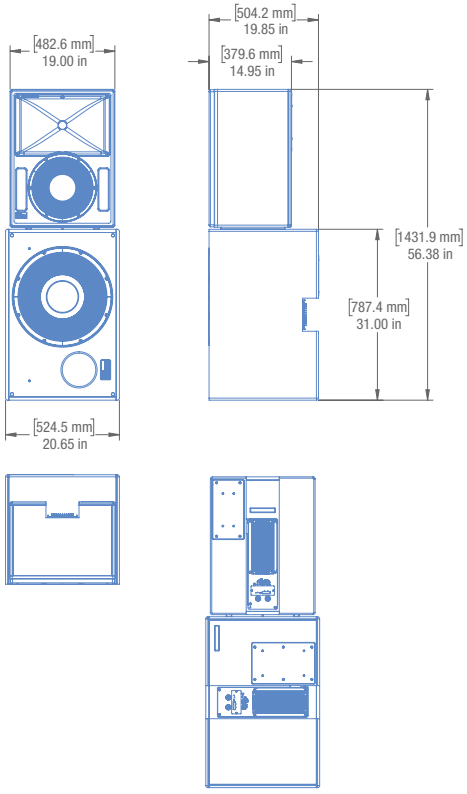
Bluehorn System Full Bandwidth Studio Monitor



Bluehorn and Bluehorn Subwoofer shown without grille frames

The Bluehorn System

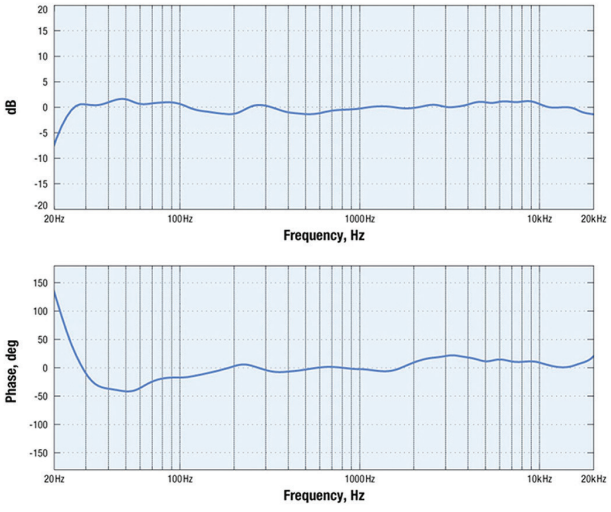
Meyer Sound designed *The Bluehorn System Full Bandwidth Studio Monitor* for the most demanding, critical-quality applications in music recording and mixing, music mastering, film scoring, film/video post-production and digital media content creation. Each Bluehorn System channel comprises a two-way, full-range loudspeaker and a separate low-frequency extension loudspeaker. The included external, dedicated Bluehorn 816 processing unit serves as an active crossover and also hosts the patented digital signal processing algorithms for full-bandwidth phase correction. Up to three Bluehorn System channels can be connected to each external processor. Bluehorn Systems are available in stereo and LCR configurations.

A Breakthrough: Measurable and Audible

By combining—for the first time—high-power, full-bandwidth audio reproduction with unprecedented frequency and phase linearity, the Bluehorn System marks a breakthrough in studio monitoring. The best of prior monitoring systems have achieved a high degree of linearity in frequency response, but realizing the same degree of perfection in phase relationships had proven elusive.

Now, after six years of intensive research and development, Meyer Sound has achieved the supreme goal: linear frequency and phase response from 25 Hz to 22 kHz.

The extraordinary linearity of the Bluehorn System is apparent in the phase and frequency plots shown in the following figure. The difference is even more revealing in a critical listening session. The Bluehorn system faithfully reproduces fine timbral details and subtle nuances, even at the lowest levels of audibility, and it reveals the ambience in recordings from naturally reverberant spaces with breathtaking realism. Regardless of output level, the response is neutral and transparent.



Frequency and Phase Response: BLUEHORN System 6.0 M Ground Plane

Pursuit of the Ultimate

Achieving perfectly linear response from a loudspeaker system has been a lifelong goal of company co-founder John Meyer. His first breakthrough came with the HD-1 studio monitor, introduced in 1989, which for decades has set the standard for accuracy and transparency in near-field studio monitors. The HD-1 marked a major leap forward in loudspeaker linearity, yet the technology of its time could not fully overcome the inherent obstacles presented by the physics of loudspeaker systems.

Sources of Phase Shift

Complex sounds such as music comprise intricate patterns of air compression and rarefaction. High frequency sounds develop quickly and are tightly spaced, while lower frequencies develop more slowly with peaks and troughs further apart.

But it is not only frequency and amplitude that matter; changes in the relative time relationships among various frequencies during propagation can also produce audible effects. All larger, multi-way loudspeakers are inherently prone to such alterations—popularly known as phase shift—due to the mass and mechanical resistance of the drivers, crossover filtering, variations in driver alignment, and cabinet resonances.

Open-air electrostatic headphones come close to zero phase shift, thanks to their single drivers with extremely low mass. But in larger, multi-way systems that require the higher power of dynamic drivers, phase shift becomes an unavoidable compromise.

A Patented Solution

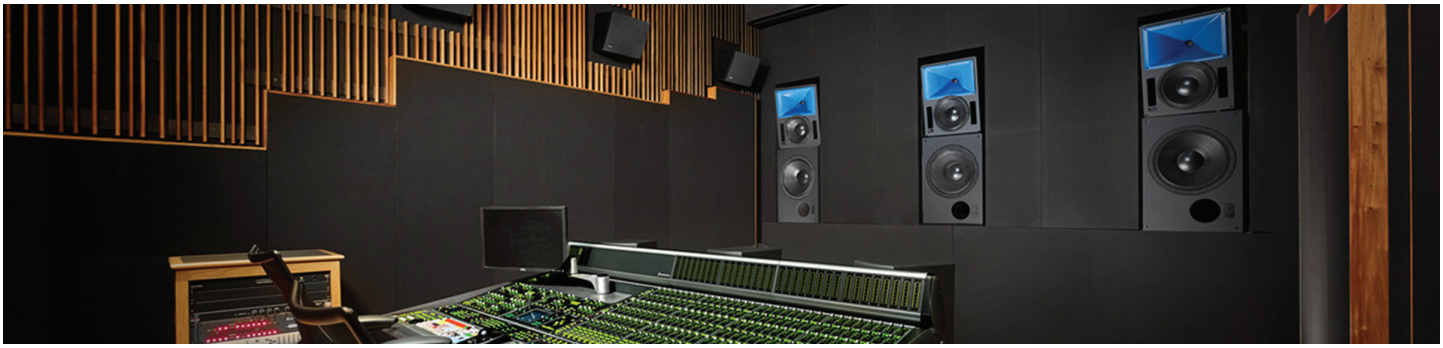
If phase shift cannot be eliminated from the acoustic output, then the only alternative is to compensate for the anomalies by introducing correction to the input signal. Phase correction in the analog domain has been implemented with some success in the past, but now the Bluehorn System applies advanced digital modeling to realize the ultimate goal: absolute phase accuracy across the entire audio bandwidth.

The first step was to develop an integrated, self-powered monitoring system capable of flat amplitude response from 20 Hz to 22 kHz at high output levels with extremely low distortion. The project involved development of a new amplifier and inclusion of the newest driver technologies from the LEO Family line arrays.

The next step was meticulous measurement of the system's phase behavior in Meyer Sound's anechoic chamber, creating a precise model in response to all types of complex input signals. The final step was to create computer algorithms to cancel phase anomalies of the physical loudspeaker systems, ensuring that the phase relationships in the original program input are preserved in the acoustical output. The digital filters fundamental to the Bluehorn System have been awarded a United States Patent (9,992,573 B1).

Unflattering Transparency for Seamless Translation

The acoustic output of the Bluehorn System replicates the input signal, revealing every detail. It does not introduce flattering characteristics that could prove misleading when mixes have to translate to other rooms and other systems later in the production process. Monitoring on a Bluehorn System ensures that nothing is overlooked.



Bluehorn System in Use

FEATURES AND BENEFITS

- Patented digital signal processing algorithms provide full-bandwidth (25 Hz to 22 kHz) phase correction
- Linear frequency response from 25 Hz to 22 kHz
- Replicates the input signal precisely in every dimension: frequency, amplitude, and time relationships between frequencies
- Consistent and accurate system results—no guess work, because the dedicated Bluehorn 816 processing unit includes all the active correction filters to drive the system.
- Overall system latency of < 50 ms. Notably fast for the amount of processing needed for phase correction down to 25 Hz.

PROFESSIONAL APPLICATIONS

- Music mastering, recording and mixing
- Film sound design, score recording and mixing
- Film/video post-production
- Media content creation
- Research/acoustics reference and measurement source
- Screening rooms and quality control suites

RESIDENTIAL APPLICATIONS

- Private Cinema
- Hi-fi

BLUEHORN AND BLUEHORN SUBWOOFER SPECIFICATIONS (BLUEHORN 816 PROCESSOR REQUIRED)

ACOUSTICAL	
Operating Frequency Range[1]	20 Hz – 22 kHz
Frequency Response[2]	22 Hz – 22 kHz ±4 dB
Phase Response	25 Hz – 22 kHz ±45°
Linear Peak SPL[3]	**130 dB with crest factor >17 dB (M-noise),** 127 dB (Pink noise), 129 dB (B-noise)
COVERAGE	
Horizontal Coverage	80°
Vertical Coverage	50°
TRANSDUCERS	
Low Frequency	One 18-inch cone driver; nominal impedance: 4 Ω
Low Frequency	One 12-inch cone driver; nominal impedance: 2 Ω
High Frequency	One 4-inch diaphragm compression driver; nominal impedance: 12 Ω
AUDIO INPUT	
Type	Differential, electronically balanced
Connectors	XLR 3-pin female input with male XLR loop output
Input Impedance	10 kΩ differential between pins 2 and 3
Wiring	Pin 1: Chassis/earth through 1 kΩ, 1000 pF, 15 V clamp network to provide virtual ground lift at audio frequencies Pin 2: Signal + Pin 3: Signal – Case: Earth ground and chassis
Nominal Input Sensitivity	10 dBV (3.2 V rms) continuous is typically the onset of limiting for noise and music
AMPLIFIER	
Type	Class D, Two-channel (Bluehorn); One-channel (Bluehorn Subwoofer)
Total Output Power[4]	1300 W peak (Bluehorn); 900 W peak (Bluehorn Subwoofer)
THD, IM, TIM	< 0.02%
Cooling	Convection, with recessed heat sink
AC POWER	
Connectors	powerCON 20 input with loop output to loop between the Bluehorn and the Bluehorn Subwoofer
Voltage Selection	Automatic, continuous from 90–265 V AC
Safety Rated Voltage Range	100–240 V AC, 50–60 Hz
Turn-on/off Points	90 V AC turn-on, no turn-off; internal fuse-protection above 265 V AC
CURRENT DRAW BLUEHORN	
Bluehorn Idle Current	0.23 A rms (115 V AC); 0.19 A rms (230 V AC); 0.24 A rms (100 V AC)
Bluehorn Subwoofer Idle Current	0.26 A rms (115 V AC); 0.16 A rms (230 V AC); 0.30 A rms (100 V AC)
Bluehorn Max Long-Term Continuous Current (>10 sec)	1.58 A rms (115 V AC); 0.83 A rms (230 V AC); 1.78 A rms (100 V AC)
Bluehorn Subwoofer Max Long-Term Continuous Current (>10 sec)	1.4 A rms (115 V AC); 0.7 A rms (230 V AC); 1.6 A rms (100 V AC)
Bluehorn Burst Current (<1 sec)[5]	3.1 A rms (115 V AC), 1.4 A rms (230 V AC), 3.6 A rms (100 V AC)
Bluehorn Subwoofer Burst Current (<1 sec)[6]	2.7 A rms (115 V AC), 1.1 A rms (230 V AC), 3.0 A rms (100 V AC)
Bluehorn Ultimate Short-Term Peak Current	12.0 A peak (115 V AC), 8.0 A peak (230 V AC), 12.4 A peak (100 V AC)
Bluehorn Subwoofer Ultimate Short-Term Peak Current	9.0 A peak (115 V AC), 6.0 A peak (230 V AC), 10.0 A peak (100 V AC)
Bluehorn/Bluehorn Subwoofer Inrush Current	< 20.0 A peak

BLUEHORN AND BLUEHORN SUBWOOFER SPECIFICATIONS, CONT'D.

PHYSICAL	
Dimensions Bluehorn	W: 19.00 in (482.6 mm) x H: 25.38 in (644.5 mm) x D: 14.95 in (379.6 mm)
Dimensions Bluehorn Subwoofer	W: 20.65 in (524.5 mm) x H: 31.00 in (787.4 mm) x D: 19.85 in (504.2 mm)
Weight	Total system: 162 lb (73.5 kg); Bluehorn: 74 lb (33.6 kg); Bluehorn Sub: 88 lb (39.9 kg)
Enclosures	Premium multi-ply birch, slightly textured black finish with black cloth protective grille frame

NOTES

1. Recommended maximum operating frequency range. Response depends on loading conditions and room acoustics.
2. Free field, measured with 1/3 octave frequency resolution at 4 meters; Bluehorn on top of Bluehorn Sub; units are coplanar and less than 12 inches (30 cm) apart.
3. **Linear Peak SPL** is measured in free-field at 4 m referred to 1 m. Loudspeaker SPL compression measured with M-noise at the onset of limiting, 2-hour duration, and 50 °C ambient temperature is < 2 dB.

   M-noise is a full bandwidth (10 Hz–22.5 kHz) test signal developed by Meyer Sound to better measure the loudspeaker's music performance. It has a constant instantaneous peak level in octave bands, a crest factor that increases with frequency, and a full bandwidth Peak to RMS ratio of 18 dB. The presence of a greater-than (>) symbol with regard to crest factor indicates it may be higher depending on EQ and boundary loading.

   Pink noise is a full bandwidth test signal with Peak to RMS ratio of 12.5 dB.

   B-noise is a Meyer Sound test signal used to ensure measurements reflect system behavior when reproducing the most common input spectrum, and to verify there is still headroom over pink noise.
4. Peak power based on the maximum unclipped peak voltage the amplifier will produce into the nominal load impedance.
5. AC power cabling must be of sufficient gauge so that under burst current rms conditions, cable transmission losses do not cause the loudspeaker's voltage to drop below the specified operating range.

BLUEHORN 816 PROCESSOR

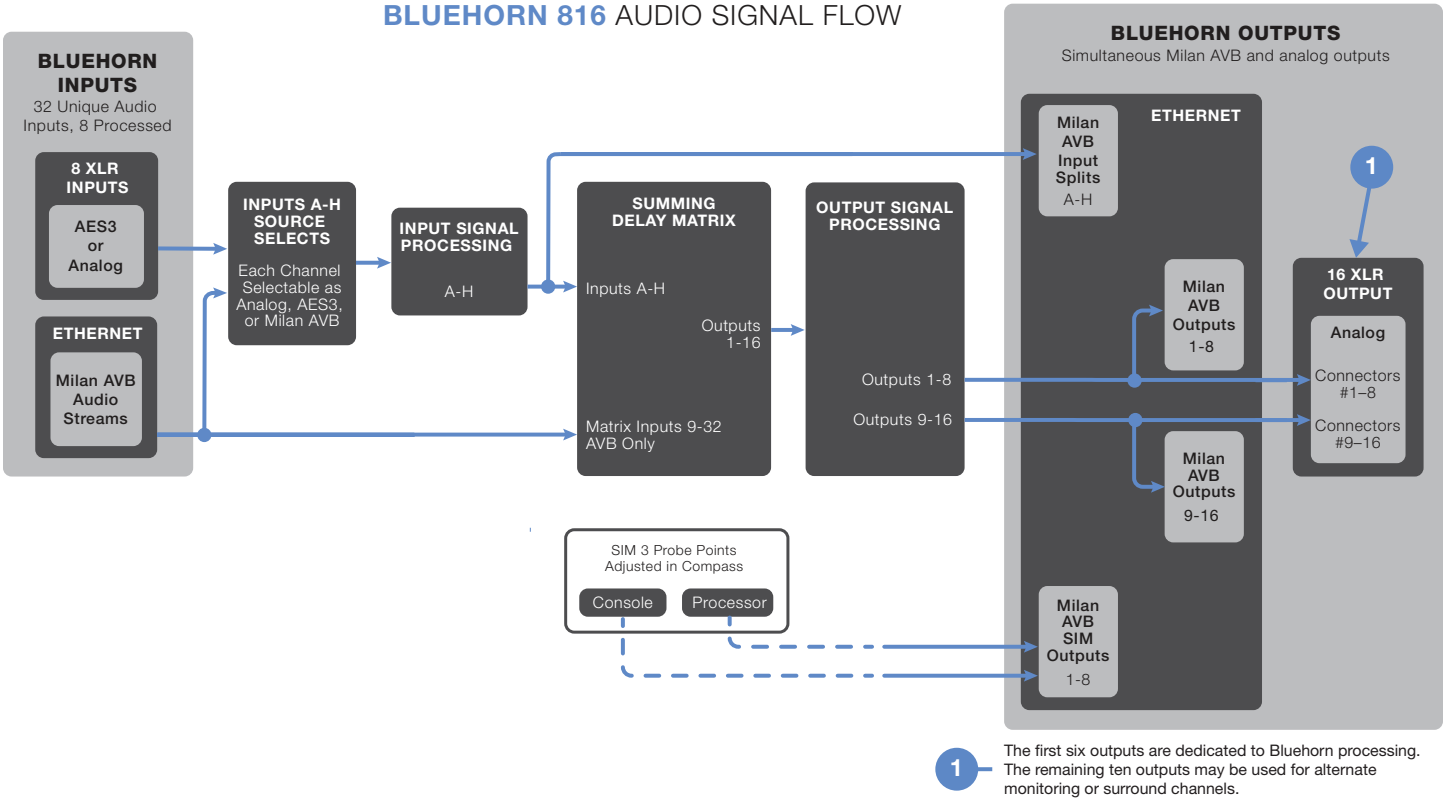
BLUEHORN 816 PROCESSOR SPECIFICATIONS

INPUTS	
Input Connectors	8 gold-plated XLR-F, 2 RJ-45 network ports
Audio Input	8 processed inputs selectable as analog, AES3 or AVB, plus 24 AVB unprocessed matrix inputs
AVB Audio Sinks	8, each capable of receiving an AVB Audio Stream Input
AVB Audio Stream Input Format	AAF PCM-INT-32, 96 kHz or 48 kHz, 1 to 8 channels per stream
AVB Clock Sink	1, capable of receiving an AVB Clock Stream Input
AVB Clock Stream Format	48 kHz CRF stream (interval equals 96, or 2 msec) and 1 timestamp per protocol data unit, single channel stream
Selectable Maximum Input Level	+16 dBu or +26 dBu BAL (input impedance 10 kΩ BAL)
Front Panel Metering	4-segment LED ladder meters on each input
Input Processing	Gain, 500 ms delay range at each input (non-fading), 5-band parametric EQ, 5-band U-Shaping EQ
OUTPUTS	
Output Connectors	16 gold-plated XLR-M, 2 RJ-45 network ports
Analog Audio Outputs	Processed outputs 1–16 on connectors 1–16
AVB Audio Sources	6, each capable of transmitting an 8-channel AVB Output Stream
AVB Stream Audio Output Format	Six AAF streams of 8 channels each: 4 streams at 96 kHz PCM-INT-32 (Outputs 1-8, 9-16, SIM, and Input Splits A-H) 2 streams at 48 kHz PCM-INT-32 (Duplicate Outputs 1-8 and 9-16)
AVB Clock Stream Format	48 kHz CRF stream (interval equals 96, or 2 msec) and 1 timestamp per protocol data unit, single channel stream
Maximum Output Level	+16 dBu or +26 dBu (selectable) 2 kΩ BAL (5 looped self-powered loudspeakers)
Output Impedance	50 Ω BAL (25 Ω per leg)
Recommended Minimum Load	10 looped self-powered loudspeakers (net load = 1 kΩ BAL)
Absolute Minimum Load	600 Ω
Front Panel Metering	LED lights: green to indicate signal presence; red for clipping on each output
Output Processing	Gain, 2000 ms delay range, polarity reversal, 10-band parametric EQ, 5-band U-Shaping EQ, Product Integration, Low-Mid Beam Control, atmospheric correction, simultaneous low- and high-pass filters with slopes up to 48 dB per octave.
MATRIX	
Summing Matrix	Sparse 32 x 16 Summing Matrix (up to 232 of 512 cross points can be set simultaneously)
Delay Matrix	Sparse 32 x 16 Delay Matrix; 500 ms delay range at each cross point (non-fading)
PROCESSING	
Digital Conversion	24-bit resolution, 96 kHz sample rate
Internal Processing	24-bit resolution, 96 kHz
Processor	FPGA-based audio processing
NETWORK CONNECTORS	
Network Control	Two RJ-45 ports for single or redundant networks
SIM	Two SIM 3 bus ports to link the GALAXY 816 processor to the SIM audio analyzer
AC POWER	
Connector	PowerCON 20
Operating Voltage Range	100–240 VAC, 50–60 Hz
CURRENT DRAW	
Idle Current	115 VAC: 0.431 A rms; 230 VAC: 0.229 A rms; 100 VAC: 0.492 A rms
Maximum Long -Term Continuous Current (>10 sec)	115 VAC: 0.576 A rms; 230 VAC: 0.306 A rms; 100 VAC: 0.657 A rms
Inrush Current	<20 A peak

BLUEHORN 816 PROCESSOR SPECIFICATIONS, CONT'D.

PHYSICAL	
Dimensions	2 RU: W 19.00 in (483 mm) x H 3.48 in (88 mm) x D 16.14 in (410 mm)
Weight	16.8 lb (7.6 kg)
ENVIRONMENTAL	
Operating Temperature Range	0° C to +45°C
Non Operating Temperature Range	–40° C to +75°C
Humidity	to 95% at 35°C non-condensing
Operating Altitude	to 2000 m (6560 ft)

BLUEHORN 816 AUDIO SIGNAL FLOW



1 The first six outputs are dedicated to Bluehorn processing. The remaining ten outputs may be used for alternate monitoring or surround channels.

BLUEHORN FULL BANDWIDTH STUDIO MONITOR SYSTEM ARCHITECTURAL SPECIFICATIONS

Each system channel shall comprise a two-way, full-range loudspeaker and a separate low-frequency extension loudspeaker driven by an external, dedicated network processor. The external unit shall serve as an active crossover and shall also host the patented digital signal processing algorithms for full-bandwidth phase correction. Up to three system channels shall be connected to each external processor.

The two-way, full-range loudspeaker shall be a compact, linear, low-distortion, studio monitor loudspeaker and shall be self-powered by a 2-channel, class D amplifier. Its transducers shall include one 12-inch cone driver, and one 4-inch diaphragm compression driver coupled to a constant-directivity, wide-dispersion horn.

The low-frequency extension loudspeaker shall be a low-distortion, studio subwoofer and shall be self-powered by a single channel, class D amplifier. Its transducer shall include one 18-inch cone driver.

Both units shall incorporate internal processing in their onboard amplifier; processing shall include equalization, phase correction, driver protection, and signal division. The operating frequency range for a typical production system channel, measured free-field with 1/3 octave frequency resolution at 4 m and coplanar to each other for less than 12 inches (30 cm) apart shall be 20 Hz–22 kHz. The linear peak SPL shall be 130 dB with crest factor >17 dB (measured with M-noise free-field at 4 m referred to 1 m).

Audio connectors shall be XLR 3-pin female with male XLR loop output, accommodating balanced audio.

The internal power supplies shall perform EMI filtering, soft current turn-on, and surge suppression. Power requirements shall be nominal 100, 110, or 230 V AC line current at 50–60 Hz. UL and CE operating voltage range shall be 100–240 V AC at 50–60 Hz. AC power connectors for input and loop output shall be powerCON 20. Maximum long-term continuous current draw for the two-way full-range loudspeaker shall be 1.58 A rms at 115 V AC, 0.83 A rms at 230 V AC, and 1.78 A rms at 100 V AC. Maximum long-term continuous current draw for the low-frequency extension loudspeaker shall be 1.40 A rms at 115 V AC, 0.70 A rms at 230 V AC, and 1.60 A rms at 100 V AC.

Components shall be mounted in optimally tuned, vented enclosures constructed of premium multi-ply birch with a slightly textured black finish. Dimensions for the two-way, full-range loudspeaker shall be W: 19.00 in (482.6 mm) x H: 25.38 in (644.5 mm) x D: 14.95 in (379.6 mm) and the weight shall be 74 lb (33.6 kg). Dimensions for the low-frequency extension loudspeaker shall be W: 20.65 in (524.5 mm) x H: 31.00 in (787.4 mm) x D: 19.85 in (504.2 mm) and the weight shall be 88 lb (39.9 kg). The total loudspeaker system weight shall be 162 lb (73.5 kg)

The external dedicated network processor shall include 96 kHz audio processing and utilize variable length integers with up to 64 bits of resolution. The processor shall dedicate 3 channels of the 8 channel inputs and shall provide 6 channels of the sixteen channel outputs exclusively for the loudspeaker system. These dedicated channels shall serve as an active crossover and also shall host the patented digital signal processing algorithms for full-bandwidth phase correction.

The processor shall accept analog balanced, AES3 or AVB. Each input channel shall include dedicated processing for mute, gain, delay, U-Shaping, and 5-band parametric equalization. Output channels shall be via AVB or analog and shall include mute, gain, delay, polarity reversal, U-Shaping equalization, 10-band parametric equalization, and delay integration, as well as high- and low-pass filters, atmospheric correction filters, and subwoofer integration.

Analog and AES3 input connectors and analog output connectors shall be balanced, gold-plated XLR connectors with high-current line drivers capable of output voltages up to +26 dBu without clipping into loads of 50 Ω or higher.

The network processor's sophisticated digital matrix processor shall allow routing and gain delays from any input, or combination of mixed inputs, to any combination of outputs with cross point delays and a fixed latency regardless of the processing applied to the signals.

The front panel shall include: a two-line LCD display for device, current snapshot, and firmware information; LED indicators for audio signal metering, AVB Sync, Audio Clock, Power, Controller, and SIM3 connections; illuminated mute switches; and signal/clip indicators for output channels. Password protection shall be available to avoid unwanted parameter changes.

The unit shall be controlled remotely from a Mac or Windows-based computer via Ethernet or wirelessly from an iPad; the client server control software shall have bidirectional communication to ensure that parameters are in sync. The processor 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 2U, 19-inch, rack-mount cabinet, measuring 16.14 inch (410 mm) in depth, and weighing 16.8 lb (7.6 kg). Its AC inlet shall be a powerCON 20 A locking connector to prevent unwanted power disconnections. Its two network inlets shall be EtherCON RJ45 connectors.

The two-way full-range loudspeaker shall be Bluehorn, the low-frequency extension loudspeaker shall be the Bluehorn Subwoofer, the network processor shall be the Meyer Sound Bluehorn 816, and its software shall be the Compass Control Software.

The complete system shall be the Meyer Sound Bluehorn System Full Bandwidth Studio Monitor.

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Bluehorn System
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