

Galileo® 616 : Loudspeaker Management System



The Galileo loudspeaker management system is an elegant hardware and software solution for driving and aligning multi-zone loudspeaker systems. The 2-space, rack-mount Galileo 616 includes six inputs, 16 outputs, and a fully digital matrix processor. The Compass® control software provides comprehensive control of all parameters from a Mac® or Windows®-based computer. The Galileo 616 is also fully programmable from its front panel for maximum flexibility.

Designed as the perfect complement to Meyer Sound's self-powered loudspeakers, the Galileo loudspeaker management system includes array correction for M Series™ array

loudspeakers, atmospheric correction filters, low- and high-pass filters for subwoofer control, and configuration presets for Meyer Sound loudspeaker systems of various types and sizes.

The Galileo 616 offers an extensive equalization architecture that includes complementary phase parametric filtering and TruShaping® low-order equalization on both inputs and outputs. 31-band graphic equalization is also available on inputs.

Equalization parameters are easily edited in the Compass control software, with numeric entry or by graphically dragging frequency

bands. Parameters can be adjusted while viewing multiple layers of equalization in a composite graphic plot to achieve the ideal equalization curve. The Compass software's intuitive user interface is the culmination of Meyer Sound's extensive experience optimizing complex loudspeaker systems.

The Galileo 616 features full digital operation with fixed latency across all output channels regardless of any applied processing. It can also be connected directly to the SIM® 3 audio analyzer, providing complete measurement and control for integrated audio systems.

FEATURES & BENEFITS

- Six inputs (analog, AES/EBU, or mixed) and 16 analog outputs with full matrix mixing and routing for driving systems of any size
- Robust +26 dBu outputs easily drive Meyer Sound self-powered loudspeaker systems over long cable runs
- A/D/A conversion with 24-bit resolution at 96 kHz; digital inputs converted to 96 kHz sample rate
- Monolithic 1 GHz vector DSP architecture
- Internal processing performed at 96 kHz, 32-bit floating point resolution with fixed latency across all output channels
- Array correction for M Series line array loudspeakers
- Atmospheric correction filters
- Patented TruShaping equalization and parametric filtering yield corrections with minimal impact on phase response
- Low- and high-pass filters
- Up to 2 seconds of delay on inputs and outputs
- Configuration presets for Meyer Sound loudspeaker systems
- Ethernet connection for remote control from Mac and Windows-based computers running the Compass control software
- Front-panel operation for standalone control
- Full bidirectional communication with computer ensures parameter settings are always in sync
- Direct connection to Meyer Sound's SIM 3 audio analyzer

GALILEO 616 HARDWARE

The Galileo 616 features six analog inputs with balanced XLR connectors and state-of-the-art A/D converters operating at 24-bit resolution with a 96 kHz sample rate. The inputs can be individually switched to operate as stereo AES/EBU digital inputs, accepting sample rates up to 96 kHz. Because internal processing is performed at 96 kHz with 32-bit vector floating point, source signals with lower sample rates are upsampled using advanced hardware sample rate converters. The six input channels can be configured in pairs to receive a combination of analog and digital sources.

The 16 analog outputs feature balanced XLR connectors with high-resolution 96 kHz, 24-bit D/A converters, and a robust maximum output level of +26 dBu, capable of driving Meyer Sound self-powered loudspeakers to full output, across all frequencies, over long cable runs.

The Galileo 616 processor is built around a monolithic, 1 GHz vector DSP architecture with a direct DMA audio path to maximize processing power and guarantee fixed low-latency performance, no matter how much processing is applied. High-quality algorithms with 32-bit floating-point resolution and 96 kHz sample rates are used to deliver a large assortment of processing.

The rear panel includes two SIM bus ports for direct connection to Meyer Sound’s SIM 3 audio analyzer, allowing the Galileo 616 to function



Galileo 616 Front and Rear Panels

as a line switcher for the analyzer so that measurements can be taken from any selection of Galileo inputs and outputs, without patching beyond a single connection to the analyzer.

Front panel controls allow the Galileo 616 to be operated intuitively and quickly during live use, without a computer. Input levels are displayed with 26-segment LED meters, while output levels are indicated with variable-intensity, bi-color clip LEDs. Inputs and outputs also include illuminated mute and select buttons.

Parameters are displayed on a 128 x 64 LCD and can be accessed and edited with the navigation buttons and high-resolution encoder knobs.

AC power is software-activated so that accidental button-pushes won’t power down the Galileo 616. A locking powerCON® AC connector prevents unwanted power disconnections. Front panel locking and password protection are available to guard against errant parameter changes.

Galileo 616 Signal Flow



The Galileo 616 includes a powerful arsenal of DSP for tuning and aligning Meyer Sound loudspeaker systems. In addition to standard DSP components like delay (up to 2 seconds), gain, and polarity reversal, the Galileo 616 boasts an unprecedented architecture of equalization and filtering capable of addressing a range of acoustic anomalies and subjective tailoring of system responses, without introducing excessive shifts in phase that degrade intelligibility and signal clarity.

TruShaping equalization, available on both inputs and outputs, is comprised of four first-order interactive filters configured in a unique cascading topology that allows bands to overlap, resulting in slopes as low as 3 dB per octave, yielding extremely smooth

response curves with minimal phase shifts. Because Meyer Sound loudspeaker systems are optimized to produce flat frequency and phase responses out of the box, the TruShaping equalizer is a powerful tool for adding warmth, presence, and other subjective sonic qualities.

To address anomalies resulting from loudspeakers interactions, or loudspeaker interactions with acoustical environments, complementary phase parametric filtering is provided — 5 bands on inputs, 10 bands on outputs. As a second-order filter, the parametric filter is ideal for treating these types of interaction artifacts.

For even more flexibility, a 31-band graphic

equalizer with a 20 Hz to 20 kHz frequency span is available on each input.

The array correction filter reduces low and low-mid frequency buildup common with line arrays and curvilinear arrays. Simply specify the M Series loudspeaker model, along with the number of cabinets employed in the array, and the Galileo 616 will use its stored table of compensation parameters to adjust for the array's output.

The atmospheric correction filter compensates for high frequencies absorbed when sound travels through the air over long distances. By entering just a few atmospheric settings — temperature, relative humidity, distance, and altitude — the system automatically calculates and applies the appropriate filtering to correct for the environmental conditions. The user-defined Atmospheric Gain Factor ensures that sufficient headroom is available for reinforcement systems that require maximum output.

Also included are low- and high-pass filters for subwoofer control.

DSP parameter settings are accessible from the Galileo 616's front panel, as well as from the Compass control software. Unique settings for multiple loudspeaker configurations can be stored as presets and recalled from the front panel or from the host computer.

$$f_{rO} = \frac{p_a}{p_r} \left(24 + \frac{(4.04 * 10^4 h)(0.02 + h)}{0.391 + h} \right) \quad (1)$$

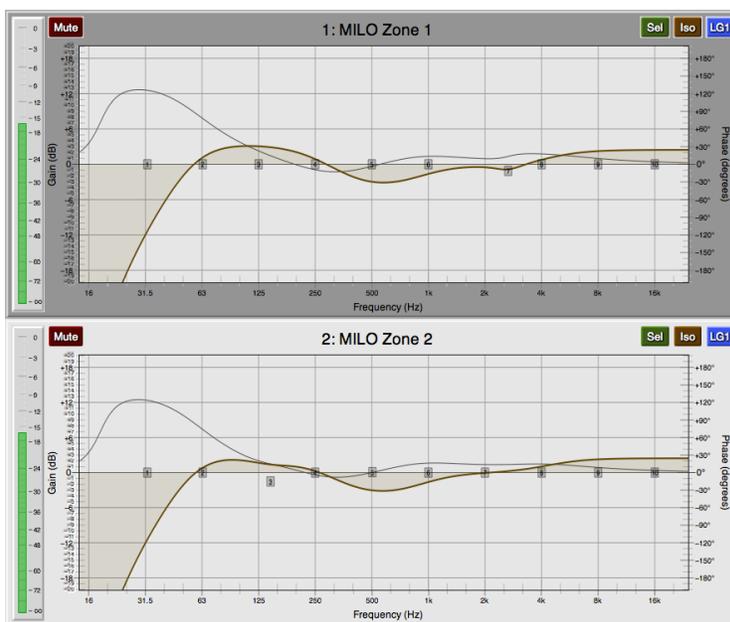
$$f_{rN} = \frac{p_a}{p_r} \left(\frac{T}{T_r} \right)^{-\frac{1}{2}} * \left(9 + 280 h \exp \left[-4.170 \left(\left(\frac{T}{T_r} \right)^{-\frac{1}{2}} - 1 \right) \right] \right) \quad (2)$$

$$\text{Oxygen} = \left(0.01275 \left[\exp \left(\frac{-2239.1}{T} \right) \right] \left[\frac{f_{rO}}{f_{rO}^2 + f^2} \right] \right) \quad (3)$$

$$\text{Nitrogen} = \left(0.1068 \left[\exp \left(\frac{-3352.0}{T} \right) \right] \left[\frac{f_{rN}}{f_{rN}^2 + f^2} \right] \right) \quad (4)$$

$$\alpha(f) = 8.686 f^2 \left(\left[1.84 * 10^{-11} \left(\frac{p_a}{p_r} \right)^{-1} \left(\frac{T}{T_r} \right)^{\frac{1}{2}} \right] + \left(\frac{T}{T_r} \right)^{-\frac{3}{2}} [\text{Oxygen} + \text{Nitrogen}] \right) \quad (5)$$

Air Absorption Calculation (ANSI S1.26 - 1995)



Compass Control Software, EQ Plots

COMPASS CONTROL SOFTWARE

The Compass control software provides comprehensive control of the Galileo 616 from an intuitive graphical user interface. The software enables easy access to all features and even provides control of multiple units. Compass runs on a Mac or Windows-based computer.

The Galileo Map tab displays a summary overview of all Galileo channels complete with signal flow. Inputs and outputs can be labeled and conveniently grouped for gang edits.

The Input Processing and Output Processing tabs provide access to all DSP settings. Equalization parameters can be easily edited with numeric entry or by graphically dragging frequency bands. Multiple layers of equalization can be viewed for a composite graphic plot of equalization curves.

GALILEO 616 SPECIFICATIONS

INPUTS	
Inputs Section	Six inputs, analog or digital (AES/EBU, selectable in pairs)
Connectors	Goldplated XLR female
Maximum Input Level	+26 dBu (maximum range selected, 0 dB input gain)
Metering	26-segment LED ladder meters on each input
OUTPUTS	
Outputs Section	16 analog outputs
Connectors	Goldplated XLR male
Maximum Output Level	+26 dBu into 600 Ω or greater (maximum range selected)
Metering	Variable-intensity, bi-color signal presence/clip LEDs on each output
SUMMING	
	Full 6 x 16 summing matrix; any input summed with any input and routed to any output
PROCESSING	
Digital Conversion	24-bit resolution, 96 kHz sample rate
Internal Processing	32-bit vector floating point, 96 kHz
Processor	Monolithic, 1 GHz vector DSP
Input Processing	Gain, delay, TruShaping equalization, 5-band parametric filtering, 31-band graphic equalization
Output Processing	Gain, delay, polarity reversal, TruShaping equalization, 10-band parametric filtering, atmospheric correction, M Series array correction, low- and high-pass filters
NETWORK/CONTROL	
Front Panel	128 x 64 LCD, navigation buttons, high-resolution encoder knobs, and illuminated mute switches
Network	RJ-45 port for network connection and control from a Mac or Windows-based computer
Software	Full bidirectional communication with Meyer Sound's Compass control software within a client-server architecture
SIM	Two SIM bus ports for linking to the SIM 3 audio analyzer for measuring Galileo outputs (either post delay or post gain)
AC POWER	
Connector	powerCON 20
Operating Voltage Range	100–240 V AC, 50/60 Hz
Current Draw	0.55 A rms (115 V AC); 0.27 A rms (230 V AC); 0.56 A rms (100 V AC)
PHYSICAL	
Dimensions	2-space rack 19.00" w x 3.48" h x 15.30" d (483 mm x 88 mm x 388 mm)
Weight	19.2 lbs (8.71 kg)



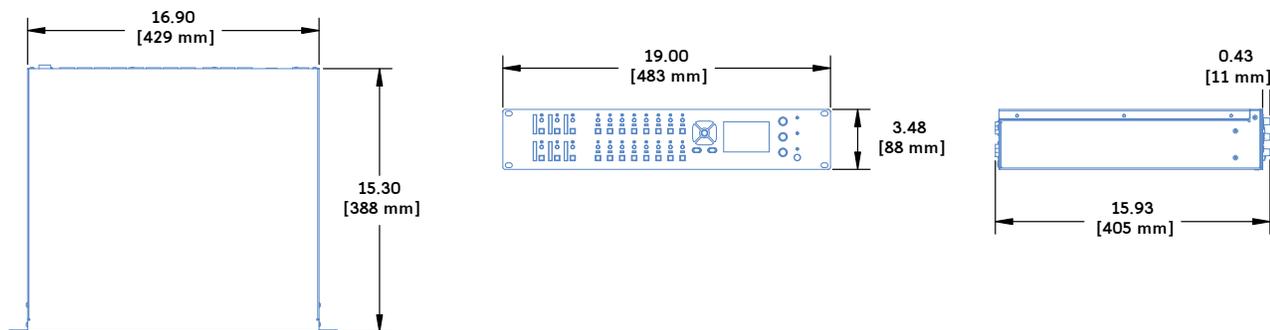
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ARCHITECT SPECIFICATIONS

The loudspeaker management system shall include 96 kHz, 32-bit floating point processing for up to six input channels (analog or AES/EBU) and 16 analog output channels. Input channels shall include dedicated processing for mute, gain, delay, TruShaping equalization, 5-band parametric equalization, and 31-band graphic equalization; output channels shall include mute, gain, delay, polarity reversal, TruShaping equalization, 10-band parametric equalization, as well as filters for subwoofer integration, low-mid buildup for line arrays and curvilinear arrays, and atmospheric correction.

Input and output connectors shall be balanced, goldplated XLR connectors with high-current line drivers capable of output voltages up to +26 dBu, without clipping, into loads of 600 Ohms or higher.

The system's complex digital matrix processor shall allow routing from any input, or combination of mixed inputs, to any combination of outputs with a fixed latency of 1.52 milliseconds, regardless of the processing applied to the signals.

All features and parameters for the loudspeaker management system shall be controlled from the unit's front panel, which shall include a 128 x 64 LCD, navigation buttons, high-resolution encoder knobs, and illuminated mute switches and signal/clip indicators for output channels. Password protection shall be available to avoid unwanted parameter changes.

The unit shall also be controlled remotely from a Mac or Windows-based computer via Ethernet; the client server

control software shall have bidirectional communication to ensure that all parameters are in sync.

The loudspeaker management system shall include direct connectivity to Meyer Sound's SIM 3 audio analyzer so that measurements can be taken directly from the unit.

The unit shall be housed in a 2-space, 19-inch rack-mount cabinet, measuring 15.3 inches (388 mm) in depth, and weighing just 19.2 lbs (8.71 kg). Its AC inlet shall be a powerCON 20 A locking connector to prevent unwanted power disconnections.

The loudspeaker management system shall be the Meyer Sound Galileo 616 and its software shall be the Compass control software.