 Microphone Emergency Loudspeaker Zone Control 65
9.1.2.11 Redundant Power Amplifiers 65
9.1.3 V2000 Static Configuration Settings 65
9.1.4 VIPEDIA-12 Dynamic Configuration 66
9.1.5 V2000 Dynamic Configuration 67
9.2 Network Configuration 67
10 System Acceptance Test 68
11 CE Marking and Labelling 69
11.1 CE Mark / EN 54 labelling (EN 54-16 clause 15 and ZA.3). 69
11.1.1 Rack Labelling 69
11.1.2 Emergency Microphone Labelling 70
11.2 LPCB Label 70
11.3 EN 54 Power Indicator Label 71
11.4 Product Safety Labelling 71
11.4.1 Terminals and Interconnections 71
11.4.2 Rack Rear Doors 72
11.4.3 Main Earth Point 72
11.4.4 Mains Disconnect Labels 73
11.4.5 Battery Disconnect Labels 73
12 Accompanying Product Documentation 74
Appendix A – ASL Rack Build Instructions 75
A.1 Terminals and Internal Cabling 75

A.1.1 Terminals 75
A.1.2 DIN Rail Locations, Cable Entry Direction and Numbering 75
A.1.2.1 Top entry 75
A.1.2.2 Bottom Entry 76
A.1.3 Identification 76
A.1.3.1 Annotation on the Rack Diagram 76
A.1.3.2 Marking of Terminals 77
A.1.3.3 Fusing 78
A.2 Rack Cross Connections 79
A.2.1 Bayed Rack Systems 79
A.2.1.1 General Signal and Control connections 79
A.2.1.2 Auxiliary Power connections 79
A.2.2 Distributed Rack Systems and Connections to Emergency Microphones 79
A.3 Internal Cable Types and Screen Termination 80
A.3.1 General Rules 80
A.3.1.1 Multi-core Cables 80
A.3.1.2 Screened Cables 81
A.3.2 Pre-manufactured Cable Assemblies 81
A.4 Labelling of Rack Items 82
A.4.1 Safety Labels 82
A.4.2 General Labelling 82
A.4.2.1 Amplifier Front and Back Panels 82
A.4.2.2 MCBs 83
A.4.2.3 MDISTs 83
A.4.2.4 100V Cables 83
A.4.2.5 Project Labelling 84
A.4.2.6 Other Labelling 84
A.5 Laminated Diagrams 84
Appendix B – Thermal Management 85
B.1 Introduction 85
B.1.1 Calculation of the Heat generated by the Rack Equipment 85
B.1.2 Internal Rack Temperature Calculations 85
B.1.3 Confirmation of Maximum Equipment Temperatures 85
B.2 Thermal Estimation 85
B.2.1 Equipment Thermal budgets 86
B.2.1.1 VIPEDIA-12 Power Dissipation 86
B.2.1.3 D500/D150 Power dissipation 87
B.2.1.4 LSZDC Power Dissipation 88
B.2.2 Estimation of Rack Ambient Temperature 88
B.2.2.1 Passive Cooling 88
B.2.2.2 Active Cooling 88
B.3 Summary Guideline for the Installation of V2000 mainframes in a Rack Environment . 93
Appendix C – Enhanced System Design 95
C.1 Hardware Bypass for Emergency Microphones 95
C.2 Standby Amplifiers 95
C.3 A-B Interleaved Loudspeaker Circuits 95
C.4 Dual-Hosted Microphones 97
C.5 Fire Alarm Panel Interface Redundancy 98
C.6 Audio Router and V2000 Redundancy Options 98
Appendix D – Product Documentation 101
D.1 VIPEDIA-12 and V2000 101
D.1.1 System Design Guide 101
D.1.2 Installation and User Guides 101
D.1.3 VIPEDIA and V2000 System Configuration Guides 102
D.1.4 Ancillary Product Documentation 102
D.1.5 Safety Leaflets 105
D.1.6 Test Documentation 105
D.1.7 Rack Design Tool 105
Appendix E – Obsolete Products 106
Appendix F – ASL PAVA Training Courses 108
Appendix G – List of Abbreviations 109
Appendix H - Regulatory Requirements 111

Figures

Figure 1: VIPEDIA-12 Front Panel View 21
Figure 2: VIPEDIA-12 Rear Panel View 21
Figure 3: BMB01 GPIO Unit 22
Figure 4: V2000 Front Panel View 23
Figure 5: V2000 Rear Panel View 24
Figure 6: MPS 20 and EMS 20 Emergency Microphones 25
Figure 7: Example of a simple Centralised / Standalone System 27
Figure 8: ASL Secure Loop Network 29
Figure 9: ASL Secure Loop Network for a distributed PAVA System including Dante® functionality. 30
Figure 10: External and Internal Views of the LLPA05 Interface Unit 32
Figure 11: Typical Hard-wired Interface with an LLPA system 32
Figure 12: Interface with a PCDVA System using the ASL Host Protocol 33
Figure 13: Typical Rack Layout 44
Figure 14: Battery Wiring for V2000 47
Figure 15: Internal Supply Arrangement incorporating a DIN-Rail-mounted DC Power Supply 52
Figure 16: Common 0V Rail Configuration 53
Figure 17: EN 54 Power Indicator Wiring Diagram 54
Figure 18: Mains-Only Powered Fan Tray Configuration 56
Figure 19: Mains/Battery Powered Fan Tray Configuration 56
Figure 20: Volt-Driven Interfacing with the Fire Panel via the BMB01 59
Figure 21: Monitoring the Fire Panel Interface from the BMB01 or VIPEDIA-12 Audio Router 60
Figure 22 : Sample EN 54 Label (for application to systems designed, built and configured by ASL) 69
Figure 23: Sample Equipment Label 70
Figure 24: Sample LPCB Label 70
Figure 25: EN 54 Power Indication Label 71
Figure 26: Rack Climate Control (Schroff) 89
Figure 27: Temperature Distribution (Rack Fan active) 91
Figure 28: Temperature Distribution (Rack Fan disabled) 92
Figure 29: Temperature Distribution (Fan Tray Active) 92
Figure 30: V2000 Installations showing the recommended Fan tray Implementation 94
Figure 31: A-B Loudspeaker Circuit Redundancy (single amplifier) 96
Figure 32: A-B Circuit Redundancy (dual amplifiers) 96
Figure 33: Enhanced A-B Amplifier/Loudspeaker Circuit Redundancy 97
Figure 34: Further Enhanced A-B Amplifier/Loudspeaker Circuit Redundancy inc. Dual VIPEDIA-12s 97
Figure 35: A-B Redundant System Configuration 99
Figure 36: ASL Active/Standby Redundant System Configuration 100

Tables

Table 1: Harmonised Standards associated with ASL product CE compliancy 10
Table 2: EN 54 Certified ASL Rack Mount and Peripheral Equipment included in this Design Guide. 11
Table 3: PAVA Ancillary Equipment 14
Table 4: EN 54 Certified Optional Functionality 17
Table 5: EN 54 Design Requirements associated with the System and Rack Design 39
Table 6: Temperature de-rating for VIPEDIA-12, -NET, -PRO, -TS1 and SFP products 55
Table 7: Network Design and Configuration Documentation 60
Table 8: Terminal Identification Prefix 76
Table 9: Terminal Fuse Requirements 78
Table 10: VIPEDIA-12/V400/V2000 Cable Assemblies 81
Table 11: Temperature De-rating for VIPEDIA-12, -NET, -PRO, -TS1 and SFP products 85
Table 12: VIPEDIA-12 Family Power Dissipations in rack 86
Table 13: Fan Usage Summary 94
Table 14: ASL Obsolete Products – EN 54 certified 106
Table 15: ASL Obsolete Products – EN 54 Certification expired 106

1 Introduction

This document is intended for use by Professional Specifiers and Integrators of Voice Alarm equipment manufactured by ASL for applications which are required to comply with EN 54-16 and/or ISO 7240-16. It provides guidance on the design and installation of rack-based VA systems using the VIPEDIA-12 family of audio routers and V2000 amplifier frames and details both the EN 54-specific and the more general and best practice design principles associated with the design and build of ASL PAVA rack systems.

It should be read and understood by anyone using ASL VA equipment to implement a Voice Alarm System and it is important that:

i) Users of this guide for the design and build of EN 54-certified PAVA Systems have previously undergone formal training in the installation and configuration of the ASL Voice Alarm product range.

   For a list of applicable training courses provided by ASL, please refer to Appendix F.

ii) EN 54-certified systems are designed and built under the auspices of a Factory Quality Control Plan forming part of a formal Quality System (e.g. in compliance with ISO9001).

Users of this Design Guide are expected to be familiar with Voice Alarm equipment standards (particularly EN 54-4 and EN 54-16) and specifications and, in Europe, with the requirements of the Construction Product Regulations.

It is important to note that loudspeakers used for EN 54-compliant Voice Alarm systems must be certified to EN 54-24, although this aspect of the system design and installation is not described in this document.

This document is divided into the following key sections:

- An Introduction to the ASL VIPEDIA-12/V2000-based PAVA Equipment which has been certified to EN 54 including listing of:
  - the associated CE Certification
  - the ASL VIPEDIA-12/V2000-based Product Range.
- Examples of PAVA System Topographies.
- Determination of the Overall System Requirements
- System Design Principles inc.
  - EN 54 requirements
  - Understanding how ASL components are assembled into systems (to meet both mandatory and recommended guidelines)
  - Assembly Safety Requirements
- System Build, Configuration and Test.
- System Labelling Requirements inc. CE Marking

In addition to the above, this document also includes the following appendices:

Appendix A:	Recommendations regarding rack cabling and labelling.
Appendix B:	Review of Thermal Design Requirements
Appendix C:	Enhanced System Design
Appendix D:	Listing of associated Product Documentation
Appendix E : certification	Listing of Obsolete Products and those not listed in ASL's current EN 54
Appendix F:	List of ASL PAVA Training Courses
Appendix G:	List of Abbreviations used in this document
Appendix H:	Details of the Regulatory Requirements

2 CE Certification

In addition to compliancy with the requirements of EN 54-16 and ISO 7240-16, the VIPEDIA-12 based product range described in this document conforms with EU Directives 2011/65/EU & 2015/863/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and conform with the provisions of the following EU Directives:

- Low Voltage Directive (LVD) 2014/35/EU
- Electromagnetic Compatibility Directive (EMC) 2014/30/EU

by application of the harmonised standards referenced in the table below which are correct at the time of publication of this document:

Table 1: Harmonised Standards associated with ASL product CE compliancy

No	Characteristic	Performance declaration			Standard Title
		Standard	Version	Class	
01	LVD Compliance	EN 62368-1	see note below	III	Audio/video, information and communication technology equipment – Part 1: Safety requirements
02	EMC Compliance	EN 55032	as above	A	Electromagnetic compatibility of multimedia equipment - Emission requirements
03	EMC Compliance	EN 55103-2	as above	E5	Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 2 – Immunity.
04	EMC Compliance	EN 50130-4	as above	-	Alarm Systems Part 4. Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
05	EMC Compliance	EN 50121-4	as above	-	Railway applications – Electromagnetic compatibility. Part 4: Emission and immunity of the signalling and telecommunications apparatus
06	EMC Compliance	EN 61000-6-2	as above	-	Electromagnetic compatibility – Part 6-2: Generic standards – Immunity for industrial environments
07	EMC Compliance	EN 61000-6-4	as above	-	Electromagnetic compatibility (EMC)- Part 6-4: Generic standards – Emission standard for industrial environments

In addition, this equipment has been tested and conforms to the following non-harmonised standard:

No	Characteristic	Standard	Version	Class	Standard Title
08	EMC Compliance	EN 55103-1	as above	E4-E5	Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 1 – Emission.

Note:

The versions of the standards listed above applicable to the ASL product certification are listed in the associated certification documents which may be obtained from the "Downloads" area of the ASL website.https://asl-control.co.uk/downloads/?limit=&catid=764&ftags=Certificates. **N.B. in order to access documents from the download site, it will first be necessary to register and login in.**

2.1 ASL Products certified to EN 54-16

The following tables list the ASL products certified to EN 54-16 and include the power supply equipment components approved to EN 54-4 and are correct at the time of publication of this document. For the latest up-to-date listing please visit https://asl-control.co.uk/downloads/?limit=&catid=764&ftags=Certificates and download document "EN-54-and-LPCB-Certificate-of-Product-Approval.pdf". N.B. in order to access documents from the download site, it will first be necessary to login in.

Although individual products may be certified to EN 54, it is important to understand that, in order for a VA system to comply with the requirements of the standard, the constituent products must be installed and configured in accordance with the design rules provided in this document and the instructions given in the individual product specific installation and user guides as listed in Appendix C of this document. N.B. Latest release versions of these documents are available via the ASL website, but please contact ASL if you require any further information or clarification.

If a VIPEDIA-12/V2000-based VA System also includes ASL VAR-based equipment, it will also be necessary to refer to the VAR-Based System Design Guide T-0667-0016, as noted in the table below.

For Systems incorporating the ASL Integra Wall-Mounted products, please refer to the "EN 54-16 Integra Design Guide, T-0667-0231.

Table 2: EN 54 Certified ASL Rack Mount and Peripheral Equipment included in this Design Guide

Product	Variants	Description
VIPEDIA-12	VIPEDIA-12	VIPEDIA-12 12*12 IP Voice Alarm Audio Router
	VIPEDIA-12-NET	VIPEDIA-12 with network card
	VIPEDIA-12-PRO	DSP Audio Processor with Dante® and network card
	VIPEDIA-NET	VIPEDIA-12 Network Card
	VIPEDIA-NET-4GB	VIPEDIA 12 Network Card with 4GB Audio Storage
	SFP-SM1G	SFP Module, Single-mode fibre.
	SFP-MM1GL	SFP Module, Multi-mode fibre.
	SFP-MM1GC	SFP Module , Multi-mode fibre
	SFP-CU1G	SFP Module, Copper Ethernet.
	BOA01	RJ45 DIN Terminal Breakout Adaptor – Single Port – With Terminations
	BOA02	RJ45 DIN Terminal Breakout Adaptor – Four Port – Straight Through
Modular Amplifier	V2000	V2000 Amplifier frame for housing D series amplifiers and amplifier interfaces
	D500	Amplifier Module 500W
	D150	Amplifier Module 150W
	LSZDC	Dual Line surveillance Interface card
	V2000-STBY	Standby Amplifier Interface card

Product	Variants	Description
EMS Series (see Note 1)	EMSxx(MK2)	Emergency Microphone which provide access to the EN 54 mandatory user interface (indications and controls). Where: xx = 01 : All call only xx = 10 : 10 button + PTT xx = 20 : 20 button + PTT xx = 30 : 30 button + PTT xx = 40 : 40 button + PTT xx = 50 : 50 button + PTT The suffix –EC may be added to indicate a euro-cylinder lock is fitted. Note: the Fire Emergency purposes EMS series of microphones
MPS Series (see note 1)	MPSxx-y0-AN	Paging and Emergency Microphone which provide access to the EN 54 mandatory user interface (indications and controls). Where: xx = 01 : All call only xx = 10 : 10 button + PTT xx = 20 : 20 button + PTT xx = 30 : 30 button + PTT xx = 40 : 40 button + PTT xx = 50 : 50 button + PTT y = G : Gooseneck Microphone; y = F : Fist Microphone An optional wall mount kit is available for MPS01/10/20.
BMB01	BMB01	RS485 Interfaced Analogue and Digital I/O Expansion Unit
Battery Packs and Chargers	BPC65	Battery Charger with Mounting Tray – 65Ah – Inc. Cables and Breakers
	BPC75	Battery Charger with Mounting Tray – 75Ah – inc. Cables and Breakers
	BPC130	Battery Charger with Mounting Tray – 130Ah – Inc. Cables and Breakers
	BPC65-BATT	Battery Pack for use with BPC65 – (2 x 12V 65Ah batteries)
	BPC75-BATT	Battery Pack for use with BPC75 and V2000 – (2 x 12V 75Ah batteries)
	BPC130-BATT	Battery Pack for use with BPC130 – (4 x 6V 65Ah batteries)
Network Switches	NETWORK-SWITCH-MM4	Multi-mode Secure Loop Switch (2*fibre, 2*RJ45)
	NETWORK-SWITCH-SM4	Single-mode Secure Loop Switch (2*fibre, 2*RJ45)

Product	Variants	Description
	NETWORK-SWITCH-MM8	Multi-mode Secure Loop Switch (2*fibre, 6*RJ45)
	NETWORK-SWITCH-SM8	Single-mode Secure Loop Switch (2*fibre, 6*RJ45)
	NETWORK-SWITCH-NF8	Secure Loop Switch (8*RJ45)
	NETWORK-SWITCH-LP01	Network Loop Switch (2*SFP, 8*RJ45)
VAR Routers (see notes 2 and 3)	VAR4 (EN 54)	Audio Router 4 x 4 DSP – EN 54
	VAR12(EN 54)	Audio Router 12x12 DSP – EN 54
	VAR20(EN 54)	Audio Router 20x20 DSP – EN 54
V400 Amplifier Mainframe (see notes 2 and 3)	V400	V400 Amplifier frame for housing M series amplifiers and amplifier Interfaces
M-series amplifiers (see notes 2 and 3)	M100	Amplifier Module 100W
	M200	Amplifier Module 200W
	M400	Amplifier Module 400W
Amplifier Interfaces for V400 mainframe (see notes 2 and 3)	LSDDC	Dual Line Surveillance Interface
	SSINT	Standby Surveillance Interface
X400 Amplifier Mainframe (see notes 2 and 3)	X400	X400 Amplifier frame for housing MX series amplifiers
MX Series amplifiers (see notes 2 and 3)	MX100	Amplifier Module 100W – MX Series
	MX200	Amplifier Module 200W – MX Series
	MX400	Amplifier Module 400W – MX Series

Notes:

1. *When used as Fire Microphones, the ASL EMS and MPS ranges must connect directly to the Vipedia-12 audio routers via a hard-wired connection. Use of an IP connection is not included in the EN 54 certification.*
2. *Use of these products is defined in the VAR System Design Guide (T-0667-0016).*
3. *These products are now obsolete and are not recommended for use on new projects (see Appendix E).*

2.2 ASL PAVA Ancillary Equipment

2.2.1 Ancillary Equipment Listing

The following ASL equipment may be provided as part of a PAVA system compliant to EN 54-16. These items are not listed on ASL's EN 54 Product certification either because:

a) their function falls outside the scope of the standard but may be necessary to support the EN 54-16 functionality (e.g., EOL10K and EOLZ end of line units).

or

b) they provide non-VA-related functionality (i.e., associated purely with PA applications) not defined in the EN 54 standards. N.B. in this case, the VA system must be configured such that these functions do not impact on its ability to meet all the performance requirements of a VA system.

Table 3: PAVA Ancillary Equipment

Product	Variants	Description
End-Of-Line Terminator and Line Blocking Capacitor Kits (see note 1)	EOL10K	End of Line Resistor: 10k 3W 1% 20PPM
	LBCs	Line blocking capacitor: 10% 250V DC polyester capacitors
Impedance Monitoring Terminator (see note 1)	EOLZ	End-of-Line Impedance Ballast
ANS Series	ANS04	IP65 Ambient Noise Sensor
	ANS04ES	Extended Temperature Ambient Noise Sensor
	ANS04E	Extended Temperature Shrouded Ambient Noise Sensor
DANS Sensors	DANS01	Dynamic Ambient Noise Sensor
VRMS Microphones	VRMS4-IP	Stainless steel, vandal resistant paging microphone (IP)
	VRMS4-C1	Stainless steel, vandal resistant paging microphone (hard-wired)
Station Announcement Point Microphones	SAP02	Single button paging microphone for rail applications. (Also supports the RMR02 Radio Microphone Receiver option for use with the RPA01 hand-held radio transmitter)
	SAP03	Paging microphone for rail applications with built-in 10 button zone selection panel.
Remote Radio Microphone Receiver	RRM02	Radio Microphone Paging Point (for use with the RPA01 hand-held radio transmitter)
Remote Control Unit	WMC01	Wall Mount Controller

Product	Variants	Description
Remote Volume Controls and Program Selectors	VC01-P	Single gang plastic panel mounted volume control
	VC01-M	Single gang metal panel mounted volume control
	PS01-P	Single gang plastic panel mounted program selector
	PS01-M	Single gang metal panel mounted program selector
	VCPS02-P	Double gang plastic panel mounted volume control and program selector
	VCPS02-M	Double gang metal panel mounted volume control and program selector
TS1 (see note 1)	VIPEDIA-TS1	Terminal Server module.
ILP Series	ILP02	Induction Loop Panel
Terminators are required to LMT Series	LMT100	Induction Loop Line matching transformer (100W)
	LMT200	Induction Loop Line matching transformer (200W)
	LMT100R	Induction Loop Line matching transformer (100W) with relay
	LMT200R	Induction Loop Line matching transformer (200W) with relay
Mains Distribution	MDIST-V2000	Mains distribution block for use with V2000
V2000 Cooling accessories	RAK-FAN-01	Fan tray for V2000 (standard flow)
	RAK-DUCT-01	Cooling Duct for V2000
DIN Rail Supply (see notes 1 and 2)	Hirschmann RPS80	120/240VAC input DIN rail supply adjustable to 28V
	Meanwell SDR-75-24	85- 264VAC input DIN rail supply adjustable to 28V.

Notes:

1. *These products have been submitted to ASL's notified body to demonstrate compliance with the requirements of EN 54-16. (e.g. EOL Terminators are not defined in EN 54-16 as a component of a VACIE but are required as part of an ASL VACIE to enable detection of an open/short-circuit failure of the transmission patch between the VACIE and the associated loudspeakers).*
2. *These products may be used to provide a mains-derived power source for EN 54-related equipment provided that an EN 54-4 compliant supply is available to take over in the event of a mains supply failure.(refer to Section 7.8.6.1)*

2.2.2 Use of Ancillary Products within an EN 54-16 Compliant System

This section details the basic rules covering how the products listed in Table 3 above may be used within a Voice Alarm system.

- **Microphones**

  The microphone types listed in **Table 3** above may be included in an EN 54 compliant system provided that are not defined as providing an emergency function and that their assigned priority is lower than that of all the emergency functions (e.g., Emergency Microphones (see note below) and Evacuation/Alert messages).

Note: EN 54-16 uses the term “Emergency Microphone” to refer to what ASL have traditionally referred to as a “Fire Microphone”. This document refers to all such types as "Emergency Microphones".

- **Ambient Noise Sensors (ANS and DANS)**

  The system should be configured such that **only** non-emergency announcements are under ANS/DANS Control.

- **End of Line Devices (EOL10K, EOLZ, AEL01)**

  Use of these devices is required to enable loudspeaker lines to be monitored to end of line as required by UK Code of Practice BS5839 Part 8. They are not included in the EN 54 certification as EN 54-16 does not include any reference to such devices.

  Where End-of-Line monitoring is performed using the DC method (i.e. using the EOL10K option) loudspeakers must be fitted with series capacitors. These may be built-in to the loudspeakers or fitted prior to installation by use of the ASL LBC capacitor kit.

- **Audio Induction Loop-based products (ILP02, LMT series)**

  These devices are specifically designed to assist the hard-of-hearing to hear non-emergency announcements (e.g., travel information in railway stations or airports). They are not included in the ASL EN 54-16 certification as the standard does not reference these types of device. However, their connection to a Voice Alarm System may be monitored and they may assist with the broadcast of emergency announcements to the hard-of-hearing.

- **Other items listed in Table 3**

  The items listed in **Table 3** which a**re** not specifically described **in this sub-section,** provide functionality within a VA system rack which is not directly defined within the requirements of EN 54.

- **Other non-certified products not included in Table 3**

  Other non-certified products may be added to an EN 54 Voice Alarm system, but they must not adversely affect the ability of the system to meet any of the requirements defined by the associated EN 54 standards and, in particular, they must not be used to provide:

  i) a sole dedicated VA transmission path,

  ii) a sole VA dedicated power supply source,

  iii) a display point for VA signals and mandatory indications.

2.3 EN 54 Optional Functions

EN 54-16 and its international (near) equivalent ISO 7240-16 define certain functions of the equipment, some of which are optional.

The table below lists the optional functions and identifies which of these are supported by the ASL VIPEDIA-12/V2000-based range of PAVA equipment.

Table 4: EN 54 Certified Optional Functionality

Option	EN 54-16 Clause	ISO 7240-16 Clause	Supported?
Alert Signal	N/A	7.2	Yes (see note 1) (refer to Section 9.1.2.1)
Voice Alarm Audible Warning	7.3	7.5	No (see note 2)
Delay(s) to entering the Voice Alarm Condition	7.4	7.6	No (see note 2)
Phased Evacuation	7.5	7.7	No (see note 2)
Manual Silencing of Voice Alarm Condition	7.6.2	7.8.2	Yes, using a configured MPS/EMS button. (refer to Section 9.1.2.2)
Manual Reset of the Voice Alarm Condition	7.7.2	7.9.2	Yes, using a configured MPS/EMS button. (refer to Section 9.1.2.3
Output to Fire Alarm Devices	7.8	7.10	No (see note 3)
Voice Alarm Condition Output	7.9	7.11	Yes, via a configured contact output. (refer to Section 9.1.2.4)
Indication of faults related to the transmission path to the CIE	8.3	8.2.6.1	Yes, using monitored contact (analogue) inputs to interface with the Fire Alarm Panel trigger/reset outputs. (refer to Section 9.1.2.5)
Indication of faults related to Voice Alarm Zones	8.4	8.2.6.2	Yes (refer to Section 9.1.2.6)
Disablement or Test Conditions	9.4	9	No
Voice Alarm Manual Control	10	11	Yes, using a configured MPS/EMS button (refer to Section 9.1.2.7)
Interface to External Control Devices	11	12	No

Option	EN 54-16 Clause	ISO 7240-16 Clause	Supported?
Manual Control - Indication of emergency-loudspeaker zones in the fault warning condition	N/A	11.3	Yes, via the MPS/EMS button indicator LEDs.
Emergency Microphones	12	13	Yes, using EMS and MPS microphones. (refer to Section 9.1.2.8
Microphone Priority	12	13.2	Yes (refer to Section 9.1.2.9)
Microphone emergency-loudspeaker-zone control	N/A	13.3	Yes (refer to Section 9.1.2.10)
Redundant Power Amplifiers	13.14	14.14	Yes (refer to Section 9.1.2.11)

Notes:

1) *Alert Messages may be included in EN 54-16 certified systems provided that that they are configured with a broadcast priority below that of the Voice Alarm Evacuation Messages.*
2) *This functionality may be supported via the Fire Panel.*
3) *"Fire Alarm Devices" are devices such as beacons, sounders, vibrating devices.*

3 Essential Product Documentation

It is essential that those responsible for system design and manufacturing have the relevant copies of the documentation listed in Appendix D of this Design Guide as defined by the associated project requirements:

The documentation listed in Appendix D includes installation, Configuration and User guides for:

- all ASL products specifically associated with VIPEDIA-12 based EN 54-16 Voice Alarm System design and build

and

- other ASL products (e.g., V400 and X400 amplifier ranges)

Unless otherwise identified, all the listed documentation is available for download from the ASL website

It is highly recommended that users of this documentation regularly check the ASL website to ensure:

- that they hold copies of the latest information

  and

- that they are aware of the availability of any new documents, as and when they may be published.

4 Key Components of an ASL PAVA System

4.1 General Description

The key components associated with an ASL Rack-mounted Voice Alarm System are:

Rack-mounted Equipment

- VIPEDIA-12 Audio Router
- V2000 Amplifier Mainframe inc.
  - D150 / D500 Amplifier Modules
  - LSZDC Loudspeaker Line Interface modules
- EN 54 Chargers and associated batteries
- BMB01 GPIO Interface Units

Peripheral Equipment

- EMS Emergency Microphones
- MPS (Emergency/Paging Microphone Consoles

Systems incorporating VIPEDIA-12 audio routers and V2000 amplifier mainframes may be configured in a variety of ways to meet individual system requirements which may include both Public Address (PA) and Voice Alarm (VA) functionality.

The systems are based on centrally located or distributed wall- and rack-mounted amplifiers and control equipment with connections to remote peripheral Emergency Microphones and loudspeakers and standard interfaces are provided for connection to EN 54-2 certified Fire Alarm Panels.

All signal paths and functionality associated with emergency purposes within the systems can be monitored over and above the requirements defined by EN 54.

Examples of PA functionality, which are independent of the VA requirements, include the incorporation into the system of:

- Zoned paging microphones
- Background music sources
- Long Line PA interfaces
- Ambient Noise Control (ANS or DANS)
- WMC01 Wall Mount Controllers
- Control Systems (e.g., ASL iVENCS and VIPA-Workstations)

In addition to the above, the VIPEDIA-12-PRO provides support for Dante® audio networking for use in PA applications.

For systems including both PA and VA functionality, the system design and configuration must ensure that, under all circumstances, VA Alarm functionality takes priority over PA functionality.

The key components of the PAVA systems described in this Design Guide are shown below.

4.2 VIPEDIA-12 Audio Router

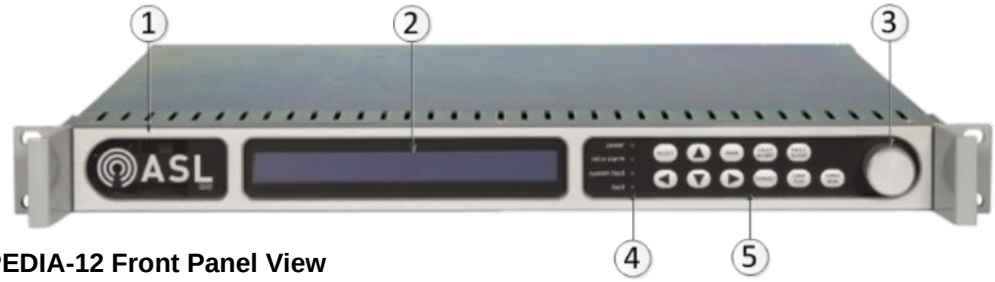


Figure 1: VIPEDIA-12 Front Panel View

1. Fault Sounder & Audio Monitoring Loudspeaker
2. 2 x 40 backlit LCD Alphanumeric Display
3. Rotary Control for increment and decrement of menu items & volume control of monitor audio
4. Mandatory EN 54 Indications
5. Menu Control Buttons

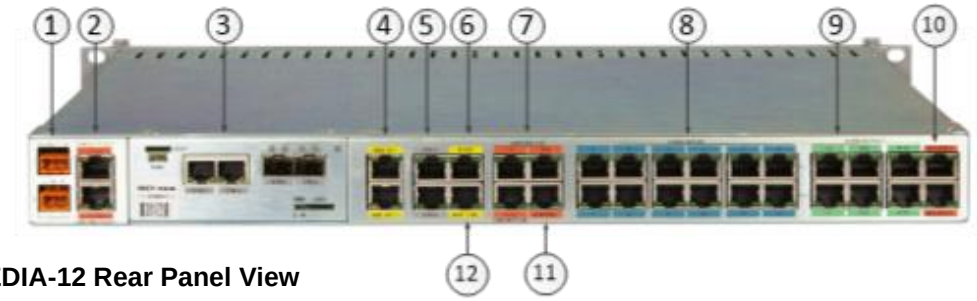


Figure 2: VIPEDIA-12 Rear Panel View

1. 18V -40V Dual DC Power Supply Input Connectors.
2. GPIO Outputs 1 to 12 (e.g., for Route-Busy signals, VA status and EN 54-16 optional fault indication) (see note 1)
3. Netcard incorporating wired Ethernet network connections and slots for SFPs (Optical fibre or wired, as required).
4. DBB Expansion Ports (to interconnect audio routers to provide a maximum 48 in x 48 out configuration).
5. Additional wired Ethernet Network Connections
6. RS232 Port (for diagnostics)
7. GPIO Inputs 1 to 12 (e.g., for Routing control or to enable indication of external equipment faults and may be configured as Volts-free or Volts-driven) (see Note 1)
8. Microphone / Audio Inputs 1 to 12 (see note 2)
9. Audio Outputs 1 to 12 (A&B)
10. Hardware Bypass Emergency Microphone (inputs 1 and 2) and Listen-in Interfaces
11. EN 54 General Fault & Voice Alarm Relays and ASL BMB01 Serial Interface (see note 1).
12. Amplifier Control Interface (Audio-CAN) (for connection to ASL V400 and X400 amplifier mainframes)

Each VIPEDIA-12 provides storage for up to 64 different DVA messages with a total maximum

duration of 40 minutes (12kHz sample rate), 20mins (24kHz sample rate) and 10 minutes (48kHz sample rate).

Notes

1: The internal GPIO Input Ports can be configured as:

- Volts-free (monitored/unmonitored) or Volts-Driven

N.B. ASL recommend that, for Fire Alarm Panels requiring a Volts-Driven interface, the interface should use the digital inputs provided by a BMB01 GPIO interface unit (see Section 4.3 below) , as the VIPEDIA-12 GPIO input ports provide a high-resistance path to ground, sufficient, in some cases, for the Fire Alarm Panel to report an Earth Leakage fault.

- The internal GPIO Output Ports, when configured, are monitored for overcurrent (when active) and connection via the associated load to the 24V supply (when inactive).

2: Each Microphone / Audio input includes:

i) an RS485 port as the control interface for the associated microphone. For unused analogue inputs, this port can be assigned as a host control interface port (HCP) (e.g., for connection to a PC-DVA System or ASL VIPA-Host).

ii) a 24Vdc nom output (EN 54 compliant)

4.3 BMB01 GPIO Module

The BMB01 GPIO Module is designed to be DIN-rail mounted within a PAVA System Rack to provide a means of extending the GPIO capability of VIPEDIA-12-based PAVA Systems. A maximum of nine BMB01 units may be connected to a single VIPEDIA-12 via an RS485 interface and each unit provides:

- GPIO outputs (x12) : monitored as described for the VIPEDIA-12 internal GPIO output ports.
- Analogue GPIO Inputs (x12) : provides monitored GPIO input capability and the connection of ANS units.
- Digital GPIO Inputs (x12) : configurable for Volts-free or volts-driven functionality (e.g. interfacing with Fire Alarm Panels).

Figure 3: BMB01 GPIO Unit

For details regarding interfacing with Fire Alarm Panels via the VIPEDIA-12 and BMB01 input ports, please refer to Section 8.2 of this document.

For further information regarding the VIPEDIA-12 and BMB01 connection details, please refer to the associated installation guides listed in Appendix D, Sections D.1.2 and D.1.4.

4.4 V2000 Amplifier Mainframe

The V2000 Amplifier Mainframe has an overall audio power output capability of 2000W and is designed to support up to ten amplifier modules (D150 (150W) and D500 (500W) each of which is capable of connection to dual A/B loudspeaker circuits.

N.B. The V2000 may be configured for use on a 120Vac mains supply in which case the overall power output capability of the frame is limited to 1000W.

The V2000 Mainframe also incorporates a Mains/Battery EN 54-4 compliant power supply and an auxiliary output (24Vdc nom) is provided to power the VIPEDIA audio routers and other ancillary equipment.

The diagrams below show the general layout of indicators and terminations associated with the V2000 mainframe.

Figure 4: V2000 Front Panel View

1. Amplifier Indication LEDs (per amplifier)
2. Mainframe Indication LEDs (per frame)

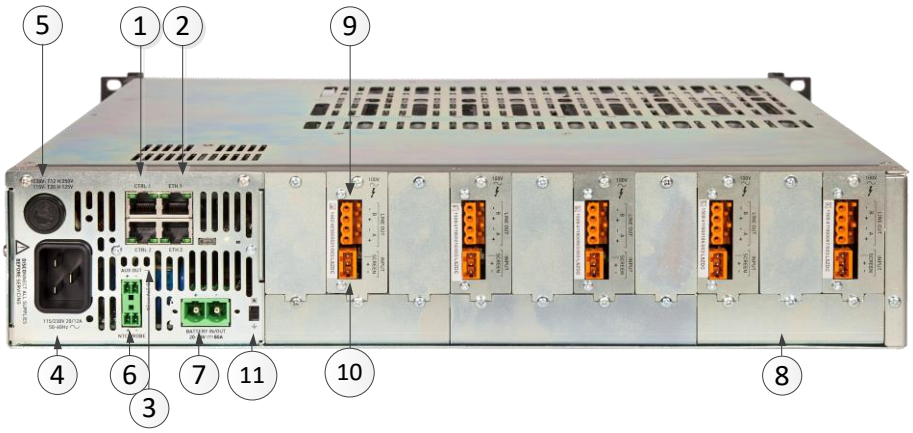


Figure 5: V2000 Rear Panel View

1. RS485 & Audio Monitor
2. Dual Ethernet Ports
3. Status LED
4. Mains Power Input
5. Mains Fuse
6. DC PSU Output & Battery Temperature Sensor
7. DC Power Input & Battery Charger Output
8. V2000-STBY Slot (Not fitted)
9. 100V A & B Loudspeaker Amplifier Output (via LSZDC interface card) (see Note)
10. Amplifier Audio Input
11. Earth Lift Switch

Note: The V2000 above is shown as populated with five D150/D500 amplifier and LSZDC Interface modules. These items are not included with the V2000 and must be separately ordered as required.

4.5 Additional EN 54 PSU Options

While the V2000 can provide the necessary battery charging capability, it may be necessary to provide additional capacity to support routers and peripheral equipment in larger systems.

Where this is the case, the ASL BPC65 and BPC 130 charger trays may be utilised (see Section 7.8.3 for further information).

Details of the approved battery types for use with these products are available in the associated product documentation listed in Appendix D, Section D.1.4.

4.6 Emergency Paging Microphones (MPS/EMS types)

Figure 6: MPS 20 and EMS 20 Emergency Microphones

Both types of microphone shown in the photos above may be configured as Emergency Microphones.

The EMS range (RH photo) are protected from access level 1 access by the use of a key lock on the front door of the unit.

The MPS range of microphones (LH photo) can be configured for use as emergency microphones such that functions only permitted under access level 2 are only made available by use of a keyswitch located on the LHS of the console base.

For further details of the access levels defined by EN 54-16, please refer to Sections 7.4.2, 7.6 and 8.1.3 of this document.

EN 54 Functions available at Access Level 1 include:

- *Live PA Paging Broadcasts (priority lower than the Emergency priority settings)*
- *Fault Indication (Display and Sounder)*
- *Fault Accept (silences the faulter Sounder)*
- *Route Status*

EN 54 functions available at Access Level 2 include:

- *Live VA Emergency Broadcasts (Priority greater than that of the automated announcements)*
- *Fault Reset*
- *Emergency Message Selection and Routing*
- *VA Silence (Mute)*

Interconnection details

- *The EMS range connect via a DIN-Rail connector located within the enclosure.*
- *The MPS range connect via RJ 45 connectors located in the base of the console.*

For further information, please refer to the associated Installation guides as listed in Appendix D, Section D.1.4.

5 Examples of PAVA System Architectures

The following sub-sections provide examples of typical system configurations using the VIPEDIA-12 and V2000 products. The associated diagrams, intentionally separate the EN 54 and non-EN 54 functionalities to identify the demarcation between the VA and PA functionality.

5.1 Introduction

ASL systems may be configured as

a) Centralised Stand-Alone systems

or

b) Distributed Networked systems

Standalone systems are centrally-based (i.e. installed in a single or bayed rack configuration) and are generally suitable for smaller installations (e.g. coverage within a single building).

For larger installations (large buildings or wide-area sites (e.g. large Railway Termini, Airports, Exhibition Centres, Ports etc), the cost and complexity involved in interfacing peripheral equipment (e.g. microphones , ANS or DANS units) and loudspeaker circuits to a central rack location may be considerable. In such cases, the cabling costs can be minimised by installing a multi-node system, distributed throughout the required area of coverage and interconnected via a wired or fibre-optic network.

In order to provide necessary redundancy and comply with the requirements of EN 54-16 Clause 13.5 the network connection between rack nodes should be connected in a loop such that if one section of the loop is damaged, full system functionality can be maintained.

Centralised / Stand-alone Systems

Figure 7 shows a VIPEDIA-12 at the heart of a simple stand-alone system. This system can accommodate up to 12 analogue audio inputs and 12 analogue outputs. However, by use of the DBB (digital backbone) interface, it may be expanded to incorporate up to a total of four VIPEDIA-12 units, thereby enabling the physical configuration of 24 x 24, 36 x 36 or 48 x 48 router inputs/outputs.

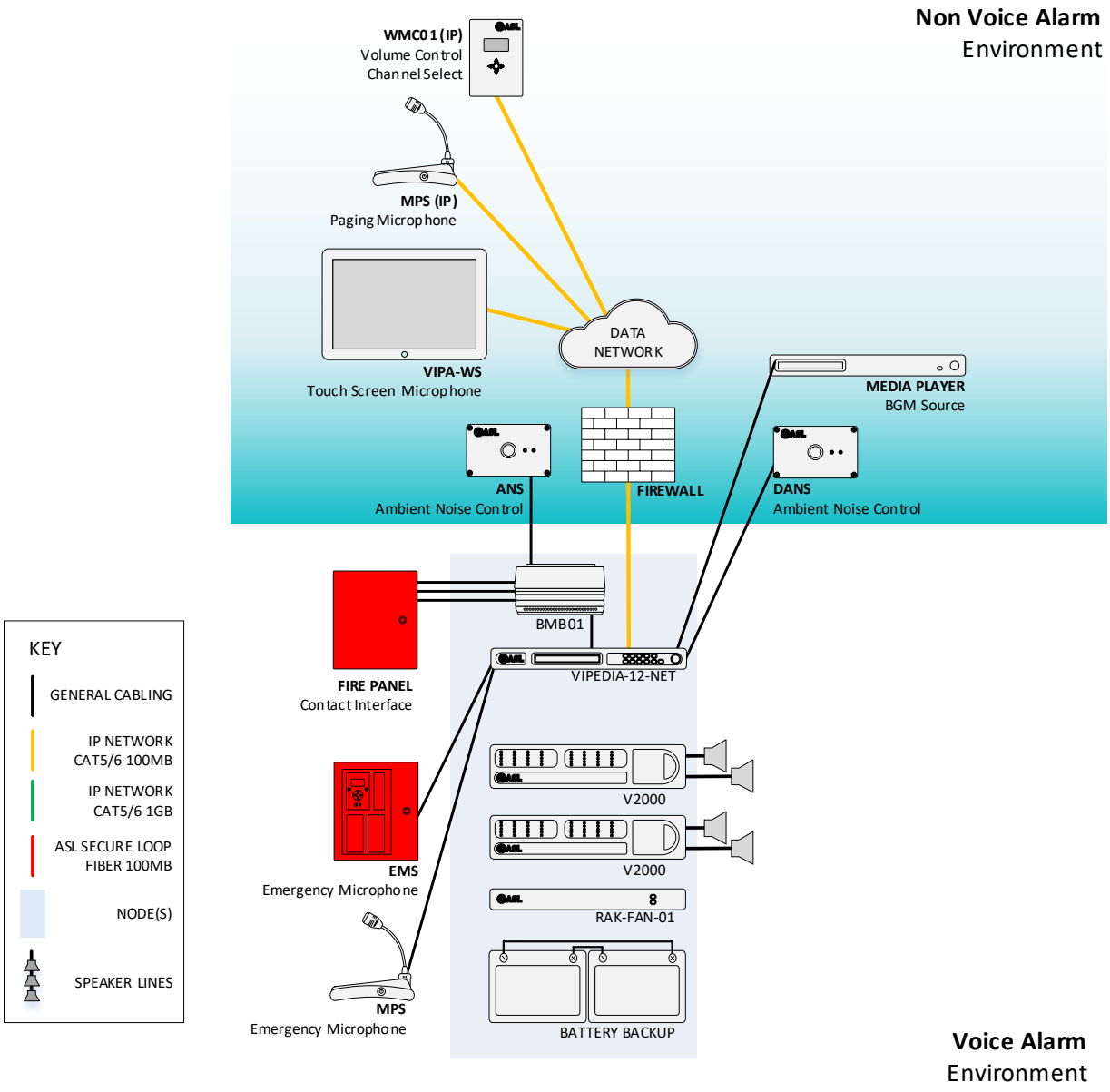


Figure 7: Example of a simple Centralised / Standalone System

In this example, the VA system includes the following key elements:

- Fire Alarm Panel (by others) interfaced via a BMB01 I/O Expansion unit
- EMS Emergency Microphone
- MPS Emergency Microphone
- VIPEDIA-12 Audio Router

- V2000 Amplifier Mainframes (x2)
- Battery Backup
- Loudspeaker circuits (incorporating End-of-Line monitoring)

The system also includes a number of elements which provide additional PA functionality and which must be configured such that they cannot jeopardise the VA performance of the system.

a) Items of equipment connected to a non-VA network with Firewall protection:

- MPS Paging Microphone (IP network connection)
- ASL VIPA Workstation
- Wall Mount Controller (WMC01)

b) Direct connection into the VIPEDIA-12

- Ambient Noise Sensors (ANS) (option also for connection via the BMB01 GPIO Analogue Inputs)
- Dynamic Ambient Noise Sensors (DANS) (via VIPEDIA-12 audio inputs)

N.B. Where ambient noise control is included in a PAVA System, it should be configured such that it only adjusts the broadcast levels for non-emergency announcements.

5.2 Distributed / Networked Systems

The example described by Figure 8 below includes the same types of VA and PA elements described for the stand-alone system but differs by the incorporation of a dedicated optical-fibre or copper ethernet loop which links the three system nodes using ethernet switches housed within the VIPEDIA-12/V2000 racks at each node.

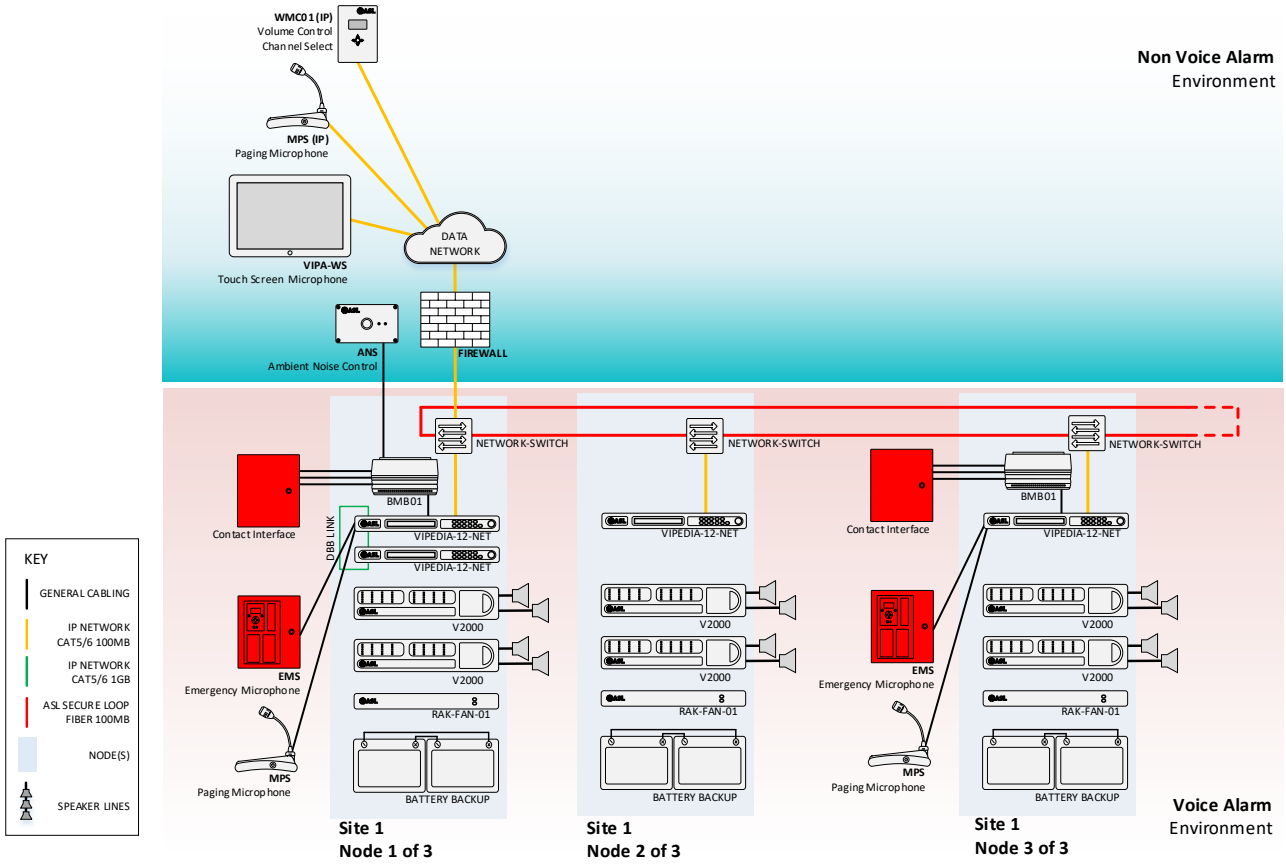


Figure 8: ASL Secure Loop Network

The ethernet switches within the racks shall be powered from an EN 54-4 compliant power supply so that if mains power is lost, the network will continue to operate without interruption (refer to Section 7.8.6 for further details).

The associated network switches must be configured such that they and the Secure Loop are continually monitored for IP connection and power supply failures, in order to confirm the operational status of the network. Any associated faults must be reported as specified by EN 54-16 via GPIO contacts and the fault defined as a "POWER" fault.

The dedicated Ethernet Loop ensures that,

- In the event of a fire, there is adequate network bandwidth to ensure that emergency announcements can be made.
- the available bandwidth for the PAVA system cannot be jeopardised by its use by other Emergency or non-Emergency functions.
- In the event of a single network fault, there is still another path available for emergency messages to be broadcast.(see EN 54-16 Clause 13.5 – Integrity of Transmission Paths).

Further information regarding the configuration of Networked Systems utilising the VIPEDIA-12 and VIPEDIA-12-PRO product range may be obtained from the ASL "Network Design Guide" and the Configuration Guide associated with each of the Network Switches included in the ASL product range (please refer to Appendix D – Section D.1.3).

5.3 PAVA Systems incorporating Dante®

Dante® is a combination of software, hardware, and network protocols that delivers uncompressed, multi-channel, low-latency digital audio over a standard Ethernet network using Layer 3 IP packets.

Dante® audio is supported using the VIPEDIA-12-PRO and Dante® audio networks using ASL audio routers and care must be taken to ensure that they are correctly configured particularly regarding network compatibility and EN 54-16 compliance.

Figure 9 below shows a distributed PAVA System similar to that described in **Figure 8** but with the addition of a Dante® audio interface.

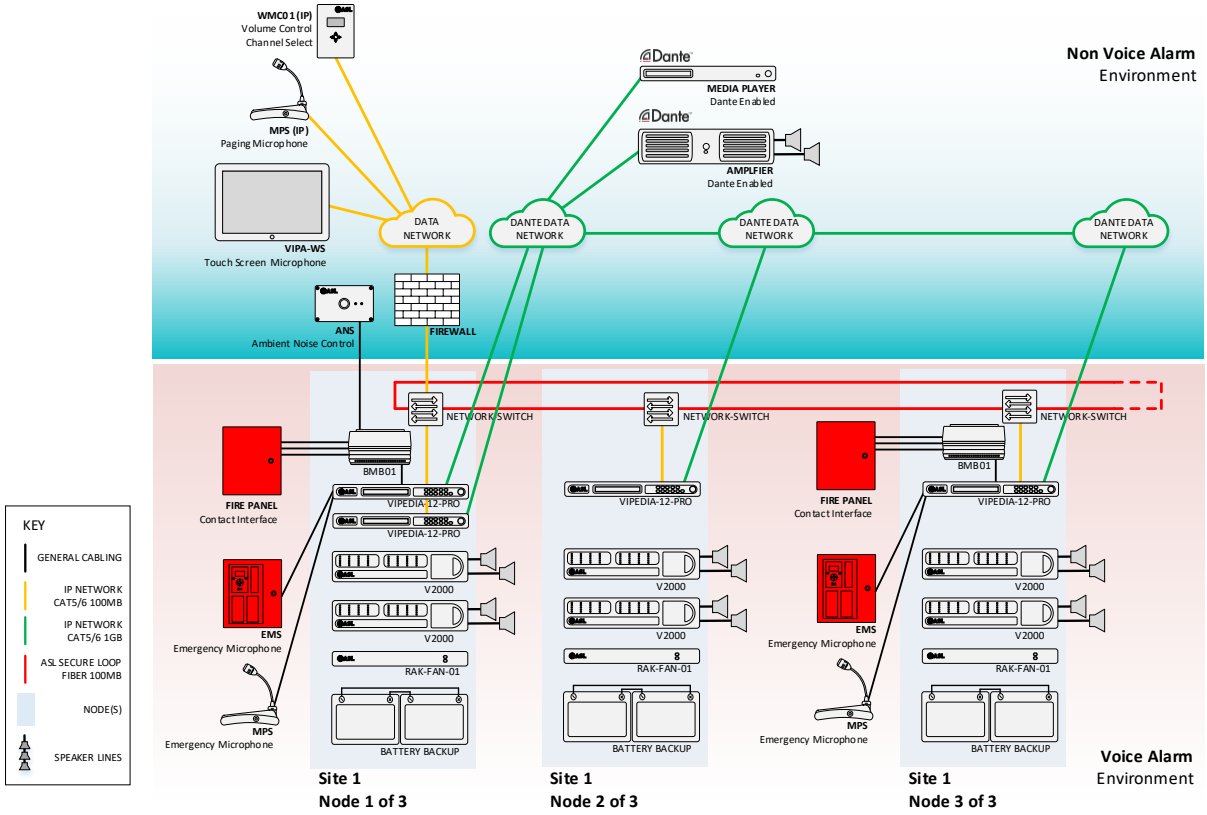


Figure 9: ASL Secure Loop Network for a distributed PAVA System including Dante® functionality.

When configuring a secure loop network incorporating VIPEDIA-12-PRO audio routers:

- the routers must connect to the network via external switches.
- The DBB function cannot be used to interface multiple VIPEDIA-12-PRO audio routers.

As shown in the diagram above, the Dante® route (indicated in green) is made between the Dante® Media Player and each of the associated VIPEDIA-12-PRO audio routers. Provision is also made for PA announcements to be broadcast via a Dante® equipped audio amplifier. N.B. Dante® routes are not directly monitored by the PAVA system and therefore must not be used for VA broadcasts (e.g. the distribution of automated or manually-controlled emergency announcements).

In order to avoid Dante® traffic appearing on the dedicated VA fibre loop (indicated in red), a separate Dante® network has been provided with individual connections to each of the VIPEDIA-12 audio routers.

Further information regarding the configuration of Dante® equipped Systems utilising the VIPEDIA-12-PRO range of products may be obtained from ASL "Dante® Configuration Guide" (refer to Appendix D, Section D.1.3).

5.4 System Configurations incorporating Enhanced Redundancy

Redundancy may be designed into an ASL PAVA system to improve its resilience under fault conditions and methods to achieve this are detailed in Appendix D of this document.

5.5 Interfacing with Third-Party Control Systems

ASL VIPEDIA-12-based PAVA Systems can interface with external control systems via number of different techniques: e.g.

- Analogue audio + hardwired control interface.
- Analogue audio + host control interface (HCP).
- Digital (PMC) audio and SIL/SDK IP interface protocol.

Such techniques may be typically used to interface with PCDVA or LLPA Systems.

It is important to note that, any interface with third-party equipment must be configured such that it cannot jeopardise the ability of the VA System to make Emergency Broadcasts: i.e. LLPA/PCDVA route priorities must always be lower than those associated with Emergency usage. It is also recommended that non-emergency functionality should be disabled in the event of mains failure unless the back-up battery capacity of the system has been calculated to allow non-emergency broadcasts to continue under this condition.

5.5.1 Analogue audio + hardwired control interface

The typical Long Line PA/ PCDVA Interface using hard-wired control consists of:

- $0dBu_{(nom)}$ audio signal
- Access Pairs (volts-free analogue or digital GPIO inputs)
- Busy Pairs (digital GPIO outputs via relays to provide a volts-free response to the LLPA system).

The busy response provided from the PAVA system needs to be configured to meet the specific requirements of the LLPA System: e.g.:

- No requirement for busy signalling
- Busy (PAVA System internal route busies only)
- Busy + LLPA Access Reassurance (PAVA System internal route busy including LLPA route busies)

N.B. Some LLPA systems require an instantaneous response to an access command, and in these cases, the ASL LLPA05 unit may be used to instantly report LLPA access without encountering the delay associated with the VIPEDIA-12 routing functionality. However, as described in the notes to Section 5.5.1 below, the LLPA05 may also be used simply to provide a volts-free relay interface for the busy response to the LLPA/PCDVA system.

For further information regarding the LLPA05 module, please refer to the installation guide detailed in Appendix D, Section D.1.4.

Figure 10: External and Internal Views of the LLPA05 Interface Unit

Figure 11 below shows a typical LLPA interface associated with the Plessey long-line PA system, including the ASL LLPA05 module.

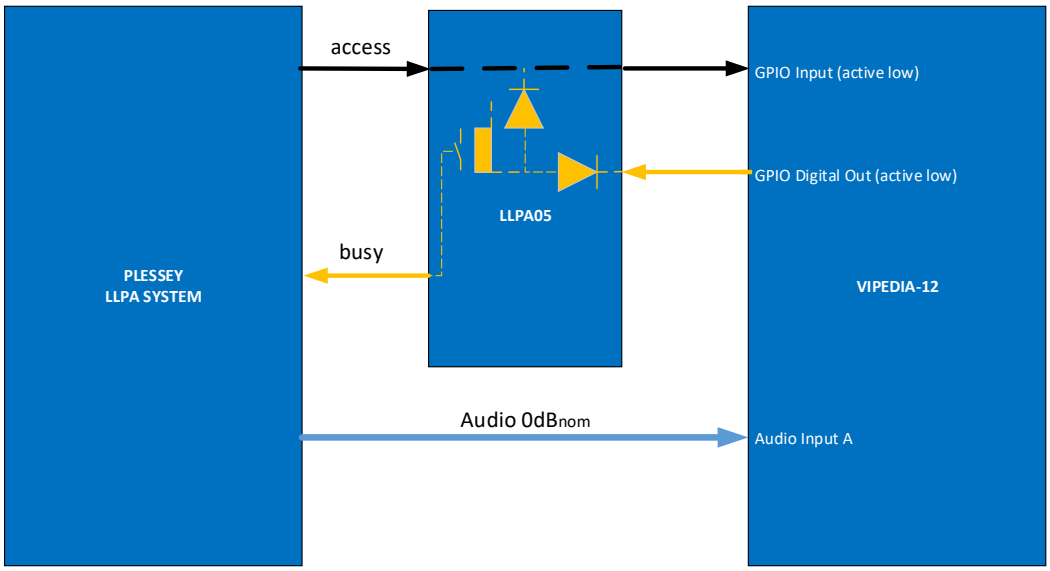


Figure 11: Typical Hard-wired Interface with an LLPA system

Notes:

1. Figure 11 shows the connection via an LLPA05 which incorporates a relay to provide each busy output to the LLPA/PCDVA System as a volts-free signal.
2. The access control interface at the VA system rack may either be connected directly to the VIPEDIA-12 GPIO input port or indirectly via a BMB01 GPIO Expansion module.
3. When connected through the LLPA05, the Access and Vipedia Route Busy signals are diode-ORed to provide a combined Busy output to the LLPA/PCDVA system.

   Where there is no need to generate a busy on receipt of an access signal, the access connection may bypass the LLPA05 module and be taken directly to the VIPEDIA-12 or BMB01 GPIO input port.

5.5.2 Analogue audio + host control interface (hcp)

Another common interface incorporates the 0dBu$_{(nom)}$ audio signal with routing controlled using the ASL Host Control Protocol (HCP) and connected to the RS 485 terminations associated with an otherwise unused analogue input.

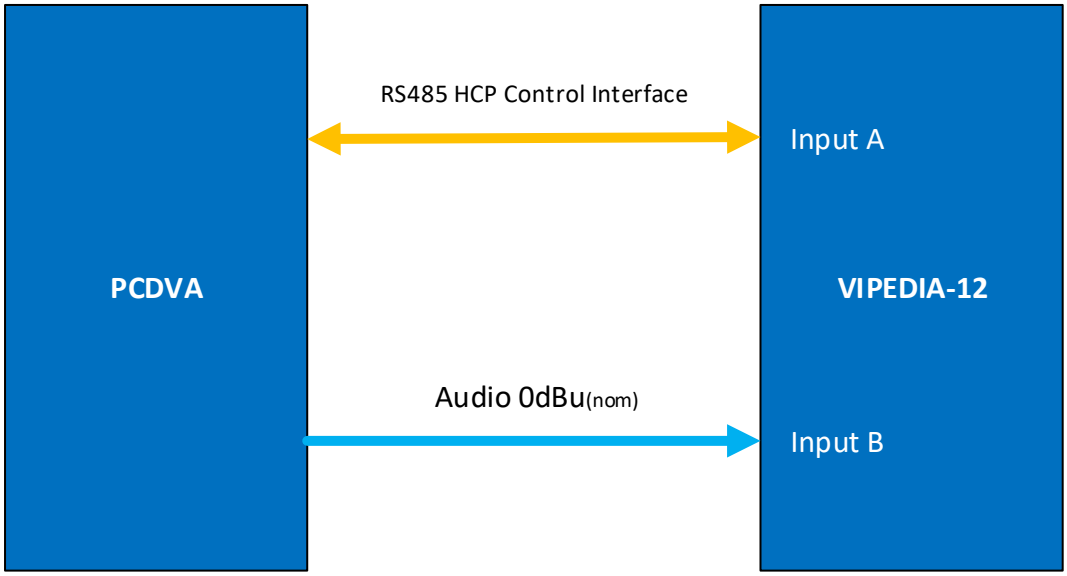


Figure 12: Interface with a PCDVA System using the ASL Host Protocol

For further details of the ASL Host Control Protocol, please contact ASL Technical Support Services.

5.5.3 Digital (PMC) audio and SIL/SDK IP interface protocol

Details of this interface are beyond the scope of this document – For further information, please contact ASL Technical Support Services.

6 Determination of the System Requirements

The system specifier will need to establish the relevant system requirements, to enable the integrator / distributor to design and build an appropriate EN 54 compliant system.

The process of defining the requirements is generally iterative and the list below provides initial guidance for their collection.

Only when all the requirements have been fully defined can they be reliably mapped to a design, prior to system build and test, in accordance with the design guidelines provided by this document,.

1. System Type
    a. distributed / non-distributed (refer to Section 0).
2. Fire Panel Interface requirements.
    a. centralised / distributed (refer to Appendix C, Section C.5).
    b. voltage reversal or monitored from the VACIE.
3. Emergency Microphones (type and quantity).
    a. EMS wall-mount types.
    b. MPS desk-mount types.
    c. hosted by single or dual audio routers.
    c. Button Allocations for the above including options (e.g., Paging Zone(s) / Zone groups, Manual Emergency Broadcasts, Manual Silence).
4. Paging Microphones (type and quantity) (see note 1 below)
    a. Analogue/serial connection.
    b. IP-connection.
5. Equipment Locations.
    a. Core equipment (racks / wall-mounted)
    b. Peripheral equipment (e.g microphones, ANS and DANS)
6. Audio Zoning and Zone Power requirements
    a. the level of granularity needed for announcements.
    b. the need for individual control of levels/graphic equalisation.
    c. the sub-division of announcements zones into speaker zones.
    d. Ambient Noise Control (Latching or Dynamic)
    e. Loudspeaker Line lengths and loadings.
    f. Loudspeaker Line Surveillance technique (e.g., DC, Impedance, Loopback).
7. Redundancy
    a. Review to determine the effect of equipment failure on the overall system integrity.
    b. Use of standby amplifiers.
    c. Use of redundant equipment e.g.,
        i) dual A-B working amplifiers or single amplifiers feeding A-B loudspeaker circuits.
        ii) audio routers in redundant configuration.
    d. Use of redundant cabling e.g.,
        i) looped IP Network cabling.
        ii) duplicated power feeds (between racks and for power feeds to Emergency Microphones).

iii) duplicated connections between Fire Alarm Panels and the PAVA System (where the cable length is greater than 10m (requirement of BS5839 Part 8:2013).

e. Calculation of system reliability (MTBF/MTTR/Availability) (see note 1 below).

8. Networking Requirements.
9. Battery backup requirements.
    a. If the mains supply fails, how long is the system required to remain functional?
    b. What functionality is required during the backup period (e.g., what equipment should be included in the battery backup calculation – see item 10 below)?
    c. How much time is required to complete a site evacuation?
    d. What is the required battery supply recharge time?
10. Equipment Types and Quantities (inc. incorporation of any non-Voice Alarm ancillary equipment).
11. Non-EN 54 related Interfaces (e.g., Background Music, Dante® Audio Equipment, Long-Line PA / PCDVA Control).
12. Electrical / Thermal Performance data of the installed equipment.
13. Equipment Housing / Rack Design
    a. Rack Selection.
    b. Equipment Placement.
    c. Electrical Safety.
    d. Ingress Protection (IP) requirements.
    e. Thermal Management.
    f. Access Levels (refer to Sections 7.4.2 and 7.6 for further details).
    g. Internal Wiring and cabling (including labelling and fusing strategy).

Notes:

1. For product reliability data, please contact the ASL Sales or Technical Support Services.

7 ASL Recommendations for Rack Design Implementation

7.1 Introduction

Following the collection of all the pertinent information relating to the system design requirements as defined previously in Section 6, the detailed rack / system design may now commence.

This section describes the design elements that need to be addressed during this process and is divided into two key parts:

Sub-sections 7.2 and 7.3 describe the initial design activities:

- Confirmation of the System Requirements.
- use of the ASL Vipedia-12/V2000 Rack Heat and Power Calculator Tool (HPC).

Sub-sections 6.4 – 6.9 describe:

- the design philosophy incorporated into the HPC.
- further recommendations relating to EN 54-related design issues including those not specifically addressed by the HPC.

7.2 Confirmation of the System Requirements

It is recommended that prior to commencing the detailed design of the system including rack layouts etc, the system requirements are fully documented including any additional details that may not have been fully defined in the original requirements specification for final approval by the customer.

ASL generate a VACOR (VA Confirmation of Requirements) document to fulfil this purpose.

7.3 VIPEDIA-12/V2000 Rack Heat and Power Calculator (HPC)

To ensure that the rack design is compliant with the requirements of EN 54-4 and EN 54-16, ASL strongly recommend that the ASL VIPEDIA-12/CV2000 Rack Heat and Power Calculator is used.

The ASL VIPEDIA-12/V2000 Rack Heat and Power Calculator is designed to assist the sales engineer/ system designer in creating a suitable rack design, using the basic input/output parameters as described earlier in Section 6 of this document.

The HPC design assumes a rack size of 43U x 800mm and allows for a maximum of four V2000 mainframes. For alternative rack sizes, the sales engineer/ system designer will need to assign amplifier frames as appropriate for the intended rack size.

The ASL HPC provides for the following user input data:

- Global Settings
    - Emergency DVA Tone and Speech parameters
    - Battery Backup Requirements
    - Mains Supply Voltage
    - Loudspeaker Surveillance Type
- Allocation of V2000 mainframes and Amplifiers and associated peripheral power requirements: (Sheets V2000#1 - #4).

Peripherals shall be assigned to the individual mainframes and a warning will be presented if the auxiliary output from the V2000 mainframe is overloaded.

N.B. Warnings will be presented if the amplifier power or peripheral loading exceeds the maximum capability of the associated V2000.

- Battery Backup configuration

  The HPC allows the system designer to allocate amplifiers and external equipment to V2000 mainframe auxiliary outputs, e.g.

  - Audio Routers (VIPEDIA-12)
  - Amplifier mainframes (V2000)
  - Peripheral Equipment (e.g., Emergency and Non-Emergency Microphones, ambient noise sensors etc.)
  - Ancillary rack-mounted equipment (e.g., I/O expansion units, network switches, fan trays etc.)

  and will provide a warning if the auxiliary output of any mainframe is overloaded.

- MISC Charger

  This enables the use of an additional Charger / Battery Pack (BPC65 or BPC130) in cases where there is insufficient auxiliary power available from the installed V2000 amplifier frames

- Summary

  Provides the following output:

  - Total Heat output per rack
  - Requirement for Forced cooling (e.g. Fan trays or Rack Door Fans)

  NOTE: The heat calculations assume that the rack size is 43U x 800mm. For other rack sizes, please refer to Section 7.8.7 and Appendix B of this document.

- Mains and DC supply consumption (per rack)
- Mains supply inrush Current (per rack)

It should be noted that at the time of publication of this document, the System Design Tool does not support V400 amplification.

7.4 Additional Rack Design Considerations

This section details design information not specifically defined in the output from the HPC.

7.4.1 Electrical Safety Requirements

ASL equipment is designed and manufactured to comply with appropriate international electrical safety standards (IEC62368 – Part 1: 2018). It is important that the safety statements and precautions given in the ASL equipment installation manuals and Product Safety Leaflets are always observed.

There may also be additional Electrical Safety requirements applied by national rules / codes of practice.

For reasons of fire-safety, it is important that flammable materials (e.g. System Schematic diagrams or other documentation) are not stored in the racks in close proximity to the V2000 amplifier mainframes.

7.4.1.1 Power Supply Isolation

A means of isolating all power source(s) from the equipment must be provided.

- a mains isolator must be provided externally to the PAVA rack to enable it to be isolated from the building's 110Vac - 230Vac mains supply.
- For maintenance purposes, individual items of equipment within a rack may be isolated from the mains supply by use of the mains switches on the front face of the MDIST-V2000 mains distribution block.
- For DC power supply connections, this is achieved by use of the breaker supplied as part of the BDIST-V2000 or BPC range of charger/battery packs.

  Note It is important to be aware that the V2000 front panel mains and battery switches do not isolate the power to the unit and mains voltages will still be present within the V2000 PSU module even if both switches are in the "off" position.

7.4.1.2 Earth bonding

For reasons of safety**:**

- each rack should include a safety earth bonding point complying with the appropriate national rules/codes of practice.
- metal rack panels (e.g., doors, side and top panels) should be connected back to the earth bonding point.
- Peripheral equipment incorporating metal housings (e.g. ANS, DANS, LMT units, loudspeakers) should be connected to local earth points using the earth bond terminals provided in the equipment.

Notes:

1. Earth bonding also ensures that the enclosure:
   a) provides electrical screening for the associated electronics assembly.
   b) ensures that the associated product can meet the necessary EMC performance.
2. When applying earth bonding, it is important to avoid the generation of "earth loops" which can introduce noise into the system and may also affect the overall EMC performance of the system

7.4.2 EN 54 Design Requirements

The majority of the EN 54 requirements are covered within the design of the individual products. However, PAVA systems using ASL products certified to EN 54 will only be fully-compliant with the standard when designed, installed and configured in accordance with the associated ASL equipment installation and user manuals. This guide expands upon the contents of those manuals.

Requirements relating specifically to the design of the system / cabinet assemblies are listed in the table below:

Table 5: EN 54 Design Requirements associated with the System and Rack Design

EN 54-16 Clause	Feature	Requirement	Recommended Design Solution
4.3	Power Supplies	The clause refers to EN 54-4 Clauses 4.2 and 5.3. i) both Mains and rechargeable battery power supplies shall be provided. ii) when the system is running from mains power, batteries shall recharge, when previously discharged to their final voltage, to 80% capacity in 24 hours and 100% capacity in 48 hours.	VIPEDIA-12 based systems derive power from mains and battery-backed DC Supplies. When connected to suitable batteries, the V2000, BPC65 and BPC130 can provide for this requirement. Refer to Section 7.8.3 for further information.
5.4	Power Indication	A green light-emitting indicator shall be visible at access level 1 on each cabinet containing EN 54-16 equipment to indicate when it is powered.	Refer to Section 7.8.6.3 for the details of the recommended implementation.
13.3.1	Cabinet IP Rating	The cabinet shall meet the IP30 rating for ingress protection. N.B. It should be noted that, for the purposes of EN 54-16 certification, the IP30 ingress protection standard is intended to protect against the entry of large insects and similar creatures. Hence the IP30 standard requires that no objects, capable of movement and larger than 2.5mm in diameter can enter the rack. In particular, refer to the note in ***Clause 13.3 of EN 60529*** – Degrees of protection provided by enclosures (IP code).	Refer to Section 7.5.1 which recommends suitable rack cabinet types and modifications which may be required to ensure compliancy and to Section 8.1.2 relating to the EMS and MPS microphones.
13.3.5	Labelling of Terminations and Fuses	Terminations and fuses shall be clearly labelled	Refer to Section 11 and Appendix A of this document for further details.
13.5.4	Redundant Power Supplies connections between cabinets	Power cabling between separate cabinets (not mechanically connected) and which supports EN 54 related functionality shall consist of at least two independently routed circuits connected in such a way that an open- or short-circuit fault on one cable shall not affect the integrity of the second supply path. This requirement also applies to the power connection between rack equipment and Emergency Microphones.	Refer to Sections 7.8.4 and 8.1.1 for further information.

EN 54-16 Clause	Feature	Requirement	Recommended Design Solution
13.6	Access Levels	**Level 1** Visible without manual intervention to enable investigation and an initial response to Fire Alarm and Fault warnings. **Level 2** Access restricted to persons having specific responsibility for safety and who are trained and authorised to operate the VACIE in the: • Quiescent condition • Voice Alarm Output condition • Fault warning condition • Disablement condition Access may be restricted by use of one or more of the following: • Mechanical keys • A code of at least 3 manual sequential operation. • Access cards **Level 3** By persons who are trained and authorised: • To reconfigure the site-specific data held within the VACIE or controlled by it (e.g., labelling, zoning, alarm organization) • To alter the storage of and change emergency tones and messages. • To maintain the VACIE in accordance with the manufacturer's published instructions and data. Access may be restricted as for Level 2 (keys, codes must be different from those assigned at level 2). In addition, access may be restricted by the use of special tools. **Level 4** By persons who are trained and authorised by the manufacturer to either repair the VACIE or alter its firmware thereby changing its basic mode of operation. Access may be restricted by use of: • mechanical keys • Special tools • External programming devices	Refer to Sections 7.6, and 8.1.3 for the access methods approved for use with ASL Voice Alarm Systems.

7.5 Cabinet Requirements

7.5.1 IP Ratings

For systems requiring certification to EN 54, the PAVA Rack cabinets must conform with IP 30 or better as amended by the note to Clause 13.3 of EN 60529 which is intended to prevent the ingress of insects into the equipment.

N.B. For information regarding the means of maintaining the IP Rating for the ASL emergency microphones, please refer to Section 8.1.2.

7.5.1.1 ASL Recommended Racks

ASL recommends the use of the following Schroff equipment racks:

- Schroff Euro-rack (IP40) (requires modifications as detailed in the note below)
- Schroff Varistar (IP55)
- Schroff Pro-line (IP55)

Note:

In its standard form, the Schroff Euro-rack does not precisely conform the IP requirements of EN 54-16. To overcome this, ASL have developed a number of modifications to enable use of this rack type.

- Addition of foam sealing strips around the doors and side panels to prevent insect ingress. ASL can provide suitable production notes upon request.
- Provision of an EN 54-16 compatible top panel to provide additional ventilation compared to that provided by Schroff's standard IP40 rack lid, whilst also meeting the required IP rating.

7.5.1.2 Alternative Rack Types

Many other manufacturers can supply suitable equipment racks which may be used, if they meet the IP30 requirements of EN 54. However, it is important to be aware that experience has shown that many rack manufacturers interpret the IP standard in a somewhat liberal manner and, as a result, racks may require additional tailoring to fully comply with the standard. For example, it may be necessary, as described for the Schroff Euro-Rack above, to fit additional foam sealing strips around the doors or side panels.

N.B. An IP4x or IP5x rated rack will nominally provide better dust-ingress protection than an IP30 rack.

7.5.1.3 Cable Glanding

Cable glands or other suitable cable entry fittings must be provided to maintain the IP30 integrity of the enclosure for external connections.

7.6 Implementation of Access Levels

In order to conform to the Access Level requirements (as defined in Section 7.4.2 Table 5), ASL PAVA Systems should be configured in accordance with the following rules:

7.6.1 General Rules

- Rack doors must be provided with key locks and be kept locked shut in normal use (refer to Section 7.5.1 above).
- If a rack-mounted VIPEDIA-12 is used to provide the EN 54-16 mandatory controls and indicators, the front rack door must be transparent and the front and rear door locks must be different, each requiring to be opened by separate keys. This is because the rear door of the rack provides access level 3 and the front door provides access level 2. (EN 54-16 Clause 13.6). (refer to Section 7.6.2 below for methods of achieving this with Schroff racks).
- ASL Fire/ Emergency Microphones require the use of keys to enable access to VA functionality.

Access Level 1: No restriction to access

- Mandatory Indications may be viewed either on Emergency Microphones or via the VIPEDIA-12 front panel GUI, if accessible.
- Controls: Operators may accept faults either via the Emergency Microphones or via the VIPEDIA-12 front panel, if accessible. N.B. faults may only be accepted at EMS microphones at Access Level 2.

Access Level 2

- EN 54 Manual Controls may be accessed at the microphone by use of a key switch.
- EN 54 Manual controls may be accessed at the rack by use of a rack door key.

Access Level 3

- Access for configuration purposes shall be by use of a special tool (SCT / VCT).

Access Level 4

- Access to the rear of the rack for maintainers etc. shall be using a different key from that used at Access Level 2.
- Mechanical Tools (e.g., Phillips screwdrivers) are required to remove / reinstall equipment items within the rack enclosure.
- Special software Tools are required to perform software updates.

7.6.2 Rack Door Locks

To comply with the "Access Level" requirements for an EN 54 certified system (see Section 7.6.17.6 above), it will be necessary to fit locks to the front and rear cabinet doors.

If the VIPEDIA-12 front panel is not being used to provide mandatory EN 54 functionality, a single key may be used to access both the front and rear doors.

However, where the VIPEDIA-12 front panel is used as the primary access point for the mandatory functions, different front and rear locks should be employed (i.e., to provide Access Level 2 protection for the front panel controls and separate Access Level 3 protection for the rack internal assemblies).

For Schroff Euro racks, ASL outline the following solutions (final details are left to the system designer and other solutions are possible):

a) Change one lock to part number 057-1-01-22 from Camlock Systems Ltd (Tel: +44 (0)1323 410996) and add a 2mm thick fibre washer under the bezel.

b) The Schroff rack door lock supplier is EMKA (http://www.emka.com). They can provide an alternate lock with differing keys. Their lock part number 1022-U58 plus cam part number 1022-20 will replace the Schroff rack rear door lock. Schroff use key number 2233x so make sure the second lock is keyed differently.

N.B. For some sizes of Schroff Euro-Racks, it is possible to fit a Eurolock to the glazed door.

7.7 Recommended Equipment Layout within a Rack

It is recommended that equipment is installed in the racks as detailed below. i.e.

- Batteries /Ancillary Chargers : at the base of the rack
- Amplifiers / associated Fan Trays : rack centre
- Vipedia Routers : close to eye level

However, under certain circumstances the layout may need to be revised (e.g., if the amplifier mainframes are heavily loaded) to ensure that the internal ambient temperatures in the vicinity of the VIPEDIA-12 audio router are maintained within acceptable limits.

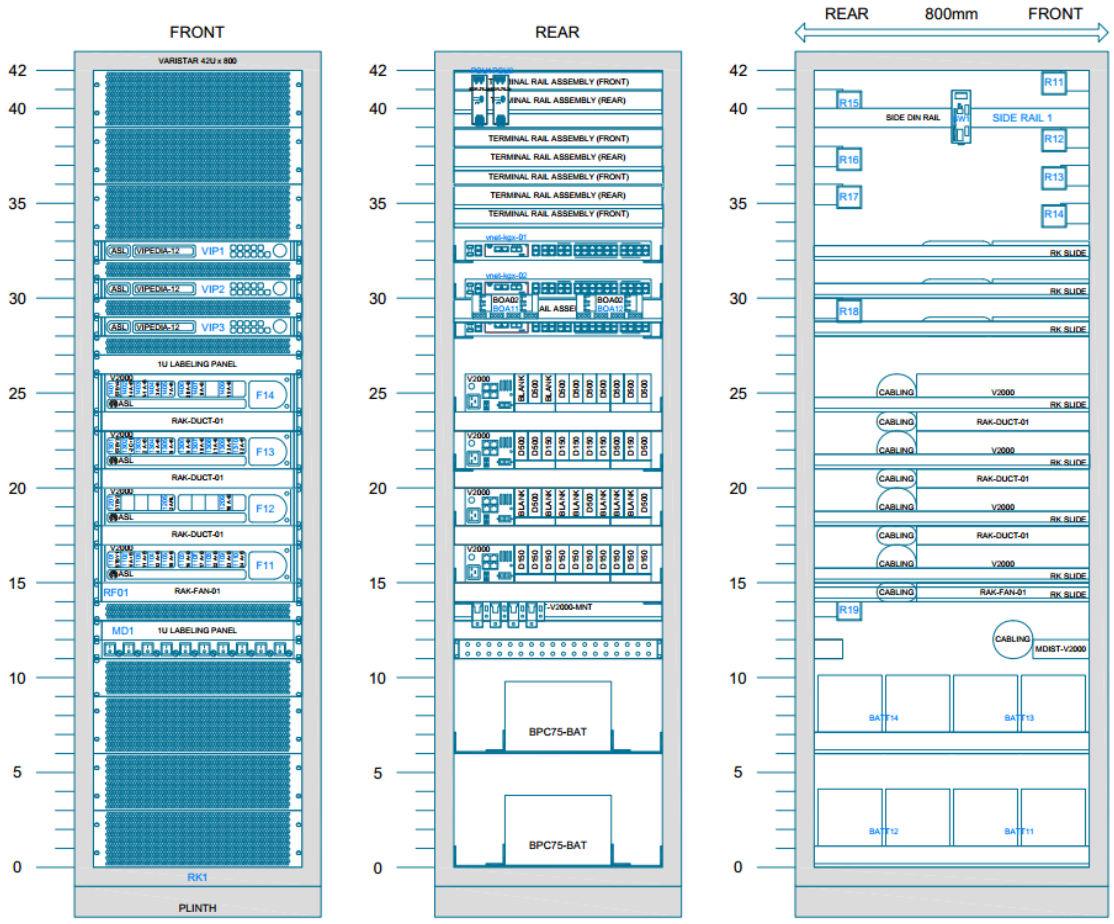


Figure 13: Typical Rack Layout

7.7.1 Equipment Spacing

Appropriate spacing between the items of rack-mounted equipment is necessary for the following key reasons:

- Electrical Safety – e.g., the separation of the 230Vac mains cabling from other rack internal cabling (refer to the individual product installation guides for further information as listed in Appendix D, Sections D.1.2 and D.1.4 of this document).
- To minimise interference and improve EMC performance – e.g., the separation of the high voltage 100V audio signal cables and 230Vac mains cabling from those associated with low-level audio or data signals.
- To optimise the Thermal Design (see Section 7.8.7 and Appendix B of this document)
- To assist with cable routing and to provide ease of maintenance.

- Where spare rack space is available, to cater for future expansion of systems – such as the addition of extra amplifier frames, audio routers, batteries, battery trays or other future upgrades.

7.7.2 Battery Placement

It is recommended that the batteries are installed towards the base of the rack for the following key reasons:

i) to provide a low centre of gravity to improve the mechanical stability of the rack.

ii) to keep them away from the hot air generated by the rack electrical equipment.

For further information regarding the requirements for batteries and battery maintenance procedures, refer to the relevant documents detailed in Appendix D Section D.1.4 of this Design Guide.

7.7.3 Amplifier Mainframe Placement

The V2000 mainframes should be mounted as close to the batteries as possible to minimise the battery cable length and hence keep losses low when the system is operating from battery power.

The placement of amplifiers and mainframes should take into consideration:

Output Power / Thermal Output Distribution (refer to Section 7.8.7 and Appendix B of this document for further details).

i) No more than four V2000 mainframes should be installed in a rack cabinet unless the associated amplifiers are lightly loaded in which case this limitation may be reassessed.

ii) Zoning Requirements

For ease of maintenance, it is recommended that amplifier locations are arranged in a logical order based on zone numbering.

iii) Economy of the Internal Rack cabling.

- to minimise rack-build and maintenance costs.

iv) A and B amplifiers, if required, should, where possible, be installed in separate mainframes

- to provide improved system redundancy.

v) Standby amplifiers should where possible be placed in the same mainframe as the active amplifiers they are backing up.

- to avoid an increase in battery pack loading in the event of an amplifier failure.
- to simplify the battery back-up calculations.

Notes:

a) In order to maximise system reliability, it is important that only the requisite number of working / standby amplifiers is installed in the V2000 frame. Unused spare amplifiers should be removed and retained for use as on-the shelf spares or for installation into future systems.

b) To simplify system build and configuration, it is also recommended that the standby amplifiers are installed into Slots #1 and/or #5 of the V2000 mainframe.

c) Depending on the power output requirement for the rack, it may be necessary to incorporate fan cooling. For further information regarding this option, refer to Appendix B, Section B.3 of this document.

7.7.4 Audio Router Placement

VIPEDIA-12 audio routers and other equipment are then typically mounted above the frames.

VIPEDIA-12 audio routers should be located within the rack, , ideally at head height, to enable easy operator access to the front panel user interface. This is particularly important where the VIPEDIA-12 is required to provide the EN 54 mandatory indications and control interface.

7.8 Power Management

7.8.1 Mains Power Distribution

ASL's MDIST-V2000 is a mains power distribution block for use within racks and it simplifies mains power distribution for up to four V2000 units each rated at 16A and in addition provides a further six IEC socket outlets, each rated at 5A.

Its input current is rated at 32A and must be fed from suitable external cabling and fused in accordance with relevant local wiring regulations.

For installation instructions, refer to the MDIST-V2000 installation guide (as listed in Appendix D, Section D.1.4).

7.8.1.1 V2000 Mains Input Connection

UK wiring regulations require that mains cable be rated to carry 12A at the rack internal ambient temperature expected in normal operation and ASL specify 90°C rated LSHF cable type LF-319 from FS Cables to meet this requirement. (BS7671 -Table 4F3A). N.B. Other national or local electrical standards may apply, in which case they must be adhered to.

7.8.2 Battery Power Distribution

7.8.2.1 BDIST-V2000 Overview

ASL's BDIST-V2000 is a kit of parts to connect the V2000 to a battery supply. The V2000 will normally provide all the battery charging and monitoring facilities required for rack implementation, but some racks may require inclusion of BPC65 or BPC130 power supplies to provide additional battery back-up capability.

The BDIST-V2000 provides:

- battery isolation for safety if the maximum current is exceeded.
- support for diagnostic, maintenance and commissioning activities.
- thermistor and cabling for monitoring the battery temperature (V2000-THERM).
- a rack-mounting bracket for support of the breakers and cabling.

Figure 14 below illustrates how a V2000 and batteries should be interconnected within a rack.

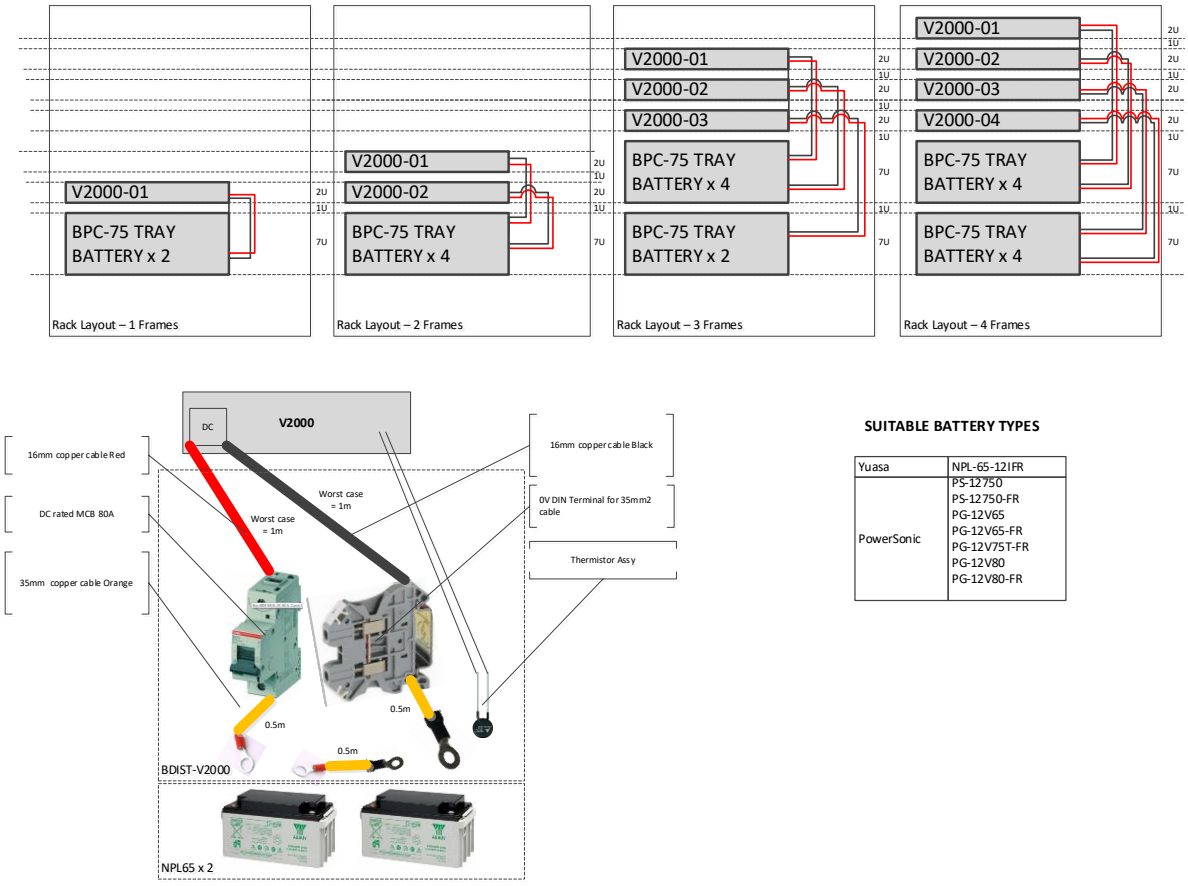


Figure 14: Battery Wiring for V2000

7.8.2.2 BDIST-V2000 Design Rules

At the very high currents which the V2000 amplifier mainframe can draw, the cable specification including conductor cross sectional area, total cable length and cable resistivity is critical to ensuring the safe operation of the system.

Small changes in overall resistance, if the specification is changed, can result in voltage drops which increase current draw which increases temperature which increases current draw and so on resulting in a system which may become unreliable at best and dangerous at worst.

To ensure safe operation, it is important that the ASL-designed BDIST-V2000 assembly is used or replicated exactly with the same cable type, cable length, circuit breakers and installation methods.

N.B. Manufacture of this cable assembly will require the use of specialist crimping tools and hardware.

For the reasons specified above:

- The Battery cable resistance must be kept as low as possible - at peak operating conditions the V2000 may draw over 200A from a 24V supply.
- The maximum permitted battery cable length between the V2000 and the Battery Circuit Breaker is 1 metre but this should always be reduced as much as possible commensurate with good cable routing.

Installation of the V2000 batteries and associated wiring must be carried out in accordance with the **"Battery Backup System Installation Guide"**, ASL document number U-0456-0199 (refer to the listing Appendix D, Section D.1.4 for further details).

Allow at least 6U rack height for up to two V2000 battery packs. (N.B. four batteries (i.e. 2 battery sets can be installed on a single tray).

Note: EN 54-4 Clause 5.4 c) states that the PSE shall be capable of recognizing and signalling a high resistance fault relating to the battery and its associated components (e.g., cables, connections and fuses). It is important therefore that the cabling and connections between the battery and the V2000 are suitable to meet both this and the peak current requirements.

7.8.3 Battery Charging and Monitoring

a) **V2000 Battery Charging**

The V2000 can supply up to 3A for battery charging. This is sufficient to charge a pair of batteries, as defined in the associated product documentation (refer to Appendix D, Section D.1.4 of this document for further details).

Note: EN 54-4 Clauses 5.2 and 5.3 specify:

5.2 Power Supply from a Standby power Source (battery)

5.2.1 *When operated from the standby power, the PSE shall be capable of operating in accordance with the specification given in the manufacturer's data irrespective of the condition of the of the main power source and with a high internal resistance of the battery and its associated circuitry, e.g., connections, fuses.*

5.2.2 *The battery shall be:*

a) rechargeable
b) suitable to be maintained in a fully charged state
c) constructed for stationary use

d) marked with its type designation and code or number identifying the production period.

If the battery is mounted in a cabinet which houses other fire detection and fire alarm equipment, it shall be of the sealed type and shall be mounted in accordance with the manufacturer's data.

***5.2.3** When operating from the standby power source, the PSE shall have a facility to switch off the PSE output(s) if the output voltage(s) or the voltage falls below a value specified by the PSE manufacturer.*

5.3 Charger

***5.3.1** The charger shall be designed and rated so that:*

a) the battery can be charged automatically

b) a battery discharged to its final voltage can be recharged to at least 80% of its rated capacity within 24 hours and to its rated capacity within 48 hours

c) the charging characteristics are within the battery manufacturer's specifications for the range of battery temperatures reached with the ambient temperature (i.e. outside the standby power source enclosure) from -5 °C to +40°C.

***5.3.2** Except for currents associated with battery monitoring, the battery shall not discharge through its charger when the charging voltage is below the battery voltage.*

b) **V2000 Battery Fault Monitoring**

The V2000 will automatically monitor the battery and report the mandatory fault conditions within the required time period (100s). Summary Fault indications will be provided by the associated VIPEDIA-12 and/or ASL's EMS and MPS Emergency Microphones and more detailed fault reports can be obtained using ASL's iVENCS or other configuration and support tools.

Note: EN 54-4 Clause 5.4 states:

The PSE shall be capable of recognizing and signalling the following faults:

a) loss of the main power source, within 30 minutes of the occurrence.

b) loss of the standby power source within 15 minutes of the occurrence

c) a high internal resistance of the battery and its associated circuitry, e.g., connections, fuses within 4 hours of the occurrence.

d) loss of the battery charger, within 30 minutes of the occurrence, except where the charger is turned off or limited as under 5.1.c).

(**ASL clarification re the reference to EN 54-4 Clause 5.1 c**) - This refers to a situation where the PSE charger may current limit as a result of an unexpected overload on an output associated with the provision of power for the VA equipment)

If the PSE is separately housed from the CIE, at least a fault output common to the above-mentioned faults shall be provided. This output signal shall also be given if the PSE is de-energized,

If the PSE is housed within the cabinet of the CIE, the above mentioned faults shall be indicated in accordance with EN 54-2 either on the CIE or on the PSE itself.

ASL Clarification: in the above, please read "VACIE" in place of "CIE".

c) BPC65 and BPC130 Chargers / Battery Chargers

When BPC65 or BPC130 power supplies and associated batteries are used, these must be installed in accordance with their associated installation guides (For further information, refer to the battery-related documentation listed in Appendix D, Section D.1.4).

N.B. Each battery supply requires at least 8U rack height.

As detailed for the V2000-BDIST, batteries should always be placed low down in the rack so as not to adversely affect rack stability but also to minimise heating of the batteries by the installed equipment.

The BPC Battery Charger range includes full monitoring of the charger and battery status, reporting faults via GPIO inputs on the VIPEDIA-12 audio router or associated BMB01 GPIO Interface unit.

7.8.3.1 Battery Current when Mains Present

Other than for the monitoring of battery status, no current may be taken from batteries while mains power is present and therefore no connections other than power to amplifier mainframes should be made directly to the battery terminals.

7.8.4 Approved Battery Types

The details of the approved battery types for use with these products are available in the associated product documentation listed in Appendix D, Section D.1.4.

7.8.5 Power Supplies for Peripherals and Ancillary Equipment

a) Emergency microphones and ancillary equipment such as BMB01 GPIO units used for Voice Alarm functionality (e.g., interfacing with the Fire Alarm Panel) or network switches carrying voice alarm audio or control data must be powered from EN 54-4 battery-backed supplies (EN 54-16 Clause 4.3).

In line with the requirement detailed in Section 7.8.3.1 above:

- **For supplies sourced from V2000 mainframes**
  The DC supply for audio routers and associated EN 54-related ancillary equipment shall be derived from the V2000 aux output.
- **For supplies sourced from BPC products**
  The 24Vnom DC supply for the audio routers and associated EN 54-related ancillary equipment shall be derived from the BDIST3A fused output (see Section 7.8.6 below to obtain the deratings which should be applied to the loading of this output to remain compliant with the requirements of EN 54).

For further information, please refer to Appendix A, Section A.2.2)

b) All power supply feeds to equipment external to the rack should be fused to ensure that any external short-circuits do not compromise the performance of the life-safety equipment.

c) Power supplies for EN 54-related equipment external to the rack must be duplicated and connected in such a way that failure of a single supply feed (open- or short-circuit) cannot jeopardise the required functionality.

For this reason, Emergency Microphones must be provided with dual power supply feeds.

d) Equipment not providing any EN 54 functionality within the PAVA system may be powered from mains-only supplies as appropriate and suitable recommended DIN-rail supplies are listed in **Table 3** in Section 2.2.1 of this document.

N.B. Any faults associated with ASL equipment (e.g., MPS microphones, ANS and DANS sensors) configured for PA only applications will be reported at the VACIE and incorporated into the "general fault" output to the Fire Alarm Panel. However, if required, audio input fault reporting for PA microphones and DANS may be disabled via the VIPEDIA-12 dynamic configuration.

7.8.5.1 V2000 Auxiliary Power Output

The V2000 auxiliary power output provides an output of up to 2A to power equipment such as the VIPEDIA-12 audio routers, peripherals and ancillary equipment.

The auxiliary output voltage, even with the mains supply connected, may vary between 21V and 28V and therefore the overall current requirement from the output should be based on that drawn at 21V when feeding equipment incorporating switched mode supplies.

In the event of a mains supply failure, the auxiliary output will automatically switch over to the battery supply source.

7.8.6 Cabinet Power Distribution Strategy

The following notes provide a simple way to ensure that both safety and operational requirements are met.

- Within a Voice Alarm System, all equipment carrying or supporting the provision of Voice Alarm signals or mandatory indications to EN 54 standards is required to be powered from a power supply conforming to EN 54-4, so as to ensure that the system can continue to function correctly in the event of the mains supply failure.

  For the above purpose, the supply may be obtained from any of the following sources:

  - V2000 auxiliary output (Imax = 2A)
  - BPC65 BDIST3A (Imax = 1.75A)
  - BPC130 BDIST3A (Imax = 3A)

  IMPORTANT NOTE: It is important that the Imax limitations applied to the individual types of BPC charger/Battery Pack are not exceeded as this would result in a failure to meet the requirements of EN 54-4 regarding the battery recharge performance of the unit.

- When a BPC65 or BPC130 battery pack is used to power equipment providing mandatory indications, it is permitted to use separate BDIST3A outputs for each power feed as the mains and battery supplies are separately fused.

- The number and type of EN 54-4 PSEs is determined from the overall current consumption of the equipment needed to meet the system functional requirements.

Current consumption figures for all ASL equipment can be found in the associated product installation guides (refer to Appendix D, Sections D.1.2 and D.1.4 for further details).

7.8.6.1 Power Supply Strategy for VIPEDIA-12 Audio Routers and Network Switches

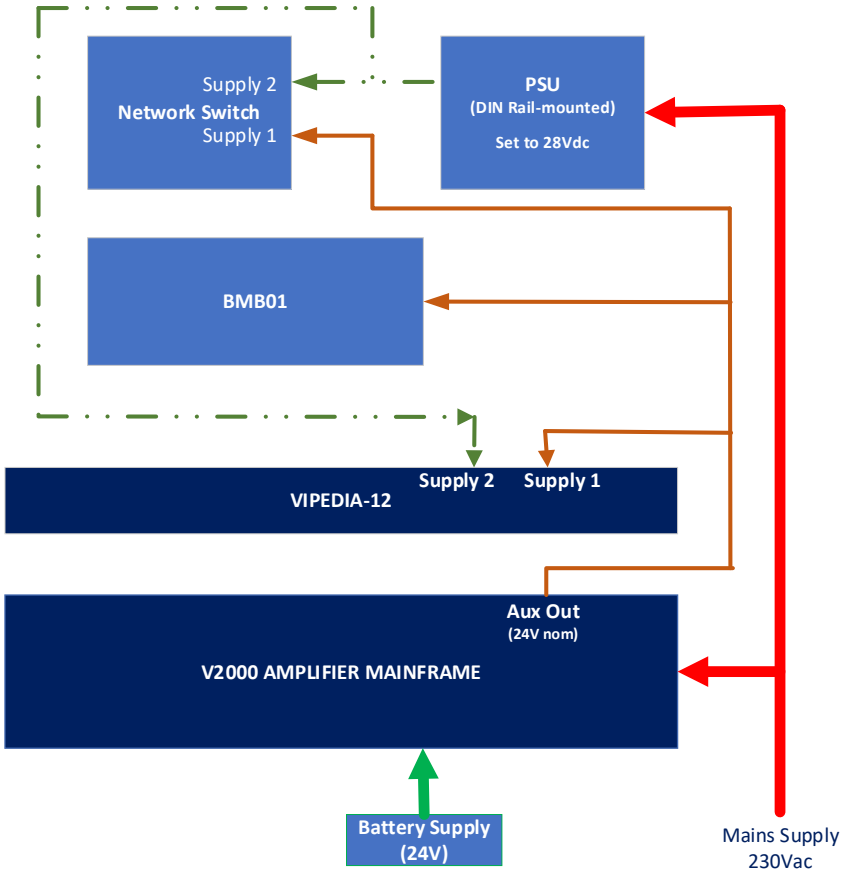


Figure 15: Internal Supply Arrangement incorporating a DIN-Rail-mounted DC Power Supply

a) VIPEDIA-12 Audio Routers

As detailed in Figure 15, the VIPEDIA-12 incorporates two 24V dc power input connectors, each of which should be connected to a separate source:

Source 1: EN 54-4 certified battery-backed supply source provided by the V2000 or BPC BDIST3A (for consistency of system design, it is recommended that this source is assigned to Power Port #1 on the VIPEDIA-12)

Source 2: This does not need to be an EN 54-4 certified supply and a simple DIN-rail mounted 24Vnom supply can be used, provided that its output is set for 28V. to ensure that it is always higher than the voltage provided by the V2000 auxiliary or BPC BDIST3A outputs. This ensures that under normal mains supply conditions, no current is drawn from the battery-derived supply other than that associated with battery condition monitoring. This technique also ensures that the V2000 aux loading does not affect the battery impedance measurement. (refer to Figure 15 above).

b) Network Switches

The same method as employed for powering the VIPEDIA-12 audio routers, should also be used for powering network switches associated with the emergency signal path, if they are installed within the PAVA rack. (refer to Figure 15 above).

Recommendations for DIN rail-mounted supplies are given in **Table 3: PAVA Ancillary Equipment** in Section 2.2.1. It is important to check that each individual supply is of a sufficient rating to provide the required power on its own.

7.8.6.2 Common 0V Rail

It is strongly recommended that the 0V connection for all power supply sources within a rack are interlinked at a common location as defined in the diagram below:

N.B. the 0V common point should be isolated from the rack chassis.

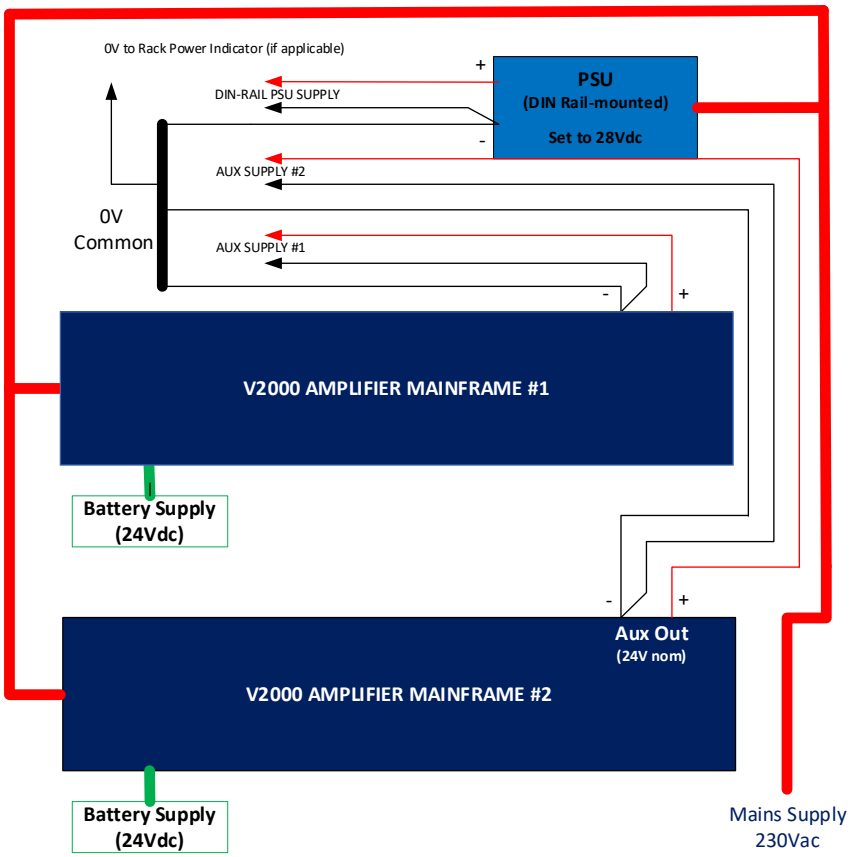


Figure 16: Common 0V Rail Configuration

Where a system consists of a number of bayed racks, a similar approach should be adopted for each of the individual racks and the common 0V rails within the racks interconnected via a single black 32.02 insulated wire

7.8.6.3 Provision of Power Indicators (EN 54-16 Clause 5.4)

Ideally, Rack Cabinets should be supplied with transparent glazed doors that allow the green power indicators of the associated equipment to be viewed.

However, if for contractual reasons, solid doors are specified, then a green light-emitting indicator is required to be provided externally on the cabinet. This indication shall be clearly labelled to identify its purpose, i.e. “EN 54 POWER INDICATION” (refer to Section 11.3) and the connection to the indicator should be provided as shown in the drawing below:

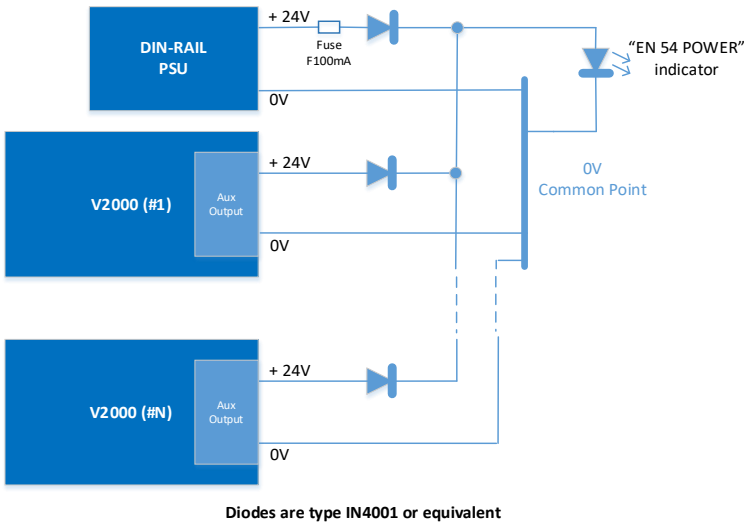


Figure 17: EN 54 Power Indicator Wiring Diagram

Notes:

1. Where the rack includes power supply feeds solely related to non-EN 54 functionality, these feeds are not required to be included in the indicator circuit described in **Figure 17** above.
2. ASL's practice is to house the diodes in one or more DIN-Rail mounted COMP boxes as applicable.
3. For details of the "0V Common Rail" please refer to Section 7.8.6.2

7.8.7 Thermal Management

7.8.7.1 General Overview

The V2000 and VIPEDIA-12 products are high performance products that integrate a high level of functionality and power output into relatively small packages. As a result, they can generate considerable heat compared to previous ASL products and therefore before finalising a rack layout, always ensure that the thermal design has been taken into consideration.

When designing a rack, it is important to ensure that:

1. There is sufficient airflow within the rack to disperse the heat from the individual equipment items into the rack.
2. There is sufficient heat flow from the rack into the equipment room to ensure that the internal rack temperatures do not exceed the equipment specifications.
3. The temperature in the equipment room in which the rack is to be installed is maintained at an acceptable level.

In line with the above requirements, ASL recommend that:

- equipment case temperatures should not exceed the temperatures detailed in Table 6.
- the equipment room is maintained at an ambient temperature below 25°C to avoid reduced battery life.
- Batteries are installed at the base of the rack where the ambient temperature will be the lowest within the cabinet.

For information regarding the effect that high ambient temperature can have on the battery life cycle and performance, please refer to ASL document **"Recommended Battery Care and Maintenance Procedures"** as listed in Appendix D, Section D.1.4.

Table 6: Temperature de-rating for VIPEDIA-12, -NET, -PRO, -TS1 and SFP products

VIPEDIA-12 Variant	Maximum ambient	
	Without TS1	With TS1
VIPEDIA-12	55°C	n/a
VIPEDIA-12-NET (No SFP modules)	55°C	55°C
VIPEDIA-12-NET (2 off SFP modules fitted)	50°C	45°C
VIPEDIA-12-PRO (No SFP modules)	50°C	n/a
VIPEDIA-12-PRO (2 off SFP modules fitted)	50°C	n/a

Notes:

1. For further information, please refer to Appendix B, Section B.3 of this document.
2. The maximum temperatures detailed above for the ASL products exceed those defined in the product test requirements of EN 54-16 which state that the equipment must operate correctly up to a maximum ambient temperature of 40°C.

7.8.7.2 Ventilation

For the reasons detailed in Section 7.8.7.1 above, the layout must take into account the thermal aspects of the equipment installation in particular to ensure that the operational ambient temperature within the enclosure is maintained at a suitable operating temperature not exceeding the stated maximum operating temperature for the installed equipment.

However, in order to preserve long-term equipment reliability, it is always recommended that the ambient temperature within the rack is maintained well below the stated maximum (e.g., 40°C).

If there is a risk that the internal rack ambient temperature may exceed this limit during normal operation it may be necessary to provide the rack with additional forced cooling.

N.B. Where forced cooling is required, it is important to ensure that the rack cabinet incorporates both and inlet and exhaust vents to enable sufficient airflow. The vents must be designed to comply with the requirements regarding equipment IP rating (refer to Section 7.5.1 for further information).

7.8.7.3 Fan Control

The output from the HPC identifies whether fan trays are required within a rack design and also differentiates between the need for mains only or mains/battery power to the fans. In either case, the fans should be activated via a control port on the associated DBB group master Vipedia, using a port assigned to the "fan" function. For additional reassurance the connection to the fan tray from the Vipedia should also be paralleled with the ASL-supplied thermal switch, which is normally located at a suitable location on the top panel of the upper V2000 in the rack.

For further details regarding configuring the Fan Control operation, please refer to Section 9.1.3 of this document.

7.8.7.3.1 Fan Tray wiring requirements

Where the rack design requires fan trays for essential cooling purposes, the following approaches should be adopted.

a) **Fan Trays – mains-only powered**

Power for the fan should be derived from a rail-mounted 24Vnom PSU, unless there is spare capacity available from a V2000 auxiliary output in which case the fan may be configured to operate both with mains and battery derived power (refer to item b) below).

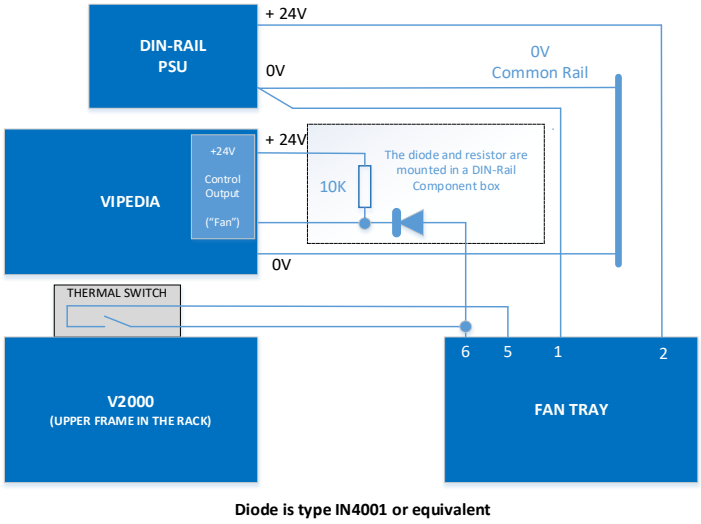


Figure 18: Mains-Only Powered Fan Tray Configuration

Notes:

1) In the case where racks are bayed, the "fan" output from the VIPEDIA-12 may also activate fans in the adjacent racks via individual diode connections to each rack and the bayed racks must have their individual 0V Connection Rails linked as described in Section 7.8.6.2.

2) The 10k 0.25W resistor is included to ensure that in the event of loss of the mains power feed to the fan tray, the contact assigned to fan control does not report a contact-related fault.

b) **Fan Trays =- mains/battery powered**

Power for the fan should be derived from the auxiliary output of a V2000 amplifier mainframe.

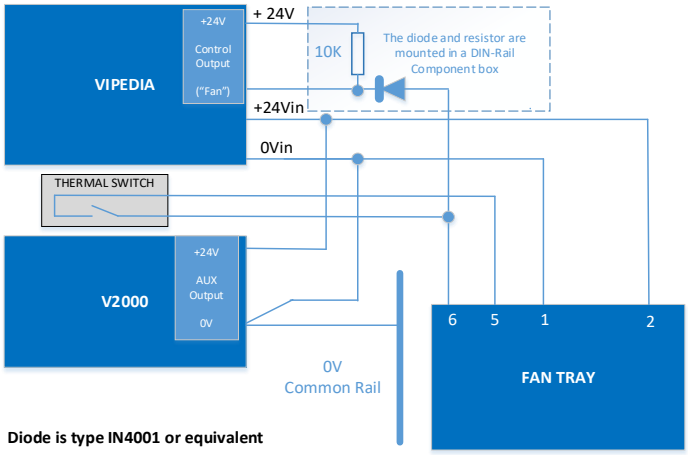


Figure 19: Mains/Battery Powered Fan Tray Configuration

1) In the case where racks are bayed, the "fan" output from the VIPEDIA-12 may also activate fans in the adjacent racks via individual diode connections to each rack and the bayed racks must have their individual 0V Connection Rails linked as described in Section 7.8.6.2.

2) The 10k 0.25W resistor is included to ensure that in the event of loss of the mains power feed to the fan tray, the contact assigned to fan control does not report a contact-related fault. The power supplies to each individual fan tray shall be monitored at source (i.e. at the V2000 AUX Output).

3) The thermal switch should be located on the top panel of the upper V2000 mainframe in the associated rack.

7.8.8 Equipment, Terminals and Cable Labelling

7.8.8.1 Equipment Labelling

Equipment should be labelled such that the name identifies the rack into which they are installed and the equipment location within the rack.

7.8.8.2 Cable Labelling

Cables should be labelled to enable simple identification of each cable against the rack drawings and, if possible, to allow the simple replacement of cables without need of reference to rack drawings. (refer to Appendix A for further information).

7.8.8.3 Fuse Labelling

Terminations and fuses within EN 54 Racks shall be clearly labelled.

7.8.8.4 Recommended Labelling Implementation

For details of how ASL-built rack systems meet the requirements for the labelling requirements defined below, refer to Section 11 and Appendix A of this document.

There are no specific constraints on how this is achieved, but it is recommended that the general principles detailed in Appendix A of this document are applied.

N.B. Should an ASL-approved integrator / distributor wish to implement an alternative method of termination and labelling, this must be in line with the above requirement and defined in their EN 54 Factory Production Plan.

8 Additional System Design Guidance

8.1 EN 54-16 Emergency Microphones

The ASL EMS and MPS ranges of microphones need to be installed recognising the following points.

8.1.1 Dual Supplies

When configured as Emergency Microphones in an ASL PAVA system, they must be provided with dual supplies as described in Section 7.8.4.

8.1.2 Maintaining the required EN 54 IP Rating

a) EMSxx Microphone Range

The EMS range of microphones are housed in an EN 54-compliant housing which must be installed in an appropriate manner to ensure that the installation does not jeopardise the integrity of the enclosure with respect to its IP rating. (i.e. it is important that all screw fixings and cable entries are in accordance with the requirements (e.g. by glanding for cable access and the use of silicon sealant to close off any gaps around fixing screws etc.).

b) MPSxx Paging microphone range

The MPS range of microphones is designed for multiple applications and as a result has multiple cable and plug ports for applications other than EN 54-16.

In order to comply with the IP rating requirements of EN 54, the unused cable ports and / or 3.5mm jack socket must be closed off. For this purpose, ASL provide sponge cord and bungs. Please refer to MPS series installation guide, for instructions regarding their fitment (refer to the document listing in Appendix D, Section D.1.4).

8.1.3 Access Level Compliance

a) EMSxx Microphone Range

All controls specifically associated with VA functionality are protected from unauthorised access by use of a key operated door lock.

A clear window provides visibility of all mandatory indicators (including indication of power), and therefore, if this product is to be used as the primary control and indicating equipment within a PAVA system, it must be installed in a manner that permits a clear view of the indications.

b) MPSxx Paging microphone range

For an MPS microphone, control functions specifically associated with VA functionality must be configured such that they can only be accessed by use of a keyswitch located to the LH side of the microphone.

All mandatory indications (including indication of power) are provided on the upper face of the microphone which, as in the case of the EMS microphone range should be installed such that the indications are readily viewable.

8.2 Interfacing with a Fire Alarm Panel

There are two possible means of providing an EN 54 compliant interface with a Fire Alarm Panel:

- Voltage -Reversal (monitored from the Fire Alarm Panel
- Contact Closure (monitored by the PAVA System)

8.2.1 Voltage Reversal interface

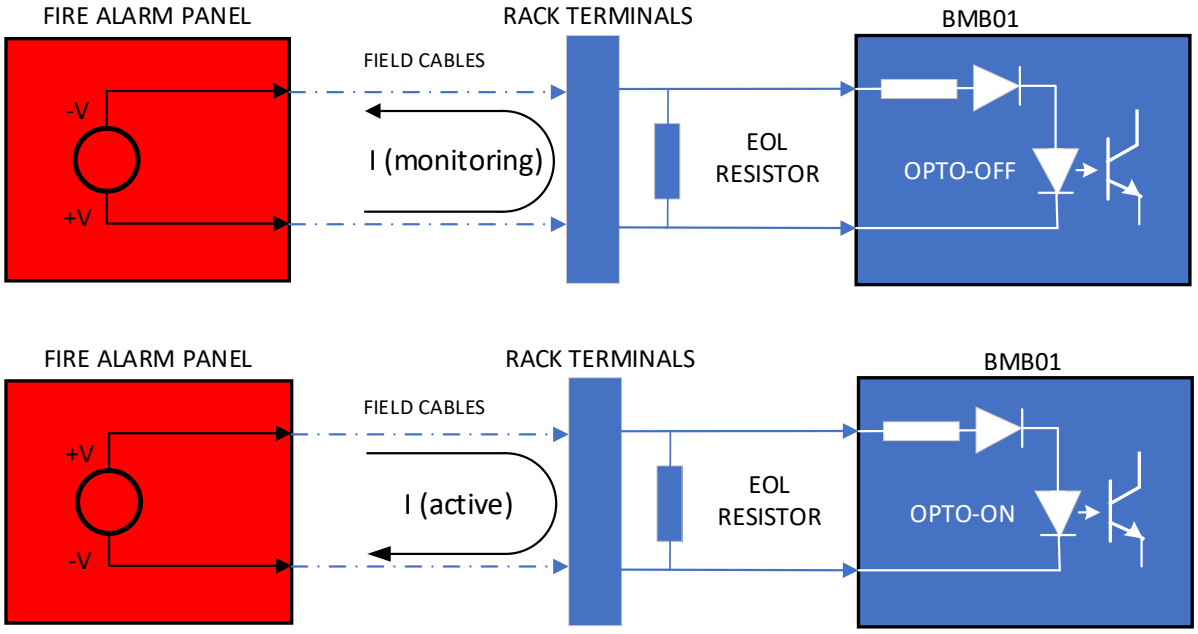


Figure 20: Volt-Driven Interfacing with the Fire Panel via the BMB01

The Voltage Reversal method required that the Fire Panel connects to GPIO inputs configured as Voltage Driven and requires the addition of an end-of-line resistor (the value of which will be specified by the manufacturer of the Fire Alarm Panel. To avoid the possibility of earth leakage faults being reported by the Fire Alarm Panel, it is recommended that the voltage reversal interface is connected via BMB01 digital inputs.

In order to reduce the power consumption of the Fire Alarm System, monitoring of the link may use a pulsed rather than dc voltage.

The Voltage Reversal method shall be used for:

- Evacuation Message Triggering
- Alert Message Triggering
- Emergency Message Reset
- Emergency Message Silencing (optional)
- Monitoring for the VA General Fault Output
- Monitoring of the VA Alarm Output (optional)

8.2.2 Contact Closure Interface

Although the interface between the Fire Alarm Panel and the PAVA System is normally monitored from Fire Alarm Panel, the connection to certain Fire Alarm Panels may require the link to be monitored by the PAVA System. In this case, the interface shall be via analogue GPIO input ports in conjunction with a resistor network installed at the Fire Alarm Panel control output (see **Figure 21** below).

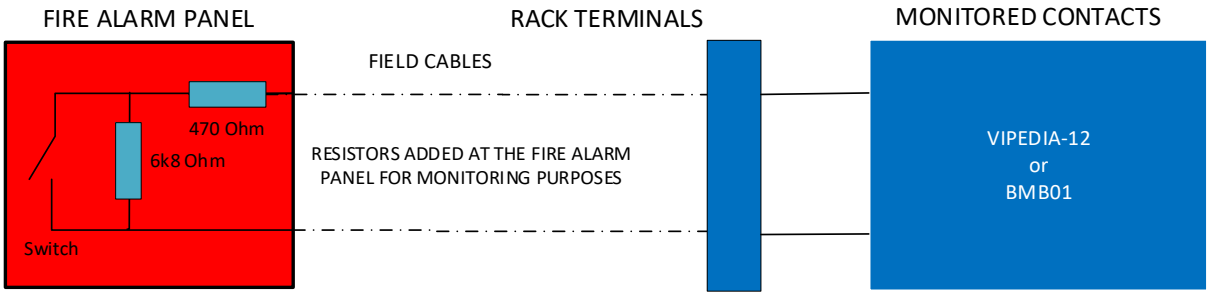


Figure 21: Monitoring the Fire Panel Interface from the BMB01 or VIPEDIA-12 Audio Router

8.3 IP Networking and Switch Configuration

Networking provides a method of reducing building wiring by distributing the amplifier functionality to where it is needed, e.g. one INTEGRA per building floor. Any of the switches listed in the INTEGRA Product certification may be installed within the INTEGRA housing to provide the required interface with the "Secure Loop" network.

For full information on networking configuration approved for use with ASL VA Systems, please refer to the following documents as listed in Appendix D, Section D.1.3.

Table 7: Network Design and Configuration Documentation

Description	Document Identifier
VIPEDIA – Multi-cluster Systems	ASL_Datasheet_VIPEDIA-12-Multi-cluster
Networking Design Guide	U-Tech_Doc_0031
Dante Configuration Guide	U-Tech_Doc_0057
Hirschmann Switch Configuration Guide covering ASL part numbers: MM4, MM8, SM4 and NF8	U-0641-3488
ASL Network Switch-LP01 Configuration Guide	U-0641-3675

9 System Configuration

Once the system has been designed and the necessary equipment installed in a rack or group of racks, it is ready for configuration.

This section focusses on the specific configuration requirements for compliance with EN 54-16. For full details regarding system configuration, refer to the "**PAVA System Configuration Tool User Guide**" (document U07010-1583) as listed in Appendix D, Section D.1.2.

N.B. ASL products are complex and are capable of configuration for multiple applications and target markets and it is important that product configuration is only performed by trained personnel.

IMPORTANT NOTE:

Failure to configure the PAVA system correctly may result in a failure of the associated system to meet the requirements of EN 54 and its ability to perform as required of a life-safety system.

9.1 VIPEDIA-12 and V2000 Static Configuration

The V2000 user's manual, document number U-0623-0383, provides general guidance on the configuration, basic operation and troubleshooting of the V2000 amplifier mainframe. It also provides guidance on setting up the VIPEDIA-12 to support the V2000. Always follow the instructions provided in this manual when configuring the V2000.

IMPORTANT NOTE: The V2000 is designed only for use with the VIPEDIA-12 and use with any other type of VA audio router is not EN 54 approved.

9.1.1 VIPEDIA-12 Static Configuration for EN 54-16 (standard functions)

9.1.1.1 Voice Alarm Zones and Amplification

For EN 54-16 compliance, the PAVA static system configuration must align the V2000 amplifier mainframes and associated amplifier slots with the associated VIPEDIA-12 audio output ports, so as to ensure that fault reporting regarding amplifiers and loudspeaker circuits correctly references the associated voice alarm zone(s).

9.1.1.2 Fault Master

Any VIPEDIA-12 Audio Router which is associated with any of the following functionality must be configured as a "Fault Master".

- Provides the VA System "General Fault" indication to the Fire Alarm System.
- Supports an Emergency Microphone providing the mandatory indications required of the VACIE.
- Provides the VACIE mandatory indications via its front panel GUI.

N.B. If required, a system may be configured to include multiple "Fault Masters".

9.1.1.3 Emergency Microphones (MPS/EMS)

For all Emergency Microphones:

1. EMS type (*BASIC SETTINGS)*

a) Select the "EN 54 Microphone Operation- Enabled" check box.

c) Select "Emergency Class" = "High"

d) Select "ANS" = "None"

e) Ensure that the "Night Volume Control" checkbox is not selected.

2. MPS type *(BASIC SETTINGS)*

a) Select the “Key Switch Controlled" check box.

b) Select the "EN 54 Microphone Operation- Enabled" check box.

c) Select "Hard-Wired" as applicable.

b) In the "MPS PTT (Switch On)" column:

i) Select "Emergency Class" = "High".

ii) Select "ANS" = "None"

iii) Select an appropriate priority to override the Emergency DVA messages.

iv) Ensure that the "Night Volume Control" checkbox is not selected.

3. EMS and MPS Microphones *(ADVANCED SETTINGS)*

For compliance with EN 54-16 and ISO 7240-16, the restrictions described in this section must be adhered to when configuring MPSXX and the EMSXX microphone units:

a) Select "PTT OPERATION" > "Store and Forward" = "Live Paging"

b) Select the "AUDIBLE NOTIFICATION" > "Fault" checkbox and set the "Fault Beep Level" to 100% or greater (see note)

Note: If the microphone is not intended to provide Control and Indicating functionality or is adjacent to the rack, the settings detailed regarding the "Fault" Indication and "Fault Beep Level" may be amended as required. However, it is important that these functions are activated in a least one location within the system.

c) Select "Dual Interface" if the microphone is dual-hosted on two VIPEDIA-12s.

d) Select "Stuck PTT Timeout (mins)" = 5

e) Deselect "Remote Priority Adjustment".

f) Audio Settings - It is recommended that " Audio Settings" should be set as default. i.e. 0dB and "Enable AGC" checked unless there is a specific requirements for them to be adjusted.

Notes:

i) Optionally the microphone can be configured to utilise a pre-announcement chime. If required, it should be configured under "Basic Settings" and the gain set as required under "Audio Settings".

ii) For early versions of VIPEDIA-12 Code, it was necessary to set up many of the microphone parameters directly via the MPS GUI. However, since the release of Release Package V3.TBD, these parameters are configured in the SCT and downloaded to the microphone at router power up.

4. EMS and MPS Microphones *(BUTTON CONFIGURATION)*

The following VA functions may also be assigned to Microphone buttons which may only be activated from an EMS multi-button microphone or MPS multi-button microphone with the key-switch activated:

- Manual Emergency Message Triggers and Resets
- VA "Manual Silence" and "Manual Silence Reset"

9.1.1.4 VA Trigger Inputs from the Fire Alarm Panel (CIE)

IMPORTANT NOTE: If the connection between the VIPEDIA-12 audio router and the Fire Alarm Panel uses the "Voltage Reversal" technique whereby the interface is monitored by the Fire Alarm Panel, it is important that the connection is made via digital inputs on a BMB01 rather than directly into the VIPEDIA-12 Control Ports. This is in due to the fact that some Fire Alarm Panels may report "Earth Leakage" faults if the VIPEDIA-12 Internal ports are used.

All VA Emergency DVA message trigger inputs from the Fire Alarm Panel (CIE) must be configured to:

1. have "High Emergency" Class
2. have appropriate priority to over-ride all lower priority announcements
3. have ANS disabled for the associated route.
4. have a method of reset from the Fire Alarm Panel (CIE).
5. provide a "Silence" function under control of the Fire Alarm Panel (CIE) (see note below)

and

6. If not monitored by the Fire Alarm Panel (CIE) (e.g., using a voltage-reversal interface), be connected via analogue contacts monitored at the VACIE (refer to Section 8.2.2, **Figure 21**)

Notes:

1. In the majority of cases, the mandatory "Silence" mode is controlled directly from the Fire Alarm System via the existing trigger and reset contacts. i.e., to silence the alarm, the Fire Alarm Panel will issue a reset and to reinstate the alarm broadcast, it will reactivate the message trigger.

2. If the method listed above is not considered suitable for use with a particular Fire Alarm Panel, ASL also offer a mode whereby the "Silence" mode can be activated using an additional pair of contacts driven from the Fire Alarm Panel specifically for this purpose. In this mode, "Silence" is reset either via a separate set of "Silence Reset" contacts activated from the Fire Alarm Panel or by reactivation of the emergency message trigger.

   Use of this EN 54 "Silence" mode requires that the route settings for each of the pre-recorded emergency messages are set as "Silenced Enabled" which also requires the "Lock to Emergency Class" padlock symbol to be unlocked to access this option.

9.1.1.5 Routing of Background Music or Other Non-Emergency broadcasts

Although BGM and other non-Emergency broadcasts are not directly associated with EN 54 Emergency functionality, ASL strongly recommend that any ancillary equipment (e.g., BGM players, radio receivers etc.) and associated audio routing not associated with Voice Alarm functionality is deactivated in the event of a mains supply failure (i.e. they should not be provided with a EN 54-4 battery-backed supply in order to minimise the battery consumption while the mains supply unavailable).

If this is not the case, the battery consumption of the ancillary device and any related power consumption (e.g. by the V2000 amplifier mainframes) must be included in the overall battery backup calculation for the system at the design stage.

N.B. Provision is included in the SCT, to configure a setting whereby, in the absence of a mains supply, amplifier routing is disabled for all routes with a priority below a defined value and/or which don't fall into the defined Class type. (follow **System>PA/VA Cluster>General Information**).

It is also highly recommended that when emergency broadcasts are in progress, other independent non-emergency broadcasts (e.g. BGM systems in retail units etc.) are overridden. In such cases, this may be facilitated by use of the VA Condition Output from the VIPEDIA-12 audio router (see Section 9.1.2.4 below).

9.1.2 VIPEDIA-12 Static Configuration of EN 54-16 (optional functions

As previously described in Section 2.3 of this document, the following optional functions are provided by the ASL VIPEDIA-12-based PAVA Systems:

9.1.2.1 "Alert" Signal

An "Alert" signal may be configured either to be triggered from the Fire Alarm Panel or Manually from an Emergency Microphone in a similar manner to that used for Evacuation announcements.

9.1.2.2 Manual Silencing of the Voice Alarm Condition

A microphone button may be configured for Emergency Microphones (EMSxx or MPSxx with keyswitch enabled) to provide "Silence" and "Silence Reset" functionality equivalent to that described in the notes to Section 9.1.1.4 above.

9.1.2.3 Manual Reset of the Voice Alarm Condition

The Voice Alarm activation may be reset at an Emergency Microphone by selecting a button as "Cancel" and configuring it to reset the Voice Alarm route(s) with which it is required to be associated.

9.1.2.4 VA Condition Output

A GPIO Output may be configurated to provide indication of VA broadcast activation, either directly or via an external relay, to the fire alarm panel or other equipment, as required.

9.1.2.5 Indication of Faults Related to the Transmission Path with the CIE

Please refer to Section 8.2 for details of this interface.

9.1.2.6 Indication of faults related to Voice Alarm Zones

This is provided as a standard feature of the EMS / MPS microphone LED indication.

9.1.2.7 VA Manual Control

This is provided as a standard configurable feature, using buttons on the EMS/MPS microphones.

9.1.2.8 Emergency Microphones

A VA System is not required to include manual control. This is provided as a standard feature of the ASL VIPEDIA-12-based PAVA system.

9.1.2.9 Microphone Priority

This a standard configurable feature of the ASL VIPEDIA-12-based PAVA System.

9.1.2.10 Microphone Emergency Loudspeaker Zone Control

Emergency Microphone zoned routing is provided by configurable Zone Select buttons provided on the Emergency microphones.

9.1.2.11 Redundant Power Amplifiers

The ASL VIPEDIA-12-based PAVA system provides the facility to configure standby amplifiers to take over in the event that one or more working amplifiers should fail in a system.

9.1.3 V2000 Static Configuration Settings

1. Add a Battery (24V version : BPC65 or BPC 75)(48V version : BPC130-48)
2. V2000 Amplifier Frame General Settings

   Set the required amplifier slot allocations to include:

   - Amplifier type : D150 / D500
   - Output Voltage : 50V / 75V / 100V
   - Output Power : loading (+ required safety margin)
   - Surveillance Type : Disabled / DC / Impedance / Loopback
   - Output Type : single or Dual (A/B) Loudspeaker circuit.
   - Audio Output : the associated VIPEDIA-12 output channel
   - Standby Amplifiers : internal / single / dual + location

3. Advanced General Frame Settings:

   - Frame Information Settings
     - Frame ID : **as required**
     - Frame IP Address : **as required**
     - DC Voltage : **24V / 48V**
   - Surveillance settings:
     - Temperature Alarm : **70°C (default) (**see note iii) below)
     - Earth Leakage Detection : **Enabled**
     - Amplifier Input Surveillance **: Enabled**
     - Amplifier Output Surveillance : **Enabled**
     - Amplifier Surveillance Frequency **: Low**
     - Loop Return Frequency : **Low**
   - Engineering Surveillance Settings:
     - Tone Interval : **85 secs or less**
     - Low Frequency Duration : **3.0 s**
     - High Frequency Duration : **3.0 s**

- Residual Current Threshold : **disabled** (Not EN 54 critical)
- Power Limiter : **enabled**

4. Advanced Miscellaneous Global settings:

   - Surveillance Tone Ramp Time : **1000ms**
   - DC EOL Delay : **4000ms**
   - DC EOL Window : **500ms**

5. Configure surveillance as required for each amplifier zone.
   Notes:
   i) Surveillance tone parameters required for the various surveillance techniques must first be configured using the VIPEDIA-12 Dynamic Configuration Tool.

   ii) For details regarding the setup and configuration of Loudspeaker Line Impedance Monitoring, please contact ASL Technical Support Services and request a copy of ASL Tech. Note #75. Please refer also to the EOLZ01 End of Line Impedance Device Installation Guide as listed in Appendix D, Section D.1.4.

   iii) The Temperature Alarm setting detailed in the above listing is a fixed default associated with versions of the SCT prior to V4.2.0.6P and defines the temperature at which a control port configured as "Fan" is activated .

   SCT V4.2.0.6P (and following versions of the tool) enable more detailed control of the Fan Control temperature ranges as follows:

Function	Default Setting (°C)	Adjustment Range (°C)	Notes
Fan Trip Temperature:	60	40 - 70	The Fan range assigns a hysteresis setting to control the temperature at which the fan is deactivated. E.g. for the default settings, the fan will activate at 60°C and run until the temperature falls to 50°C.
Fan Range	10	5 - 20	
Amp Fan Trip	60	40 - 70	
Amp Fan Range	10	5 - 20	

6. Configure Standby Amplifiers as required (optional EN 54-16 feature).

9.1.4 VIPEDIA-12 Dynamic Configuration

Microphone Input Surveillance : Must be configured for all Emergency Microphones.

Microphone Input Equalisation : The VIPEDIA-12 dynamic configuration settings for the input associated with the MPS/EMS used as an Emergency Microphone should be set to accept LF surveillance at -14dBu and provide 3.3dB attenuation at 251Hz with a Q of 1. All other settings must be set to default.

VIPEDIA-12 Output Surveillance Tones: Must be configured as required for the associated amplifier configuration (refer to the associated Installation

manuals listed in Sections D.1.2 and D.1.3 of Appendix D).

VIPEDIA-12 Output Equalisation **:** Must be configured on an output-by-output basis when the EN 54 certification for the associated loudspeaker types requires it. For further information, refer to the published specifications for the loudspeaker types installed as part of the system.

9.1.5 V2000 Dynamic Configuration

The V2000 system surveillance must be set up using the dynamic configuration tool for all V2000 Amplifier Slots associated with Voice Alarm zone outputs.

Amplifier Input Surveillance : Not required for EN 54-16 if the VIPEDIA-12 and V2000 are in the same cabinet but ASL recommend that it is configured in all cases.

Amplifier Surveillance : Must be configured.

Loudspeaker Line Monitoring **:** Must be configured using DC-EOL or Impedance monitoring.

Earth Leakage **:** Must be configured.

9.2 Network Configuration

For details of the configuration of the Network and associated switches, please refer to the appropriate documents as listed in Appendix D, Section D1.3).

10 System Acceptance Test

After Design and Build of an EN 54-16 system using ASL components, the system must be tested to ensure that it meets the design requirements.

ASL has produced a guideline system check list for EN 54-16 racks designed and built in accordance with this system design guide. ASL customers building their own Voice Alarm Systems may use this to assist development of their own System Acceptance Test Plans.

This document, filename T-0667-0117, is subject to change in accordance with ASL document control procedures. Please contact ASL to obtain a copy of the latest version.

11 CE Marking and Labelling

11.1 CE Mark / EN 54 labelling (EN 54-16 clause 15 and ZA.3).

IMPORTANT NOTES:

The following information defines the labelling which may be applied to systems designed, assembled, configured and tested by Application Solutions (Safety and Security) Ltd.

i) For systems designed, assembled, configured and tested by system integrators/distributors, the responsibility for applying the requisite labelling shall lie with the associated company/organisation.

ii) Use of this label is invalid if the installation is not made in accordance with the instructions in the associated installation manuals and this design guide.

iii) This label should not be applied to the system racks if the system is to be used purely for a Public Address (i.e. non-VA) application.

iv) The approval reference number, 2831-CPR-F0143, differs from that applied to the INTEGRA Wall-mounted products and should be replaced by the integrator/distributor's certification code if applicable (please refer to note i) above.

11.1.1 Rack Labelling

Labelling equivalent to that shown in the sketch below shall be fitted to the outside surface of the rack or group of bayed racks so that it is visible at access level 1.

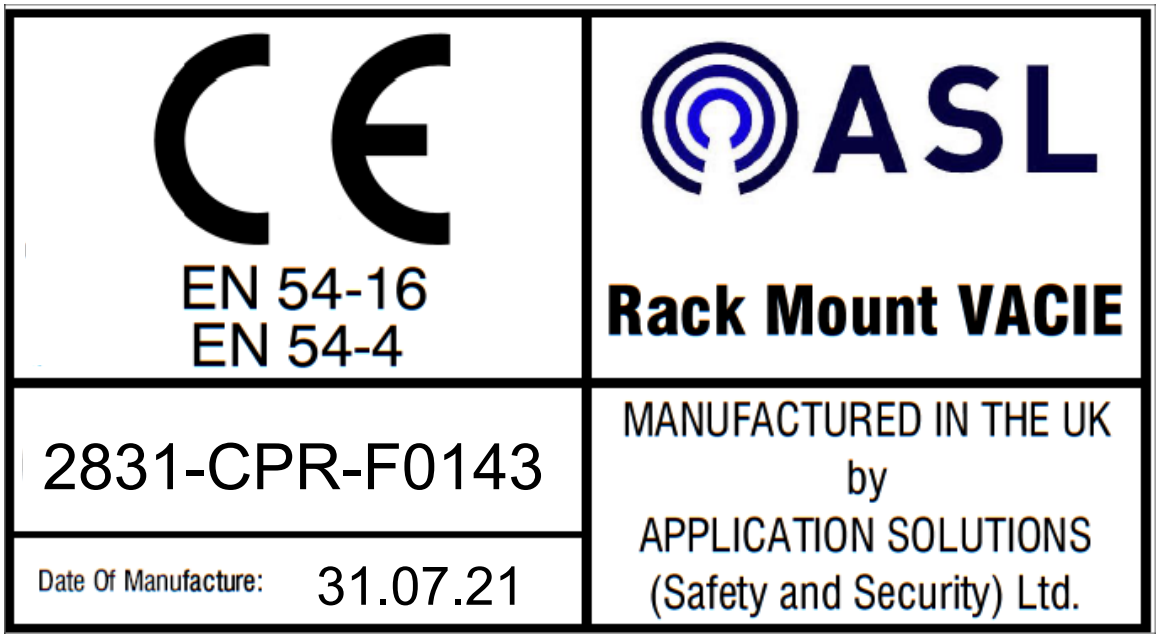


Figure 22 : Sample EN 54 Label (for application to systems designed, built and configured by ASL)

11.1.2 Emergency Microphone Labelling

All Emergency Microphone Stations and devices with mandatory EN 54-16 controls and indicators are required to have a label as below or equivalent affixed and viewable at Access Level 1. Applicable ASL products will have this label fitted at manufacture and it should not be removed.

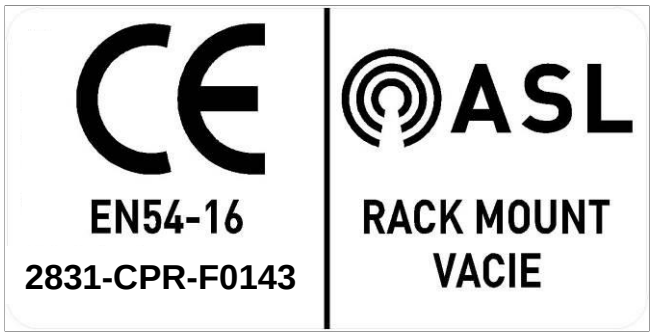


Figure 23: Sample Equipment Label

11.2 LPCB Label

For ASL-built racks only, in addition to the CE label, the LCPB Label shown below shall also be affixed to the rear door of the bayed cabinet array adjacent to the CE label (see Figure 22 above).

Figure 24: Sample LPCB Label

11.3 EN 54 Power Indicator Label

For EN 54 system racks not incorporating a transparent door, the label shown in Figure 25 below should be affixed to the outside surface of the rack door immediately above the Power Indicator LED.

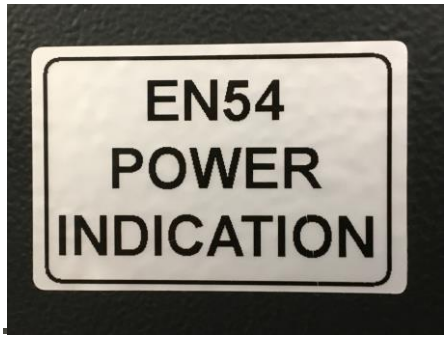


Figure 25: EN 54 Power Indication Label

11.4 Product Safety Labelling

The following information identifies the general requirements for the application of safety labelling of an ASL rack assembly in order for it to comply with the requirements IEC62368-Part1. For the latest information regarding equipment safety requirements, refer to the ASL website downloads area (see listing in Appendix C, Section C.1.5 of this document).

11.4.1 Terminals and Interconnections

Any terminals carrying greater than 50V must be labelled  at both ends of the associated group of terminals.

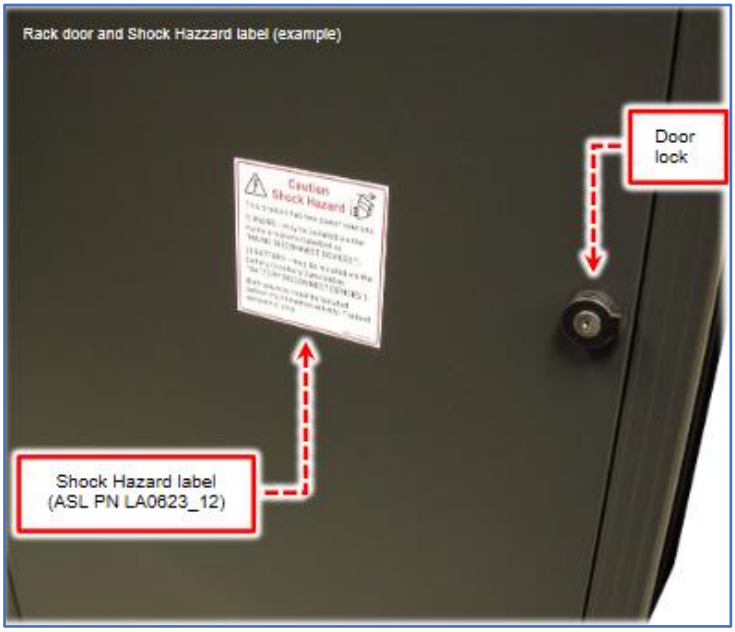
Any interconnections carrying greater than 50V must also be labelled as above.

11.4.2 Rack Rear Doors

Rack rear doors must carry, the following labels placed adjacent to the lock.:

i) “230V” ,  and “THIS EQUIPMENT MUST BE EARTHED"

ii) The "SHOCK HAZARD" label (provided with the V2000 mainframes)

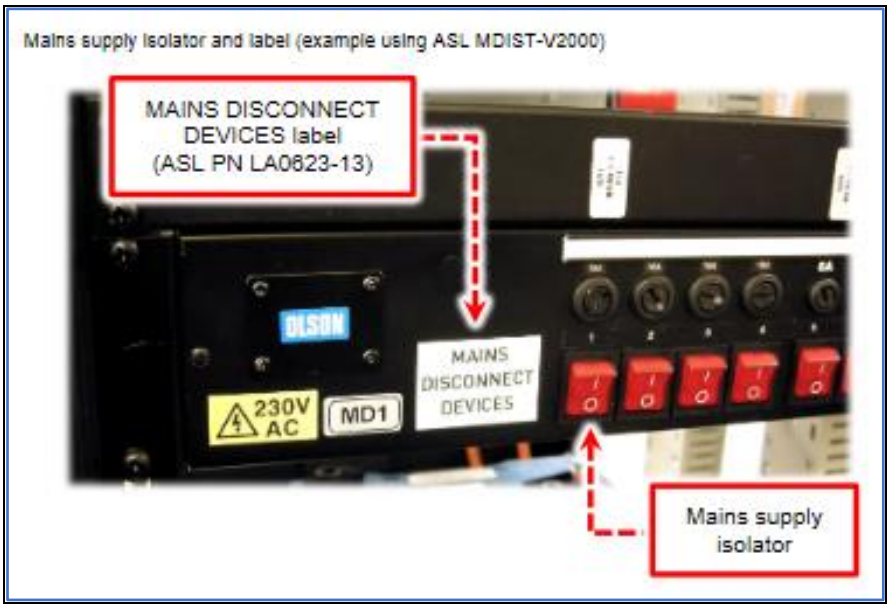


11.4.3 Main Earth Point

The Main Earthing Point must carry a ⏚ label adjacent to the post.

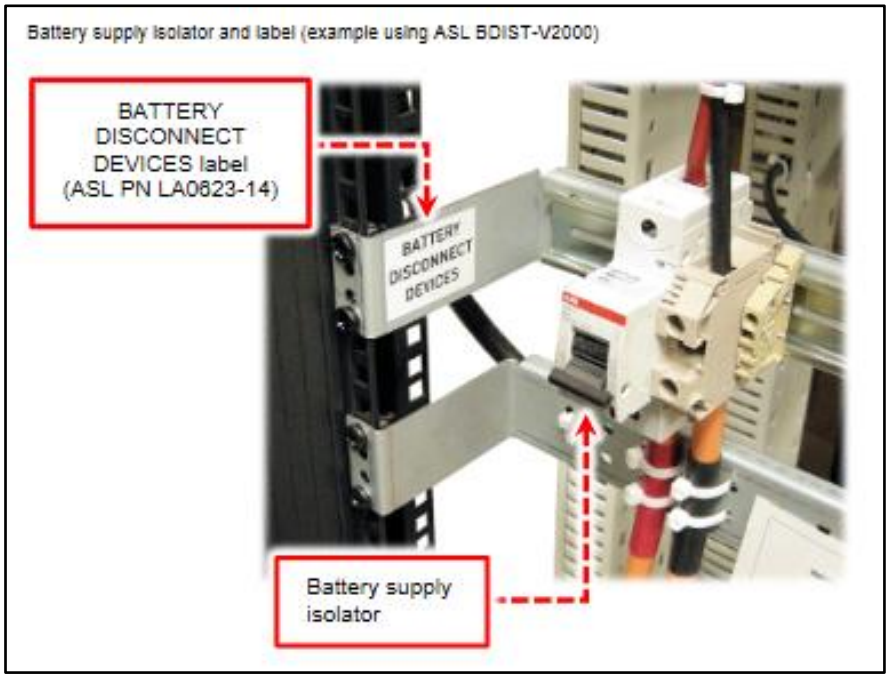
11.4.4 Mains Disconnect Labels

The "MAINS DISCONNECT DEVICES" label (provided with the V2000 mainframes) must be fitted next to any mains supply isolation devices/breakers.



11.4.5 Battery Disconnect Labels

The "BATTERY DISCONNECT DEVICES" label (provided with the V2000 mainframes) must be fitted next to any battery disconnect devices/breakers.



12 Accompanying Product Documentation

In addition to all relevant product manuals, the completed rack must be accompanied by documentation that meets the requirements of both EN 54-16 and the Construction Product regulations (see note 1). The content below is suitable and should be provided with the completed Voice Alarm System (see notes 2 and 4).

IMPORTANT NOTE: The list of "Provided Options" should only include the options configured for a particular project and as such should be individually compiled on a project-by-project basis.

CE 13	The CE mark followed by last two digits of the year in which the mark is first affixed.
2831	Identification number of notified body. (see note 4)
Application Solutions (Safety and Security) Ltd. Unit 17, Cliffe Industrial Estate, Lewes, East Sussex, BN8 6JL U.K.	Name and address of system manufacturer.
Voice Alarm Control and Indicating Equipment according to Declaration of Performance reference T-0667-0384	Product type designation and DofP reference (note 2)
EN 54-16: 2008	European standard reference
Voice alarm control and indicating equipment for fire detection and fire alarm systems for buildings	Description of product
Provided Options *Manual Silencing of the Voice Alarm Condition* *Manual reset of the Voice Alarm Condition* *Voice Alarm condition output* *Indication of faults related to the transmission path to the CIE* *Indication of faults related to voice alarm zones* *Voice Alarm manual control* *Emergency Microphones* *Redundant Power Amplifiers*	List of optional functions incorporated into the specific system to which this notice relates. *(for further details refer to Section 2.3 of this document)*
EN 54-4:1997+A1+A2 Power supply equipment for fire detection and fire alarm systems for buildings.	European standard reference. Description of product
Refer to manufacturer's installation and product manuals for other technical data.	Other information.

Notes:

1. Reference: EN 54-16 clause ZA.3 and Construction Product Regulations article 9.
2. ASL provide this as a laminated document which accompanies the rack on despatch.
3. If simplified procedures as defined by article 5 of the Construction Product Regulations are used, this can be replaced by the number of the EC Certificate of Conformance. For ASL products this is 2831-CPR-F0143.
4. The Identification number of the notified body should match that associated with EN 54 label (see Section 11)

Appendix A – ASL Rack Build Instructions

A.1 Terminals and Internal Cabling

A.1.1 Terminals

This section provides guidance on the termination methods and labelling conventions used by ASL to satisfy the requirements of EN 54-16 with respect to Rack builds.

In general, external cabling is connected to screw-type terminals mounted on 35 mm DIN rail within the rack cabinet although where applicable, direct connections may be made via RJ45 connections (e.g., network copper cables etc.).

Terminal labelling is achieved by marking each terminal with an identifying mark as described in this section. A terminal wiring diagram showing the function of each terminal and ratings of fuses shall be installed inside the cabinet to clearly identify the terminal configuration.

A.1.2 DIN Rail Locations, Cable Entry Direction and Numbering

Cable entry shall always be deemed to be through the top of the cabinet unless otherwise specified in the VACOR.

A.1.2.1 Top entry

In this case, terminal rails are usually placed as high as possible (rack height –1U) with field cable entry into the bottom of the terminals. Location is to be specified pictorially on the layout drawing.

If one terminal rail only is required, this should be positioned at the rear.

If two terminal rails are required, these should be positioned at the front and rear if rack space allows. Terminals should start on the front rail and continue on the rear. ASL convention is as follows:

- Front Rails - Low voltage wiring (e.g., audio inputs, control inputs/outputs.
- Rear Rails – High voltage wiring (e.g., 230Vac and 100V audio outputs).

If multiple terminal rails are fitted front and/or rear, then terminals should start on the top rail and continue downwards. Except under exceptional circumstances, terminal rails should be vertically spaced by a minimum of 3U to ensure unhindered access for external cable management.

Always number DIN rails in sequential order, starting at the front top of the rack and working down. (e.g., rail11; rail12; rail13 etc)

The first digit indicates the rack number (e.g., rail 11, 21 etc)

Terminals shall be numbered from left to right (as viewed externally) in all instances. Terminal groups should be arranged so that they run in alphabetical order wherever possible, the exception being high voltage/current terminals (see below).

Any terminals carrying voltages greater than 50V or current greater than 10A are to be segregated on the terminal rail and positioned to the V2000 mains side (RHS as viewed from the rack front face) of the cabinet. Under general circumstances, this only applies to 100V line outputs and V2000 battery feeds. A minimum separation of two-end blocks should be maintained.

Double terminals shall be provided for the interface with the Fire Alarm Panel where the interface is of the voltage -reversal type, to provide a simple means of installing the associated line-termination resistors.

A.1.2.2 Bottom Entry

The basic rules detailed above shall apply - however:

- the terminal rails shall be installed to the base of the rack (-1U)
- field cable entry shall be via the top of the terminal rails.
- the lowest equipment item within the rack (typically BPC65, BPC75 or BPC130 shall be raised such that it is located at least 3U above the upper terminal rail.

A.1.3 Identification

A.1.3.1 Annotation on the Rack Diagram

Field terminals shall be annotated using the scheme ann mm, where a is an alpha-numeric prefix from the list in Table 8 below, nn is the rack location identifier and mm is the terminal number.

Table 8: Terminal Identification Prefix

Prefix	Description
A	ANS
B	For future use
C	SMS MIC / HCI MIC
D	DANS
E	Emergency Microphone (e.g., EMS/MPS)
F	Fire Panel
G	PCDVA audio and Control Interfaces
H	HCP Serial Control Interface
J	Emergency Network I/O (Intellevac)
K	For future use
L	LLPA Audio Inputs and Control
M	Mains Supply (115Vac /230Vac)
N	Mind-the-Gap, Message trigger inputs
P	Paging Microphone (e.g., MPS and other non-emergency general paging microphones)

Prefix	Description
Q	Other Control Inputs / Outputs
R	Rack Internal connections
S	SAPs / RRMs
T	Other audio inputs
U	Other audio outputs
V	Volume Control / Program Selectors
W	Fan Power (V2000, Door-mounted and Top-Panel mounted)
X	Inter-rack connections
Y	EN 54 Power Indicator
Z	100V LINE O/Ps

Note: this table includes a detailed listing of rack-facing interfaces including those not associated with EN 54 functionality.

e.g.,

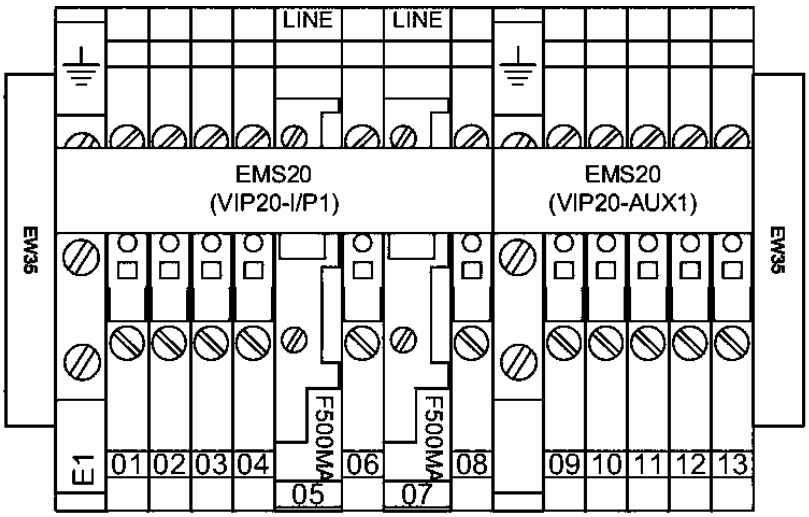
Description	Terminal Annotation
EMS1 terminal 12	E1 12
ANS11 terminal 3	A11 3
Zone 1 100V output	Z1-1 & Z1-2

A.1.3.2 Marking of Terminals

Block number (e.g., as A1 below) to be marked at side of the first terminal.

Terminal numbers to be marked at the field wiring side of each terminal.

Example for EMSxx shown below.



A.1.3.3 Fusing

The following terminals shall be fused:

Table 9: Terminal Fuse Requirements

Interface	Terminal	Rating
SMC	+V SUPPLY	F500mA
FMSxx	+VSUPPLY	F500mA
	SN LED+	F63mA
	ACO LED+	F63mA
DMSxx	+VSUPPLY	F500mA
EMSxx/MPsxx	+SUPPLY#1	F500mA
	+SUPPLY#2	F500mA
SAP02 (see note)	+V SUPPLY	T500mA
SAP03 (see note)	+V SUPPLY	T500mA
ANS	+V SUPPLY	T100mA
DANS01	+V SUPPLY	F500mA
RAK-FAN-01	+V SUPPLY	T1.6A
RAK-FAN-02	+V SUPPLY	T5.0A

Note: The stated fuse rating for the SAP variants is compatible with the SAP and RMR combination.

A.1.3.4 Earth Terminals

Earth terminals shall be allocated to align with the expected field cable interface (e.g., one connection per CAT5 screened cable or one connection per 100V line cable pair).

Terminals should be selected to be large enough for the anticipated cable capacity - normally WPE4.

A Main earthing point shall be provided.

A.2 Rack Cross Connections

A.2.1 Bayed Rack Systems

Multiple rack systems shall be cross-connected by flying leads terminated by D-type connectors or using CAT5 cables terminated by RJ45 connectors, as applicable.

All flying leads shall be sourced from the rack with the lower ident number for connection to fixed connectors in the racks with the higher ident numbers.

Where D-connectors are used, the connectors shall be arranged to ensure that live (source) connections are always presented on female connectors.

Rack cross-connectors are prefixed X followed by sequential numbering.

e.g.,

Description	Schematic
Rack 1 (to Rack 2) cross-connection	X1
Rack 2 corresponding connection	X1

On large multi-rack systems, a more detailed labelling system may be used as appropriate to indicate the source and destination racks.

A.2.1.1 General Signal and Control connections

General Signal and Control signals shall be connected between racks by flying leads terminated by either 25way D-type male or female connectors or CAT5 connections as applicable.

Examples of CAT5 interconnections between racks are:

- A group of audio router outputs is fed into a separate rack and locally distributed in that rack to amplifier inputs via a BOA2.
- Copper network interconnections

  N.B. In the case of CAT5 interconnections, they will be labelled to indicate the source (e.g., VIP1 AOUTA 1-4) and the destination is identified on the system drawings.

A.2.1.2 Auxiliary Power connections

Where Standby amplifier output and battery feeds are required to distribute auxiliary power between bayed racks, this shall be done using flying leads with 5W5 Power-D type connectors.

A.2.2 Distributed Rack Systems and Connections to Emergency Microphones

If a requirement exists for Power Distribution between non-bayed racks, the power feeds must be duplicated in such a way that a failure of one connection cannot affect the second connection.

Duplicated supplies are also a requirement for the connection between the rack and Emergency Microphones and should be provided in accordance with the following rules:

- Dual power feeds are required in such a manner that failure of one supply (o/c or s/c) will not jeopardise the ability of the system to function as intended.
- Both power supply feeds should be derived from EN 54-4 battery-backed supply sources.

- The two power feeds may be provided from a single source via separate fuses provided that a short circuit on one or other of the power feeds cannot not adversely affect the supply source.

  i.e. the protection associated with the power supply source must not react more rapidly than the time for the power feed fuse to rupture.

- To utilise the hard-wired hardware bypass facility associated with VIPEDIA-12 inputs 1 and 2, neither power feed for the microphone should be derived from the associated audio router inputs.

  N.B.. This is because failure of the audio router's CPU will disable the power supply provided via the audio input.

A.3 Internal Cable Types and Screen Termination

A.3.1 General Rules

1. For compliance with RoHS and REACH, cables, wiring and terminations must be of appropriate types.
2. Cables should be installed within the rack in a logical and tidy manner: it is recommended that:

   - Signal cables are segregated from Power and 100V loudspeaker line output cabling.

     In ASL racks, when viewed from the rear, power and 100V line cables are installed to the LH side while the signal/low level control cabling is installed to the RH side.

   - Cable/wiring lengths should be chosen to ensure that:

     a) the cables/wiring are not stressed when installed.

     b) there is sufficient spare length to enable terminations to be remade in the event of a cable/wiring breakage or connector failure.

     c) equipment can be removed/maintained without obstruction.

A tidy and well-organised wiring layout also shows that the rack has been designed and assembled in a professional manner which will help to provide the customer with reassurance of the quality of the delivered system.

A.3.1.1 Multi-core Cables

- All multi-core cables shall be of the Low Smoke Zero Halogen type.

- Short single core connections may be standard PVC type.

- All multi-core cabling shall be screened with the following exceptions:

  - Mains feeds.

  - 100V amplifier O/Ps including standby amplifier feeds internal to the rack.

  - DC power.

A.3.1.2 Screened Cables

- All cable screens should be made off at both ends where possible.
- Additional earthing DIN rail terminals to be provided where required for connection to cable screens.
- The screen tail length shall be ≤ 30mm.
- The unscreened tail length shall be ≤ 30mm.

A.3.2 Pre-manufactured Cable Assemblies

The following cable assemblies should be specified wherever possible to improve system build time:

Table 10: VIPEDIA-12/V400/V2000 Cable Assemblies

Part no.	Description	Notes
A0548001	160mm CAT5 screened	General interconnections
A0548002	260mm CAT5 screened	General interconnections
A0548003	1 metre CAT5 screened	General interconnections
A0548004	2 metre CAT5 screened	General interconnections
A0548011	3 metre CAT5 screened	General interconnections
A0548005	4 metre CAT5 screened	General interconnections
MDIST-V2000	Mains Cable set	Connection from the MDIST to the V2000 mainframe.
BDIST-V2000	Battery Cable set	Connection between the battery tray and the V2000 mainframe.
A0477010	RACK CAN BUS LSHF CABLE ASSY	Connection of the AUDIO-CAN function between V400 mainframes at 3U spacing only.
A0477024	V400 Mains Cables	Connection between the MDIST and the V400 mainframe.
A0477012	V400 Battery Cables	Connection between the battery tray and V400 mainframe.

Other pre-manufactured cables are available for system build but not generally specified in design documentation, e.g., mains cables, battery cables, RJ45 screened cables.

A.4 Labelling of Rack Items

A.4.1 Safety Labels

For full details regarding safety-related labelling, refer to Section 11.4 of this document.

A.4.2 General Labelling

A.4.2.1 Amplifier Front and Back Panels

All amplifier mainframe front panels to be labelled at right hand end with mainframe number and system description.

- V400 : on front panel and behind the panel
- V2000 : on RHS mainframe handle

e.g.,

F01

ST HENRY
STATION

where the frame number is derived in a continuous bottom-to-top sequence commencing in Rack #1 and moving through additional racks (if applicable) in number sequence. i.e., F01 is the lowest amplifier mainframe in Rack #1.

All amplifier front panels to be labelled with the mainframe/slot, zone description, zone number and power rating. Similar labels shall also be added to the rear of the mainframe, directly above the associated interface cards.

Viewed from the Mainframe front panel, amplifier slots shall be numbered in left to right sequence.

e.g.,

F11/01

TKT HALL

ZONE 1A

500W

A.4.2.2 MCBs

All MCBs to be labelled with their BDIST reference, current rating and destination(s).

e.g.,

Breaker #1
BDIST80-A
F01

or:

BREAKER #3
BDIST12-B
VAR1 / SC1

Important Note: Also refer to Appendix A, Section A.1.5.1.3.

A.4.2.3 MDISTs

All MDIST sockets and mains cables to be labelled with their MAINS reference and destination

e.g.,

MDIST 1-1
MAINS1
F01

or:

MDIST 2-1
MAINS2
CH1

Important Note: Also refer to Appendix A, Section A.1.5.1.4.

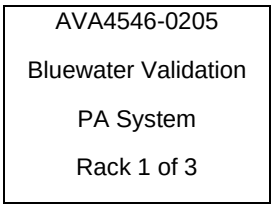
A.4.2.4 100V Cables

All 100V line output cables to be labelled at the DIN-rail terminations with zone number and name as referenced on the schematic e.g.,

ZONE 1A

A.4.2.5 Project Labelling

All racks to be labelled with project number, system name and rack number e.g.,



A.4.2.6 Other Labelling

a) All other ASL products incorporated into a rack build to be labelled with their drawing reference.

b) Particular jobs may require additional labelling e.g., Traffolite ID labels. Refer to the customer requirements for details, as required.

A.5 Laminated Diagrams

The following laminated diagrams shall be installed inside the cabinet:

1. One or more A3 terminal diagrams to clearly identify the terminal configuration including the function of each terminal and fuse ratings etc.
2. An A3 rack layout drawing to clearly identify the rack layout and the location of mainframes, PSUs, other rack mounted equipment and terminal rails.
3. An A4 copy of the document detailed in Section 12.

Appendix B – Thermal Management

B.1 Introduction

This appendix provides an expanded version of the information provided in Section 7.8.7 of this Design Guide.

B.1.1 Calculation of the Heat generated by the Rack Equipment

It is important to understand the amount of heat that is generated within the rack. This is done by producing a list of all the equipment within the rack and for each item assessing how much heat it will generate. The amount of heat generated by any item of equipment will be extremely dependent upon the equipment type, its configuration and its operating mode. Section B.2.1 of this document details the heat produced by ASL equipment in some of its typical configurations and operating modes.

B.1.2 Internal Rack Temperature Calculations

Having assessed the amount of heat produced in the rack, the next part of the design is to work out the approximate internal rack air temperature. This temperature should be less than the recommended maximum values defined in Table 11. The air temperature inside the rack is dependent upon the ability of the rack to exchange heat with the external rack environment. The method of assessment is provided in Appendix B, Section B.2.2 of this document. When calculating the internal ambient rack temperature, it should be noted that this assumes that the external ambient temperature is to some extent controlled. However, the necessity for air cooling of the external equipment room ambient environment is outside the scope of this document.

B.1.3 Confirmation of Maximum Equipment Temperatures

Once a suitable internal rack ambient temperature has been established, the next step is to ensure that, to maximise product reliability, the equipment within the rack does not exceed the recommended maximum equipment temperature as detailed in Table 11 below. This is established from the individual equipment power dissipation, the ambient rack temperature and the airflow through or round about it. The details of these estimations are provided in Appendix B, Section B.3. It maybe that after doing these final estimations of equipment temperature, there is a need to revisit the internal rack ambient temperature to achieve a satisfactory temperature level.

N.B. It is also important to take into account the recommended maximum ambient temperatures associated with the batteries, which are likely to suffer a reduced operational life at ambient temperatures exceeding 25°C.

B.2 Thermal Estimation

It should be noted that the estimations given in the following sections are not exact and some margin for error should be factored into the design. It should also be noted that the estimates assume steady state conditions, this will impose a higher level of ventilation and battery backup of the ventilation than may be necessary for the real system implementation. For some systems where the normal power dissipation is much lower than the emergency operating power, it may be more appropriate to use a transient analysis for estimating equipment temperatures. Transient analyses should be done with care and should be verified empirically.

Table 11: Temperature De-rating for VIPEDIA-12, -NET, -PRO, -TS1 and SFP products

VIPEDIA-12 Variant	Maximum ambient temperature	
	Without TS1	With TS1
VIPEDIA-12	55°C	n/a
VIPEDIA-12-NET (No SFP modules)	55°C	55°C
VIPEDIA-12-NET (2 off SFP modules fitted)	50°C	45°C
VIPEDIA-12-PRO (No SFP modules)	50°C	n/a
VIPEDIA-12-PRO (2 off SFP modules fitted)	50°C	n/a

B.2.1 Equipment Thermal budgets

The amount of power dissipated within a 19" rack containing VA equipment will range from less than 100W in a single VIPEDIA-12 with 400W amplification to over 1kW in a multi-bayed multi-VIPEDIA-12 system with multiple V2000 amplifier mainframes.

The following section provides typical details of the power dissipated by ASL rack components. These should be validated by the designer against the particular site operation and conditions of deployment.

B.2.1.1 VIPEDIA-12 Power Dissipation

VIPEDIA-12 power dissipation during normal operation is typically up to 18W. The input power can be greater than this dependent upon what external power connections are provided for peripheral equipment (e.g., microphones and contact outputs). Table 12 below provides typical values for each family variant.

Table 12: VIPEDIA-12 Family Power Dissipations in rack

VIPEDIA-12 Variant (Supply = 27.3V, typical for Voice Alarms)	Power Dissipation (Watts)
VIPEDIA-12	11W
VIPEDIA-12-NET (No SFP modules)	14W
VIPEDIA-12-NET (2 off SFP modules fitted)	16W
VIPEDIA-12-PRO (No SFP modules)	16W
VIPEDIA-12-PRO (2 off SFP modules fitted)	18W

The optional VIPEDIA-TS1 module adds approximately 1 Watt to the above figures.

B.2.1.2 V2000 Power Dissipation

There are a number of components that contribute to the V2000 power dissipation:

- PSU Management Power, P_{man}, constant power draw when V2000 is active (2W).
- Battery Charging Power, P_{charge}, variable power loss due to losses in battery charging supply (1W to 8W).
- Mains-derived Back Plane Power, P_{mbp}, applicable on when unit is powering amplification from mains supply (100W + (Amplifier losses + Output power + LSZDC power) * ((1 / PSU_Efficiency) - 1).
- PSU efficiency is 0.9 for the above calculation (90%).
- Battery-derived Back Plane Power Losses, P_{bbp}, applicable when unit is powering amplification from battery supply (0 to 10W max).

B.2.1.3 D500/D150 Power dissipation

The power dissipation within a D150 unit depends upon its operating mode, input signal, and output loading.

The power dissipation may be thought of as having three components:

- Sleep mode power dissipation, P_{sleep}, (0.34W typical).

- Idle switching power consumption, $P_{idle,}$ this is input source dependent and is incurred whenever the amplifier is not in sleep mode,

    - P_{idle} = 0W when in sleep
    - P_{idle} = 6.7W when not in sleep and has no audio signal input applied
    - P_{idle} = 13.5W when not in sleep and has $1/8^{th}$ power pink noise signal input applied
    - P_{idle} = 19.5W when not in sleep and has sine-wave input applied

- Output losses, $P_{out,}$ related to amplifier efficiency and loading

    - P_{out} = Output Power * (1/efficiency – 1)
    - Note that the efficiency is a function of load power.
    - e.g., with 500W load and $1/8^{th}$ power Pink Noise input signal, P_{out} = 500W / 8 * (1/0.86 – 1) = 10W

An Example for a D500 operating with a pink noise input and 500W load is.

$$P_{total} = P_{sleep} + P_{idle} + P_{out} = 0.34W + 13.5W + 10W = 23.8W$$

B.2.1.4 LSZDC Power Dissipation

The LSZDC has two power modes: sleep and normal.

In sleep mode, the power dissipation is 0.1W and in normal mode is 1W.

B.2.2 Estimation of Rack Ambient Temperature

B.2.2.1 Passive Cooling

The passive cooling of a cabinet requires dissipation from the cabinet surfaces into the environment. The external environment temperature must always be less than the internal temperature for dissipation to occur. The dissipating surfaces can be calculated with the rule of thumb 5W per m^2 per degree C, assuming the air inside is evenly distributed. Beware that if external thermal radiation (perhaps solar or from a radiator) is present then the calculation is not valid.

A full-size cabinet 42U high 600mm wide and 800mm deep (approximately $5m^2$ effective surface area) will have a thermal difference of 10°C with a heat dissipation of approximately 250W.

A 34U cabinet 600mm wide and 800mm deep (approximately $4m^2$ effective surface area) will have a thermal difference of 10°C with a heat dissipation of approximately 200W.

If the external room temperature can be kept to less 30°C, then this form of cooling is appropriate for systems dissipating up to about 500W.

This sets the maximum system size at about two VIPEDIA-12 and two fully-loaded V2000 mainframes.

N.B. It is important to understand that this assumes that the internal air temperature is uniform within the enclosure.

B.2.2.2 Active Cooling

When we are dealing with internal dissipation levels of greater than 500W or when the equipment room ambient exceeds 30°C, it becomes essential to use fans to remove and distribute excess heat.

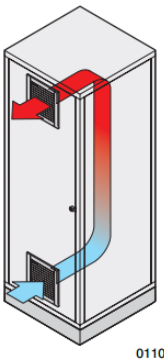
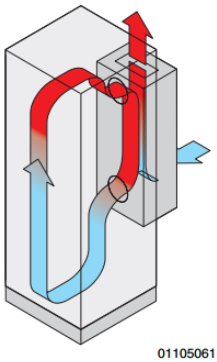
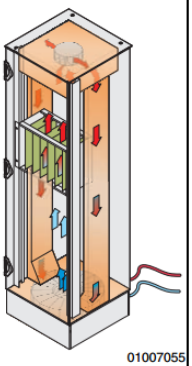
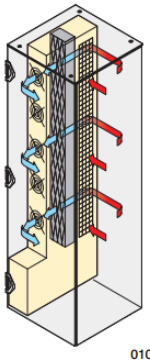
Fans help both by eliminating hot spots within the rack which in turn ensures lower equipment temperatures and also by expelling hot air from the enclosure.

As a rule of thumb, with an air volume of $3.3m^3/h$, the temperature increases by 1°C for each 1W of power dissipation. Therefore, with a power dissipation of 1000W and a temperature increase of 10°C, an air volume of $3.3 * 1000/10 = 330m^3/h$ is necessary.

This can be provided by a simple air-filtered fan rack as shown below.

Climate control

Products / cooling concepts

Product	Air filtered fan	Climate equipment	Air / air-heat exchanger LHX 3	Air / water-heat exchanger LHX 20/40
Cooling concept	 01102050	 01105061	 01007055	 01005081
Description	Cooling with air	Cooling with air	Air conditioner	Cooling with water
Type of protection	≤ IP 54	≥ IP 55	≥ IP 55	≥ IP 55
Noise level approx.	39 ... 71 dB(A)	60 ... 81 dB(A)	45,2 dB(A)	50 ... 70 dB(A)
Ambient conditions	$T_i > T_a$	$T_a \leq 55°C$	$T_a \leq 70°C$	$T_a \leq 70°C$
Cooling capacity approx.[1)]	< 1500 W	< 2600 W	< 3000 W	< 40000 W

1) depending on cabinet size, electronic components , location and room cooling concept
T_i = cabinet inner temperature T_a = cabinet ambient temperature

Figure 26: Rack Climate Control (Schroff)

The addition of a rack fan provides both improves air distribution within the rack and reduces the required internal rack-to-ambient temperature gradient needed for a given power.

This provides a good solution for a system containing up to two VIPEDIA-12 and two fully loaded V2000s, especially if these can be separated by 2U or more.

For larger systems with three or more fully loaded V2000s, it becomes more difficult to guarantee a uniform air temperature within the unit even with an external fan and therefore, to prevent local hot spots, it is necessary to use rack tray fans in addition to the rack fans.

When specifying 19” fans, the required air capacity will be calculated to dissipate the heat generated in the system:

The required airflow volume is calculated as follows:

$$V = (f \times P_v) / \Delta T$$

Where:

V = airflow volume

f = Air constant=3.3m^3 K/Wh

P_v = Heat dissipation of the system (W)

ΔT = Difference between the internal air below the device and the maximum allowable temperature in the device.

The ASL fan tray (RAK-FAN-01) will provide an airflow of about 150m^3/h in the frame immediately above it. If multiple V2000 frames are used, then ASL air-guides should be placed between the frames to contain the airflow. The airflow will however decrease slightly to around 100m^3/h in a stack of four frames and as a result, the temperature difference between the lower surface and upper surface of a V2000 frame with a given power dissipation will be slightly higher for the one at the top of the stack compared with that for the one at the bottom.

For example, if we have an internal air temperature below a frame of T_0,=30°C, and we are dissipating 200W of power in the frame, then we would expect the temperature at the top of the frame to be:

$$T_0 + \Delta T = T_0 + (f \times P_v)/ V = (3.3 * 200) / 150 = 30C + 4.4C = 34.4°C$$

Typically, an ASL fan tray containing six fans mounted below the lowest unit will result a temperature difference of 5 to 7 degrees C across each unit up the stack whereas a three-fan tray unit will result in a difference of about 7 to 9 degrees.

If the fan trays are not active, then airflow will drop to less than 16m^3/h and the temperature difference across the units may increase to over 30°C in the steady state.

This is clearly not acceptable in general terms, but under certain circumstances may actually comply with the system requirements. However, it also brings into question the need for the fans to have a battery-backed supply.

As a guide, without forced ventilation, the initial rate of rise of temperature of an amplifier frame dissipating 210W is of the order of 1°C per minute. The initial rate of rise of the average rack air temperature is of the order of 0.3°C per minute per 100W of rack power. The rate of rise of temperature will reduce as units approach their equilibrium.

The two most important analyses which should be carried out when designing or validating the suitability of a particular thermal management regime are:

- Steady state analysis
    - In a steady state analysis,:
        i) it is assumed that the equipment is operating with constant power dissipation and that the equipment temperatures and the airflow inside and outside the rack is steady.
        ii) It will generally take several hours for a fully loaded 43U rack to reach a steady state condition from a cold power on.
        iii) It should be carried out by averaging the worst-case heat dissipation conditions that may persist over several hours.
        iv) all the excess thermal energy from each piece of equipment, the rack, and the equipment room must be removed as fast as it is produced.
- Transient Analysis
    - Transient analyses are usually undertaken when there is a rapid change in the thermal environment.
        - This may happen if the equipment undergoes a rapid increase in the amount of heat it requires to dissipate: for example, if the system goes from the quiescent state into broadcasting an all-zone evacuation,

      and also
        - If there a change in the thermal exchange characteristics of the system (for example an interruption of fan power).
    - Transient analyses involve considerably more computational effort and system modelling than steady state analyses.
    - For transient analysis to be worth undertaking, the duration of the event must be significantly less than the time required for the system to reach the steady-state condition.
    - Under transient conditions, much of the thermal energy generated by the equipment is linked to overcoming the thermal inertia of the system.
    - Generally, the equipment temperatures reached during a transient event are less than the steady-state temperatures.

Example:

An analysis was undertaken to examine the effect of turning off the fans after the system has reached a full power steady-state condition. This simulates the effect of using mains driven fans.

A steady-state analysis was performed with three V2000s in a 43U rack. Each frame was fully populated with D500s running 200W pink noise. The rack fan was turned on and an ASL fan tray, populated with three fans only, was also turned on.

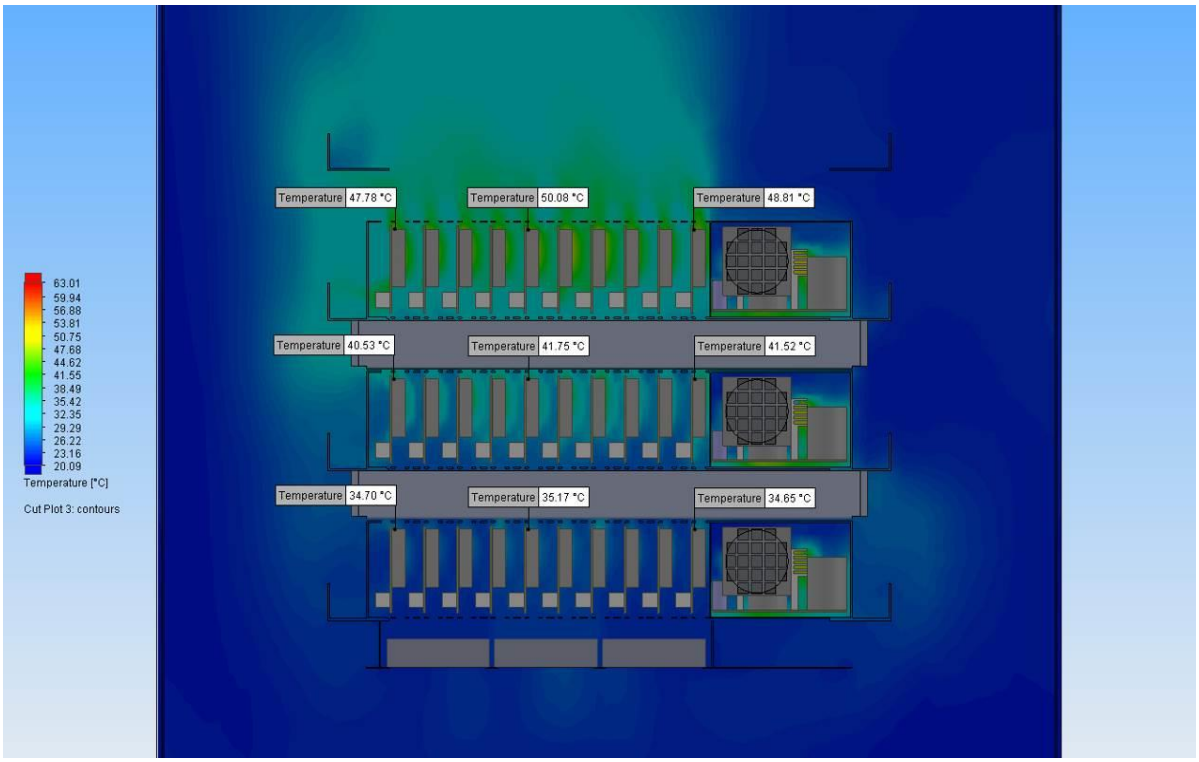


Figure 27: Temperature Distribution (Rack Fan active)

The image above shows the result of this example and indicates that a maximum heat sink temperature of about 50°C is attained at the top rack position.

To analyse the effect of the removal of fan power, a 30-minute transient analysis was then carried out, using the results of the previous steady study as the starting point and the result of this analysis are shown in the image overleaf:

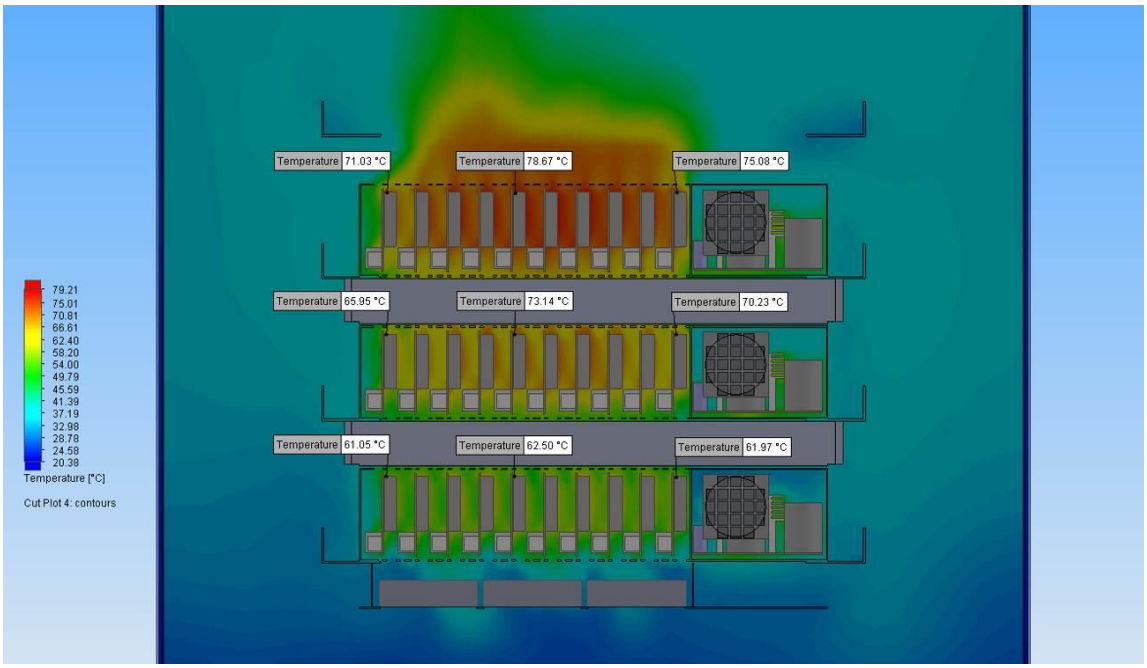


Figure 28: Temperature Distribution (Rack Fan disabled)

The image shows that the maximum heat sink temperature rises to about 77°C which is acceptable for short durations.

As the above analysis shows, with three V2000 units in a rack at operating with full power speech signal, the system requires a battery-backed fan tray if the unit is to operate for much longer than 30 minutes.

The diagram below shows the typical temperatures which result from a pink noise input signal within the four V2000 stack with an ASL fan tray installed.

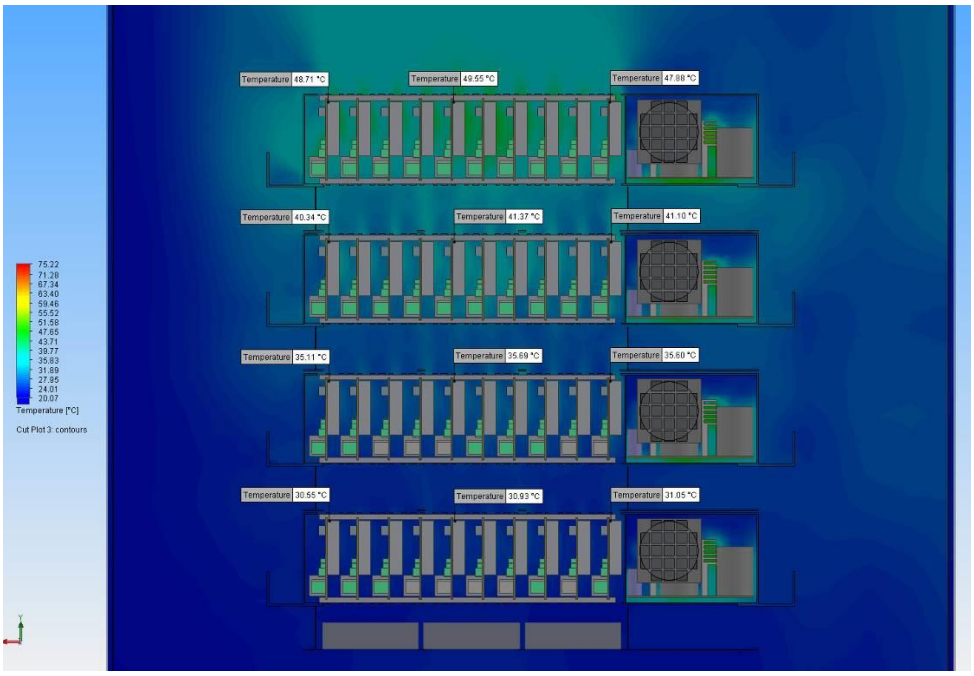


Figure 29: Temperature Distribution (Fan Tray Active)

B.3 Summary Guideline for the Installation of V2000 mainframes in a Rack Environment

The following provides a simple guideline for the placement of V2000 and associated equipment in a rack. These are for guidance only and the designer should satisfy himself that equipment temperatures are not exceeded by any of the operational requirements.

- In the steady state condition, a 43U rack will not provide cooling for more than 400W internal heat without fan assistance.
- For short durations (in the order of 30 minutes) - the power dissipated in the rack may significantly exceed the recommended steady state power dissipation, but the designer must be aware that exceeding this duration may lead to a partial or complete thermal reduction of the systems audio power output.
- Battery units should be mounted at the base of the rack and close to the V2000 units: the recommended implementation is shown in **Figure 13**.
- Battery units cannot be shared between V2000 units.
- The V2000 units should be mounted as close to the bottom of the cabinet as possible: normally this will involve the provision of a gap of about 1U above the batteries and associated wiring.
- If single V2000 units are used, they should be mounted with at least 2U free space above and 1U free space below. If only one V2000 is present in the rack and if the unit is not subject to high demand (< 50%) and high total load levels (< 1.5kW), it will not normally be necessary to fit a fan tray
- If multiple V2000 units are required in the same rack:
    - They should be stacked above each other with a 1U air flow guide positioned in between units.
    - The units with the highest power loading should be situated at the bottom of the stack.
    - A fan tray (RAK-FAN-01) should be fitted below the lowest unit and there should be at least a 1U gap immediately below the fan tray to allow free air flow into the fan.
    - An ASL airflow guide (RAK-DUCT-01) should be placed between units and if necessary. the fan should be battery-backed (refer to Appendix B, Section B.2.2.2 for further details).
    - The fan tray should be run either continuously or from a thermostat fitted immediately above the V2000 stack.
    - Fans trays should be powered from a battery backed supply. If the potential power dissipation in the V2000 stack is less than 400W, then it may be possible to power the fan tray from a mains-only supply but note that this will limit the maximum time of full output power to about 0.5 hour. If, after this time period, the internal V2000 temperature exceeds its design limits, the V2000 units will go into a reduced power mode. The designer should evaluate this carefully.
    - Not more than four V2000 units should be mounted in the same cabinet.

    N.B. Fan usage summary is given in the Table 13 overleaf
- VIPEDIA-12s or other equipment should be mounted as far above the top of the V2000 stack as is possible and in no case should the spacing be less than 2U.
- Pre-announcement tones associated with Evacuation and Alert messages should not exceed 3dB below full output. In most cases, they will be less than this anyway in order not to sound excessively loud in comparison with the associated voice message.
- Mains wiring to each V2000 mainframe should be capable of 12A.

Table 13: Fan Usage Summary

System Dissipation	Rack Fan (550 m^3/ h)	Fan Tray	Comment
Less than 200W	Not required	Not required	Assumes rack surface area of at least 4m^2
Between 200W and 400W	Not required	Mains	Assumes a 43U rack size and the duration of non-mains powered operation at full power is less than 30 minutes.
Between 400W and 600W	Mains	Mains	Assumes a 43U rack size and the duration of non-mains powered operation at full power is less than 30 minutes.
Between 600W and 800W	Mains	Battery-backed	Assumes a 43U rack size and the duration of battery-backup at full power is less than 45 minutes.
Between 800W and 1000W	Battery backed	Battery-backed	
Above 1000W	Battery backed	Battery-backed	Detailed analysis required to confirm equipment limits are not exceeded.

Figure 30 below shows the typical rack installation arrangements for one, two, three or four V2000 amplifier mainframes.

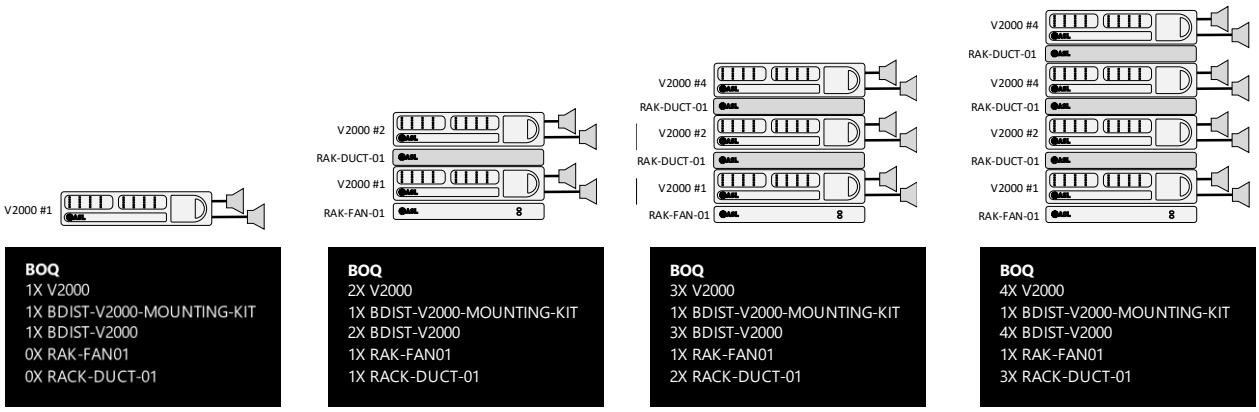


Figure 30: V2000 Installations showing the recommended Fan tray Implementation

Appendix C – Enhanced System Design

In order to comply with local Codes of Practice or customer requirements it may be necessary to incorporate some degree of redundancy in the system design. This appendix identifies common approaches to providing enhanced system redundancy.

C.1 Hardware Bypass for Emergency Microphones

Inputs 1 and 2 of the VIPEDIA-12 audio router may be configured to host emergency microphones (EMSXX and MPSXX) so that in the event of loss of comms via the RS485 connection or a VIPEDIA-12 processor failure, they may continue to operate on an All-Call basis via a hard-wired PTT Control line. This functionality is available for both single router or multiple DBB-linked router applications.

In "Hardwire Bypass" mode, Input 1 has priority over Input 2 and for a DBB Group this priority sequence extends across all the VIPEDIA-12 audio routers in the group

(i.e. VIPEDIA #1 Input1 > Input2 > VIPEDIA #2 Input1 > Input2 > VIPEDIA #3 Input1 > Input2 > VIPEDIA #3 Input1 > Input2)

Notes:

1. "Hardwire Bypass" functionality does not support audio broadcasts distributed between networked nodes.
2. Within a DBB group, it is important that the DBB Master switch (located to the bottom RH corner of the VIPEDIA-12 net-card rear panel) is set to "M" to define the "master" unit within the group and is set to "S" to define that all the other VIPEDIA-12s units in the DBB group are "slaves".

   For further information, please refer to the Installation and user guides as listed in Appendix D, Section D.1.2.

C.2 Standby Amplifiers

ASL PAVA system support the EN 54-16 Standby amplifier option and standby amplifiers may be installed and configured to automatically replace working amplifiers identified as faulty (refer to the V2000 Installation Guide for further information – see Appendix D, Section D.1.2).

C.3 A-B Interleaved Loudspeaker Circuits

Loudspeaker zones may be configured such that the broadcast area within a zone is covered by dual A-B interleaved loudspeaker circuits with alternate loudspeakers within the coverage area connected to the A and B circuits. Ideally, the loudspeaker cables should take diverse routes so that damage to one of the feeds is unlikely to affect the other.

This ensures that in the event of an open- or short-circuit on one of the loudspeaker lines, the average broadcast level in the zone will only reduce by approximately 3dB.

For loudspeaker line surveillance purposes:

a) Using DC surveillance, both the A and B lines must be installed with the same number of EOL units (up to an overall total of 10: i.e. 5 + 5).

b) Using Impedance Monitoring, both lines should be of a similar length and loading and be equipped with the same quantity of EOLZ units

The following diagrams show various approaches towards providing A-B Circuit redundancy.

Figure 31 shows A-B circuits fed from a single amplifier using the A-B functionality designed into the LSZDC Amplifier Interface Card.

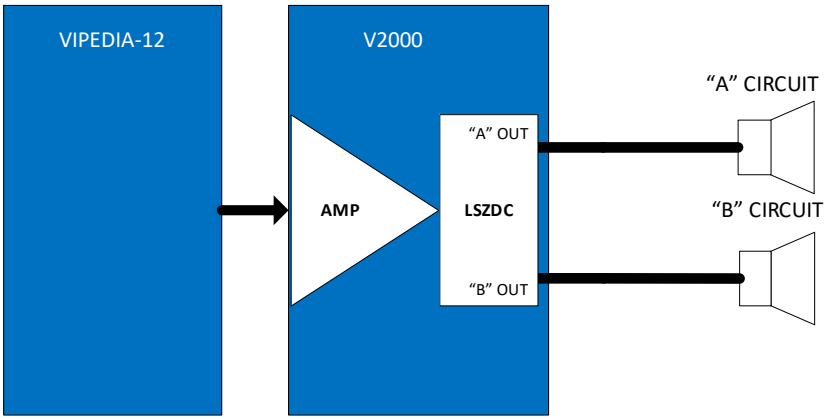


Figure 31: A-B Loudspeaker Circuit Redundancy (single amplifier)

Figure 32 shows an enhanced approach whereby the A-B circuits are separately fed from two amplifiers, one taking its audio feed from the VIPEDIA-12 "A" output and the other from the "B" output.

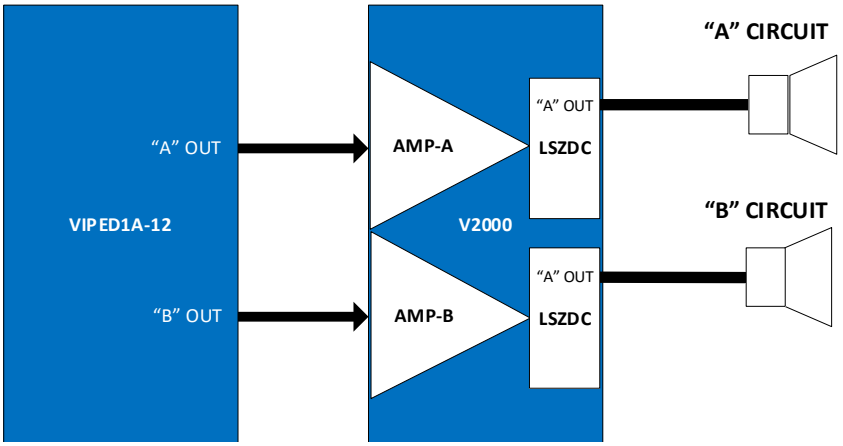


Figure 32: A-B Circuit Redundancy (dual amplifiers)

Further enhancements and adaptations to this approach are possible (e.g. see **Figure 33** and **Figure 34** below, which expand upon the approaches shown in **Figure 9** and **Figure 31** to provide further levels of redundancy).

In the case of **Figure 33**, this configuration adds A, B, C and D interleaved circuits.

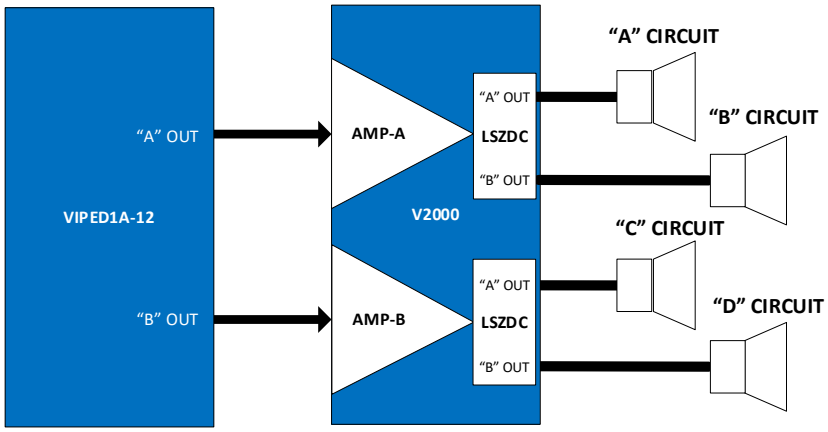


Figure 33: Enhanced A-B Amplifier/Loudspeaker Circuit Redundancy

In the case of Figure 34, redundancy is provided by use of dual VIPEDIA audio routers. The system should be configured such that each amplifier receives the same audio signal simultaneously from both routers. In the event that one of the VIPEDIA-12 audio routers fails, the amplifiers will continue to receive signal from the remaining unit, albeit with the output level reduced by approximately 6dB.

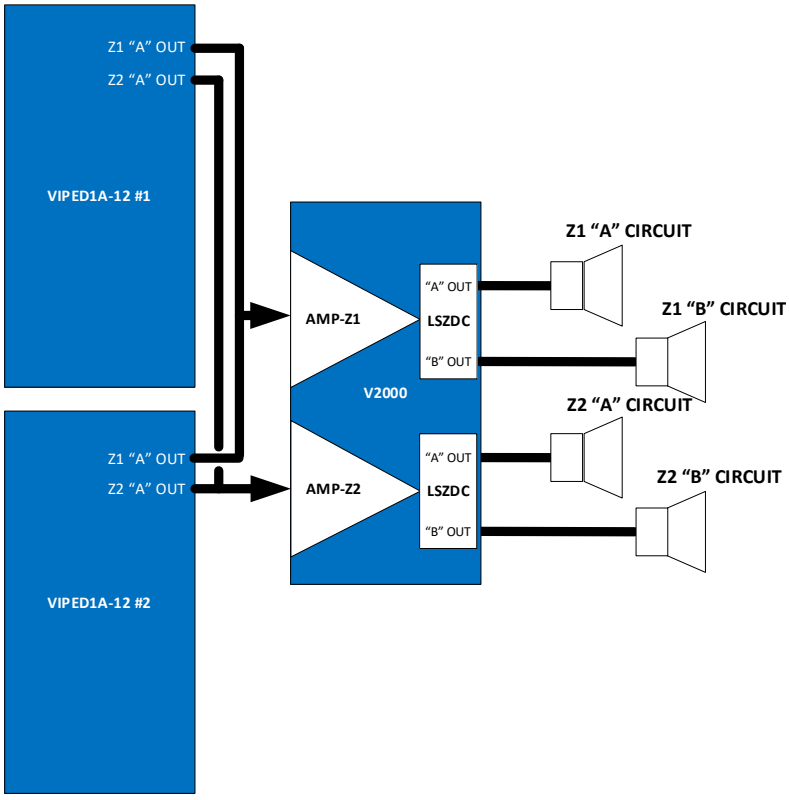


Figure 34: Further Enhanced A-B Amplifier/Loudspeaker Circuit Redundancy inc. Dual VIPEDIA-12s

C.4 Dual-Hosted Microphones

In VA systems incorporating more than one VIPEDIA-12, individual ASL Emergency (and non-emergency) microphones may be simultaneously connected to two audio routers to provide redundancy for both the audio and control functionality. Examples of the use of dual-hosted microphones are provided in Section C.6.

Note: It is important to be aware that the redundancy provided by dual-hosted microphones relies on the integrity of the network connection between the associated nodes.

C.5 Fire Alarm Panel Interface Redundancy

Fire Alarm Panels may be connected via one or more VIPEDIA-12 audio routers to ensure that the loss of a system node cannot jeopardise the Emergency broadcasts to continue to be made to all zones which remain available.

Normally this will be achieved by configuring the contacts for the duplicated inputs such that the Emergency DVA broadcasts activated from one of the routers will be assigned a higher priority than those activated via the second router.

It is also important to be aware that in the UK, Clause 9.3 of BS 5839 Part 8 states that:

"The fire alarm interface wiring should be arranged such that a single fault on the wiring cannot disable any part of the interface between the fire detection and the fire alarm system and the VAS, unless both the fire detection and the fire alarm system CIE and the VACIE are separated by less than 10m and located in the same area of low fire risk".

Examples of systems which incorporate Fire panel interface redundancy are shown in Figure 8 and Figure 9 in Section 5 of this Design Guide and in Figure 35 and Figure 36 of this appendix.

C.6 Audio Router and V2000 Redundancy Options

Networked systems can be configured to provide additional redundancy beyond that described above and two design approaches are detailed below. Both options allow the use of:

- Dual-hosted microphones

  To enable live broadcasts to be made in the event of the failure of the interface between the microphone and either of the two associated audio routers.

- Multiple Fire Panel interfaces

  To ensure that failure of the interface between the Fire Panel and a single audio router does not jeopardise the ability of the system to automatically broadcast a pre-recorded emergency message.

a) A - B Redundancy

This redundancy mode is intended to ensure that a single fault, no matter how catastrophic, on either the Audio Router, Amplifier Frame or Amplifier module, cannot inhibit the reliable distribution of Voice Alarm broadcasts.

This architecture provides complete Audio Router, Amplifier and interleaved loudspeaker redundancy and also incorporates dual-hosted microphones and dual-Fire Alarm Interfaces.

For this option, two separate audio routers connected via a DBB interface are both configured identically (with the exception of IDs and IP addresses) and are both simultaneously active. In the event that a fault affects functionality on one of the two VIPEDIA-12 audio routers, the remaining active router will continue to operate as intended.

The Fire Alarm Panel is connected to both the A and B VIPEDIA-12 audio routers

The Fire Microphone is hosted on both the A and B VIPEDIA-12 audio routers.

Interleaved loudspeaker circuits are provided such that, with either the A or B audio router in fault, the average broadcast SPL in the zone will be reduced by no more than 3dB, as described previously in Section C.3.

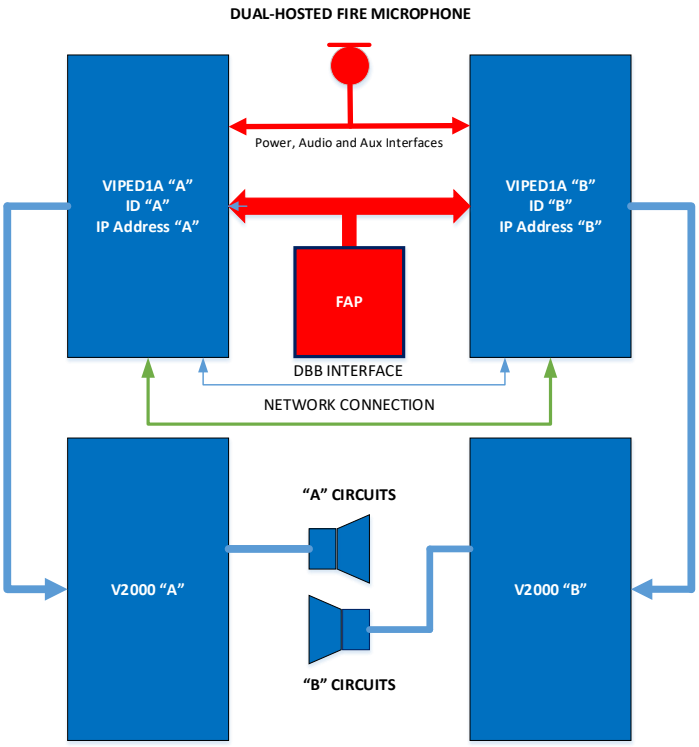


Figure 35: A-B Redundant System Configuration

Notes:

- The VIPEDIA-12 must be configured in the SCT as type VIPEDIA-12AB.
- Each zone is served by two loudspeaker circuits assigned separately to both A and B systems. Cables extending from the system to field devices should ideally follow diverse routes to maximise the system redundancy.

b) Active/Standby Redundancy

This architecture provides full Audio Router redundancy, whereby two routers (Active and Standby) are configured identically, but only one is active at any one time.

In the event of a fault, which affects functionality of the active VIPEDIA-12, the standby unit will then become 'active' and automatically takeover ensuring that full functionality is restored.

In the case where both VIPEDIA-12s have faults, the VIPEDIA-12 with the least number of major-category faults will become active.

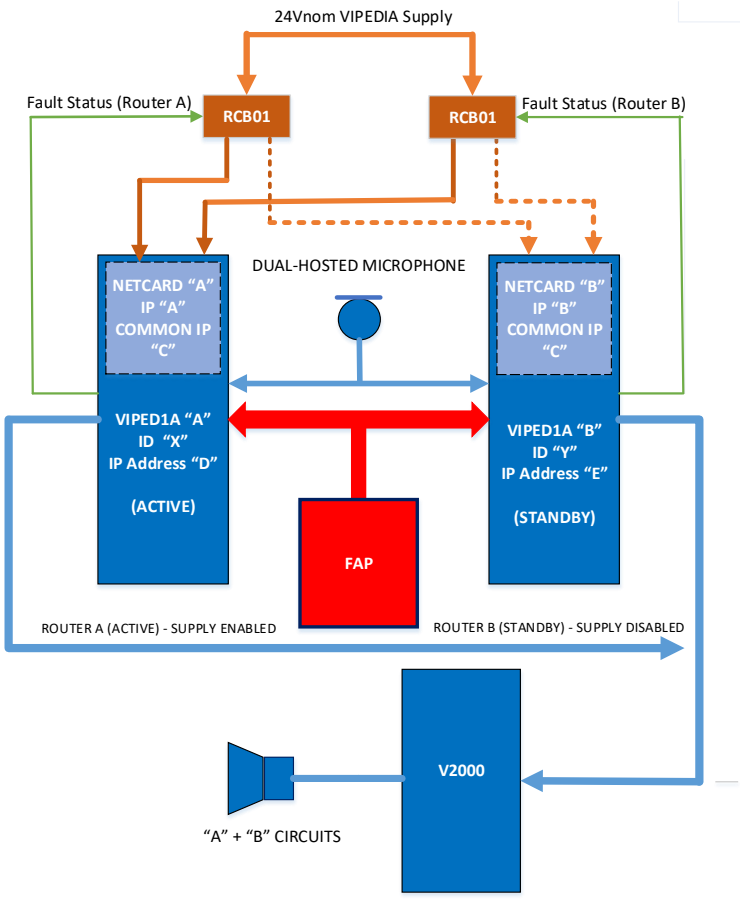


Figure 36: ASL Active/Standby Redundant System Configuration

Notes:

- This redundancy mode is intended to ensure that a single fault associated with a VIPEDIA-12 Audio Router, no matter how catastrophic, cannot inhibit the reliable distribution of Voice Alarm broadcasts from either the local microphones or a third-party SCADA system.
- External networked equipment (e.g., iVENCs or VIPA-Hosts) shall interface with the Active/Standby redundant system by means of the netcards' Common IP Address "C".
- The Active/ Standby Mode requires:

  a) the use of dual-hosted microphones.

  b) Message triggers (e.g., from a fire panel) to be connected to both audio routers.

  c) An external switch unit (RCB01) to enable the changeover between audio routers.

Active / Standby Redundancy is described in detail in ASL document reference U-0641-3090: VIPEDIA-12 AS (Active / Standby) Redundant System Guide (refer to Appendix D, Section D.1.3).

IMPORTANT NOTE: At the time of publication of this guide, the RCB01 is not included in the EN 54 approved product list.

Appendix D – Product Documentation

Please refer to the documents appropriate to the version of software installed on the system.

N.B. At the time of publication of this document, the documents highlighted in yellow are not available for download from the ASL website. Please contact the ASL Technical Support team, if you require copies of these documents.

D.1 VIPEDIA-12 and V2000

D.1.1 System Design Guide

Category	Title	Filename
General	EN54 Vipedia 12 System Design Guide	T-0667-0185

D.1.2 Installation and User Guides

Category	Title	Filename
General	VIPEDIA-12 Installation Guide	U-0641-0344_VIPEDIA-12_Install
	V2000 Installation Guide	U-0623-0291_V2000_Install
	V2000 STBY Installation Guide	U-0623-0413
	Event Logger User Manual	U-0641-3133
VIPEDIA S/W Release V3.X	VIPEDIA-12 Users' Manual	U-0641-3283
	PAVA System Configuration Tool User Manual	U-0701-1583_PAVA-SCT_V3.x_UMan
VIPEDIA S/W Release V2.1	VIPEDIA-12 Users' Manual	U-0641-2637_VIPEDIA-12-V2.1_UManual
	PAVA System Configuration Tool	U-0701-1093_PAVA-SCT_V2.1.2_UManual
VIPEDIA S/W Release V1.9	VIPEDIA-12 Users' Manual	U-0641-1605_VIPEDIA-12_UManual
	PAVA System Configuration Tool	U-0701-0110_V12-SCT_UManual
VIPEDIA S/W Release Pre-V3.X	V2000 Users' Manual	U-0623-0383_V2000_UManual
VIPEDIA S/W Release V3.X	V2000 User's Manual	U-0623-1005_V2000_UManual

D.1.3 VIPEDIA and V2000 System Configuration Guides

Category	Title	Filename
General	VIPA – VIPEDIA-12 / INTEGRA Contact Inputs – Configuration Guide	U-0582-4644
	VIPEDIA-12 AS (Active / Standby) Redundant System Guide	U-0641-3090
	VIPEDIA – Multi-cluster Systems	ASL_Datasheet_VIPEDIA-12-Multi-cluster-V1.1
	Networking Design Guide	U-Tech_Doc_0031 (see note below)
	Dante Configuration Guide	U-0461-3466
V2000 S/W Release V2.1	VIPEDIA-12 / VIPEDIA-NET / V2000 / MPS / EMS Firmware and Configuration Load Procedures VIPEDIA-12 V2.1	U-0641-2585_FW_V2.1_Config_Load_03
VIPEDIA S/W Release V3.X	VIPEDIA-12 / VIPEDIA-NET / V2000 / INTEGRA / MPS / EMS Firmware and Configuration Load Procedures	U-641-3036_FW-Config-Load_V3.1_01
Network Switches (Hirschmann)	Hirschmann Switch Configuration Guide covering ASL part numbers: MM4, MM8, SM4 and NF8	U-0641-3488
Network Switch LP-01	ASL Network Switch-LP01 Configuration Guide	U-0641-3675

Note: At the time of publication of this design guide, these documents are not yet available and are expected to be released in the 3rd quarter of 2022.

D.1.4 Ancillary Product Documentation

Product	Title	Filename
EMS range	EMS10, EMS20 and EMS50 10, 20 and 50-Button Emergency Microphone Stations User's Manual Software V1.7.7 – ASL Serial Protocol	U-0664-0464_EMS10-20-50_UManual_VIPEDIA-12
	EMS01 Mk2 User Manual	U-0664-0465
	EMS10, EMS20 and EMS50 10, 20 and 50-Button Emergency Microphone Stations Installation Guide	U-0664-0404_EMS10-20-50_Install

Product	Title	Filename
	EMS01 Mk2 Installation Guide	U-0664-0405
	Button Label Insert Template	U-0664-0277_MPS10-20_Insert_Template
	Technical Note – Type B products	Type_B_Microphone_Note_U_0664-0994
	Microphone and Wall-Mount Controllers Type A and Type B Firmware Update Procedure	U-0664-1005_Type_AB_FW_Update
MPS range	MPS-Series Modular Paging Microphone Station User's Manual	U-0664-1007_MPS_V3.3_UManual
	MPS-Series Installation Guide	U-0664-0174_MPS01-10-20_Install
	Wall and Desk/Console Mounting Instructions for MPS01 / MPS10 / MPS20 Microphones	U-0664-0310_MPS_WallMountKit_Install
	Button Label Insert Template	See EMS range
	Technical Note – Type B products	See EMS range
	Microphone and Wall-Mount Controllers Type A and Type B Firmware Update Procedure	See EMS range
	VIPA Microphones ASL Serial Protocol Configuration Guide	U-0582-4379_VIPA-MIC_Guide
EAP01	EAP01 Product Manual	U-0464-0530_EAP01_Manual
	EAP01 Installation Guide	U-0464-0734_EAP01_Install
BOA01	Refer to the VIPEDIA-12 manuals	
BOA02		
BMB01	BMB01 Installation Guide	U-0450-1693_BMB01_Install
LLPA05	LLPA05 Installation Guide	U-0585-0005_LLPA0X_Install
D150	Refer to the V2000 manuals	
D500		
LSZDC		
V2000-STBY	V2000-STBY V2000/INTEGRA Standby Interface Card Installation Guide	U-0623-0413_V2000-STBY_Install
V2000 **V3.0.2.**	Technical Note IEL Detection	ASL0623-Tech-Note-IEL
EOLZ01	EOLZ01 End of Line Impedance Device Installation Guide	U-0623-0640_EOLZ01_Install

Product	Title	Filename
EOL10K	EOL10K and LBC2W to LBC63W End-Of-Line Terminator and Line Blocking Capacitor Kits Installation Guide	U-0398-0656_EOL10K_BLCx_Install
RAK-FAN01 Fan Tray	RAK-FAN-01/02 and RAK-DUCT-01 Cooling Duct Installation Guide	RAK-FAN01-Installation-Guide
RAK-DUCT-01 Cooling Duct		
BPC65	BPC65/BDIST/MDIST Installation Guide	U-0456-0142_BPC65_Install
	BPC65/BDIST/MDIST Product Manual	U-0456-0143_BPC65_Manual
BPC130	BPC130/BDIST/MDIST Installation Guide	U-0456-0144_BPC130_Install
	BPC130/BDIST/MDIST Product Manual	U-0456-0145_BPC130_Manual
BDIST-V2000	BDIST-V2000 + Battery Installation Guide	U-0456-0199_V2000_BDIST-BATT_Install
Battery Packs (general information)	Battery Requirements for EN 54 certified PAVA Systems	WP-0014-EN 54 Battery Requirements
	Recommended Battery Care and Maintenance Procedures	U0246-212
MDIST-V2000	MDIST-V2000 Installation Guide	U-0623-0420_MDIST-V2000_Install

D.1.5 Safety Leaflets

Category	Title	Availability
General	VIPEDIA-12 Safety Leaflet	Supplied with product and via ASL website "downloads"
	V2000 Safety Leaflet	As above
	EMS10-20-50 Safety Leaflet	As above
	EMS01 Safety Leaflet	As above
	MPS Safety Leaflet	As above
	BMB01 Safety Leaflet	As above

D.1.6 Test Documentation

Category	Title	Filename
General	EN 54-16 System Test Check List for ASL Rack-Mounted PAVA Systems	T-0667-0117 – EN 54 System Checklist

D.1.7 Rack Design Tool

Category	Title	Filename
General	VIPEDIA-12/V2000 Rack Heat and Power Calculator (HPC)	T-0623-1400

Appendix E – Obsolete Products

Table 14: ASL Obsolete Products – EN 54 certified

The following products are obsolete and, although retaining EN 54 certification, are no longer recommended for use on new projects.

Product	Variants	Description
VAR Router range	VAR4 (EN 54)	Audio Router 4 x 4 DSP – EN 54
	VAR12 (EN 54)	Audio Router 12x12 DSP – EN 54
	VAR20 (EN 54)	Audio Router 20x20 DSP – EN 54
V400 Amplifier range	V400	V400 Amplifier frame for housing M series amplifiers and amplifier Interfaces
	M100	Amplifier Module 100W
	M200	Amplifier Module 200W
	M400	Amplifier Module 400W
	LSDDC	Dual Line Surveillance Interface
	SSINT	Standby Surveillance Interface
X400 Amplifier range	X400	X400 Amplifier frame for housing MX series amplifiers
	MX100	Amplifier Module 100W – MX Series
	MX200	Amplifier Module 200W – MX Series
	MX400	Amplifier Module 400W – MX Series

Table 15: ASL Obsolete Products – EN 54 Certification expired.

The following products are now obsolete and are no longer included within ASL's EN 54-16 certification.

Product	Variants	Description
DMS Microphone range	DMS5	5 Button paging Mic
	DMS10	10 button Paging Mic
	DMS20	20 button paging Mic.
SMS Microphone range	SMS02	Single Button paging microphone variants for rail applications.
	SMS03	As above
	SMS04	As above
SMC Microphone range	SMC01G	Station Masters Console – Desk Mount with gooseneck microphone 20 buttons + hardwired PTT
	SMC01GS	As above with soft PTT
	SMC01F	Station Masters Console – Desk Mount with fist microphone 20 buttons + hardwired PTT
	SMC01FS	As above with soft PTT

Product	Variants	Description
	SMC02F	Station Masters Console – 19” Panel Mount with fist microphone 20 buttons + hardwired PTT
	SMC02FS	As above with soft PTT
Active End of Line Units (see notes 1, 2 and 3)	AEL01	IP 55 rated alternative end of line device for fitting to systems where end of line resistors and line blocking capacitors cannot be used.
	AEL02	IP 65 rated alternative end of line device for fitting to systems where end of line resistors and line blocking capacitors cannot be used.
VAR8 Series	VAR8-ACU (EN 54)	Intellevac Audio Control Unit – Rack Mount – Base Unit – EN 54
	VAR8 (EN 54)	Audio Router 8x8 DSP – Base Model – A Audio Outs only (No B Outputs) EN 54
	VAR8-E (EN 54)	Audio Router 8x8 DSP – A & B Audio Out (Inc. VAR8-EXP-BOARD) EN 54
VAR8 options	EFI01	European Fire Interface Card – VAR8 – Analogue In & Digital out card (Mini-BMB)
	VAR-ANIC	VAR8 Intellevac Network Interface Card
	VAR8-EXP8	VAR8 Expansion Board – A & B Audio Outs + 10 more digital inputs
	GENT Fire Loop Interface	Interface for VAR8-E to GENT Fire Loop. It requires the VAR8-EXP8.
VAR-NIA (see note)	VAR-NIA	VAR Audio Router Intellevac Network Interface Adaptor
FMS Microphone Series	FMS1	All Call Fireman’s Microphone All Call
	FMS5	Zone Selectable Fireman’s Microphone 5 Buttons + PTT
	FMS10	Zone Selectable Fireman’s Microphone 10 Buttons + PTT
	FMS20	Zone Selectable Fireman’s Microphone 20 Buttons + PTT
All-Call Message Trigger Panel	MT-01	Facility to enable manual control of All-Call Voice Alarm Message broadcasts

Appendix F – ASL PAVA Training Courses

ASL can provide the following PAVA training courses designed to ensure that our customers are fully equipped with the necessary knowledge to design, manufacture, install and commission Voice Alarm systems based on the ASL product range.

Product Code	Description
TRAIN-ASL-00	INTRODUCTION TO PAVA. CARRIED OUT AT ASL (1 DAY – 1 TO 3 TRAINEES)
TRAIN-MAINT-01	PAVA COMMISSIONING AND MAINTENANCE OF ASL PA/VA PRODUCTS AT ASL (2 DAYS – 1 TO 3 TRAINEES)

Additionally, if required, ASL can offer bespoke versions of the above courses to meet specific customer requirements.

Please contact the ASL Sales Team, for prices and availability for both the standard and bespoke options.

Appendix G – List of Abbreviations

AC	: Alternating Current
ANS	: Ambient Noise System/Sensor
BDIST	: Battery Distribution
BGM	: Background Music
CAN	: Controller Area Network
CE	: Conformitè Europëenne
CIE	: Control and Indicating Equipment (i.e A Fire Alarm Panel as defined in EN 54)
CPR	: Construction Products Regulations
DANS	: Dynamic Ambient Noise System/Sensor
DC	: Direct Current
DIN	: Deutsches Institut fur Normung
DSP	: Digital Signal Processing
DVA	: Digital Voice Announcement/Announcer
EMC	: Electromagnetic Compatibility
EN	: Euro Norm (i.e. European Standard)
EOL	: End-of-Line (associated with loudspeaker line surveillance)
GPIO	: General Purpose Input/Output
GUI	: Graphical User Interface
HCI	: Human Control Interaction
HPC	: Vipedia-12/V2000 Rack Heat and Power Calculator
ID	: Identification
IEC	: International Electrotechnical Commission
IP	: intrusion Protection (refer to EN 60529 for further details)
IP	: Internet Protocol
I/P	: Input
LH	: Left Hand
LHS	: Left Hand Side
LLPA	: Long Line Public Address
LPCB	: Loss Prevention Certification Board
MCB	: Miniature Circuit Breaker
MDIST	: Mains Distribution
MTBF	: Mean Time between Failures
MTTR	: Mean Time to Repair
O/P	: Output
PA	: Public Address
PCDVA	: PC-based Digital Voice Announcement System (typically associated with rail passenger announcements etc.)
PMC	: Portable Media Carrier

PSE	: Power Supply Equipment
PSU	: Power Supply Unit
PTT	: Press-to-Talk
PVC	: Polyvinyl Chloride
REACH	: Registration, Evaluation, Authorisation and Restriction of Chemicals
RH	: Right Hand
RHS	: Right Hand Side
RoHS	: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
SCT	: System Configuration Tool
SDK	: Software Development Kit
SFP	: Small Form-Factor Pluggable
SIL	: Software Interface Library
STBY	: Standby
VA	: Voice Alarm
Vac	: Volts (alternating current)
VACIE	: Voice Alarm Control and indicating Equipment (as defined in EN 54-16)
Vdc	: Volts (direct current)
VCT	: VIPA Configuration Tool

Appendix H - Regulatory Requirements

ASL supply Voice Alarm and Public Address products and systems that exceed the minimum legal requirements within the European Community (EC). The advice given in this section is intended for system integrators using ASL products in Voice Alarm and Public Address systems of their own design and build.

It is important to note that the legal requirements of the Construction Product Requirements (CPR) within the EC, apply to each "Economic Operator" in the supply chain and system integrators must ensure (taking legal advice if necessary) that they comply. ASL cannot take legal responsibility for value-add or product modifications applied after delivery from ASL and users of ASL products are advised to take appropriate advice.

Voice Alarm products installed in buildings within the European Community must be compliant with the requirements of the Construction Products Regulations (CPR). ASL Voice Alarm System components listed in section 2.1 are compliant but only when correctly configured in accordance with the instructions for use.

Because Voice alarm systems come under the CPR's system 1 accreditation, a notified body is required to initially type test and to continually assess the factory production control of the manufacturing site. ASL voice alarm products have been assessed by our assigned notified body, BRE, in a representative system and BRE carry out regular assessments of ASL's factory production controls. In addition, ASL carries out product audits at least once per year on all products to ensure that the products remain compliant.

ASL has created a Declaration of Performance for all its EN 54 accredited products. This is in addition to the Declaration of Conformity required to demonstrate compliance with the Low Voltage and EMC directives.

EN 54 also requires special product documentation to accompany the CE mark in commercial documentation.

ASL voice alarm products are also marked with an EN 54 specific CE label visible at access level 1.

System manufacturers producing a one-off rack system are exempt only from the need to produce a Declaration of Performance. All other documentation and labelling must be provided. Please refer to Sections 11.1 and 12 of this document for examples in which the ASL contact information should be replaced by the system manufacturer's details.

Because of the type 1 system of accreditation required by EN 54 harmonised standards, the CPR requires that a notified body accredit the system design documentation before the EN 54 CE marking can be applied to the system. At the time of writing, it is believed that so long as the system integrator is subject to a system of Factory Production Control, which itself is subject to third party assessment by a notified body and follows the system design and test guidance provided in this document, this will be sufficient. If this is not the case, the documents must be submitted to a notified body. It is not entirely clear what level of documentation is required but the following is suggested as a minimum:

- Copies of Declarations of Performance for all system components associated with Voice Alarm (EN 54) functionality including Power Supply Equipment for the voice alarm system components.
- Declaration of Conformity to the EMC and LVD Directives by the system integrator[1] (see note 1)
- System Design documentation (schematics, layout drawings, maintenance instructions etc.).
- Statement(s) that the components used have been installed and configured in accordance with the installation instructions and restrictions on use as provided by ASL[2] (see note 2)

[1] Evidence beyond supply of component Declarations of Conformity may also be required as CE+CE ≠ CE
[2] And of any other manufacturer's components

- Evidence of system functional test in accordance with EN 54-16.

The use of system components not included in ASL's Declaration of Performance, for voice alarm signal paths, will require that the system integrator obtain notified body approval for their incorporation into a system design and this will require, as a minimum, the documentation detailed in the list above. For instance, ASL audio routers are not accredited for use with the amplifiers manufactured by a third party (even if they have a Declaration of Performance from the third party). e.g., combining them in a system to carry voice alarm signals may affect correct fault reporting as required by EN 54-16 and thus compliance would be invalidated.

THIS PAGE IS INTENTIONALLY BLANK


ASL
zenitel