Vari-directional Array

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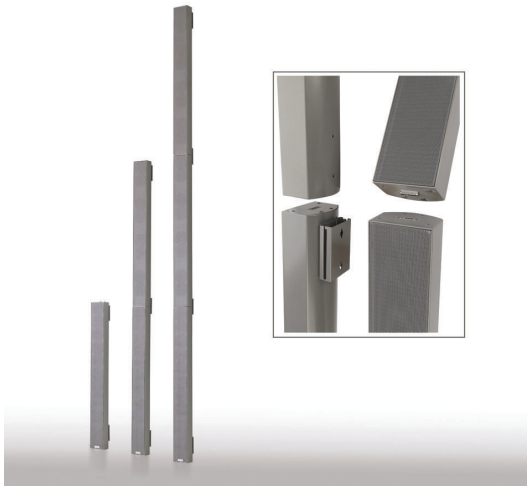


- Unmatched sound quality and speech intelligibility
- Smart modular design, flush mountable
- Sophisticated beam configuration with EASE support
- Integrated ambient noise level sensor for AVC

Many large modern and classical buildings, like passenger terminals and cathedrals, use hard reflective materials for floors, walls and ceilings. Due to their size and absence of absorbing materials the reverberation time is long and the amount of indirect reverberant sound compared to direct sound is high. This is disastrous for good speech intelligibility. Still it is very important to hear and understand the spoken message, whether it is a gate change announcement on an airport or a prayer in a house of worship. Here the Bosch Vari-directional Array offers a really smart and easy solution.

System overview

The Bosch Vari-directional Array series is a comprehensive set of array loudspeakers to address people with clear intelligible messages in large reverberant spaces. These active units utilize integrated digital signal processing and high efficiency class-D amplifiers. Using a PC configuration program the array can be adapted to the venue where it is used and its sound output optimally aimed at the audience, creating a maximum direct to ambient sound ratio, for best intelligibility given the circumstances.

The modular concept allows for three different array lengths for small to large areas. Using separate array elements makes transport easy and upgrading to a longer array possible. An optional CobraNet module allows the array to be networked and to receive digital audio data via CobraNet and to monitor the operational status of the loudspeakers. The units are suited for both background music and speech. Although these loudspeaker arrays are very sophisticated and offer unrivalled sound in difficult acoustical environments, the advanced configuration software makes setup quick and easy.

Functions

Advanced beam steering
The Bosch Vari-directional Array provides a very good direct to reverberant sound ratio. Firstly, it radiates more direct sound to the audience and secondly, it induces less ceiling reflections. The increased direct sound is also due to a lower rate of decay of the sound level with distance compared to a traditional loudspeaker acting as a point source.
Instead of mechanically aiming the complete loudspeaker column to the listeners, the Bosch Vari-directional Array is capable of virtually aiming the loudspeaker array by electronic means. It drives the

loudspeakers of the array individually with differently delayed signals, virtually moving the loudspeakers. Now the array can be positioned vertically against a wall or even recessed into the wall. This is esthetically more pleasing and as a bonus also reduces disturbing incoherent reflections from the wall. Furthermore, the Bosch Vari-directional Array uses very advanced beam steering techniques to achieve a beam shape that provides an equal level for all frequencies in the range of interest at all listening positions. Only then, listeners will get a balanced sound.
Another important factor is the loudness of the signal, which should be almost the same for all listening positions, avoiding hot spots. To create an even sound level in a large area, the shape of the beam should be optimized to the listening plane (ear level). Solving these challenges requires that for every audio frequency in the range of interest the level of each individual loudspeaker should be carefully controlled. The Bosch Vari-directional Array performs this combination of frequency response and delay tailoring in the digital domain using a DSP and subsequent multi-channel amplification. Then a very consistent SPL from front to rear can be attained in the listening plane, with a minimum of side lobes.
But the Bosch arrays excel in two additional ways. In the first place it is able to deal with non-flat audience planes, for instance theaters and auditoriums. Secondly, it does not solely try to maximize the direct output to the listening plane, but also to minimize the output to unwanted areas. Due to physical limitations of a loudspeaker array every practical array will have side lobes. The configuration of the Vari-directional Array uses an advanced optimization algorithm that allows for minimization of the most harmful side-lobes, to achieve the best possible coverage combined with a maximum direct to reverberant ratio.

Easy installation and setup
The Bosch Vari-directional Array makes installation and configuration fairly easy for the installer and sound engineer.
The majority of the applications can be described in a rather straightforward way, where the configuration can be selected from a database of pre-optimized setups. Selection is quick and interactively by entering some key parameters of the room, the position of the array and the listening plane. The configuration program then shows graphically the realized direct SPL coverage.
The Vari Configuration Set includes a USB to RS485 converter to connect a PC's USB port to one or more (networked) Vari units, even across longer distances. Using the optional CobraNet module it is even possible to configure and monitor multiple units across an Ethernet network.

Modular approach
One-key design factor for a line array is its length. To enable a long throw, the array should be long. If the audience is closer to the array, it can be shorter. Because the array is modular, arrays of three different lengths are possible: 1.20, 2.40 or 3.60 m. It consists of a base unit as a minimum and one or two extension units. Each unit is only 1.20 m in length for easy transport. The base unit contains the controller, the DSP, the power supply and 8 power amplifiers and loudspeakers. The extension unit contains 8 loudspeakers with supporting power amplifiers. All necessary interconnections between base and extension units are established automatically when the units are invisibly bolted together. Signal and power cables enter the base unit through a hole on the rear side of the unit to the internal tamper resistant connection compartment, which is only accessible during installation.
The Bosch Vari-directional Array, with its full steel cabinet and grill, powder coated silver gray, blends easily with contemporary and traditional interiors and exteriors. Since front-cooling is applied, even flush mounting is possible.
Swivel-wall mounting brackets come with the units as standard.

CobraNet connectivity
The Bosch Vari-directional Array offers the possibility to equip the base unit with a small CobraNet module that allows the array to be connected to an Ethernet network via a CAT-5 cable connection. This way the audio signal to the array is delivered in a digital format to the array with low latency and a high degree of routing flexibility. Furthermore the array can be configured via Ethernet, its operation can be supervised and logged.
Use of standard Ethernet wiring reduces costs. CobraNet technology allows for the co-existence of audio and data traffic over existing standard Ethernet infrastructure resulting in substantial savings in design and installation. CobraNet is a technology that is owned by Cirrus Logic and is used by many professional audio manufacturers as the technology of choice in digital audio networking.

Supervision
The Vari-directional Array provides a pilot tone detection circuit at the input for surveillance of the audio connection, internal supervision of operation, connection for a 24 V (battery) backup power supply, a fault output relay and a fault log with network access.

Automatic Volume Control (AVC)
In certain environments, such as sports stadiums and passenger terminals, the background noise level fluctuates constantly. This may seriously affect the intelligibility of spoken messages. The Bosch Vari-directional Array has a built-in noise level sensor

that can be configured to control the gain of the amplifiers to constantly adjust the sound level. This automatic volume control (AVC) keeps the audio level comfortably above the background noise level for improved intelligibility without becoming unnecessarily loud.

Sound-processing
Large halls or platforms may need multiple arrays at different locations. The audio output of these arrays should be time-aligned to avoid echoes at the audience position. The Bosch Vari-directional Array provides a built-in high resolution delay adjustment. An 8-section parametric equalizer is present for adjustment of the array to the acoustical environment, e.g. to increase the margin before acoustic feedback occurs. Separate 4-section equalizers at the inputs enable separate frequency responses for e.g. background music and announcements.

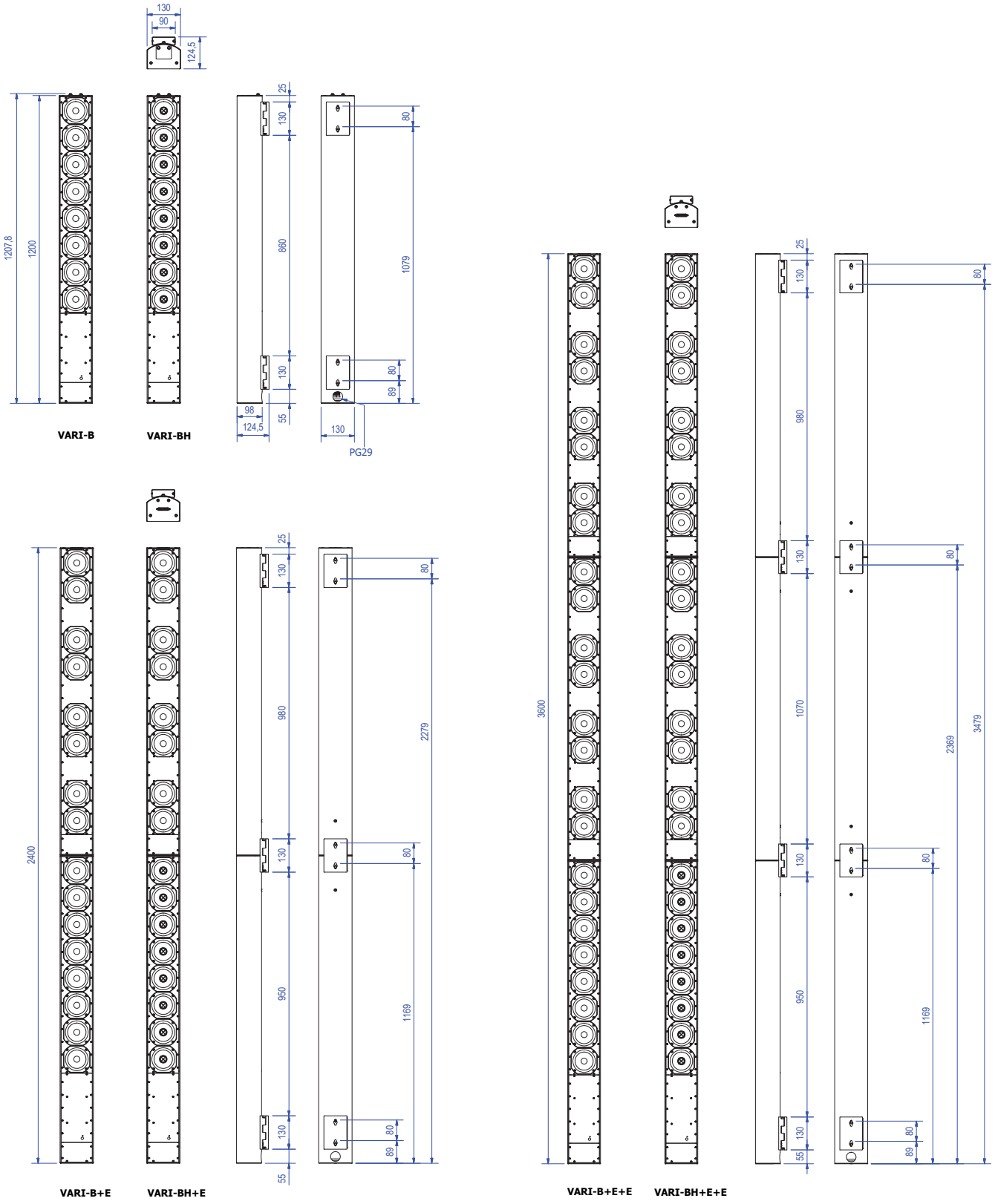
Certifications and approvals

Safety	according to IEC 60065: 2001 + A1: 2005
Immunity	according to EN 55103-2: 2009 according to FCC-47 part 15B
Emissions	according to EN 55103-1: 2009 according to EN 50130-4: 2006 according to EN 50121-4: 2006 according to EN 61000-3-2: 2006 + A1: 2009 + A2: 2009
Wind-force	according to Bft 11
Water and dust protection	according to EN60529 IP54
Approval	CE

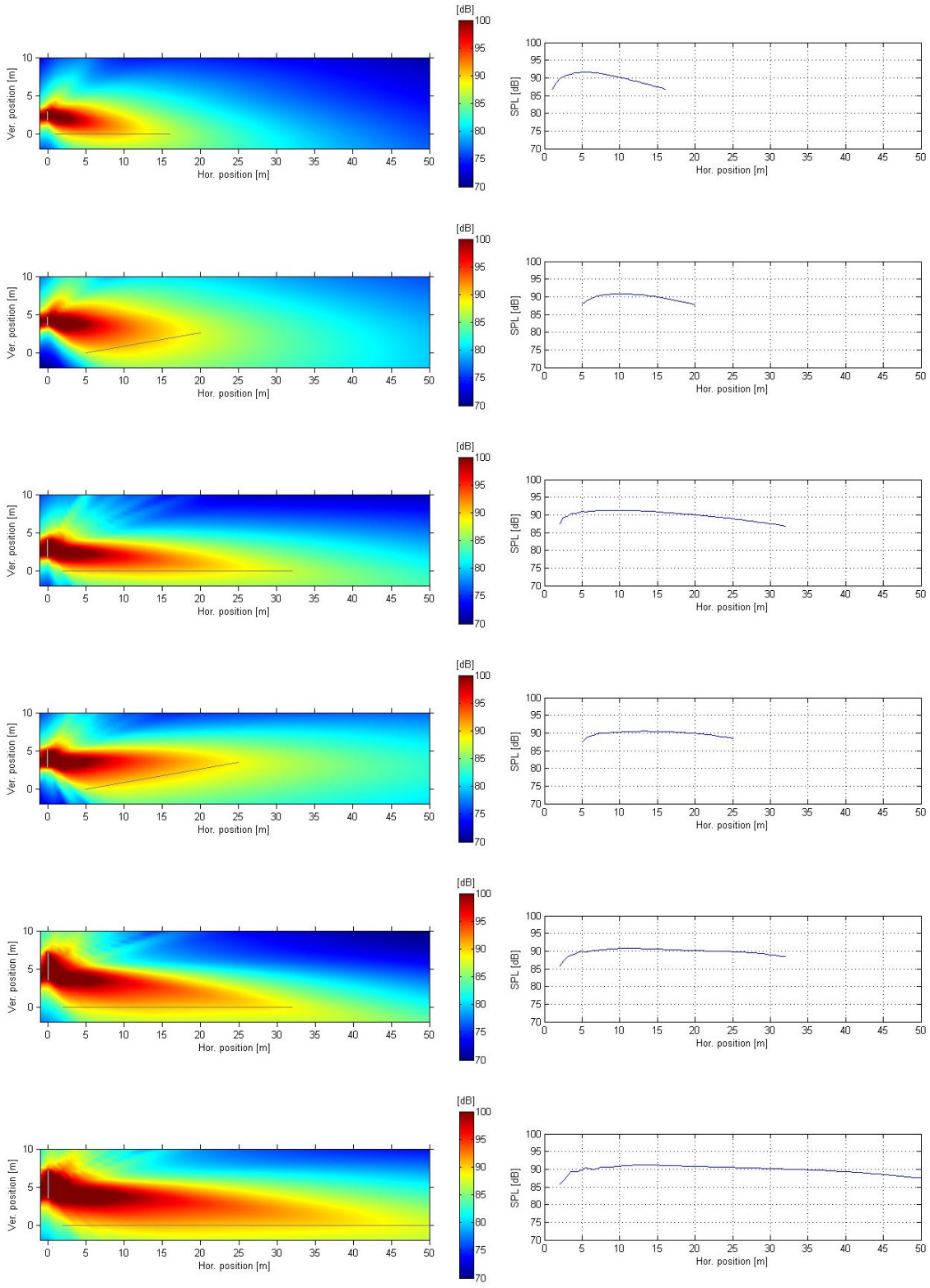
Region	Certification
Europe	CE

Installation/configuration notes

Array moniker	Array composition	Elements used		
		LA3-VARI-B	LA3-VARI-BH	LA3-VARI-E
Vari-array-B1	VARI-B	1		
Vari-array-B2	VARI-B+E	1		1
Vari-array-B3	VARI-B+E+E	1		2
Vari-array-H1	VARI-BH		1	
Vari-array_H2	VARI-BH+E		1	1
Vari-array-H3	VARI-BH+E+E		1	2



Mechanical dimensions (mm)



Examples of vertical beam cross sections and SPL at ear level (2 x VARI-B, 2 x VARI-B+E, 2 x VARI-B+E+E)

Parts included

Quantity	Components
	LA3-VARI-B

1	Vari Base Unit
2	Wall bracket
1	Right angle IEC mains connector C13
1	Cover plate
1	Connection set (Phoenix)
1	Grille removal tool
1	Installation Manual

	LA3-VARI-BH
1	Vari Base Unit HF
2	Wall bracket
1	Right angle IEC mains connector C13
1	Cover plate
1	Connection set (Phoenix)
1	Grille removal tool
1	Installation Manual

Quantity	Components
	LA3-VARI-E
1	Vari Extension Unit
1	Wall bracket
2	Fixing bolts

	LA3-VARI-CS
1	USB to RS485 converter
1	USB cable
1	RS485 cable

	LA3-VARI-CM
1	CobraNet module
2	Fixing screws
1	CAT-5 cable

Technical specifications

Acoustical[1]

Frequency range[2]	
VARI-B	130 Hz to 10 kHz (±3 dB)
VARI-BH	130 Hz to 18 kHz (±3 dB)

Max SPL[3]	Continuous / peak
VARI-B	90 / 93 dB SPL (A-weighed at 20 m)
VARI-B+E	90 / 93 dB SPL (A-weighed at 32 m)
VARI-B+E+E	88 / 91 dB SPL (A-weighed at 50 m)
VARI-BH	89 / 92 dB SPL (A-weighed at 20 m)
VARI-BH+E	89 / 92 dB SPL (A-weighed at 32 m)
VARI-BH+E+E	87 / 90 dB SPL (A-weighed at 50 m)

Coverage	
Horizontal (fixed)[4]	130° (-6 dB, avg. 1 to 4 kHz)
Vertical (adjustable)[5]	Software configurable
Maximum throw:	
VARI-B(H)	20 m
VARI-B(H)+E	32 m
VARI-B(H)+E+E	50 m

Transducers	
VARI-B	4” Full Range (8 x 1 driver)
VARI-BH	4” Coaxial (8 x 1 driver)
VARI-E	4” Full Range (4 x 2 drivers)

Electrical

Input Line (2x)	
Input level nominal	0 dBV rms
Input level maximum	+20 dBV peak
Type	Transformer balanced
Impedance (balanced)	7.8 kohm at 1 kHz
Input 100 V (2x)	
Input level nominal	+40 dBV rms
Type	Transformer balanced (floating input)
Impedance (balanced)	1 Mohm at 1 kHz
Power Amplifiers	

Power	
VARI-B(H)	8 x 15 W (class-D full bridge)
VARI-E	4 x 25 W (class-D full bridge)
Protection	Thermal shutdown
	Current limiting
Dynamic range[6]	>105 dB

PSU	
Mains voltage	100 to 120 V / 200 to 240 V (auto switching)
Power consumption	@ Mains / 24 Vdc (22 V min, 36 V max)
Power save	
VARI-B(H)	13 / 4.5 W
VARI-B(H)+E	17 / 7 W
VARI-B(H)+E+E	19 / 9 W
Idle	
VARI-B(H)	18 / 8.5 W
VARI-B(H)+E	23 / 13 W
VARI-B(H)+E+E	28 / 17 W
Max. (Noise, CF 6 dB)	
VARI-B(H)	60 / 36 W
VARI-B(H)+E	97 / 75 W
VARI-B(H)+E+E	124 / 100 W
Power factor	According to EN61000-3-2, class A
Mains inrush current	<70 A (at 230 V)
Protection	Thermal shutdown
	Current limiting
	Under voltage lock-out

Signal processing[5]	
DSP	32-bit floating point, 900 Mflops
ADC / DAC	24-bits S-D, 128 x oversampling
Sample rate	48 kHz
Functions	Pre-delay (max. 21 s)
	Input-delay (max. 2 x 10 s / 4 x 5 s)
	Equalizer and compensation filtering
	Compressor
	Volume
	AVC

Control	
Network interface	RS-485 full duplex, auto-switching 115k2, 57k6, 38k4, 19k2 baud, optically isolated
Max. number of units[7]	126
Surveillance	General status
	Amplifier and load monitoring
	External pilot-tone detection (20 kHz to 30 kHz, min. level -22 dBV)
	Built-in ambient noise sensing microphone
	Thermal overload protection
Failure relay	Maskable conditions
Contact 1	No failure = closed / Failure = open
Rating	Max. 24 V, 100 mA
Contact 2	No failure = 10 k ohm / Failure = 20 k ohm
Control voltage input	5 to 24 Vdc, optically isolated

CobraNet	
Interface	RJ-45, Ethernet 100 Mbps
Word length	16-/20-/24-bit (set by transmitter)
Sample rate	48 kHz
Additional latency	1.33/2.67/5.33 ms (set by transmitter)

Mechanical

Dimensions (H x W x D)	
VARI-B(H)	1200 x 130 x 98 mm (47.2 x 5.1 x 3.8 in)
VARI-B(H)+E	2400 x 130 x 98 mm (94.5 x 5.1 x 3.8 in)
VARI-B(H)+E+E	3600 x 130 x 98 mm (141.7 x 5.1 x 3.8 in)
Bracket	27 mm (1.1 in) additional depth, flat mounted
VARI-CM	100 x 50 x 23 mm (3.9 x 2.0 x 0.9 in)

Weight	
VARI-B(H)	13.0 kg (28.7 lbs)

VARI-B(H)+E	24.7 kg (54.5 lbs)
VARI-B(H)+E+E	36.4 kg (80.3 lbs)
Color	
Enclosure: VARI-B(H) and -E	RAL9007 (gray aluminum)
Grill: VARI-B(H) and -E	RAL9006 (white aluminum)

Environmental

Operating temperature	-25 °C to 55 °C (-13 °F to 131 °F)
Storage and transport temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Relative humidity	<95 %

Notes:

1. Measured outside under semi-anechoic 'full-space' conditions with typical filter and delay settings unless stated otherwise.
2. Measured on-axis. The frequency response of the complete array is depending on the actual signal processing parameters and air absorption (at larger distances). A typical bandwidth is specified for the complete array under 'full-space' radiation conditions.
3. Levels are valid for pink noise (100 Hz to 20 kHz bandwidth) with a crest factor of 3 dB, default EQ and minimum opening angle setting. 'Continuous' is the RMS level, 'Peak' is the absolute peak level, both determined at the onset of the output limiter. SPL values will vary depending upon opening angle.
4. For this measurement the signals at all power amplifier outputs are summed together.
5. Additional processing capabilities available.
6. Measured as the A-weighed difference (in dB) between the maximum rms level (with pink noise input signal) and the noise output (with no input signal present).
7. Maximum number that can be connected to one RS-485 subnet, multiple subnets can be controlled by one host PC.

Ordering information

LA3-VARI-B Vari Base Unit
Active vari-directional array loudspeaker.
Order number **LA3-VARI-B**

LA3-VARI-BH Vari Base Unit HF
Active vari-directional array loudspeaker with coaxial drivers for improved high frequency response.
Order number **LA3-VARI-BH**

LA3-VARI-E Vari Extension Unit
Active vari-directional array extension, to be used with a base unit to increase the coverage distance. A maximum of two extension units can be used with a base unit.
Order number **LA3-VARI-E**

Accessories

LA3-VARI-CM Vari CobraNet Module
CobraNet module for connecting the vari-directional array to a CobraNet network. The module must be mounted inside the base unit.
Order number **LA3-VARI-CM**

LA3-VARI-CS Vari Configuration set
Configuration set for the vari-directional array contents: USB to RS-485 converter, USB cable (1.8 m) for connection to the PC USB port and RS-485 connection cable (5 m) for connection to the vari-directional array.
Order number **LA3-VARI-CS**

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