

Galileo GALAXY 408  
Galileo GALAXY 816  
Galileo GALAXY 816-AES3



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Galileo GALAXY User Guide, PN 05.230.005.01 F

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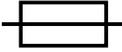
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## IMPORTANT SAFETY INSTRUCTIONS

These symbols indicate important safety or operating features in this booklet and on the frame or chassis:

### SYMBOLS USED

					
<b>Dangerous voltages: risk of electric shock</b>	<b>Important operating instructions</b>	<b>Replaceable Fuse</b>	<b>Protective earth ground</b>	<b>Hot surface: do not touch</b>	<b>Electronic instructions for use: instruction location in QR code</b> 
<b>Gefährliche Spannungen: Stromschlaggefahr</b>	<b>Hinweis auf wichtige Punkte der Betriebsanleitung</b>	<b>Austauschbare Sicherung</b>	<b>Schutzerde</b>	<b>Heiße Oberfläche: nicht berühren</b>	<b>Elektronische Gebrauchsanweisung: anweisungsort im QR-Code</b>
<b>Pour indiquer les risques résultant de tensions dangereuses</b>	<b>Instructions d'utilisation importantes</b>	<b>Fusible remplaçable</b>	<b>Terre de protection</b>	<b>Surface chaude: ne pas toucher</b>	<b>Mode d'emploi électronique: emplacement des instructions dans le code QR</b>
<b>Para indicar voltajes peligrosos</b>	<b>Instrucciones importantes de funcionamiento y/o Mantenimiento</b>	<b>Fusible reemplazable</b>	<b>Toma de tierra de protección</b>	<b>Superficie caliente: no tocar</b>	<b>Instrucciones de uso electrónicas: ubicación de instrucciones en el código QR</b>

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with Meyer Sound's installation instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
9. Do not defeat the safety purpose of the grounding-type plug. A grounding type plug has two blades and a third grounding prong. The third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus. The AC mains plug or appliance coupler shall remain readily accessible for operation.
11. Only use attachments/accessories specified by Meyer Sound.
12. Use only with the caster rails or rigging specified by Meyer Sound, or sold with the apparatus. Handles are for carrying only.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. If equipped with an external fuse holder, the replaceable fuse is the only user-serviceable item. When replacing the fuse, only use the same type and the same value.
15. Refer all other servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as when the power-supply cord or plug has been damaged; liquid has been spilled or objects have fallen into the apparatus; rain or moisture has entered the apparatus; the apparatus has been dropped; or when for undetermined reasons the apparatus does not operate normally.



**WARNING:** For Meyer Sound IntelligentDC Power Supply models MPS-488HP and MPS-482HP, the external wiring connected to the output terminals of the units require installation by an Instructed person or the use of ready-made leads or cords.



**WARNING:** To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Do not install the apparatus in wet or humid locations without using weather protection equipment from Meyer Sound.



**WARNING:** Class I apparatus shall be connected to a mains socket outlet with a protective earthing connection.



**CAUTION:** Disconnect the mains plug before disconnecting the power cord from the loudspeaker.

## English

- To reduce the risk of electric shock, disconnect the apparatus from the AC mains before installing audio cable. Reconnect the power cord only after making all signal connections.
- Connect the apparatus to a two-pole, three-wire grounding mains receptacle. The receptacle must be connected to a fuse or circuit breaker. Connection to any other type of receptacle poses a shock hazard and may violate local electrical codes.
- Do not install the apparatus in wet or humid locations without using weather protection equipment from Meyer Sound.
- Do not allow water or any foreign object to get inside the apparatus. Do not put objects containing liquid on or near the unit.
- To reduce the risk of overheating the apparatus, avoid exposing it to direct sunlight. Do not install the unit near heat-emitting appliances, such as a room heater or stove.
- If equipped with an external fuse holder, the replaceable fuse is the only item that can be serviced by the user. When replacing the fuse, only use the same type and value.
- This apparatus contains potentially hazardous voltages. Do not attempt to disassemble the unit. The only user-serviceable part is the fuse. All other repairs should be performed only by factory-trained service personnel.

## Deutsch

- Zur Minimierung der Gefahr eines elektrischen Schlages trennen Sie das Produkt vor dem Anschluss von Audio- und/oder Steuerleitungen vom Stromnetz. Das Netzkabel darf erst nach Herstellung aller Signalverbindungen wieder eingesteckt werden.

- Das Produkt an eine vorschriftsgemäss installierte dreipolige Netzsteckdose (Phase, Neutralleiter, Schutzleiter) anschließen. Die Steckdose muss vorschriftsgemäß mit einer Sicherung oder einem Leitungsschutzschalter abgesichert sein. Das Anschließen des Produkts an eine anders ausgeführte Stromversorgung kann gegen Vorschriften verstossen und zu Stromunfällen führen.
- Das Produkt nicht an einem Ort aufstellen, an dem es direkter Wassereinwirkung oder übermäßig hoher Luftfeuchtigkeit ausgesetzt werden könnte, solange es sich nicht um ein Produkt handelt, dass mit der Meyer Sound Weather Protection Option ausgestattet ist.
- Vermeiden Sie das Eindringen von Wasser oder Fremdkörpern in das Innere des Produkts. Stellen Sie keine Objekte, die Flüssigkeit enthalten, auf oder neben dem Produkt ab.
- Um ein Überhitzen des Produkts zu verhindern, halten Sie das Gerät von direkter Sonneneinstrahlung fern und stellen Sie es nicht in der Nähe von wärmeabstrahlenden Geräten (z.B. Heizgerät oder Herd) auf.
- Bei Ausstattung mit einem externen Sicherungshalter ist die austauschbare Sicherung das einzige Gerät, das vom Benutzer gewartet werden kann. Verwenden Sie beim Austausch der Sicherung nur den gleichen Typ und Wert.
- Dieses Gerät enthält möglicherweise gefährliche Spannungen. Versuchen Sie nicht, das Gerät zu zerlegen. Der einzige vom Benutzer zu wartende Teil ist die Sicherung. Alle anderen Reparaturen dürfen nur von im Werk geschultem Servicepersonal ausgeführt werden.

## Français

- Pour éviter tout risque d'électrocution, débranchez l'enceinte de la prise secteur avant de mettre en place le câble audio. Ne rebranchez le cordon secteur qu'après avoir procédé à toutes les connexions de signal audio
- Brancher l'appareil sur une prise secteur à trois fils et deux pôles avec mise à la terre. La prise doit être reliée à un fusible ou à un disjoncteur. Le branchement à tout autre type de prise présente un risque de choc électrique et peut enfreindre les codes locaux de l'électricité.
- N'installez pas l'enceinte dans des endroits humides ou en présence d'eau sans utiliser d'équipements de protection adéquats fournis par Meyer Sound.
- Ne laissez pas d'eau ou d'objet étranger, quel qu'il soit, pénétrer à l'intérieur de l'enceinte. Ne posez pas d'objet contenant du liquide sur ou à proximité de l'enceinte.
- Pour réduire les risques de surchauffe, évitez d'exposer directement l'enceinte aux rayons du soleil. Ne l'installez pas à proximité de sources de chaleur, radiateur ou four par exemple.

- S'il est équipé d'un porte-fusible externe, le fusible remplaçable est le seul élément qui peut être réparé par l'utilisateur. Lors du remplacement du fusible, n'utilisez que le même type et la même valeur.
- Cet appareil contient des tensions potentiellement dangereuses. N'essayez pas de démonter l'appareil. Le fusible est la seule pièce réparable par l'utilisateur. Toutes les autres réparations doivent être effectuées uniquement par du personnel de maintenance formé en usine.

## Español

- Para reducir el riesgo de descarga eléctrica, desconecte el aparato de la red eléctrica antes de instalar el cable de audio. Vuelva a conectar el cable de alimentación sólo después de realizar todas las conexiones de señal.
- Conecte el aparato a una toma de corriente de tres hilos y dos polos con conexión a tierra. El receptáculo debe estar conectado a un fusible o disyuntor. La conexión a cualquier otro tipo de receptáculo representa un riesgo de descarga eléctrica y puede violar los códigos eléctricos locales.
- No instale el aparato en lugares húmedos o mojados sin usar el equipo de protección contra intemperie de Meyer Sound.
- No permita que penetre agua u otros objetos extraños en el interior del aparato. No coloque objetos que contengan líquido sobre o cerca de la unidad.
- Para reducir el riesgo de sobrecalentamiento del aparato, evite exponerlo a la luz solar directa. No instale la unidad cerca de aparatos que emitan calor, como un calefactor o una estufa.
- Si está equipado con un portafusibles externo, el fusible reemplazable es el único elemento que puede ser reparado por el usuario. Cuando reemplace el fusible, use solamente el mismo tipo y valor.
- Este aparato contiene voltajes potencialmente peligrosos. No intente desmontar la unidad. La única pieza que el usuario puede reparar es el fusible. Todas las demás reparaciones deben ser realizadas únicamente por personal de servicio capacitado de fábrica.



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## CHAPTER 1: INTRODUCTION

### HOW TO USE THIS MANUAL

Please read these instructions in their entirety before configuring a Meyer Sound loudspeaker system. In particular, pay close attention to material related to safety issues.

As you read these instructions, you will encounter the following icons for notes, tips, and cautions:



**NOTE:** A note identifies an important or useful piece of information relating to the topic under discussion.



**TIP:** A tip offers a helpful tip relevant to the topic at hand.



**CAUTION:** A caution gives notice that an action may have serious consequences and could cause harm to equipment or personnel, or could cause delays or other problems.

Information and specifications are subject to change. Updates and supplementary information are available at [meyersound.com](http://meyersound.com).

Meyer Sound Technical Support is available at:

- **Tel:** +1 510 486.1166 (Monday through Friday 9:00 am to 5:00 pm PST)
- **Tel:** +1 510 486.0657 (after hours support)
- **Web:** [meyersound.com/support](http://meyersound.com/support)

## GALILEO GALAXY NETWORK PLATFORM

The Galileo GALAXY Network Platforms contain audio processors that are sophisticated loudspeaker management tools offering comprehensive control of Meyer Sound loudspeaker systems. They provide powerful tool sets for corrective equalization and creative fine-tuning in fully networkable devices.



**NOTE:** For expediency in the following documentation, the Galileo GALAXY Network Platform is referred to as the “GALAXY processor” or where appropriate, by specific models such as “GALAXY 408 processor,” “GALAXY 816 processor,” and “GALAXY 816-AES3 processor.” Similarly, Compass Control Software is referred to simply as “Compass” or “Compass Go.”

### Powerful Audio Processing

GALAXY processors feature a 96 kHz audio processing sample rate and use 24-bit/96 kHz A/D and D/A converters. Input processing tools include gain, delay, 5-band parametric EQ, and 5-band U-Shaping EQ. Output processing tools include gain, delay, polarity reversal, 10-band parametric EQ, 5-band U-Shaping EQ, Low-Mid Beam Control (LMBC, see Appendix D, “Low-Mid Beam Control”), atmospheric correction (see Appendix E, “Atmospheric Correction”), high- and low-pass filters, and all-pass filters.

Built-in summing and delay matrices allow users to easily assign gain and delay values at each routing cross-point, enabling any single loudspeaker to serve as an output for multiple, independently processed input signals. The Product Integration feature combines the Delay Integration setting and Starting Points (saved channel settings) capability into a single dialog. This feature facilitates optimization of systems in order to achieve the best possible performance (see Appendix C, “Product Integration”).

The GALAXY 408 processor, the GALAXY 816 processor, and the GALAXY 816-AES3 processor have the same audio processing capability with different physical inputs and outputs. The GALAXY 816-AES3 processor also includes a BNC connection for external word clock input. See “Specification Table” on page 41 for more details.

### Extensive User Control

Users can control any of the GALAXY processors using Compass Control Software (hosted on a Mac or PC) or via the Compass Go application for the iPad. Compass provides a complete toolkit for audio routing, system optimization, processing, and monitoring.

For units equipped with this component, the rear panel includes SIM 3 bus port(s) (one on the GALAXY 408 processor and two on both the GALAXY 816 processor and the GALAXY 816-AES3 processor) for direct connection to Meyer Sound’s SIM audio analyzer, allowing GALAXY processors to function as line switchers for the analyzer. With this capability, users can take measurements from any selection of GALAXY processor inputs and outputs without patching beyond a single connection to SIM.

### Milan-Certified Network Platform

Galileo GALAXY Network Platforms are Milan certified, providing plug-and-play network interoperability with other Milan-certified devices via AVTP Audio Format (AAF) and Clock Reference Format (CRF) AVB streams. Milan is the application layer built onto the AVB network protocol that adds a framework of interoperability for professional AV devices. Milan certification denotes true network redundancy for AVB and control signals, as well as guaranteed on-time arrival and bandwidth reservations for AVB signals. For more information about networking the GALAXY processors, please see the AVB Networking Guide, PN 05.010.541.01, available at [meyersound.com/documents](http://meyersound.com/documents).

## Galileo GALAXY Network Platform Features Overview

GALAXY processors include the following features:

- Complete system control, optimization, and monitoring with Compass Control Software for Mac and Windows-based computers
- Mobile system control, optimization, and monitoring with the Compass Go application for iPad
- 5-band U-shaping on inputs and outputs
- 5-band parametric EQ on inputs and 10-band parametric EQ on outputs
- High/low pass filters with slopes up to 48 dB per octave
- All pass filters to change the phase relationship between various frequencies, while not altering the gain at any frequency
- Product Integration [combines Delay Integration setting and Starting Points (saved channel settings) capability]
- Fixed low latency system
- Optional asynchronous sample rate converters for AES3 inputs
- Cross-point delay and summing matrix
- Atmospheric correction filters
- Interoperability with other Milan-certified third party hardware, which includes features such as:
  - Support for redundant AVB networks, allowing for fail-over without audio interruption
  - Communication of AVB timing data and audio signals via AAF packets (AVTP Audio Format)
  - Communication of AVB clock signals via CRF packets (Clock Reference Format)
  - Ability to synchronize multiple AVB signals across multiple GALAXY processors
- Selectable input and output voltage scaling that make it compatible with most consoles
- Integrable with the SIM Audio Analyzer System.
- User-selectable AVB output points for routing measurement signals to other calibration tools
- Access protection policies to enable restriction of the GALAXY processor settings accessible to each operator
- Easy integration with third-party controllers, such as AMX and Crestron

## GALAXY 816 Processor Input/Output Summary

The GALAXY 816 processor is a 2RU, 19-inch rack mountable device with the following inputs/outputs:

- 8 inputs that can receive analog, AES3, or AVB signals
- 24 AVB unprocessed matrix inputs
- 16 outputs that can deliver processed analog and/or AVB signals via XLR connectors
- 6 output sources, each capable of sourcing an 8-channel AVB stream via RJ-45 connectors



Galileo GALAXY 816 Processor Front and Rear Panels

## GALAXY 408 Processor Input/Output Summary

The GALAXY 408 processor is a 1RU, 19-inch rack mountable device with the following inputs/outputs:

- 4 processed inputs that can receive analog, AES3 or AVB signals
- 4 processed inputs that can receive only AVB signals
- 24 AVB unprocessed matrix inputs
- 8 outputs that can provide processed analog signals
- 16 outputs that can provide processed AVB signals via XLR connectors
- 6 output sources, each capable of sourcing an 8-channel AVB stream via RJ-45 connectors



Galileo GALAXY 408 Processor Front and Rear Panels

## GALAXY 816-AES3 Processor Input/Output Summary

The GALAXY 816-AES3 processor is a 2RU, 19-inch rack mountable device with the following inputs/outputs:

- 8 inputs that can receive analog, AES3, or AVB signals
- 24 AVB unprocessed matrix inputs
- 16 outputs that can deliver processed AES3 or AVB signals via XLR connectors
- 8 outputs (9-16) that can deliver analog signals via XLR connectors
- 6 output sources, each capable of sourcing an 8-channel AVB stream via RJ-45 connectors



*GALAXY 816-AES Processor Front and Rear Panels*



## CHAPTER 2: GALAXY ENCLOSURES AND I/O

All three GALAXY processors offer the same processing on inputs and outputs but differ in their size and physical connections. The GALAXY 816-AES3 processor also includes a BNC connector for external word clock input.

### GALAXY PROCESSOR ENCLOSURES

The three GALAXY processors are designed to be mounted in 19-inch wide racks. The GALAXY 408 processor is 1RU in height, and the GALAXY 816 processor and the GALAXY-816-AES processor are 2RU in height (for exact specifications, see “Dimensions” on page 43). The enclosures are made from steel with a slightly textured graphite gray finish.

### GALAXY PROCESSOR FRONT PANELS

The GALAXY processor front panels (Figure 1) provide basic information and mute control of the loudspeaker management system.

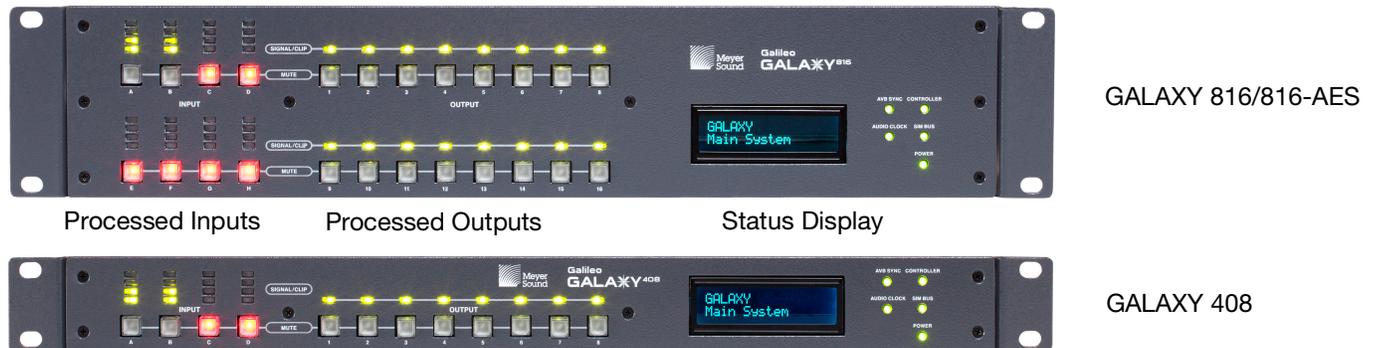


Figure 1: GALAXY Front Panels (816 and 816-AES are identical in the front, except for name label)

The GALAXY front panel is divided into three sections:

- Processed Inputs
- Processed Outputs
- Status Display

## Front Panel Processed Inputs Section

The GALAXY processor front panel processed inputs section is on the left side (Figure 2) and consists of input level meters and input mute buttons.

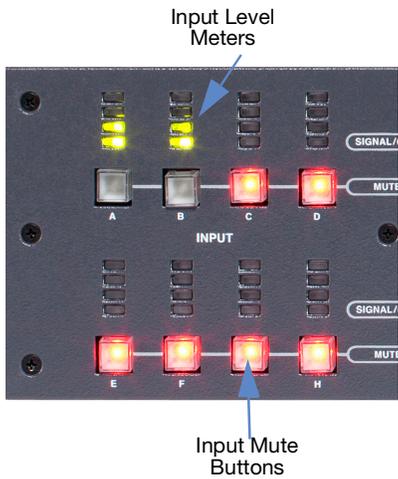


Figure 2: GALAXY Processor Front Panel Processed Inputs Section

- **Input Level Meters:** Four-segment LED ladders represent the level for each input channel. The green LED range begins at approximately -80 dB below clipping. The yellow LED range lights a few dB below clipping. The top LED turns red as the input signal level reaches full scale digital (0 dBFS). In Compass (Settings > Input and Output), the Voltage Range may be set for all input and output channels to either +16 dBu (4.89 V rms) or +26 dBu (15.5 V rms); this selection determines the clipping levels.



**NOTE:** The default Input Voltage Range is +26 dBu.

- **Input Mute Buttons:** Each input channel has a mute button. Toggling an input mute button in Compass also toggles this mute button.

## Front Panel Processed Outputs Section

The GALAXY processor front panel processed outputs section is in the middle (Figure 3) and consists of output signal/clip LEDs and output mute buttons.

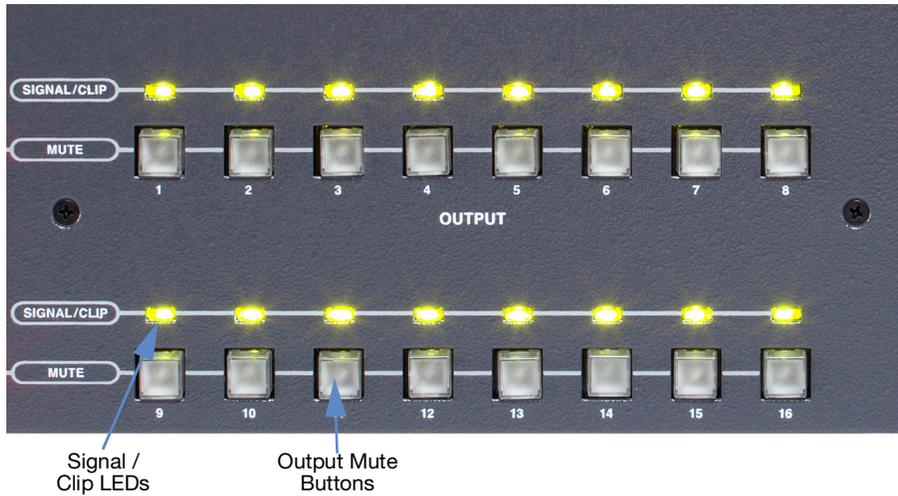


Figure 3: GALAXY Processor Front Panel Processed Outputs Section

- Signal / Clip LEDs:** Output level is indicated by one multi-color LED for each output channel. The LED turns green to indicate output levels from -85 dB to -5 dB below clipping. The LED glows brighter as the signal level increases. The LED turns amber to indicate levels from -5 dB to just below the clipping level. The LED turns red as the output signal level reaches full scale digital (0 dBFS). In Compass (Settings > Input and Output), the Voltage Range for all input and output channels can be set to either +16 dBu (4.89 V rms) or +26 dBu (15.5 V rms); this setting determines the clipping levels.



**NOTE:** The default Output Voltage Range is +26 dBu.

- Output Mute Buttons:** Each output channel has a mute button. Toggling an output mute button in Compass also toggles this mute button.

## Front Panel Status Display Section

The GALAXY processor front panel status display is on the right side (Figure 4) of the enclosure and includes the front panel display as well as informational LEDs.

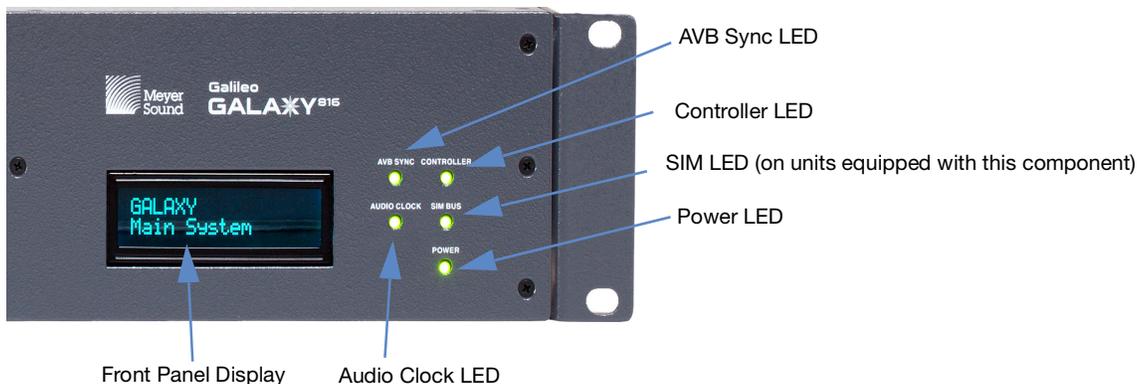


Figure 4: GALAXY Processor Front Panel Display

- **Front Panel Display:** The front panel display provides the device name, current snapshot, device identity indicator, and other critical device notifications available on the GALAXY. Use the Front Panel Display Control in Compass to adjust the brightness and color.
- **Controller LED:** Indicates activity when the GALAXY is connected to a client computer running the Compass Control Software.
- **SIM LED (on units equipped with this component):** Indicates if the GALAXY is connected to a SIM audio analyzer.



**NOTE:** The GALAXY SIM Address must be set to a number in the range 0–14 (default is 10) in the SIM tab in Compass. It will then be available in the Switcher section of SIM under tabs 0–14, and can be configured to perform audio measurements.

- **Power LED:** When lit, this LED indicates the GALAXY DC power supply is operating properly.
- **AVB Sync LED:** When lit, the LED indicates the GALAXY AVB Media Clock is locked.
- **Audio Clock LED:** When lit, the LED indicates the selected System Clock (AVB, AES, or Internal) is locked.

## GALAXY PROCESSOR REAR PANELS

The GALAXY 816 processor, the GALAXY 408 processor, and the GALAXY 816-AES3 processor have different rear panel connectors.

### GALAXY 816 Processor Rear Panel Connectors

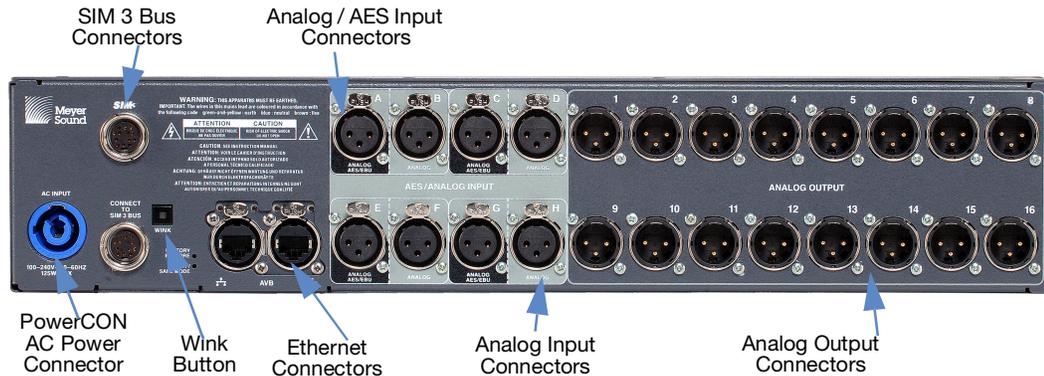


Figure 5: GALAXY 816 Processor Rear Panel

The GALAXY 816 processor rear panel provides the following connectors:

- **PowerCON AC Power Connector:** This locking connector mates with the provided AC power cable.

**CAUTION:** Make sure the AC power cable has the appropriate power plug on the other end for the area in which you will operate the GALAXY processor.

**NOTE:** The GALAXY processor incorporates Meyer Sound’s *Intelligent AC* power supply, which automatically adjusts to any line voltage worldwide, and provides *soft turn-on* and *transient protection*.

- **Ethernet Connector:** The two RJ-45 connectors can be used to attach the GALAXY processor to an AVB network to send audio signals through time-sensitive networks, and allow it to be controlled by Compass and/or Compass Go. Use a Giga-bit Ethernet network cable (CAT5e or better). All Primary network connections should be made to AVB port 1 on GALAXY processors. All Secondary connections should be made to AVB port 2.
- **Analog / AES3 Input Connectors (A, C, E, G):** Four XLR-3F input connectors accept either a standard line-level analog signal or an AES two-channel digital signal. In Compass (Settings > Input and Output), these inputs can be set to Analog, AES3 Left or AES3 Right. Input Connectors B, D, F, H can only be used as analog inputs. The GALAXY processor supports standard AES3 digital audio signals at discrete sample rates in the range of 20–216 kHz (see “Input Sample Rates” on page 52).
- **Analog Input Connectors (B, D, F, H):** Four XLR-3F input connectors accept standard line-level audio only. These inputs are typically paired with their corresponding input pairs (A, C, E, G) to receive two-channel audio signals. The analog-only inputs are disabled when their input pair is set to AES mode (i.e., when input A is set to AES mode, input B is disabled).
- **Analog Output Connectors (1–16):** Sixteen XLR-3M connectors route audio to Meyer Sound self-powered loudspeakers or to amplifier channels driving passive systems.
- **SIM 3 Bus Connectors (for units equipped with these components):** Connects to the SIM audio analyzer so the GALAXY’s inputs and outputs can be used as measurement points. A second SIM 3 bus port is provided to loop to additional GALAXY processors or to a SIM-3088 Line Switcher.

- **Wink Button:** Pressing the Wink button on the rear of a GALAXY processor will cause the device to enter the Identify Mode, a bidirectional processor identification feature that helps users locate processors in multi-processor configurations. The front panel will flash, and Compass will show an indication on both the GALAXY processor's Inventory tab and the Settings > Network tab of each processor ("Settings Tab" on page 24). To exit Identify Mode, push the Wink button on the processor again or click on the Identify button on the Network tab in Compass.

## GALAXY 408 Processor Rear Panel Connectors

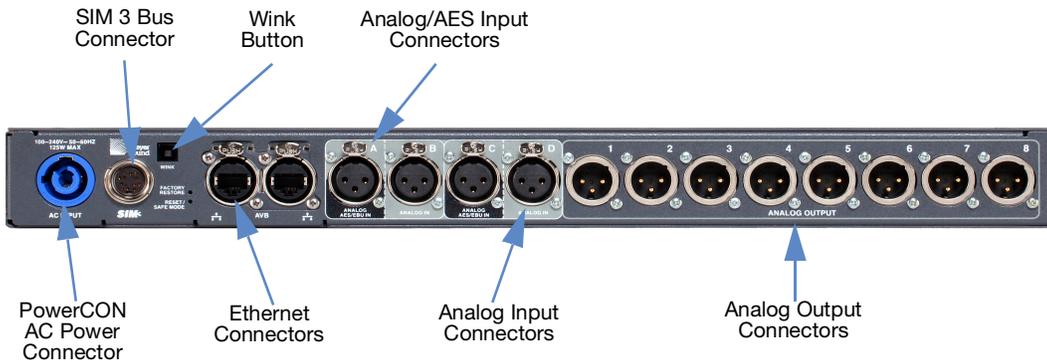


Figure 6: GALAXY 408 Processor Rear Panel

The GALAXY 408 processor rear panel provides the following connectors:

- **PowerCON AC Power Connector:** This locking connector mates with the provided AC power cable.



**CAUTION:** Make sure the AC power cable has the appropriate power plug on the other end for the area in which you will operate the GALAXY.



**NOTE:** The GALAXY processor incorporates Meyer Sound's *Intelligent AC* power supply, which automatically adjusts to any line voltage worldwide, and provides *soft turn-on* and *transient protection*.

- **Ethernet Connector:** The two RJ-45 connectors can be used to attach the GALAXY processor to an AVB network to send audio signals through time-sensitive networks, and allow it to be controlled by Compass and/or Compass Go. Use a Giga-bit Ethernet network cable (CAT5e or better).
- **Analog /AES Input Connectors (A, C):** Two XLR-3F input connectors accept either a standard line-level analog signal or an AES two-channel digital signal. In Compass (Settings > Input and Output), these inputs can be set to Analog, AES3 Left or AES3 Right. Input Connectors B and D can only be used as analog inputs. The GALAXY processor supports standard AES3 digital audio signals at discrete sample rates in the range of 20–216 kHz (see "Input Sample Rates" on page 52).
- **Analog Input Connectors (B, D):** Two XLR-3F input connectors accept standard line-level audio only. These inputs are typically paired with their corresponding input pairs (A, C) to receive two-channel audio signals. The analog-only inputs are disabled when their input pair is set to AES mode (i.e., when input A is set to AES mode, input B is disabled).
- **Analog Output Connectors (1–8):** Eight XLR-3M connectors route audio to Meyer Sound self-powered loudspeakers, or to amplifier channels driving passive systems.
- **SIM 3 Bus Connectors (for units equipped with these components):** Connects to the SIM audio analyzer so the GALAXY's inputs and outputs can be used as measurement points.

- **Wink Button:** Pressing the Wink button on the rear of a GALAXY processor will cause the device to enter the Identify Mode, a bidirectional processor identification feature that helps users locate processors in multi-processor configurations. The front panel will flash, and Compass will show an indication on both the GALAXY processor's Inventory tab and the Settings>Network tab of each processor ("Settings Tab" on page 24). To exit Identify Mode, push the Wink button on the processor again or click on the Identify button on the Network tab in Compass.

## GALAXY 816-AES Processor Rear Panel Connectors

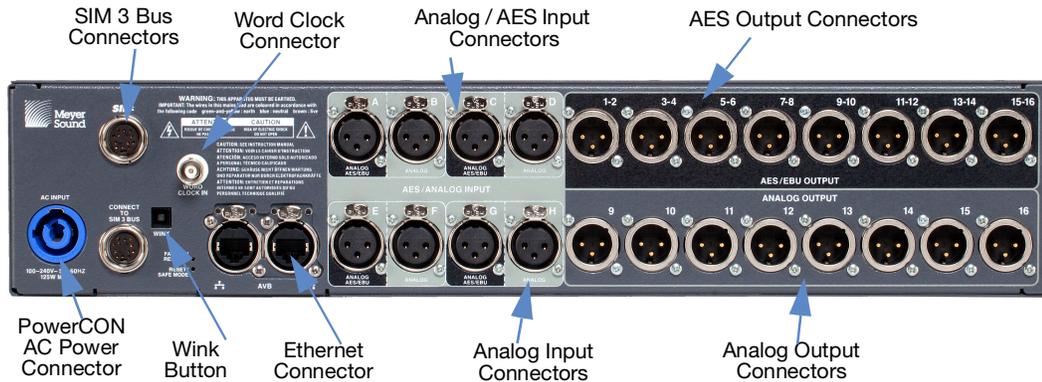


Figure 7: GALAXY 816-AES Processor Rear Panel

The GALAXY 816-AES processor rear panel provides the following connectors:

- **PowerCON AC Power Connector:** This locking connector mates with the provided AC power cable.



**CAUTION:** Make sure the AC power cable has the appropriate power plug on the other end for the area in which you will operate the GALAXY.



**NOTE:** The GALAXY incorporates Meyer Sound's *Intelligent AC* power supply, which automatically adjusts to any line voltage worldwide, and provides *soft turn-on* and *transient protection*.

- **Ethernet Connector:** The two RJ-45 connectors can be used to attach the GALAXY processor to an AVB network to send audio signals through time-sensitive networks, and allow it to be controlled by Compass and/or Compass Go. Use a Giga-bit Ethernet network cable (CAT5e or better).
- **Analog / AES3 Input Connectors (A, C, E, G):** Four XLR-3F input connectors accept either a standard line-level analog signal or an AES two-channel digital signal. In Compass (Settings > Input and Output), these inputs can be set to Analog or AES3 Left or AES3 Right. The GALAXY processor supports Standard AES3 digital audio signals at discrete sample rates in the range of 20–216 kHz (see "Input Sample Rates" on page 52). Input Connectors B, D, F, H can only be used as analog inputs.
- **Analog Input Connectors (B, D, F, H):** Four XLR-3F input connectors accept standard line-level audio only. These inputs are typically paired with their corresponding input pairs (A, C, E, G) to receive two-channel audio signals. The analog-only inputs are disabled when their input pair is set to AES mode (i.e., when input A is set to AES mode, input B is disabled).
- **AES Output Connectors (1–16):** The top row of eight XLR audio outputs for the GALAXY 816-AES3 provides 16 channels of AES3 digital outputs (two channels per output: 1–2, 3–4, etc.). Use only cables rated for AES signals to connect these outputs to the inputs of AES3 devices.
- **Analog Output Connectors (9–16):** The bottom row has eight XLR-3M connectors to route audio to Meyer Sound self-powered loudspeakers or to amplifier channels driving passive systems. Any output processing applied to outputs 9–16 is mirrored in digital format on the appropriate AES3 output and on the corresponding analog output.

- **SIM 3 Bus Connectors (for units equipped with these components):** Connects to the SIM audio analyzer so the GALAXY's inputs and outputs can be used as measurement points. A second SIM 3 bus port is provided to loop an additional GALAXY or to a SIM-3088 line-level switcher.
- **Wink Button:** Pressing the Wink button on the rear of a GALAXY processor will cause the device to enter the Identify Mode, a bidirectional processor identification feature that helps users locate processors in multi-processor configurations. The front panel will flash, and Compass will show an indication on both the GALAXY processor's Inventory tab and the Settings > Network tab of each processor (see "Settings Tab" on page 24). To exit Identify Mode, push the Wink button on the processor again or click on the Identify button on the Network tab in Compass.

## POWER CONNECTOR

The GALAXY uses a locking PowerCON® connector (Figure 8) to provide AC voltage to the unit. Its internal switching power supply has a safety-agency-rated operating range of 100–264 V AC, 50/60 Hz.



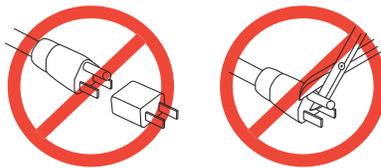
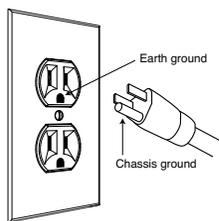
Figure 8: Locking PowerCON connector for AC power

## Electrical Safety Issues!

Pay close attention to these important electrical and safety issues:

 **CAUTION:** The PowerCON 20 connector should not be engaged or disengaged when under load or live. Disconnect the mains plug before disconnecting the power cord from the device.

 **CAUTION:** GALAXY requires a grounded outlet. Always use a grounded outlet and plug.



## SIM 3 CONNECTORS (FOR UNITS EQUIPPED WITH THESE COMPONENTS)

The GALAXY rear panel includes a bus port for direct connection to the SIM audio analyzer. The GALAXY can then act as a line switcher for the analyzer and measure across any selection of inputs and outputs without additional patching.



Figure 9: GALAXY Processor SIM 3 connectors: Connection to SIM and/or Looping to other GALAXY Processors (second looping connector not available on the GALAXY 408 Processor)

The default bus address for the GALAXY processor is 10 and the available range is 0–14. The bus address is changed in Compass, (Settings > SIM). The GALAXY processor to SIM connection is auto-detected. The connection is indicated in SIM, in Compass, and with the SIM Bus LED on the GALAXY processor front panel.

A second SIM Bus connector is included on the GALAXY 816 processor and the GALAXY 816-AES processor rear panels. It can be used to connect to additional GALAXY processors or SIM-3088 Line Switchers.



**NOTE:** The GALAXY 408 processor does not have a looping SIM Bus connector.

## CLIENT COMPUTER CONNECTION

The GALAXY's RJ-45 port connects to a standard computer Ethernet port with Gigabit-capable (CAT5e or better) network cables. A Mac or Windows-based computer running Compass Control Software uses an Ethernet connection to control the unit remotely. Bi-directional communication between the GALAXY processor and Compass allows the user to change settings on either device and stay in sync.

To establish a connection between a single GALAXY processor and a computer, do the following:

1. Download the latest version of Compass Control Software from the Meyer Sound website:  
[meyersound.com/product/compass/#software](http://meyersound.com/product/compass/#software)  
There is a registration procedure for first-time web site users.
2. Install the Compass Control Software on a Mac or Windows-based computer.
3. Connect both the GALAXY processor and the Computer with Compass Control Software installed to the network switch.

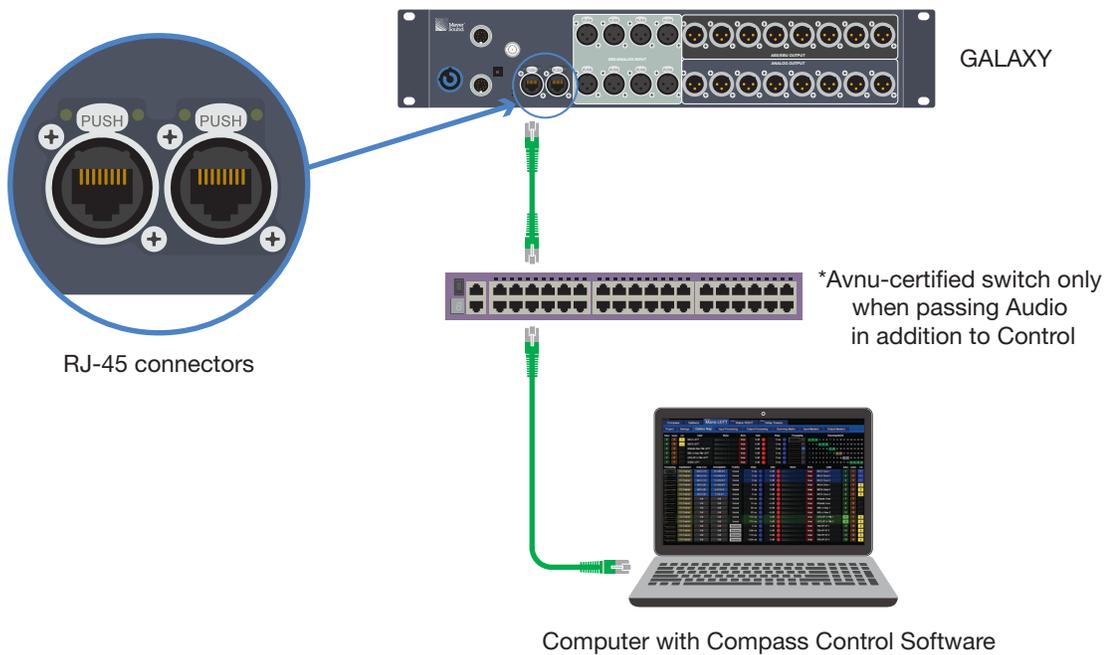


Figure 10: GALAXY Processor and Computer Connected to a Network Switch

4. Apply power to the GALAXY processor by connecting the powerCON first, then the other end of the electrical cable.

5. Start the Compass application on the computer. The default user interface for Compass is shown in Figure 11.

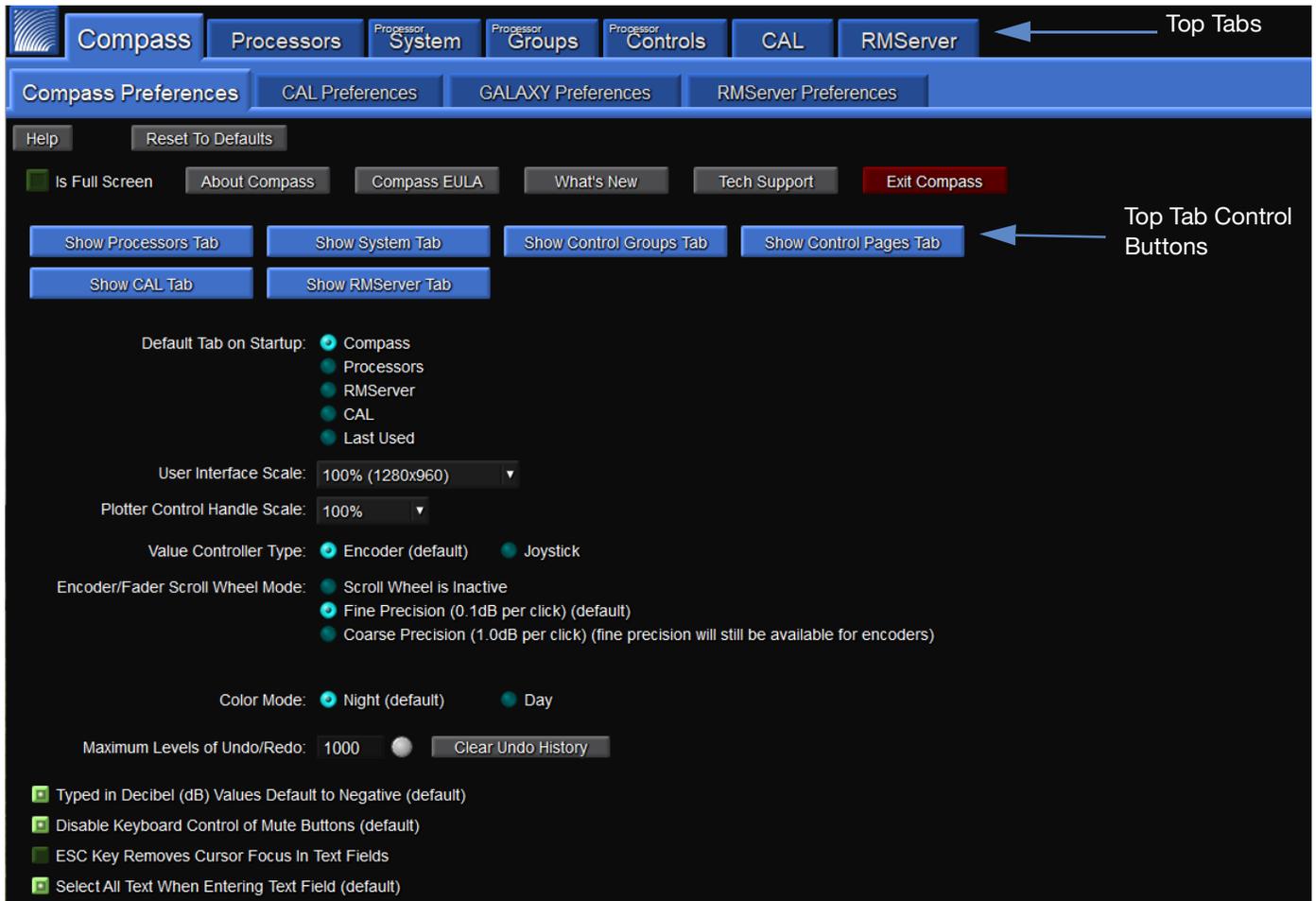


Figure 11: Compass Default Landing GUI

At this tab interface, the user can set a wide variety of preferences, including which tabs to show along the top of the Compass interface. Preferences for GALAXY processor may also be set at this level (see “Setting Preferences” on page 19).

Make sure the “Show Processors Tab” is selected. It will be blue when selected, gray when deselected.

6. Click on the top tab labeled “Processors,” which then displays the Inventory tab (Figure 12). Click the “Find Devices” button in the upper-left corner to list the available GALAXY processors if they have not already been auto-discovered. The GALAXY processor connected in Step 2 should automatically be listed. If it is not listed, verify that the switch is properly configured and all cabling is correct.
7. Click the “Connect” button for each of the processors to establish the Client/Server connection.

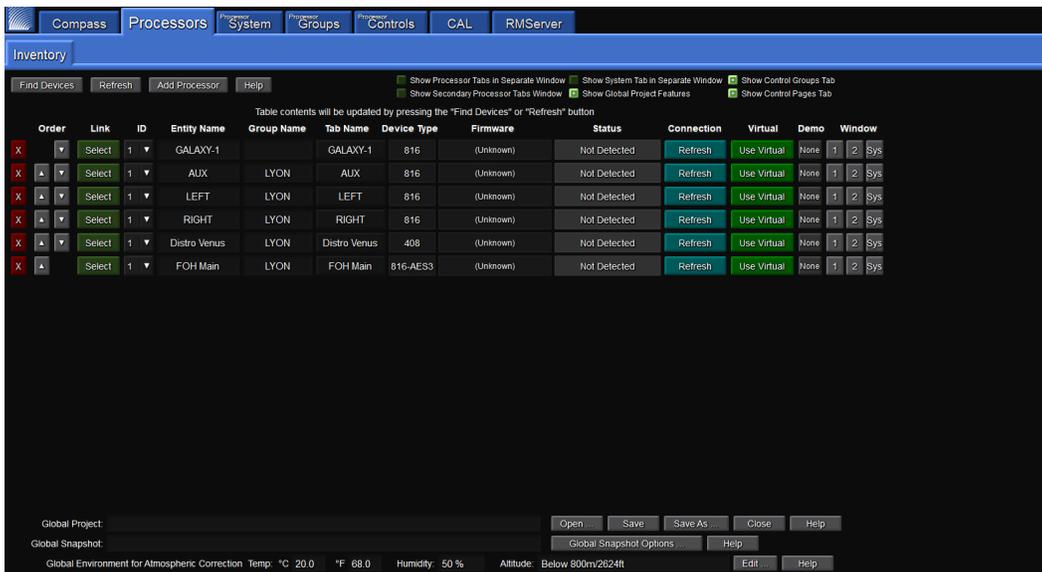


Figure 12: Processor Tab Landing Window



**NOTE:** The Client/Server connection between GALAXY processors does not require setting IP Addresses. Compass uses IPv6 to connect to the processors. If the switches are properly configured and the cabling is correctly routed, Compass will automatically connect to the GALAXY processors.



**NOTE:** If IPv6 addressing is not available, the GALAXY processors will default to IPv4 addresses as an alternate method of configuration. If using a third-party controller that requires IPv4, GALAXY processors can be assigned IPv4 addresses. If assigning IPv4 addresses to a GALAXY processor, the Port 1 address and the Port 2 address cannot be the same.

## GALAXY PROCESSORS IN A NETWORK CONFIGURATION

The GALAXY processor includes two network ports for both AVB and control connections (Figure 10). Either port can be used to make single connections to a network. These ports take advantage of multiple industry-standard networking protocols enabling automatic fail-over. For more information about how to make AVB connections between devices, see the AVB Networking Guide (PN 05.010.541.01) available at [meyersound.com/documents](http://meyersound.com/documents).

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## CHAPTER 3: CONTROLLING GALAXY PROCESSORS WITH COMPASS

Compass Control Software provides comprehensive control of GALAXY processors using an intuitive graphical user interface on a Mac® or Windows®-based computer. Compass provides control of all features on multiple units simultaneously. This chapter is a brief introduction to controlling the GALAXY processor via Compass and highlights some key GALAXY processor features.



**TIP:** Compass Go is an iPad application, a light version of the Compass Control Software. It provides all the key functionalities of Compass with maximum mobility.



**NOTE:** Meyer Sound has developed videos to provide an overview of Compass Control Software; please visit [meyersound.com/videos/#support](https://meyersound.com/videos/#support)



**NOTE:** Meyer Sound Compass 4.3.6, Compass Go AM824, and their included GALAXY processor firmware are the last versions that support AM824 audio format. Compass 4.6 and beyond support AAF audio streams and CRF clock streams. GALAXY processors with different firmware will NOT be compatible with each other. For most applications, Meyer Sound recommends upgrading GALAXY processors to the latest firmware, available for download at: [meyersound.com/product/compass/](https://meyersound.com/product/compass/)

### SETTING PREFERENCES

The Compass Control Software allows users to set a wide variety of preferences, effectively customizing the interface to suit the needs of a particular application. If none of the Show Tab Controls (see Figure 11) are selected, the Compass control window will only show the Preference setting tabs.

Each of these Preference tabs has a help button in the upper left corner that provides more detail about the various selectable options. There is also a button to Reset to Defaults if desired.

The GALAXY Preferences tab (Figure 13) has five sub tabs: Controls; Startup, Shutdown and Confirmation; Snapshot Recall; Select, Isolate and Linking; and Global Linking. The Controls tab has a drop-down menu to select delay units; all other preference options are indicated with square green buttons (on/off selections) and round blue buttons (either/or selections).

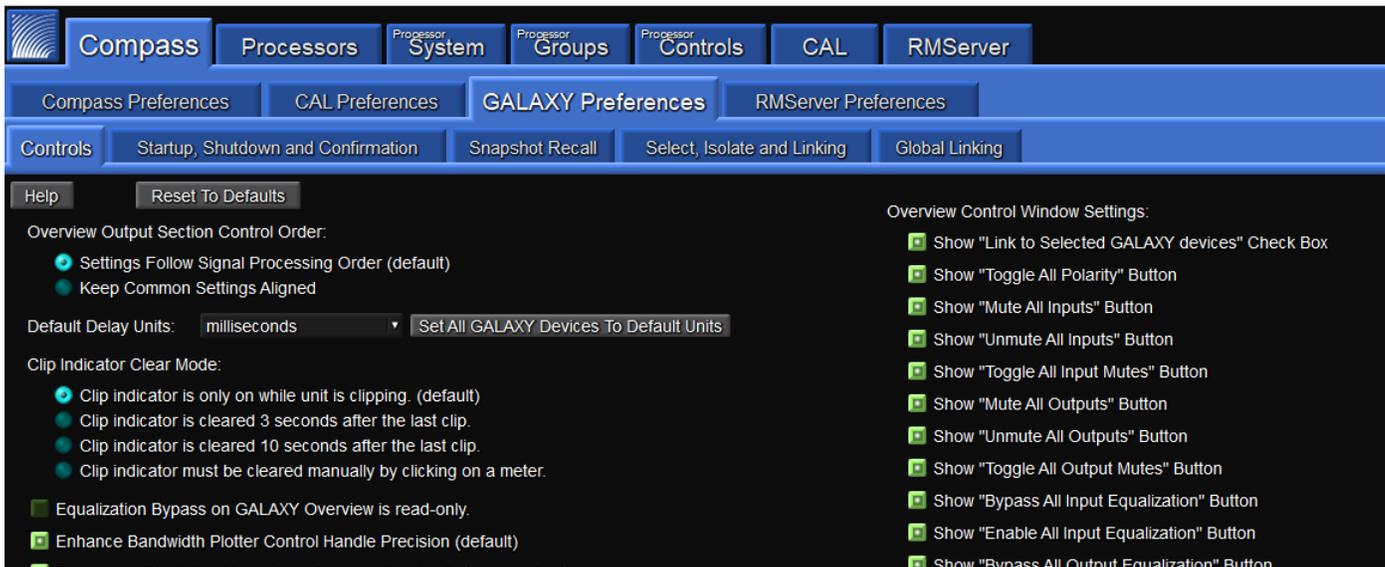


Figure 13: GALAXY Preferences tab

## GALAXY PROCESSOR USER INTERFACE

To enter the GALAXY processor control area of Compass, select the Processors tab (Figure 14). The processors that have been automatically discovered will be listed here. If one or more processors are not listed, click the “Find Devices” button (upper-left). If the listed processors have a Status other than Available, click the “Refresh” button. The “Refresh” button only applies to devices already in the list after selecting “Find Devices.” When a processor is listed in the Inventory, the available GALAXY processor control tabs will appear next to the Inventory tab. The “Refresh” button next to Find Devices only applies to devices already in the list after selecting Find Devices.



**NOTE:** The “Find Devices” function uses mDNS protocol to discover devices. If “Find Devices” does not return any items, check to ensure mDNS is enabled.



**TIP:** Compass has context help available within the program. Look for a gray button labeled “Help,” or on the denser screens, a gray button with a small “?” on it.



**TIP:** Meyer Sound has developed system example videos for the GALAXY processor that provide a good introductory overview. Visit: [meyersound.com/videos/#support](https://meyersound.com/videos/#support)

## Inventory Tab

Users can add, connect, and configure GALAXY processors within the Inventory tab. Select the “Show Global Project Features” button at the top, which displays the options to save Global Projects, create Global Snapshots, and change the Global Environment settings. This tab provides the ability to:

- Remove processors
- Reorder the processors in the window
- Link multiple processors together
- See the detected version of GALAXY processor firmware
- Connect/disconnect/refresh individual devices

- Launch “Virtual” mode to work on a project without being connected to a real GALAXY processor (this feature also supports a demo mode with simulated meter values that sweep up and down)
- Select whether a GALAXY processor is displayed in the main Compass window or a secondary window
- Select whether or not the Systems tab will display a device’s settings.

If any of the processors are running firmware that is incompatible with the version of Compass, the firmware version will be displayed with an amber background rather than blue. The Galaxy firmware must be the version that corresponds with the Compass application being used. Either update the GALAXY processor firmware or use the version of Compass that corresponds to the GALAXY processor’s firmware.

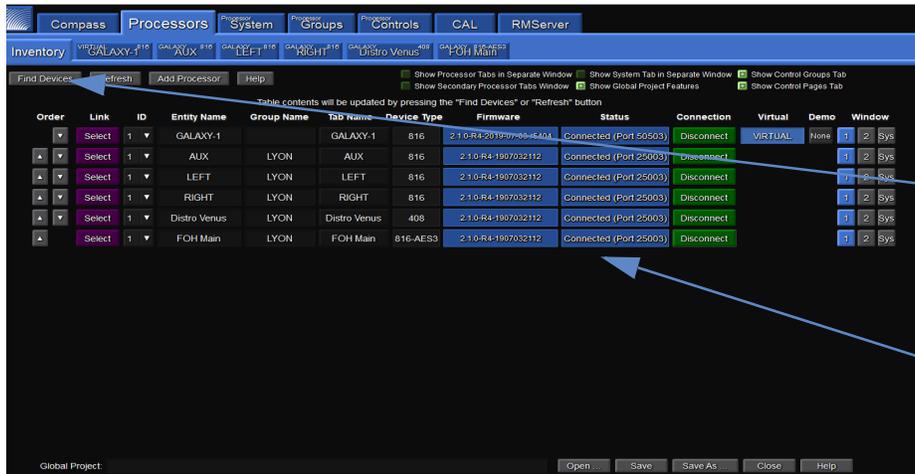


Figure 14: Inventory tab

## Upgrading Firmware

If firmware updating is required, see “Network” on page 24 or visit [meyersound.com/videos/#support](https://meyersound.com/videos/#support) for a how-to video.

## Individual Processor Control Tab

Select the tab of a connected GALAXY processor at the top of the screen. The Overview tab will be displayed (Figure 15). Each processor tab has nine sub-tabs that provide controls to adjust the processor functions: Project, Settings, Overview, Input Processing, Output Processing, Summing Matrix, Delay Matrix, Input Masters, and Output Masters.

A status bar (Figure 15) is at the bottom of each GALAXY processor tab that includes:

- Clock Status—current clock status is displayed as locked or unlocked.
- Project and Snapshot Controls—the current project and snapshot (see “Projects Tab” on page 22) are displayed. The user can also save a project, update or create snapshots, and monitor whether or not a boot snapshot is enabled.
- Channels Control—the three row Channels bar allows a user to Select (link channels), Isolate (temporarily isolate a channel from other channels to which it is linked), and Link Groups (enable selection of multiple channels by selecting one) for all input and output channels.
- Server Connection Status—two small indicators in the bottom right will flash every couple of seconds when the server (processor) is properly connected. These lights signify that upload (ping) and download (pong) data transfers are happening.

## Overview Tab

The Overview tab is shown in Figure 15. It provides a high level view of GALAXY processor settings. The basic input and output settings can be modified by clicking, entering new values, or click-dragging controls. Many of the graphic elements are shortcuts to other tabs or open dialogs: Input Processing, Summing Matrix, Output Processing, Product Integration Dialog, and Atmospheric Correction Dialog.

The dialog to adjust Product Integration settings can be accessed by clicking on the Product Integration indicator for each output. See Appendix C, "Product Integration."

The screenshot shows the 'Overview' tab of the GALAXY processor interface. It features a top navigation bar with 'Compass', 'Processors', 'System', 'CAL', and 'RMServer'. Below this is a 'VIRTUAL GALAXY-1' header and a 'Project' dropdown. The main interface is divided into several sections:

- Input Processing:** A table with columns: Sel, Iso, Link, Label, Meter, Mute, Gain, Delay, and Processing. It lists inputs A through H, each with a 'Muted' status and a gain of 0.0 dB.
- Summing Matrix:** A grid of 16x16 cells representing the summing matrix, with columns 1-16 and rows 1-16.
- Output Processing:** A table with columns: Processing, EQ, Product Integration, Atmos., Polarity, Delay, Gain, Meter, Mute, Label, Sel, Iso, and Link. It lists outputs 1 through 16, each with a 'Mute' status and a gain of 0.0 dB.
- Control Panel:** Includes sliders for 'Environment for Atmospheric Correction' (Temperature: 20.0 °C, Humidity: 50%), 'Save Project' (No Project), 'Update' (No Snapshot), and 'Clock Status' (N/A).

Figure 15: GALAXY Processor User Interface in Compass Control Software

## Projects Tab

GALAXY processor project files can be saved by the Compass Control Software to the client computer. Project files contain all of the Snapshots stored in the processor and all of the current control point values.

A Snapshot contains all of the control point values of a processor when a Snapshot is created. The GALAXY processor can store up to 255 Snapshots in the Snapshot Library.

The relationship between the GALAXY processor and Compass is server/client: the GALAXY processor is the server, Compass the client. When a computer is connected to a GALAXY processor, the Compass Control Software reads and displays the current state of all control points and the list of Snapshots stored in the GALAXY processor. However, opening another GALAXY Project file (stored on the computer) will overwrite the Snapshot Library and, if selected, the current device settings.

Compass also has a Virtual mode that is selectable from the Inventory tab. This mode allows a user to work on a project file without being connected to real GALAXY processor hardware. In effect, Compass is connecting to a virtual GALAXY server.



**CAUTION:** Opening a project file in the Compass Control Software when the computer is connected to a GALAXY processor overwrites all stored Snapshots and the current device settings of the GALAXY processor if Load Device Settings is selected when the GALAXY Project is opened. To merge snapshots from another Project file into the current Snapshot library in a GALAXY processor, use the Merge Project option from the Project tab (click the More>> button for this option to appear).



**TIP:** Use Compass Control Software to store GALAXY processor control point values as a Snapshot in the GALAXY processor. The Snapshot Library is stored as a Project on the client computer and can later be reloaded into the GALAXY processor.



**NOTE:** Firmware updates do not affect Snapshots or control point values. To restore factory defaults, see “Network” on page 24.

## Settings Tab

The Settings tab has eight sub-tabs: Network, Input and Output, SIM, Environment, Access, Low-Mid Beam Control, Link Groups, and Log.

### Network

The Network tab lists the GALAXY processor Device Type, Entity Name, Group Name, Serial Number, IPv6 Address, IPv4 Address, MAC Address, Front Panel Display Color and Brightness, Date and Time, Operating Mode Indicator, Soft Reboot Options, Upload Firmware options, and Edit Network Settings options.

- The Device Name, Group Name, Ipv4 Address, Front Panel LCD Display options, GALAXY processor Date and Time may all be edited.
- Firmware may be uploaded from this page by following these steps:
  1. Reboot the GALAXY processor into Recovery Mode, enabling the Upload Firmware, and Upload Firmware to all GALAXY devices.
  2. Firmware can be uploaded to one or all connected processors by clicking Upload Firmware or Upload Firmware to all GALAXY devices.
  3. Select either the “.bluehornFirmware” or “.galaxyFirmware” file that matches the GALAXY processor type from the Compass Application folder.
  4. The firmware will begin uploading when OPEN is clicked. The progress is indicated in a pop-up window, which can be closed while the upload continues. While the firmware upload is in progress, the GALAXY processor will not pass audio and the tab color will change to amber.
- The time of the GALAXY processor may be set to a specific time or to the connected computer’s time using the Set Device Time button. In this dialogue, there is an option to set just one, or all connected GALAXY processors to the new time.
- The GALAXY Front Panel LCD Color can be adjusted for brightness and color. The available options are Green, Blue, Cyan, Yellow and Magenta. The Front Panel Display can be set to Normal, Dim, and Bright.
- There is also an option to reboot to the factory defaults by selecting the “Reboot with Factory Defaults” button on this page.

### Identify Button

Pressing the Wink button on the rear of a GALAXY processor will cause the device to enter the Identify Mode, a bidirectional identification feature. The front panel will flash, and Compass will show an indication on both the GALAXY processor’s Inventory tab and the Settings > Network tab (Identify button will flash) of each processor. To exit Identify Mode, push the Wink button on the processor again, or click on the Identify button on the Network tab in Compass.

Identifying a GALAXY processor and then naming that processor helps make identification easier.

### Input and Output

Under the Settings tab, the user can configure input channel types, AVB Control Mode, Channel Selection, System Clock, AES Output Clock (AES Version Only, see Appendix B, “Clocking”), and input/output voltage ranges.

- Input Channel Types are configured individually to either Analog, AES3, or AVB. For the GALAXY 816 processor and the GALAXY 816-AES processor, AES connections are made to ports A, C, E, G; the companion ports B, D, F, and H must be left unconnected. For the GALAXY 408 processor, AES connections are made to connectors A and C; the companion ports B and D must be left unconnected. Compass indicates which XLR connectors are utilized based on the input channel’s analog or AES3 status.

- **AVB Control Mode:** network digital source signals may be connected to the AVB/Network port connectors (labeled 1 and 2) on the GALAXY processor rear panel. These connectors allow for the usage of Milan-compliant AAF streams for Audio (see the AVB Networking Guide, available at <https://meyersound.com/documents>).

Milan-compliant AAF and CRF streams are supported for Clocking. There are two modes: Internal and External. Internal Mode allows the GALAXY Internal AVB connection manager to control all AVB Input Streams. External Mode disables the GALAXY Internal AVB connection manager and allows an external Milan controller to connect the AVB streams.

Only one signal type can be selected for each input. Outputs from available GALAXY processors will populate the AVB browser when that device is selected from the available Devices list. The Group can be selected from the Group selection menu. Connections can be established and disconnected.

- **AVB Stream Info:** to access the AVB Stream Info, press the “Info” button on the Input and Output tab GUI, opening a secondary window. The left side lists data about the Primary input source and the right side lists data about the Secondary input source.
- **Channel Selection:** “selected” channels are linked. Changes made to one selected channel will be made to all other selected channels of the same type (input or output) in a device. Depending on the Global Link Preferences, channels on other devices may be affected as well. Use Link Groups (see “Link Groups” on page 26) to quickly select or deselect multiple channels. Selected channels have a green background.
- **AVB Output Settings:** the Default Presentation Time can be set for each GALAXY processor on the Network from 0.250–2 ms; the default value is 2 ms. Reducing the value of the Presentation Time will lower the latency of the AVB stream output from a talker to a listener. The MSRP Accumulated Latency will display the worst case time through the network, and can be used as a reference of how low the Default Presentation Time can be set. In some cases, it is desirable to use a lower latency, which can be accomplished by reducing the Default Presentation Time. The Default Presentation Time should never be set lower than the MSRP Accumulated Latency.

For more information about network configurations and a discussion about Presentation Time, see the AVB Network Guide (PN 05.010.541.01) available at [meyersound.com/documents](https://meyersound.com/documents)

- **System Clock:** the GALAXY System Clock can be configured to either the Internal Clock, an AVB Clock CRF, an AES input, or an AVB AAF Input. For the GALAXY 816-AES processor, the Word Clock (BNC connector) can also be configured as the GALAXY processor Media Clock. This option allows the GALAXY 816-AES3 processor to be synchronized to an external source for both the system clock and AES output clock, at 48 or 96 kHz. AES allows discrete values in the range from 20–216 kHz (see “Input Sample Rates” on page 52).



**NOTE:** “Media Clock” is the common terminology used in the Milan specification. Within the GALAXY processor Settings: Input and Output tab, the Media Clock choice is selected under the “System Clock: Clock Mode” pull-down menu.



**NOTE:** When an incoming 96 kHz AES signal is selected as a clock source under the system clock pull-down tab, disable the Asynchronous AES sample rate converters to reduce latency through the system. These ASRC converters are only available on the AES inputs and only required when the incoming AES signal does not match the 96 kHz internal clock frequency to within +/- 100 ppm.



**CAUTION:** When AES ASRC is enabled on an input, the clocking data associated with that input is removed by the GALAXY processor, and that input may not be used as a valid System Clock.



**CAUTION:** All AVB inputs must be synchronized to a common media clock, and the clock must originate from one of the incoming AVB sources and cannot be daisy-chained (see “Common Media Clock for Multiple Interconnected GALAXY Processors” on page 50).

- **Input/Output Voltage Range:** allows the user to set analog channels to either +16 dBu or +26 dBu. These settings only apply to analog channels.

## SIM

Under the SIM tab, the user may configure settings related to the SIM Audio Analyzer. There are two probe points (SIM Console and SIM Processor) that can each be set to any of the five possible probe selections: Input Post Source Select, Input Post Processing, Output Post Matrix, Output Post EQ, and Output Post Processing (Figure 16).

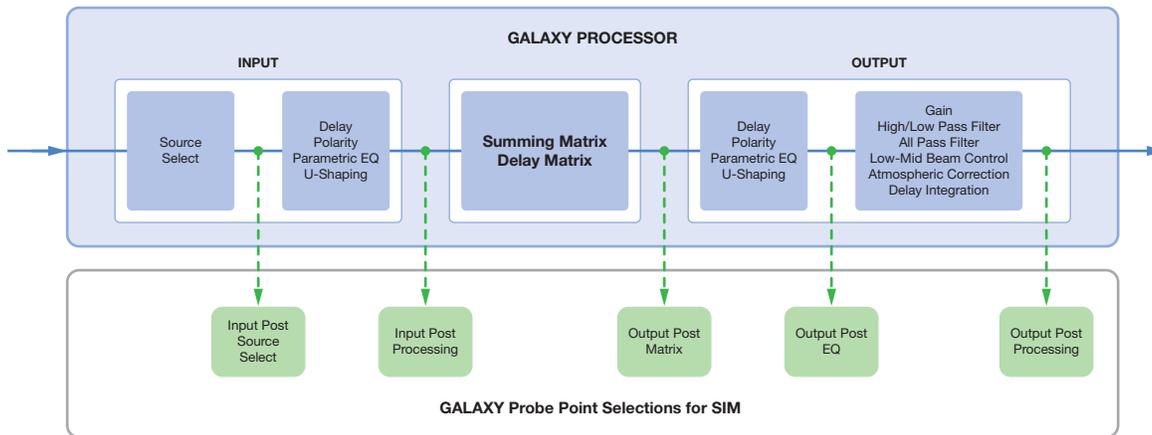


Figure 16: Possible GALAXY Processor SIM Probe Point Selections

## Environment

The Environment tab is one place to adjust the global values for temperature, humidity, and altitude. These settings, in conjunction with the parameters of each output channel (Atmospheric Gain and Distance), recall filter settings to compensate for high-frequency attenuation due to propagation loss through air. There is also a square on/off toggle button to select whether or not to Link Correction Distance and Atmospheric Gain Factor settings across all output channels.

## Access

The Access tab allows a user to control the access to various GALAXY processor settings, confining access to particular controls for different users based on Role settings. These settings apply to situations such as permanent installations where multiple users have access, or situations where various parts of show design are divided amongst several people.

## Low-Mid Beam Control

Low-Mid Beam Control is a tool for GALAXY processor users to modify the natural vertical coverage of the Low to Mid Frequencies of a Meyer Sound line array (up to 32 elements) to more closely match the high frequency coverage (see Appendix D, "Low-Mid Beam Control").

## Link Groups

Link Groups allows for the editing of multiple channels simultaneously. The Link Group index buttons are blue when enabled, yellow when bypassed, and gray when not in use.

**Log**

The Log tab displays a date- and time-stamped running record of a GALAXY processor's operation. This display is a subset of all log data (includes client level messages). For a more detailed log history (that might help Meyer Sound Tech Support, for example, in a debug situation), use the Save System Logs button under the Settings tab. Clicking this button will save more information, including kernel logs and operating system details.

## Input Processing Tab

The display under the Input Processing tab (Figure 17) is divided into two sections. The upper part provides a Plotter display, where a user can visualize input channel equalization. The plotter plots gain (left vertical axis) and phase (right vertical axis) against frequency (x-axis). If gain and phase happen to align, that situation is purely coincidental. Two select buttons on the top control whether the display is dual (two channels simultaneously) and whether or not to show the settings control mini tabs. When selected, three mini tabs will appear to the right of the display: Plotter, Handles, and Response:

- The Plotter mini tab provides some axis control. It also allows control of the number and arrangement of plotters, and what to display or hide. More than one EQ plot may be shown at a time by selecting “Multiple” under the Plotter mini tab.
- The Handles mini tab controls the display or removal of EQ handles in the plotter.
- The Response mini tab controls whether to display or hide specific response curves in the plotter.

All of these mini tabs can be hidden from view by using the right/left blue arrows on the bottom right of the mini tab.

The bottom part of the tab displays the input processing control. This part of the display may be minimized by clicking the up/down arrow under the Plotter display. Within the control area under the Input Processing tab, a user may select the processing desired for each input. Possible processing includes Gain, Delay, 5-band Parametric EQ, and 5-band U-Shaping EQ.

This window has three tabs near the bottom left of the screen to control the processing parameters: Channel Settings, Parametric, and U-Shaping.

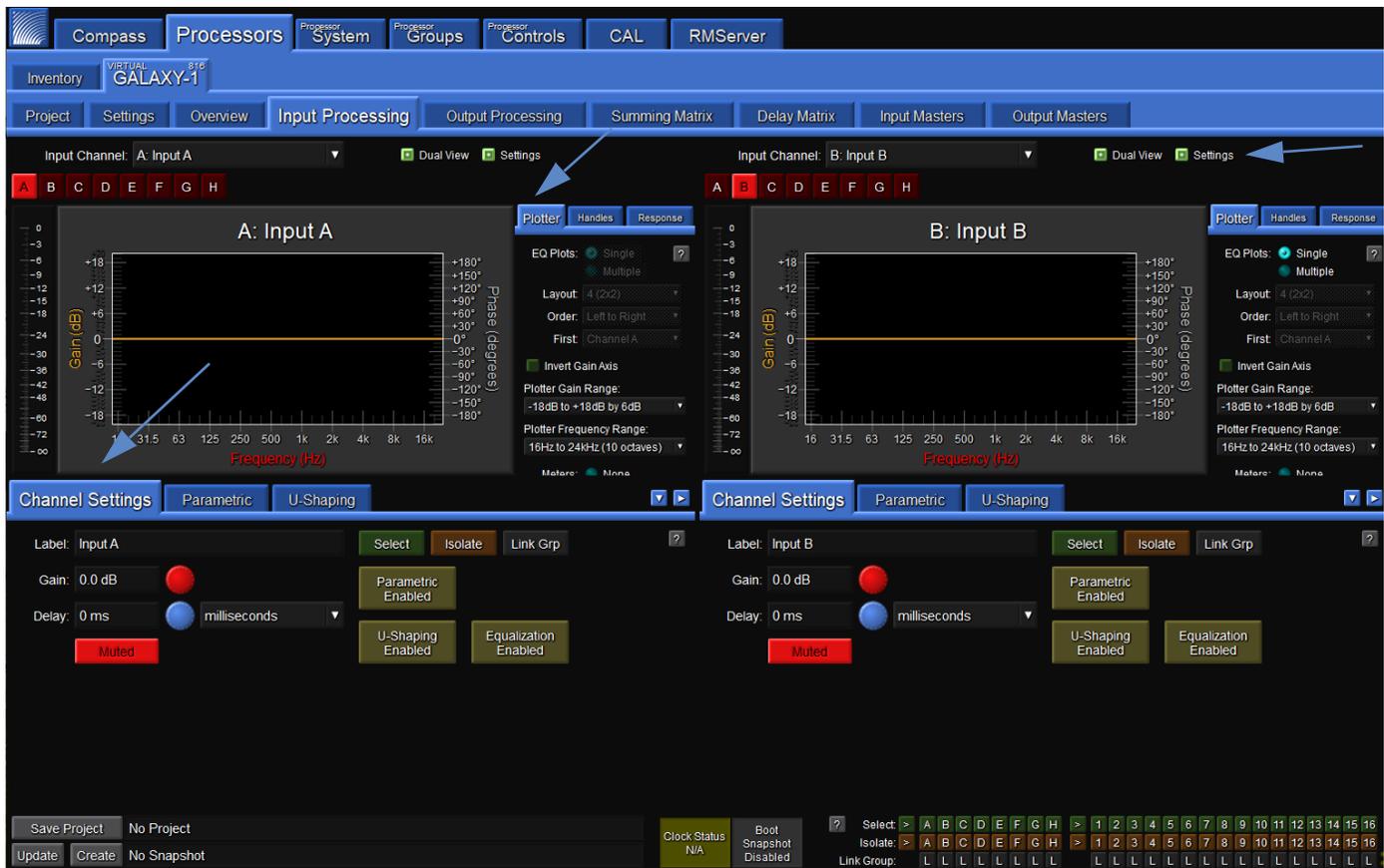


Figure 17: Processor > Input Processing tab

## Channel Settings

Under the Channel Settings tab in Input Processing (see Figure 17, lower half), the user can set a Label, Gain value, Delay Value, Mute the Channel, and enable or bypass Parametric, U-Shaping, and/or all EQ for a particular input channel. Select the Input Channel to control via the drop-down menu or individual alphabetic channel buttons (e.g., A-H for a GALAXY 816 processor) above the plotter display.

- The Label widget allows a user to enter a short text description of a Channel, Array Group, or Link Group. It is for informational purposes only.
- The Gain widget lets the user increase or decrease the signal level by decibels (dB). The default assumes negative gain values. Entering any integer will result in the gain being set to the negative of that integer (e.g., “3” becomes -3 dB gain). (The default may be changed to positive gain values in the Compass Preferences tab.)
- The Delay widget allows the user to add a delay in various units to an input channel or matrix input signal. The range is 0–500 ms.
- Clicking the input channel Mute button prevents any signal from being sent to the Matrix.
- Clicking the Select button causes this channel to be linked to other input channels that are also selected. Changes made to one selected channel will be made to all other selected channels of the same type (input or output) of a device. Depending on the Global Linking Preferences, channels on other devices may be affected as well. Use Link Groups to quickly select or deselect multiple channels. Selected channels have a green background.
- Use the Isolate button to temporarily isolate a channel from other channels to which it is linked. Isolating a channel will change its background color to amber.
- Use the Link Groups button to edit multiple channels simultaneously. The Link Groups tab is also accessible from this pop-up menu. The Link Group to which a channel belongs is indicated by the number next to “LG.” Link Group index buttons are blue when enabled, yellow when bypassed, and gray when not in use. Channels in active link groups may have a blue background, depending on the Link Groups and Selects mode.
- The Parametric EQ Bypass button allows the user to bypass Parametric EQ for an input channel without affecting the individual Parametric Band Bypass settings.
- The U-Shaping Bypass button allows the user to bypass the U-Shaping EQ filter on a GALAXY processor input channel.
- The EQ Bypass button allows the user to bypass all input Equalization filters while leaving filter-specific EQ bypass settings alone.

## Parametric

Parametric controls may be set via a tab in the lower half of the Input Processing tab (Figure 18). Input Parametric EQ has 5 bands. Each band has four settings: Bypass, Frequency, Bandwidth and Gain.

- Bypass allows the user to bypass an individual parametric EQ band for that channel.
- Frequency allows the user to adjust the central frequency of a parametric EQ band. The Frequency range is 10 Hz – 20 kHz. When entering a value, the Hz suffix is optional. A value can be entered in a number of ways. For example, 1500 Hz may be entered as 1.5 k, 1k5, and 1500.
- Bandwidth size sets the range of frequencies that are affected by band gain changes. The Bandwidth range is 0.1–2.0. When the Bandwidth is “1,” the handles span one octave. Setting it to “2” means the handles span two octaves.
- Gain allows the user to adjust the gain of a parametric EQ band. The Gain range is -18 dB to +18 dB.



Figure 18: Processor > Input Processing > Parametric and U-Shaping tabs

## U-Shaping

Controls for U-shaping are located within a tab also in the lower half of the Input Processing tab (Figure 18). The U-Shaping filter has five gain bands and four frequency breakpoints.

Each gain band may be individually set within the U-Shaping tab. The default assumes negative gain values (e.g., entering a “3” into the number box will result in a gain of -3 dB). This default setting may be changed to positive gain values via the Compass Preferences tab (“Setting Preferences” on page 19).

Each of the four frequency breakpoints may also be set within the U-Shaping tab. The numerical input accepts a variety of format options. For example, 1500 Hz may be entered as 1.5 k, 1k5, and 1500. Entering “Hz” is optional.

The Slope settings are controlled via a pull-down menu. The two slopes on the left offer 6, 12, 18, 24, 30, 36, or 48 dB/octave. The two on the right do not have the 48 dB option.

The Bypass button allows U-shaping to be bypassed without affecting the settings.

## Output Processing Tab

Similar to the Input Processing tab, the Output Processing tab (Figure 19) allows a user to visualize and edit output channel equalization and settings. The upper part of the display is the plotter, the lower part the control. The plotter plots gain (left vertical axis) and phase (right vertical axis) against frequency (x-axis). If gain and phase happen to align, that situation is purely coincidental. Two select buttons on the top control whether the display is dual (two channels simultaneously) and whether or not to show the settings control mini tabs. When selected, three mini tabs will appear to the right of the display: Plotter, Handles, and Response:

- The Plotter mini tab allows control of the number and arrangement of plotters, what to display or hide, and provides some axis control.
- The Handles mini tab controls the display or removal of EQ handles in the plotter.
- The Response mini tab controls whether to display or hide specific response curves in the plotter.

The mini tabs can be hidden from view by using the right/left blue arrows on the bottom right of the mini tab.

The bottom part of the display enables output processing control. This part of the display may be minimized by clicking on the up/down arrow under the Plotter display. Within the control area under the Output Processing tab, a user may select the processing desired for each input. Possible processing includes Gain, Delay, Polarity reversal, 10-band Parametric EQ, 5-band U-Shaping EQ, Low-Mid Beam Control, atmospheric correction, simultaneous high- and low-pass filtering and All Pass filtering.

This window has four tabs near the bottom left of the screen to control the processing parameters: Channel Settings, Parametric, U-Shaping, and All Pass.



Figure 19: Processor > Output Processing > Channel Settings and Parametric tabs

## Channel Settings

Under the Channel Settings tab in Output Processing (see Figure 19, lower half), the user can set a Label, Gain value, Delay Value, Mute the Channel, and enable or bypass Parametric, U-Shaping, All Pass Filtering, and/or all EQ for a particular output channel. Select the Output Channel to control via the drop-down menu or individual alphabetic channel buttons above the plotter display.

- The Label widget allows a user to enter a short text description of a Channel, Array Group, or Link Group. It is for informational purposes only.
- The Gain widget lets the user increase or decrease the signal level by decibels (dB). The default assumes negative gain values. Entering any integer will result in the gain being set to the negative of that integer (e.g., “3” becomes -3 dB gain). (Default may be changed to positive gain values on the Compass Preferences tab.)
- The Delay widget allows the user to add a delay (0–2000 ms) in various units to an output channel signal.
- The Polarity button allows the user to change the polarity of each output channel from Normal (Pin 2 positive relative to Pin 3) to Reversed Polarity (Pin 3 positive relative to Pin 2).
- Clicking the Mute button prevents any signal from being sent to the output of the channel.
- Clicking the Select button causes this channel to be linked to other output channels that are also selected. Changes made to one selected channel will be made to all other selected channels of the same type (input or output) in a processor. These changes are relative by default. If channel 1 delay is 0 ms and channel 2 delay is 10 ms, when they are linked and channel 1 delay is changed to 5 ms, channel 2 delay will be 15 ms. Hold ALT while pressing ENTER for absolute values. To change default preference, change settings on this tab: Compass > GALAXY Preferences > Select, Isolate and Linking. Depending on the Global Linking Preferences, channels on other devices may be affected as well. Use Link Groups to quickly select or deselect multiple channels. Selected channels have a green background.
- Use the Isolate button to temporarily isolate a channel from other channels to which it is linked. Isolating a channel will change its background color to amber.
- Use the Link Groups button to edit multiple channels simultaneously. The Link Groups tab is also accessible from this pull-down menu. The Link Group to which a channel belongs is indicated by the number next to “LG.” Link Group index buttons are blue when enabled, yellow when bypassed, and gray when not in use. Channels in active link groups may have a blue background, depending on the Link Groups and Selects mode.
- The LMBC Bypass button is a shortcut to the Low-Mid Beam Control tab (see Appendix D, “Low-Mid Beam Control,” on page 57).
- The Parametric EQ Bypass button allows the user to bypass Parametric EQ for an output channel without affecting the individual Parametric Band Bypass settings.
- The U-Shaping Bypass button allows the user to bypass the U-Shaping EQ filter on a GALAXY processor output channel.
- The EQ Bypass button allows the user to bypass all output Equalization filters while leaving filter-specific EQ bypass settings alone. Product Integration and Atmospheric Correction settings are not bypassed with this control.
- The High Pass Filter widget allows the user to select a high-pass filter for the output channels from nine different options.
- The Low Pass Filter widget allows the user to select a low-pass filter for the output channels from eight different options.
- The Atmospheric Correction widget allows the user to apply equalization to the higher frequencies of a signal that might be affected by the natural environment. There are also widgets to enter the distance between the loudspeakers and the listening area. The attenuation of higher frequencies in the air varies with temperature, humidity, and altitude. There are Global Environment settings that allow a user to adjust for a particular natural environment (see “Environment” on page 26 and “Atmospheric Correction” on page 61).
- The Product Integration button allows a user to turn on Product Integration for a particular channel (see “Product Integration” on page 53).

## Parametric

Parametric controls may be set via a tab in the lower half of the Output Processing tab (Figure 19). Output Parametric EQ has 10 bands. Each band has four settings: Bypass, Frequency, Bandwidth and Gain.

- Bypass allows the user to bypass an individual parametric EQ band for that channel.
- Frequency allows the user to adjust the central frequency of a parametric EQ band. The Frequency range is 10 Hz – 20 kHz. When entering a value, the Hz suffix is optional. A value can be entered in a number of ways. For example, 1500 Hz may be entered as 1.5 k, 1k5, and 1500.
- Bandwidth size sets the range of frequencies that are affected by band gain changes. The Bandwidth range is 0.1–2.0. When the Bandwidth is “1,” the handles span one octave. Setting it to “2” means the handles span two octaves.
- Gain allows the user to adjust the gain of a parametric EQ band. The Gain range is -18 dB to +18 dB.

## U-Shaping

Controls for U-shaping are located within a tab also in the lower half of the Output Processing tab (Figure 20). The U-Shaping filter has five gain bands and four frequency breakpoints.

Each gain band may be individually set within the U-Shaping tab. The default assumes negative gain values (e.g., entering a “3” into the number box will result in a gain of -3 dB). This default setting may be changed to positive gain values via the Compass Preferences tab (“Setting Preferences” on page 19).

Each of the four frequency breakpoints may also be set within the U-Shaping tab. The numerical input accepts a variety of format options. For example, 1500 Hz may be entered as 1.5 k, 1k5, and 1500. Entering “Hz” is optional.

The Slope settings are controlled via a pull-down menu. The two slopes on the left offer 6, 12, 18, 24, 30, 36, or 48 dB/octave. The two on the right do not have the 48 dB option.

- The Bypass button allows the U-shaping to be bypassed without affecting the settings.

## All Pass Filters

The All Pass Filter tab (Figure 20) allows the user to engage up to three second-order all-pass filters, changing the phase relationship between various frequencies, while not altering the gain at any frequency. Adding all-pass filters is different than adding pure delay. While delay introduces the same amount of delay to all frequencies, all-pass filters introduce different amounts of delay at different frequencies. These filters are described by the frequency at which the phase shift is 180°.

Within this tab, the user may set the center frequency of the all-pass filter (frequency at which the phase shift crosses 180°) and the bandwidth Q of the filter. The lower the Q, the greater the bandwidth.

- All Pass filters will alter the native phase response of the loudspeaker. This alteration may degrade performance and should only be used by experienced operators.



Figure 20: Processor > Output Processing > U-Shaping and All Pass tabs

## Summing Matrix Tab

The Summing Matrix (Figure 21) allows the user to route inputs to outputs within the processor. A maximum of 232 out of 512 connections between input channels and output channels (cross-points) can be made in the Summing Matrix tab. Each input channel can be level adjusted independently to individual output channels.

The Show Matrix Rows drop-down is used to select which inputs are displayed for routing. Inputs are the eight channels of processed inputs. Matrix In 9-16, 17-24, and 25-32 are only used for unprocessed AVB inputs.

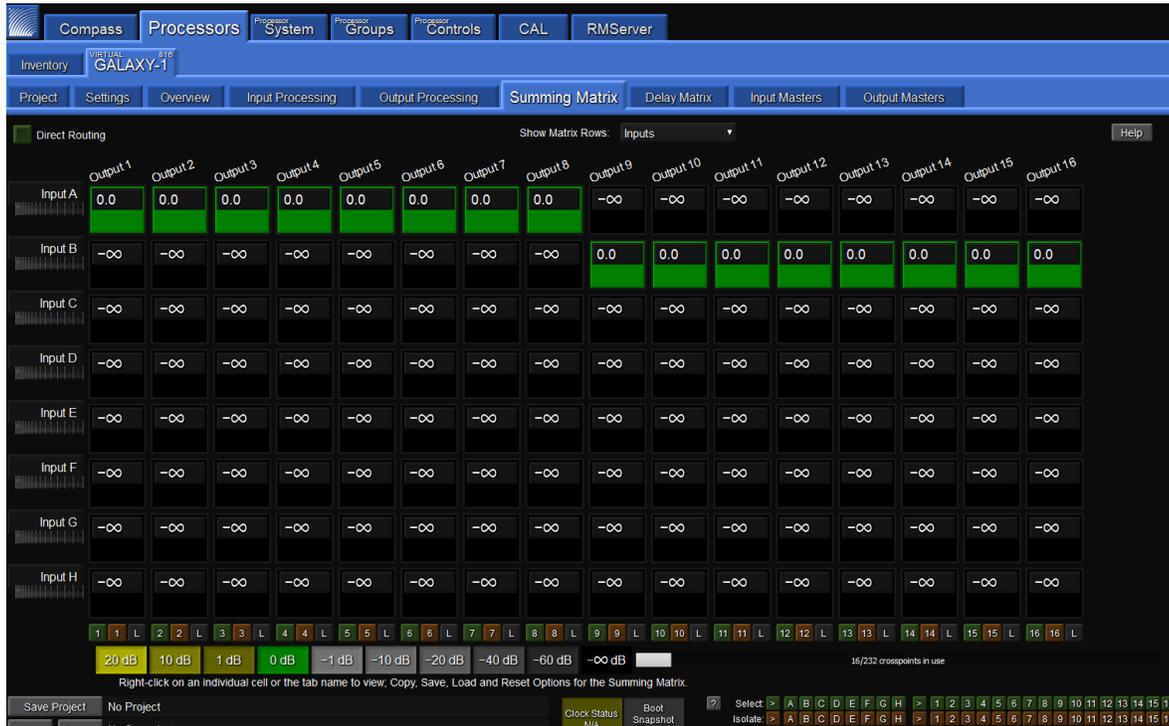


Figure 21: Processor > Summing Matrix tab

### Matrix Modes: Summing or Direct Routing

The Summing Matrix has two modes: Summing or Direct Routing. The mode is controllable via a select button at the top left of the Summing Matrix display window.

Summing is the default setting that allows the user to route multiple inputs to single or multiple outputs.

When the Direct Routing button is selected, only one of the input channels may be assigned to one output.

### Summing Matrix Operation

In both modes, the gain value for any matrix cross-point can be adjusted. The gain range is -90 dB to +20 dB, where -90 dB equals -infinity dB.

To select which group of 8 inputs to view at any one time, use the Show Matrix Rows drop-down menu above the matrix display in the middle of the screen.

The lower right hand corner has a display indicating the number of cross-points in use. Of the 512 possible cross-points, 232 can be set simultaneously.

### Color Coding

Negative gain values scale from light gray to dark gray. Positive gain values scale from dark olive to light olive. There is a color legend below the matrix.

### Delay Matrix Tab

Delay times may be assigned to each matrix cross-point in the Delay Matrix tab (Figure 22). Any delay values implemented here are independent of delay times included in the input or output processing blocks.

Each input channel can be assigned a time value independently to individual output channels.

To select which group of 8 inputs to view at any one time, use the Show Matrix Rows drop-down menu above the matrix display in the middle of the screen.

The Delay can be bypassed by pressing the small button labeled “B” next to the delay time for each cross-point. Numeric Delay values can be input for any matrix cross-point between 0–2000 ms.

The units for all channels may be set at the bottom right corner of this window.



Figure 22: Processor > Delay Matrix tab

## Input Masters Tab

The Input Masters tab (Figure 23) provides fader controls to adjust the signal levels of the Inputs by decibels (dB).

Clicking above or below the handle results in single dB increments or decrements; clicking on a dB value to the right of the control will cause the gain to jump to that value.

There are also buttons to link channels of the same type by “Selecting” them, temporarily isolate a channel from other channels to which it is linked, or link groups to select multiple channels simultaneously.

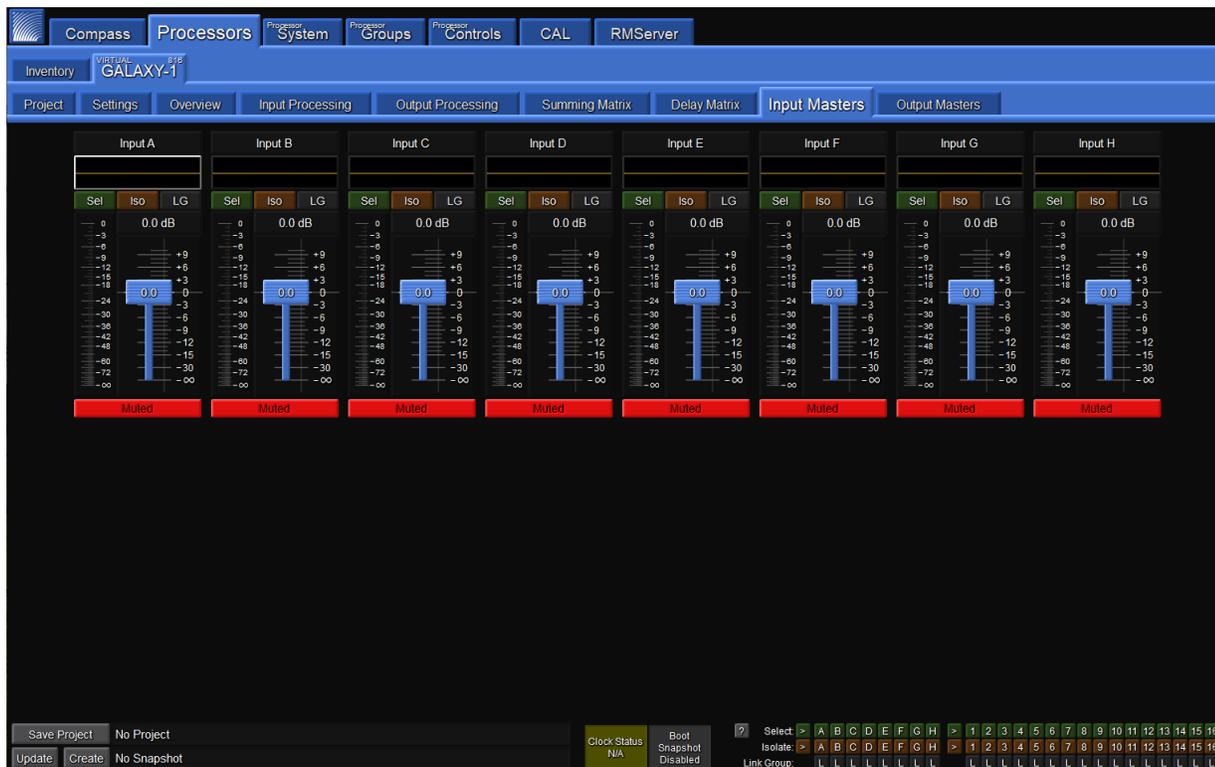


Figure 23: Processor > Input Masters tab

## Output Masters Tab

The Output Masters tab (Figure 24) provides fader controls for adjusting the signal levels of the Outputs by decibels (dB).

Clicking above or below the handle results in single dB increments or decrements; clicking on a dB value to the right of the control will cause the gain to jump to that value.

There are also buttons to link channels of the same type by “Selecting” them, temporarily isolate a channel from other channels to which it is linked, or link groups to select multiple channels simultaneously.



Figure 24: Processor > Output Masters tab

## SYSTEM TAB

The System tab allows a user to view settings for multiple GALAXY processors simultaneously in one window. It is read-only. Under the Inventory tab, select the processors to display by clicking on the small buttons to the far right of each device row (Figure 25). If blue, the settings for this device will display in the Processor System tab. If gray, they will be excluded. To enable viewing the same processor in two Compass application windows click the number 2 in the Window column, then click Show Secondary Processor Tabs Window.

Within the System tab display, there are controls for moving the displays to customize the view and pan/zoom capability.



**NOTE:** Any customized view created is not saved with the Compass Project.

Processor System tab Location

Enable Inclusion in Processor System Display

Order	Link	ID	Entity Name	Group Name	Tab Name	Device Type	Firmware	Status	Connection	Virtual	Demo	1	2	Sys			
X	▲	▼	Select	1	▼	GALAXY-1		GALAXY-1	816	2.1.0-R4-2019-07-03-r5404	Connected (Port 50503)	Disconnect	VIRTUAL	None	1	2	Sys
X	▲	▼	Select	1	▼	AUX	LYON	AUX	816	2.1.0-R4-1907032112	Available	Connect	Use Virtual	None	1	2	Sys
X	▲	▼	Select	1	▼	LEFT	LYON	LEFT	816	2.1.0-R4-1907032112	Available	Connect	Use Virtual	None	1	2	Sys
X	▲	▼	Select	1	▼	RIGHT	LYON	RIGHT	816	2.1.0-R4-1907032112	Available	Connect	Use Virtual	None	1	2	Sys
X	▲	▼	Select	1	▼	Distro Venus	LYON	Distro Venus	408	2.1.0-R4-1907032112	Available	Connect	Use Virtual	None	1	2	Sys
X	▲	▼	Select	1	▼	FOH Main	LYON	FOH Main	816-AES3	2.1.0-R4-1907032112	Available	Connect	Use Virtual	None	1	2	Sys

Figure 25: Enabling System View

## PROCESSOR GROUPS TAB

Users may choose individual channels from across multiple GALAXY devices to be a Group. Each Group will have a separate sub tab and as many groups as are desired may be made. Individual Groups or collections of multiple Groups can be saved and reloaded. The Group function allows users to gang inputs or outputs together from a single or multiple GALAXY processor(s) in a way that makes sense for a particular application. These Groups may then be controlled via the Processor Controls tab

## PROCESSOR CONTROLS TAB

Controls are added and assigned to Groups, moved and resized, and adjusted. There are three modes: Layout, Configure, and Operate, which are selected in the upper-right corner. Choose Layout to add controls, gain, mute, etc., move and resize. Choose Configure to make Group selections for each Control. In Operate mode, the Control makes relative changes to all of the inputs or outputs assigned to the Group to which the Control is assigned. Controls that may be added are Delay, Gain, Mute, EQ Bypass, EQ Plot, Meter, and U-Shaping Gain. There is also an option to include a background image.



## CHAPTER 4: Galileo GALAXY NETWORK PLATFORM SPECIFICATIONS

### SPECIFICATION TABLE

	Galileo GALAXY 408	Galileo GALAXY 816	Galileo GALAXY 816-AES3
<b>INPUTS</b>			
<b>Input Connectors</b>	4 gold-plated XLR-F, 2 RJ-45 network ports	8 gold-plated XLR-F, 2 RJ-45 network ports	
<b>Audio Input</b>	4 processed inputs selectable as analog, AES3 or AVB, 4 processed AVB only, plus 24 AVB unprocessed matrix inputs	8 processed inputs selectable as analog, AES3 or AVB, plus 24 AVB unprocessed matrix inputs	
<b>AVB Audio Sinks</b>	8, each capable of receiving an AVB Audio Stream Input	8, each capable of receiving an AVB Audio Stream Input	
<b>AVB Audio Stream Input Format</b>	AAF PCM-INT-32, 96 kHz or 48 kHz, 1 to 8 channels per stream		
<b>AVB Clock Sink</b>	1, capable of receiving an AVB Clock Stream Input		
<b>AVB Clock Stream Format</b>	48 kHz CRF stream (interval equals 96, or 2 msec) and 1 timestamp per protocol data unit, single channel stream		
<b>Selectable Maximum Input Level</b>	+16 dBu or +26 dBu BAL (input impedance 10 k $\Omega$ BAL)		
<b>Front Panel Metering</b>	4-segment LED ladder meters on each input		
<b>Input Processing</b>	Gain, 500 ms delay (non-fading), 5-band parametric EQ, 5-band U-Shaping EQ		
<b>WORD CLOCK INPUT</b>			
<b>Connector</b>	N/A		BNC female—50 $\Omega$
<b>OUTPUTS</b>			
<b>Output Connectors</b>	8 gold-plated XLR-M, 2 RJ-45 network ports	16 gold-plated XLR-M, 2 RJ-45 network ports	
<b>AES Audio Outputs</b>	N/A	N/A	Processed outputs 1–16 on connectors 1–8
<b>Analog Audio Outputs</b>	Processed outputs 1–8 on connectors 1–8 (9–16 AVB outputs only)	Processed outputs 1–16 on connectors 1–16	Processed outputs 9–16 on connectors 9–16
<b>AVB Audio Sources</b>	6, each capable of sourcing an 8 channel AVB Stream Audio Output		
<b>AVB Stream Audio Output Format</b>	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)		
<b>AVB Clock Reference Stream Format</b>	48 kHz CRF stream (interval equals 96, or 2 msec) and 1 timestamp per protocol data unit, single channel stream		
<b>Maximum Output Level</b>	+16 dBu or +26 dBu (selectable) 2 k $\Omega$ BAL (5 looped self-powered loudspeakers)		
<b>Output Impedance</b>	50 $\Omega$ BAL (25 $\Omega$ per leg)		
<b>Recommended Minimum Load</b>	10 looped self-powered loudspeakers (net load = 1 k $\Omega$ BAL)		
<b>Absolute Minimum Load</b>	600 $\Omega$		
<b>Front Panel Metering</b>	LED lights: green to indicate signal presence; red for clipping on each output		
<b>Output Processing</b>	Gain, 2000 ms delay (non-fading), polarity reverse, 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.		

<b>MATRIX</b>			
<b>Summing Matrix</b>	Sparse 32 x 16 Summing Matrix (up to 232 of 512 cross-points can be set simultaneously)		
<b>Delay Matrix</b>	Sparse 32 x 16 Delay Matrix; 500 ms delay range at each cross-point (nonfading)		
<b>PROCESSING</b>			
<b>Digital Conversion</b>	24-bit resolution, 96 kHz sample rate		
<b>Internal Processing</b>	24-bit resolution, 96 kHz		
<b>Processor</b>	FPGA based Audio Processing		
<b>NETWORK CONNECTORS</b>			
<b>Network Control</b>	Two RJ-45 ports for single or redundant networks		
<b>SIM (on units equipped with these components)</b>	One SIM 3 bus port to link the GALAXY 408 processor to the SIM audio analyzer	Two SIM 3 bus ports to link the GALAXY 816/816-AES3 processor to the SIM audio analyzer	
<b>AC POWER</b>			
<b>Connector</b>	PowerCON 20		
<b>Operating Voltage Range</b>	100–240 VAC, 50–60 Hz		
<b>CURRENT DRAW</b>			
<b>Idle</b>	0.229 A rms (115 V AC) 0.162 A rms (230 V AC) 0.256 A rms (100 V AC)	0.431 A rms (115 V AC) 0.229 Arms (230 V AC) 0.492 A rms (100 V AC)	0.336 A rms (115 V AC) 0.197 A rms (230 V AC) 0.415 A rms (100 V AC)
<b>Maximum Long-Term Continuous (&lt;10 sec)</b>	0.306 A rms (115 V AC) 0.195 A rms (230 V AC) 0.343 A rms (100 V AC)	0.576 A rms (115 V AC) 0.306 A rms (230 V AC) 0.657 A rms (100 V AC)	0.449 A rms (115 V AC) 0.263 A rms (230 V AC) 0.554 A rms (100 V AC)
<b>Inrush</b>	<20.0 A peak	<20.0 A peak	<20.0 A peak
<b>PHYSICAL</b>			
<b>Dimensions</b>	1 RU: W 19.00 in (483 mm) x H 1.74 in (44 mm) x D 16.14 in (410 mm)	2 RU: W 19.00 in (483 mm) x H 3.48 in (88 mm) x D 16.14 in (410 mm)	
<b>Weight</b>	13.2 lb (6.0 kg)	16.8 lb (7.6 kg)	
<b>ENVIRONMENTAL</b>			
<b>Operating Temperature</b>	0° C to +45° C		
<b>Non-Operating Temperature</b>	–40° C to +75° C		
<b>Humidity</b>	to 95% at 35° C non-condensing		
<b>Operating Altitude</b>	to 2000 m (6560 ft)		
			

## Galileo GALAXY NETWORK PLATFORM PARTS AND ACCESSORIES

Part Description	Part Number
GALILEO GALAXY 816 REAR RACK BRKT 18–20 inches	40.230.035.01
GALILEO GALAXY 816 REAR RACK BRKT 20–22 inches	40.230.035.02
GALILEO GALAXY 816 REAR RACK BRKT 22–24 inches	40.230.035.03

## DIMENSIONS

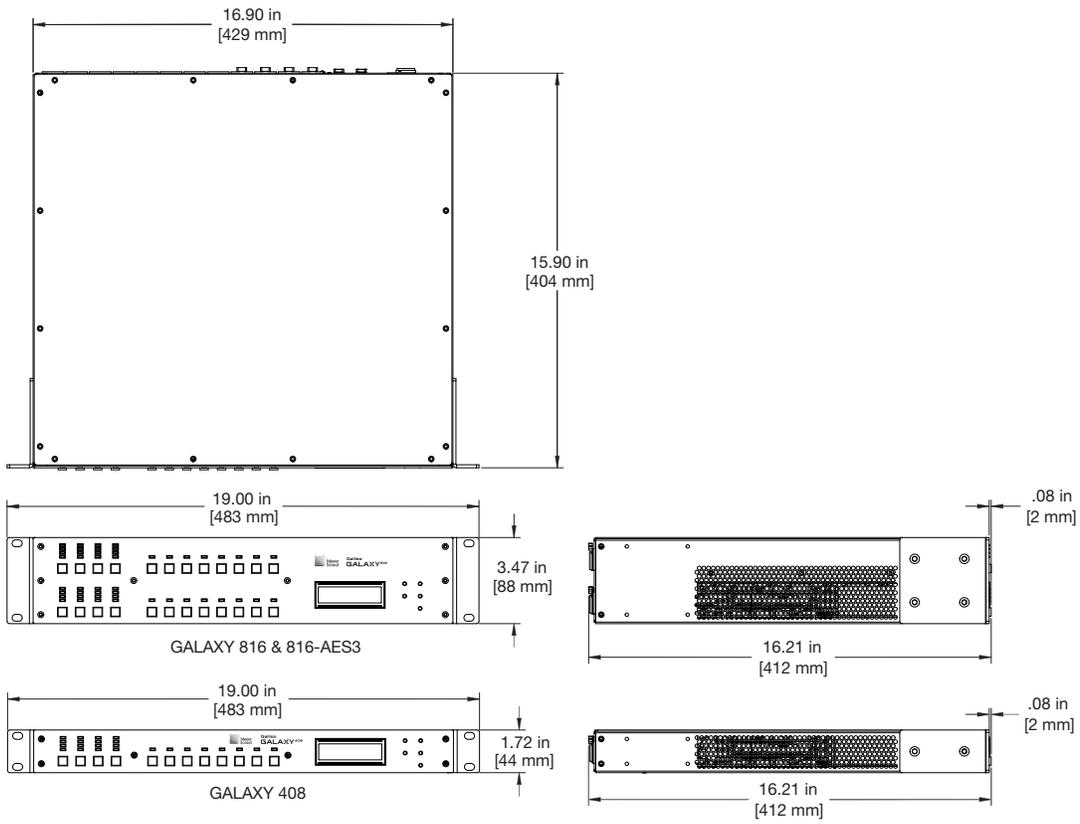


Figure 26: GALAXY 408, GALAXY 816, and GALAXY 816-AES Dimensions



## APPENDIX A: AUDIO SIGNAL FLOW

As noted earlier, all GALAXY processors offer the same processing for audio signals. However, the inputs and outputs are different, so the signal flow is also slightly different. This appendix provides signal flow diagrams for all three processors and a few more details about terminology.

### COMMON TERMINOLOGY

For clarity, a few definitions are repeated in Table 1. The GALAXY processors can serve as both AVB Listeners (receive networked audio data streams) and AVB Talkers (generate networked audio data streams).

**Table 1: Audio Input and Output Terminology**

Name	Description
Listener	A device that is capable of receiving one or several streams
Sink	A virtual input connector that is able to receive and unpack one stream.
Source	A virtual output connector that is able to generate and transmit one stream.
Talker	A device that is capable of transmitting one or several streams.

Through the Ethernet ports, GALAXY processors can function as Listeners capable of accepting up to 8 Streams of AAF/AVB audio input. Each stream can contain up to eight channels. An additional Stream serves a GALAXY processor Clock Sink. Table 2 provides Stream to Channel translation.

**Table 2: GALAXY Processor Input Stream to Channel Translation**

Listeners (Stream Inputs)	Channels
Stream Input 0–7	GALAXY Processor up to 8 inputs as assigned
Stream Input 8	GALAXY Processor Clock Sink 1

The GALAXY processors can also function as Talkers through the Ethernet port. GALAXY processors are capable of generating 6 output streams with varying output types further described in Table 3. An additional Stream serves as a GALAXY processor Clock Source.

**Table 3: GALAXY Processor Output Stream to Channel Translation**

Talkers (Stream Outputs)	Channels
Stream Output 0	GALAXY Processor Outputs 1–8 (96 kHz)
Stream Output 1	GALAXY Processor Outputs 9–16 (96 kHz)
Stream Output 2	GALAXY Processor SIM Outputs
Stream Output 3	GALAXY Processor Inputs A–H Split (post input processing)
Stream Output 4	GALAXY Processor Outputs 1–8 (48 kHz)
Stream Output 5	GALAXY Processor Outputs 9–16 (48 kHz)
Stream Output 6	GALAXY Processor Clock Source 1

## GALAXY 816 PROCESSOR AUDIO SIGNAL FLOW

Figure 27 illustrates the audio signal flow for a GALAXY 816 processor. For details about clocking, see Appendix B, “Clocking.”

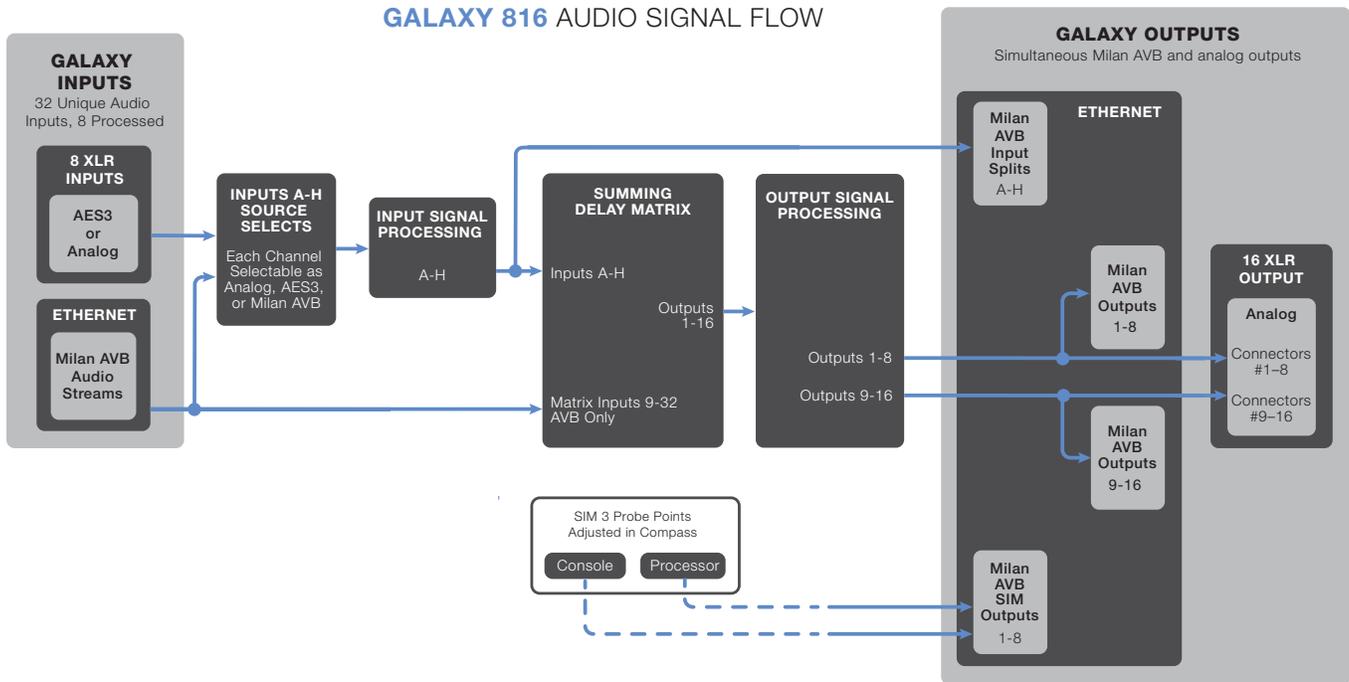


Figure 27: Audio Signal Flow for the GALAXY 816 Processor

## GALAXY 408 PROCESSOR AUDIO SIGNAL FLOW

Figure 28 illustrates the audio signal flow for a GALAXY 408 processor. For details about clocking, see Appendix B, “Clocking.”

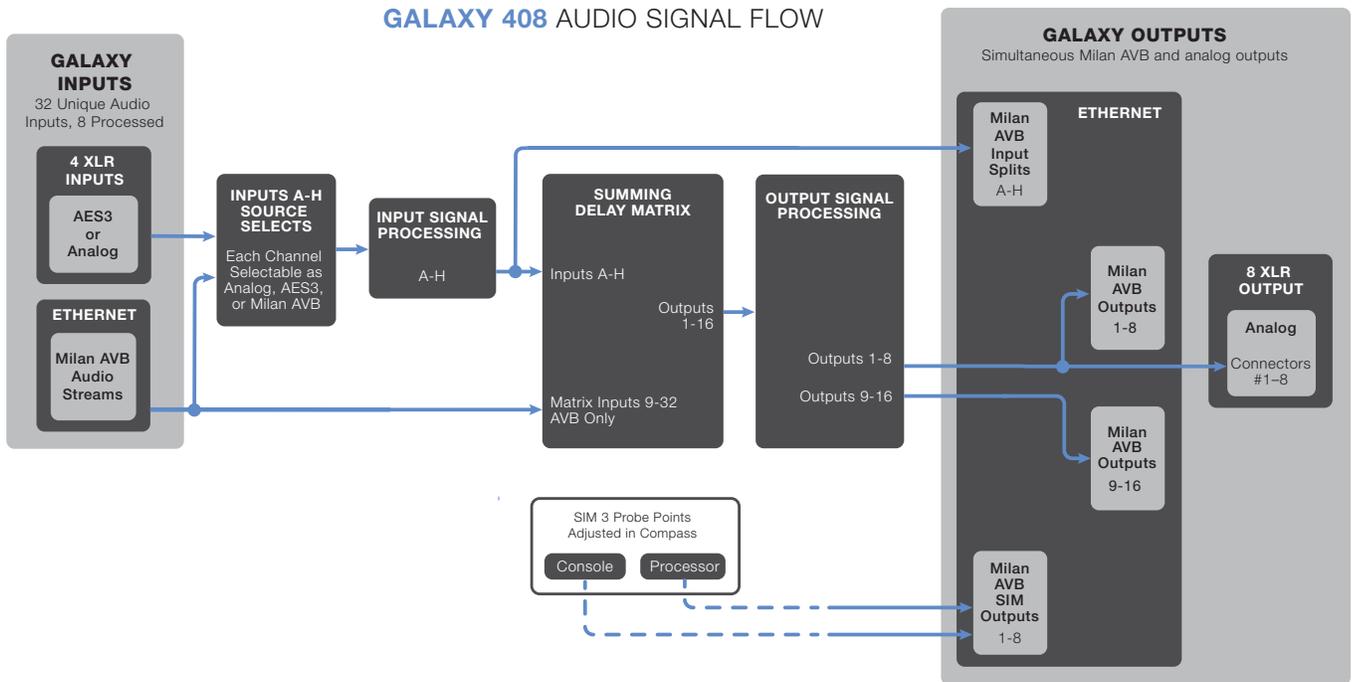


Figure 28: Audio Signal Flow for the GALAXY 408 Processor

## GALAXY 816-AES PROCESSOR AUDIO SIGNAL FLOW

Figure 29 illustrates the audio signal flow for a GALAXY 816-AES processor. For details about clocking, see Appendix B, “Clocking.”

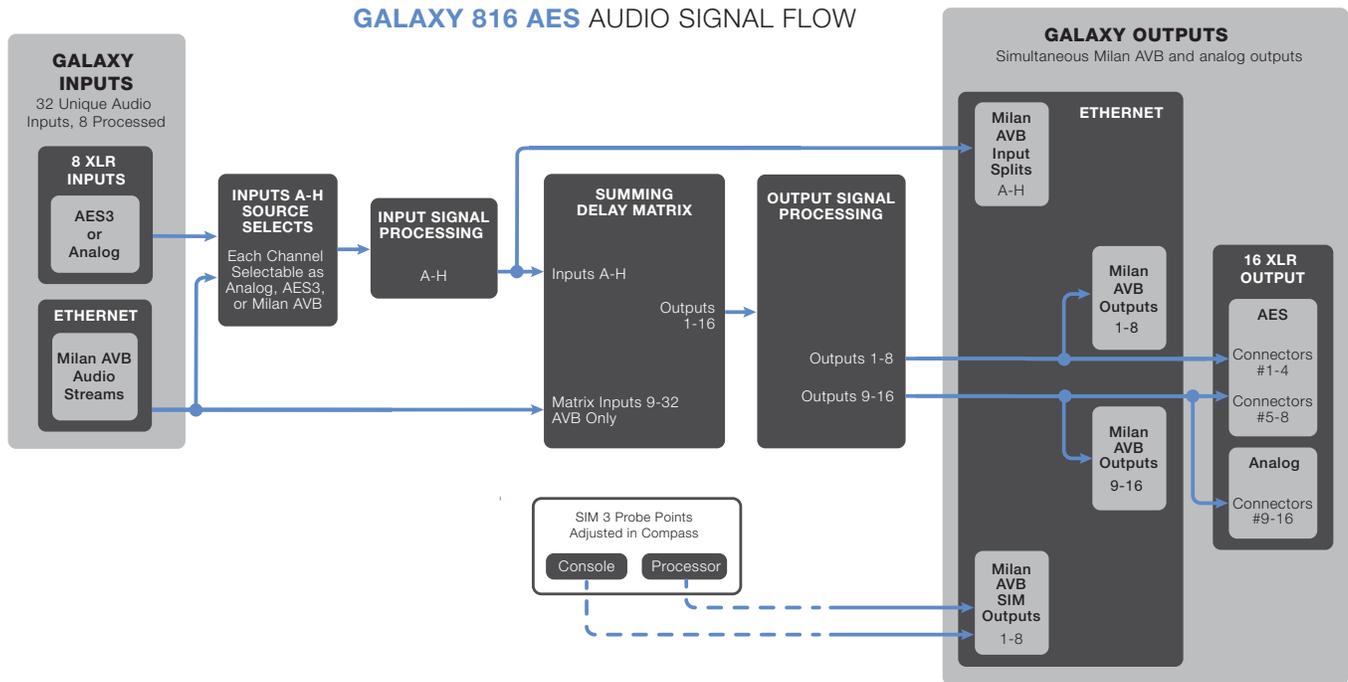


Figure 29: Audio Signal Flow for the GALAXY 816-AES Processor

## APPENDIX B: CLOCKING

### MEDIA CLOCK FOR A SINGLE GALAXY PROCESSOR

 **NOTE:** “Media Clock” is the common terminology used in the Milan specification. Within the GALAXY processor Settings: Input and Output tab, the Media Clock choice is selected under the “System Clock: Clock Mode” pull-down menu.

The GALAXY 816 processor and the GALAXY 408 processor offer four clock options for the media clock: GALAXY Internal Clock, CRF Clock Stream, AAF Audio Stream Clock, and AES3 Clock (the first four choices shown in Figure 30, GALAXY System Clock Selection box).

The GALAXY 816-AES3 processor offers the same four plus a Word Clock of 48 or 96 kHz via an additional BNC connector. The GALAXY 816-AES3 processor can be synchronized to an external source depending on the digital input selection: AES3 offers discrete values in the range from 20–216 kHz (see “Input Sample Rates” on page 52).

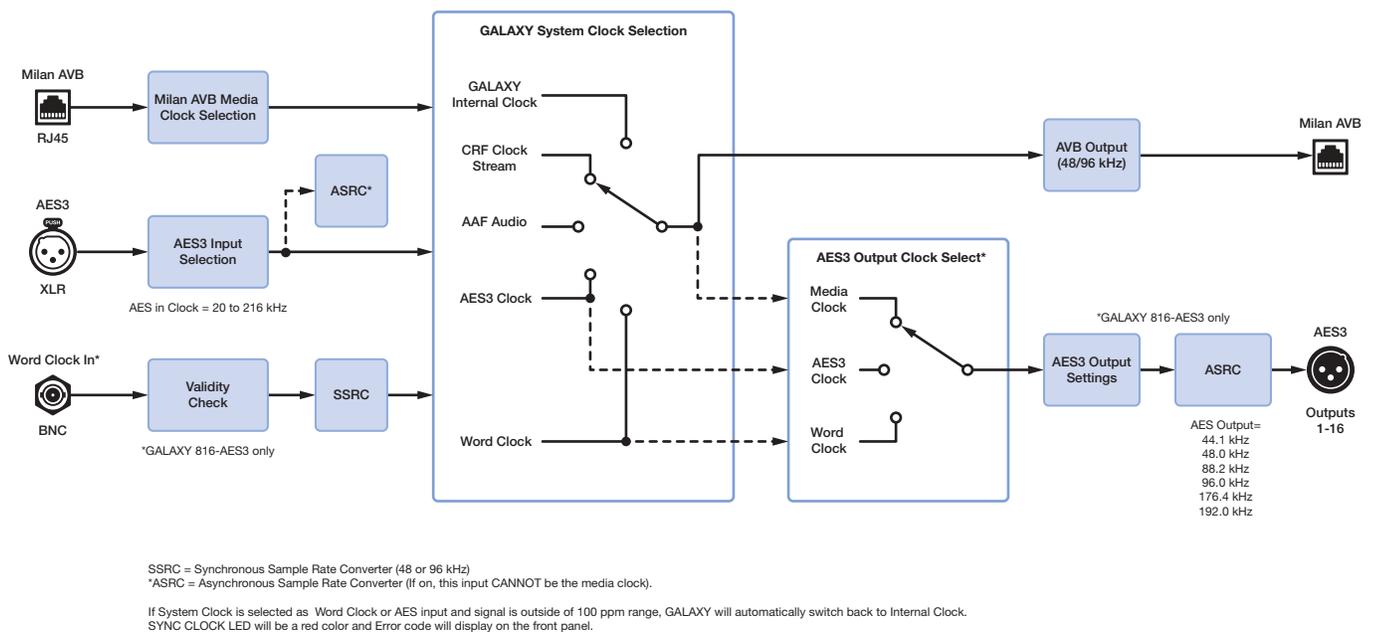


Figure 30: GALAXY Processor Clocking Scheme

 **NOTE:** For an AES3 input to be selectable in the System Clock, Clock Mode drop-down, it must be synchronous to the GALAXY internal clock (48 kHz or 96 kHz  $\pm$ 100 ppm). Synchronous means the external source and the GALAXY processor have a common clock (to within  $\pm$ 100 ppm). A common clock with the sender of data is necessary for any device to accurately interpret the binary data it receives. If the device clocks are asynchronous—any of the allowable AES input clock rates NOT equal to 48 kHz or 96 kHz, and thus not common with the GALAXY internal clock—they cannot be used as a system clock. Furthermore, any audio input associated with this asynchronous clock must pass through the Asynchronous Sample Rate Converter (ASRC) to make that input data synchronous, or accurately aligned to the GALAXY processor internal processing clock.

## COMMON MEDIA CLOCK FOR MULTIPLE INTERCONNECTED GALAXY PROCESSORS

When connecting multiple GALAXY processors together, it is imperative that one common media clock be used. Clocks should never be daisy-chained. Even small timing differences can cause audio degradation that is audible. Figure 31, Figure 32, and Figure 33 illustrate some of the more common multiple GALAXY processor clocking configurations for networked GALAXY processors. They do not cover all possible clocking schemes.

For more information about networking schemes in general, see the AVB Networking Guide (PN 05.010.541.01) available at [www.meyersound.com](http://www.meyersound.com).

Figure 31 illustrates an example where an Analog or Asynchronous AES3 input must be sent through several GALAXY processors. While an audio signal may be daisy-chained from one GALAXY processor to the next, it is worth repeating that the clock must never be daisy-chained. In the case illustrated in Figure 31, GALAXY 1 receives an Analog or Asynchronous AES3 input, and its System Clock should be set to Internal to use the device clock. For an AES3 Asynchronous signal, the Asynchronous AES3 Sample Rate Converters (ASRC) must be enabled for that input.

Subsequent processors (in this case GALAXY processors 2, 3, 4 and 5) must receive their System Clock from the same source (GALAXY 1), which can be accomplished by using the CRF clock (Clock Reference Format packets) from GALAXY 1.

 **NOTE:** An AAF Clock may also be sent from GALAXY 1 as a Media Clock, but the CRF clock is preferable as it is more bandwidth efficient.

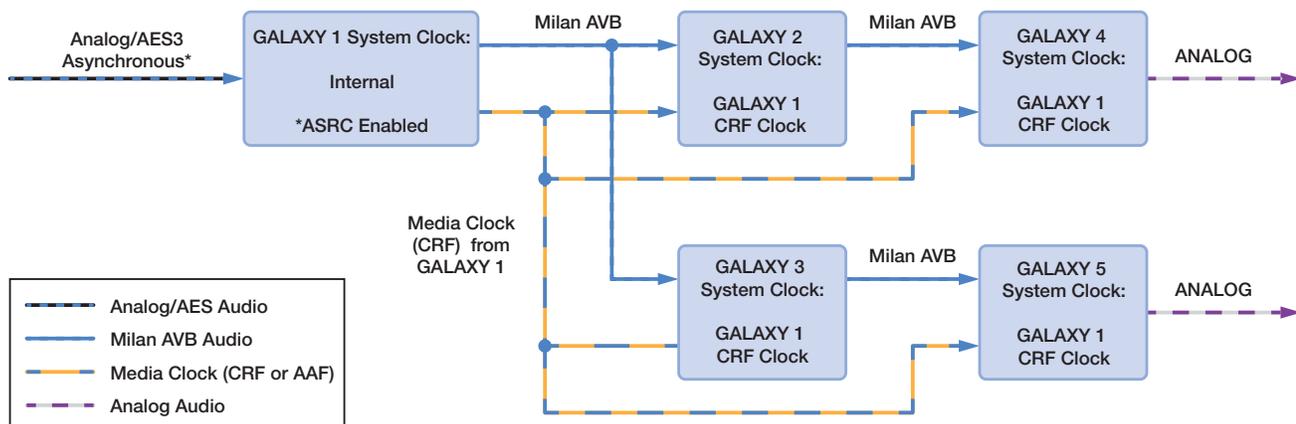


Figure 31: Clocking Scheme for Multiple GALAXY Processors—Analog or AES3 Asynchronous Inputs

Figure 32 illustrates an example where an AES3 signal aligned to a Word Clock must be sent through several GALAXY processors. Again, the clock cannot be daisy-chained along with the audio signal. In this case, if GALAXY A (which must be a GALAXY 816-AES3 processor) receives an AES3 input synchronized at its source to a Word Clock, its System Clock should be set to the Word Clock received from the same source via the BNC connector. In this case, the AES ASRC must be disabled.

Subsequent processors (GALAXY processors B, C, D and E, which can be any GALAXY processor model) must receive their System Clock from the same source (GALAXY A). Use the CRF clock (Clock Reference Format packets) from GALAXY A as the System Clock Mode selection. The AES ASRC for succeeding GALAXY processors (B, C, D, and E) must also be disabled.

**NOTE:** An AAF Clock may also be sent from GALAXY A as a Media Clock, but the CRF clock is preferable as it is more bandwidth efficient.

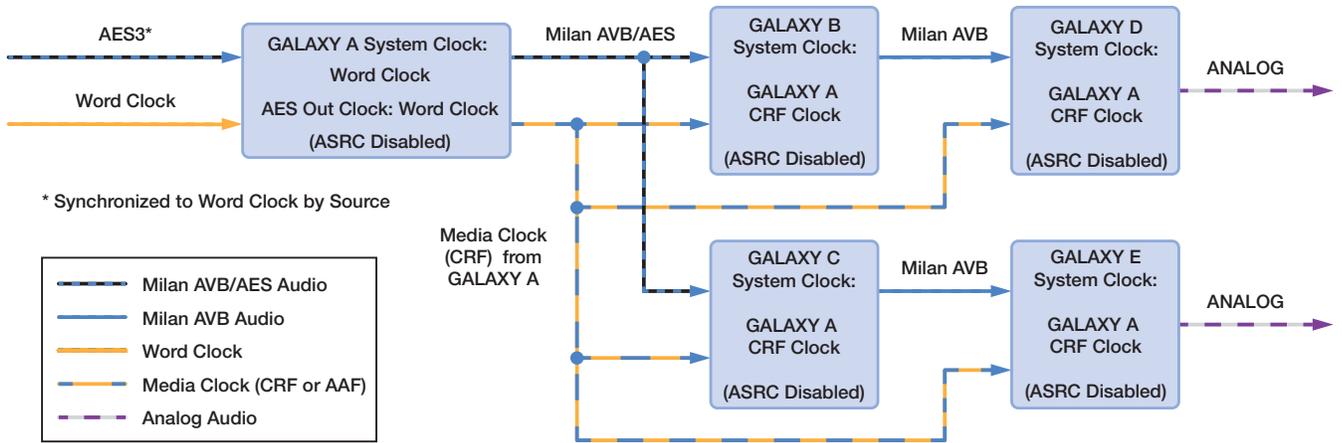


Figure 32: Clocking Scheme for Multiple GALAXY Processors—AES3 Input with Word Clock

Figure 33 illustrates an example where an AVB signal coming into the first GALAXY processor must be sent through several GALAXY processors. Again, the clock cannot be daisy-chained along with the audio signal. In this case, the source of the AVB signal must also provide the Media Clock, because GALAXY 1 would add latency, as it is essentially daisy-chained itself from the input source. In this case, all GALAXY processors (1–5) can receive the same Media Clock by dedicating 1 of the available 32 AVB channels to act as a system clock. Select the System Clock Mode to be any of the AAF audio streams.

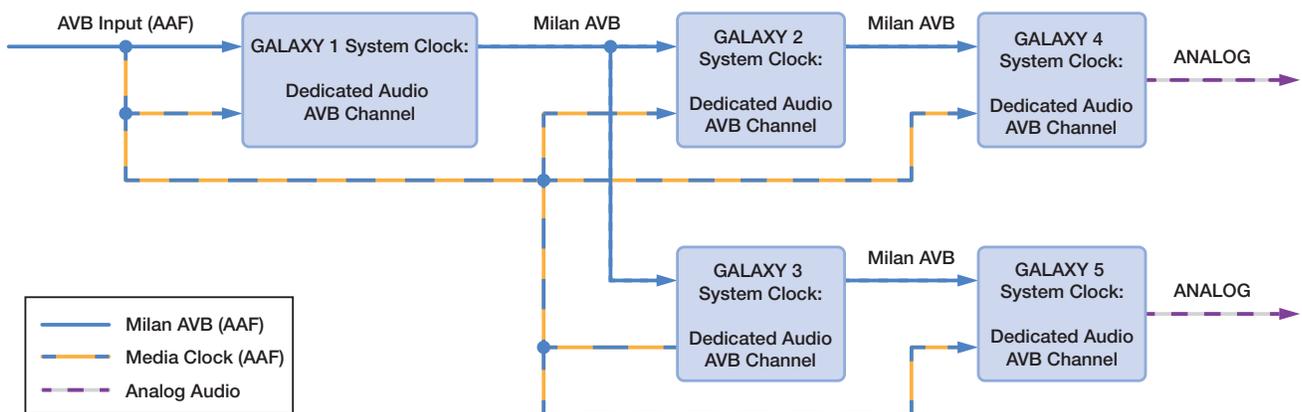


Figure 33: Clocking Scheme for Multiple GALAXY Processors—AVB Input Source

## DIGITAL LATENCY

GALAXY processors feature fixed latency across all output channels, regardless of the processing applied. The analog latency for GALAXY processors (AD/DA) is fixed at 0.5968 milliseconds. GALAXY processor AES3 inputs have sample rate converters that support a range of sample rates. Changing the sample rate can increase the latency to approximately four times this value, depending on the sample rate selected.



**NOTE:** While each GALAXY processor has fixed latency, overall system latency from a local GALAXY processor's (Talker) physical analog outputs and any remote GALAXY processors' (Listeners) physical analog outputs can vary. To ensure proper alignment, measure the delay between the local GALAXY processor's physical analog outputs to any remote GALAXY processor(s) physical analog outputs using an accurate audio analyzer (such as Meyer Sound's SIM System).

## INPUT SAMPLE RATES

With the ASRC enabled, the GALAXY processor can accept a range of sample rates for AES inputs (see Table 4). To use AVB inputs, a common clock must be selected.

**Table 4: Accepted Input sample rates and bit depth based on format**

Format	Input Sample Rates Accepted (kHz)	Bit Depth
AES3	20 – 216	up to 24 bit
AVB	48 or 96	24 bits in 32 bit integer

## AES3 OUTPUT SAMPLE RATES

If an AES3 or Word Clock input is selected as the AES output clock source (GALAXY 816-AES3 processor only), then the following sample rates may be used:

- 44.1 kHz
- 48.0 kHz
- 88.2 kHz
- 96.0 kHz
- 176.4 kHz
- 192.0 kHz

---

## APPENDIX C: PRODUCT INTEGRATION

### PRODUCT INTEGRATION

Product Integration combines both Delay Integration and Starting Point settings in a single dialog. Using Product Integration is the first step to complete when optimizing a system. It is not recommended for use when a system has previously been optimized, as some or all of the output processing filters and settings may be over-written.

By selecting the loudspeaker model in the pop-up window, the Delay and Starting Point drop-down menus are populated with the available options.

A video describing Product Integration in more detail is available at [meyersound.com/videos/#support](https://meyersound.com/videos/#support)

### Delay Integration

Delay Integration aligns the phase responses of different loudspeaker model families to match predefined target curves.

After selecting the product this setting will apply to, choose the desired target phase curve frequency: 55-70, 100, or 125 (Hz). Different products will have different phase curve options available, though PC125 will be available for every product. Choose the lowest target phase curve that is available for all loudspeaker types in a system.

Some subwoofer Delay Integration settings also implement filters that change the frequency response of the product. This is necessary to achieve the appropriate phase response to be compatible with the phase curve family.

### Starting Points

Starting Points includes two types of settings: the first are filter presets for line array models, the second are delay and polarity settings for the rear-facing element(s) of gradient subwoofer arrays.

### Line Array Models

When certain line array products are chosen, the user can select a Starting Point from the drop-down menu. These presets use U-Shaping filters that adjust the frequency response to a usable result. For most products, the response will be close to equal magnitude (flat) for arrays that are 6-8 elements.

Some line array products have presets that are based on the total splay angle between four elements, shown as “Wide,” “Medium,” or “Narrow.” Choose the setting that best matches the splay angles between the elements this output channel will be driving.

For example, if an output will be driving four elements of a LYON-M array where there is 3° of splay between every element, the total splay between four elements is 9°, and the “Medium” preset would be most appropriate.

Some line array products have a single preset that can be used as a starting point in any configuration. If a line array product does not have an Starting Point preset available, it is designed to be used in Native Mode and does not require a preset. For more information about Native Mode, consult the User Guide for that product.

### Subwoofers

Starting Point settings for some subwoofers provide a choice to select a front- or rear-facing subwoofer. These settings are designed for subwoofers being used in gradient configurations that produce cardioid coverage patterns. Selecting a “Front Facing” Starting Point will not implement any processing for most models. Selecting a “Rear Facing” Starting Point will invert the polarity and implement appropriate delay to synchronize the output of the rear-facing element with the output behind the array of the front-facing elements. This delay is applicable to subwoofers that are physically reversed in an array or ground-stack.

## Product Integration by Loudspeaker

To implement Product Integration:

1. Select the Overview tab.
2. Click the Product Integration button for any output to open the dialog.
3. Select the loudspeaker model connected to the output from the Product drop-down menu.
4. Select the lowest DI Standard that is common to all models used in the system.
5. Select the Starting Point processing to use for this output.

The available target phase curve selections are:

- pc55-70
- pc100
- pc125

Systems comprising multiple loudspeaker types with different native phase responses can result in undesired summation or cancellation in the low-mid frequencies. As Meyer Sound improves the native phase response of its loudspeakers, the Product Integration feature quickly matches the phase responses of mixed loudspeaker models used in a given system.

Product Integration is available on every GALAXY processor output.

The native phase curves exhibited by Meyer Sound products can be differentiated by the lowest frequency at which each product deviates by 180 degrees of relative phase. Product Integration uses the concept of phase curve families shared by different products: For example, LYON (see Figure 34, red line) and LEOPARD loudspeakers both have a low-mid phase response of 180 degrees at 55 Hz (pc55-70); LEO-M (see Figure 34, blue line) and UPQ loudspeaker both have a low-mid phase response of 180 degrees at 100 Hz (pc100).

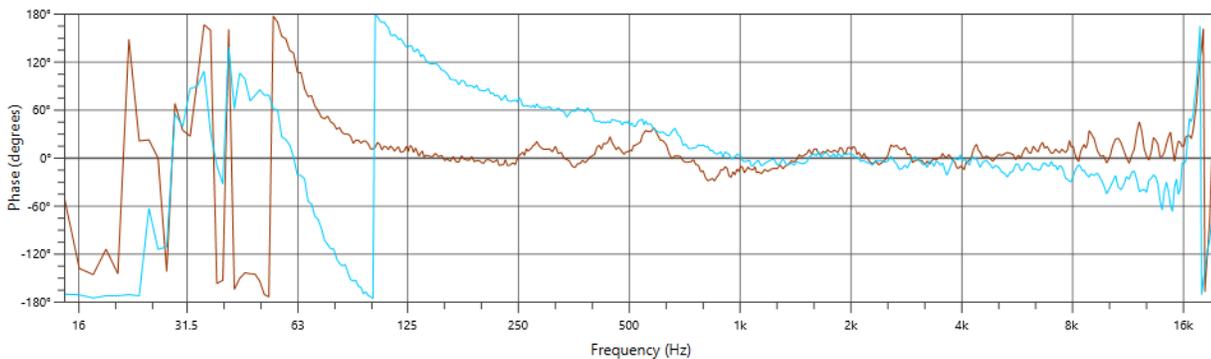


Figure 34: LYON (red) and LEO-M (blue) Phase Response Plots

## Product Integration Example

Product Integration is especially appropriate when applied to loudspeakers that are not in the same native phase curve family. For example, to accomplish Product Integration for LEOPARD with UPQ-1P:

1. Enable Product Integration on both the LEOPARD and UPQ-1P outputs.
2. Select pc100 for both outputs.
3. Use pure delay to time align the two loudspeakers at a coverage location where they are equal in level.
4. Select the Overview tab to verify all loudspeaker system outputs are set to the same phase curve value.

**Technical Notes**

- For best results, apply the lowest common phase curve value to different loudspeaker models. For example on the UltraSeries models, pc100 is the lowest common value.
- Although the M Series phase response is 180 degrees at 350 Hz, it can be improved by using pc125 when used in close proximity to other Meyer Sound loudspeakers.
- When Product Integration is applied to subwoofer outputs, the phase slope is optimized to align with the mid-high loudspeakers using the same phase curve setting.
- The changes in phase response caused by Product Integration are not displayed in Compass, but they can be modeled in MAPP or measured using the transfer function in SIM.
- If a Delay Integration Standard is selected that natively exhibits the same phase curve frequency, the output processing will not be altered. For example: LEO-M is natively pc100. If Product Integration is enabled for the LEO-M and set to pc100, no measurable change occurs.



## APPENDIX D: LOW-MID BEAM CONTROL

Low-Mid Beam Control (LMBC) is a tool that utilizes signal processing to help line arrays achieve more consistent frequency response over their vertical coverage. LMBC allows the low-mid frequency coverage of an array to be shaped (increase the vertical width) or steered (modify the direction) so that it more closely matches the array's high-frequency coverage.

Based on user-entered parameters, LMBC generates specific, unique All Pass filters for elements in a line array. These All Pass filters adjust the relative timing of low-mid frequencies compared to high frequencies, essentially allowing low-mid frequencies to be modified without affecting the coverage of high frequencies that are controlled by the horn. The result is more consistent coverage across the entire operating range of the array.

For an in-depth explanation of the theory behind LMBC please watch the video on the Meyer Sound website: [meyersound.com/videos/#support](http://meyersound.com/videos/#support)

LMBC should always be modeled in MAPP so that performance can be evaluated before it is implemented.

To use LMBC, under the Processors tab:

1. Select the GALAXY processor that is controlling the line array to be modified.
1. Select the Settings > Low-Mid Beam Control tab (Figure 35).

**Low-Mid Beam Control**

Array Name	Status	Control Type	Elements Per Output	Start On Output	# of Elements	Element Location	Product Type	Array Splay	Associated Outputs
Array 1: Array 1	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	
Array 2: Array 2	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	
Array 3: Array 3	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	
Array 4: Array 4	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	

**Example of a Flown Loudspeaker System Properties Window from MAPP XT:**

ID	ELEMENT MODEL	SPLAY	REAR	FRONT	TOTAL
7	LEOPARD	-3°	-3°		-9.5°
8	LEOPARD	-4°	-4°		-13.5°
9	LEOPARD	-5°	-5°		-18.5°
10	LEOPARD	-6°	-6°		-24.5°
11	LEOPARD	-8°	-8°		-32.5°
12	LEOPARD	-11°	-11°		-43.5°

Array Splay is the sum of the splay angles in the array. To calculate Array Splay: Subtract the Rotation About Reference Point value from the Total splay value in MAPP, and enter the result. NOTE: The splay angle between the top grid and the first element should be set to 0 degrees. (if Rotation About Reference Point = -2 and Total Splay = -56, then the Array Splay = 54 degrees)

Figure 35: Low-Mid Beam Control tab

Under the Low-Mid Beam Control tab, there are a number of settings the user can control:

### **Array Name**

Each line array being driven by this processor can be named for quick identification by clicking in the Array Name widget and entering the appropriate text.

### **Status**

This button lets a user Enable or Bypass LMBC processing for all affected channels.

### **Control Type**

Under Control Type, the user can select one of two coverage patterns: Beam Spread, or Steer Up. Beam spread will widen the low-mid frequency coverage. Steer Up will steer low-mid frequency upward. The appropriate Control Type should be determined in MAPP prediction software.

### **Elements Per Output**

This control lets the user select whether a single processor output will drive one or two line array elements. Use one element per output for best performance.

### **Start On Output**

This selection determines which Output Channel will be used as the first output channel of LMBC. Element number one always starts at the top of the array.

### **Number of Elements**

This widget allows the user to define the number of elements within the array.

### **Element Location**

This widget determines the element's relative position in the array. Use of this tool is necessary when LMBC processing is spread across multiple processors. For example, consider a 24-element array where each element receives a discrete LMBC filter. Two GALAXY processors are required (GALAXY A and GALAXY B). If elements 1-16 are driven by Output Channels 1-16 on GALAXY A, the Element Location for GALAXY B would be 17. Both processors 'Start On Output' value would be set to Output 1.

### **Product Type**

The Product Type widget allows a user to enter the line array product being driven.

### **Array Splay**

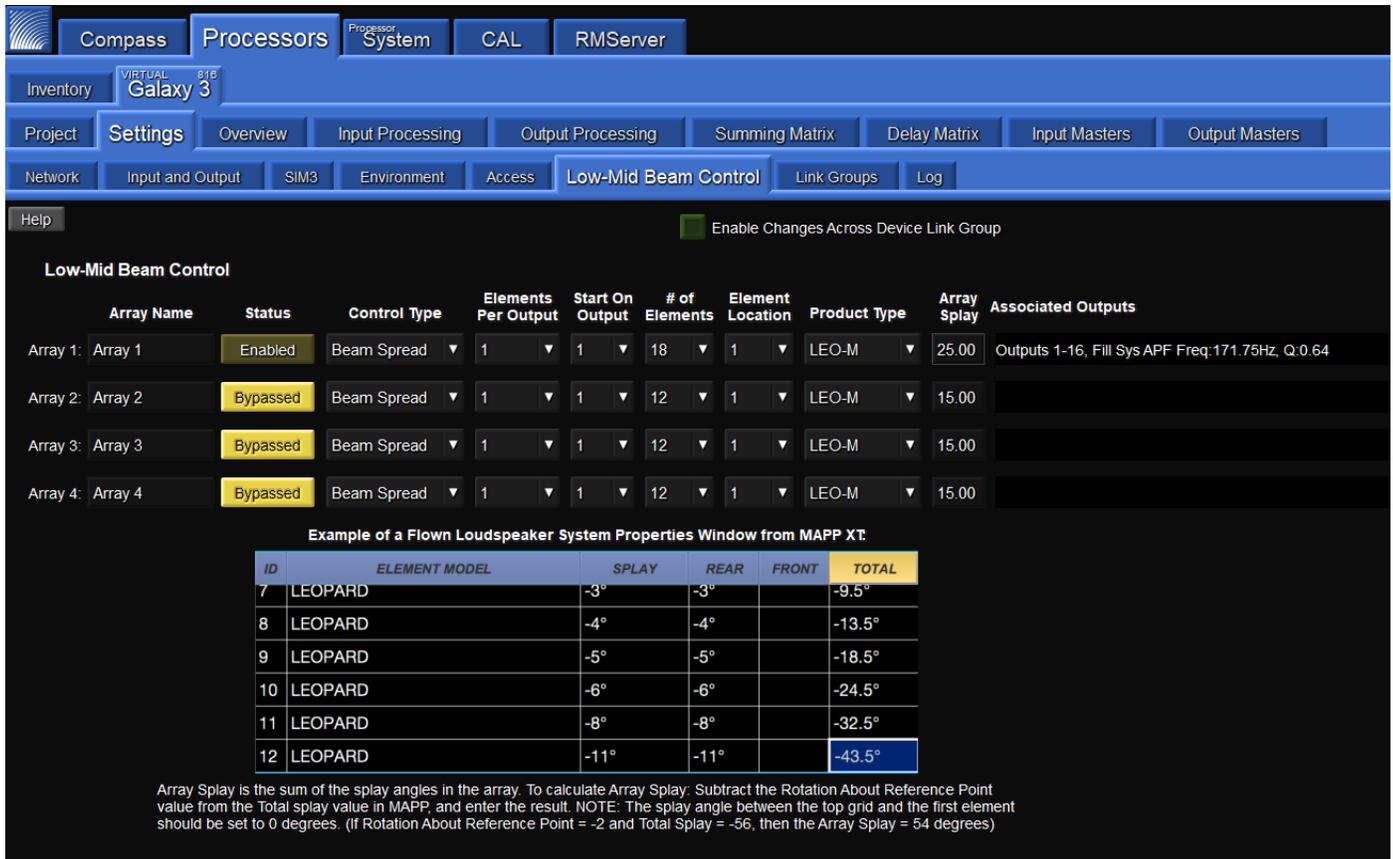
This widget allows the user to enter the summed total of the splay angles within the array. To calculate Array Splay using the MAPP System Design Tool:

1. Determine the correct value from MAPP's Array Splay located in the Loudspeaker System Properties Dialog Box.
2. Enter the result from the Compass or Compass Go Array Splay column.

 **NOTE:** The splay angle between the top grid and the first element should be set to 0 degrees.

### Associated Outputs

The Associated Outputs dialog box displays the processor outputs associated with an array’s LMBC processing. It also provides All Pass filter parameters (center frequency and Q) that can be applied to fill loudspeakers connected to other processor outputs to optimize alignment with the line array system using LMBC. In the example of Figure 36, LMBC has been enabled for an array of LEO-M loudspeakers (Array 1).



**Low-Mid Beam Control**

Array Name	Status	Control Type	Elements Per Output	Start On Output	# of Elements	Element Location	Product Type	Array Splay	Associated Outputs
Array 1: Array 1	Enabled	Beam Spread	1	1	18	1	LEO-M	25.00	Outputs 1-16, Fill Sys APF Freq:171.75Hz, Q:0.64
Array 2: Array 2	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	
Array 3: Array 3	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	
Array 4: Array 4	Bypassed	Beam Spread	1	1	12	1	LEO-M	15.00	

**Example of a Flown Loudspeaker System Properties Window from MAPP XT:**

ID	ELEMENT MODEL	SPLAY	REAR	FRONT	TOTAL
7	LEOPARD	-3°	-3°		-9.5°
8	LEOPARD	-4°	-4°		-13.5°
9	LEOPARD	-5°	-5°		-18.5°
10	LEOPARD	-6°	-6°		-24.5°
11	LEOPARD	-8°	-8°		-32.5°
12	LEOPARD	-11°	-11°		-43.5°

Array Splay is the sum of the splay angles in the array. To calculate Array Splay: Subtract the Rotation About Reference Point value from the Total splay value in MAPP, and enter the result. NOTE: The splay angle between the top grid and the first element should be set to 0 degrees. (If Rotation About Reference Point = -2 and Total Splay = -56, then the Array Splay = 54 degrees)

Figure 36: LMBC enabled for Beam Spread of a LEO-M Line Array

Once LMBC has been enabled, the All Pass filters can be seen on each Output Processing Channel, and via the (output) Processing thumbnails on the left side of the Overview tab.

Sel	Iso	Link	Label	Meter	Mute	Gain	Delay	Processing	Summing Matrix
A	A	LG	Input A	AES3L	Muted	0.0 dB	0 ms	A	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
B	B	LG	Input B	AES3R	Muted	0.0 dB	0 ms	B	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
C	C	LG	Input C	No Input	Muted	0.0 dB	0 ms	C	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
D	D	LG	Input D	No Input	Muted	0.0 dB	0 ms	D	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
E	E	LG	Input E	No Input	Muted	0.0 dB	0 ms	E	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
F	F	LG	Input F	No Input	Muted	0.0 dB	0 ms	F	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
G	G	LG	Input G	No Input	Muted	0.0 dB	0 ms	G	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
H	H	LG	Input H	No Input	Muted	0.0 dB	0 ms	H	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Processing	EQ	Product Integration	Atmos.	Polarity	Delay	Gain	Meter	Mute	Label	Sel	Iso	Link
1	Enabled	Off	150 m/492.1 ft	Normal	0 ms	0.0 dB		Mute	Output 1	1	1	LG
2	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 2	2	2	LG
3	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 3	3	3	LG
4	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 4	4	4	LG
5	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 5	5	5	LG
6	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 6	6	6	LG
7	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 7	7	7	LG
8	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 8	8	8	LG
9	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 9	9	9	LG
10	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 10	10	10	LG
11	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 11	11	11	LG
12	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 12	12	12	LG
13	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 13	13	13	LG
14	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 14	14	14	LG
15	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 15	15	15	LG
16	Enabled	Off	Edit	Normal	0 ms	0.0 dB		Mute	Output 16	16	16	LG

Figure 37: The Processing Column on the Overview tab Indicates the LMBC All Pass Filters

## TIPS FOR USING LMBC

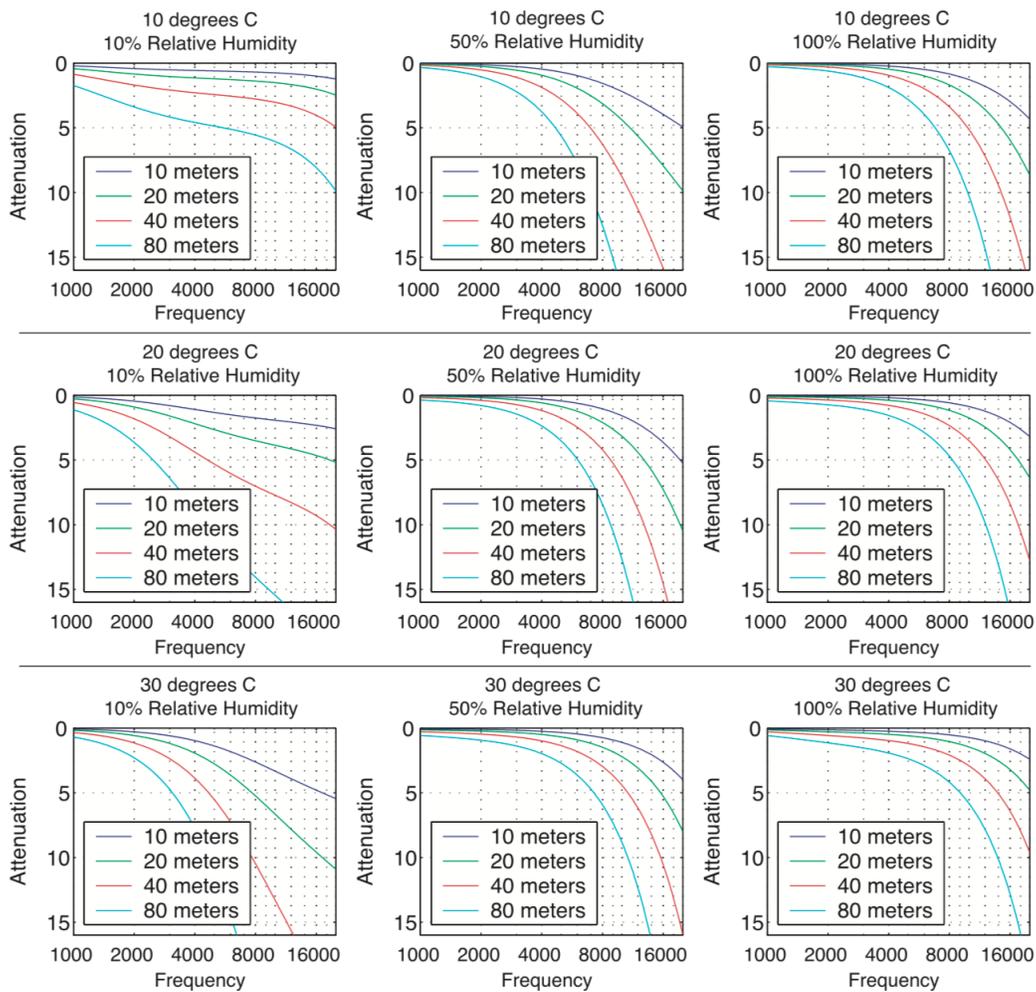
- Signal drive lines must have correct polarity.
- Apply LMBC before any other EQ is applied.
- Gain Tapering can make LMBC ineffective.
- Do not treat array zones with different processing/gain below 1000 Hz. (e.g., correct for low-mid buildup with the same filters on the entire array, correct for HF distance only above 1 k on individual zones).
- Spread is not optimal above 95° Total Array Splay.
- Steer Up is not optimal above 45° Total Array Splay.
- One array element per output is optimal.
- Two array elements per output is maximum and can only be used with arrays of twelve elements or more. Grating lobes will occur using this setting.
- Compass Control Software has been designed to not allow invalid or non-optimal configurations.
- LMBC is not designed for mixed product types in one array.
- All speakers within a system should be set to the same Delay Integration phase curve (PC) setting.

## APPENDIX E: ATMOSPHERIC CORRECTION

### OVERVIEW

The GALAXY processor's Atmospheric Correction function uses atmospheric loss equations and pre-calculated values to maintain system response as temperature and humidity vary. The correction coefficients are determined by user-entered parameters: the environmental conditions, and unique to each output, Atmospheric Gain Factor and Distance.

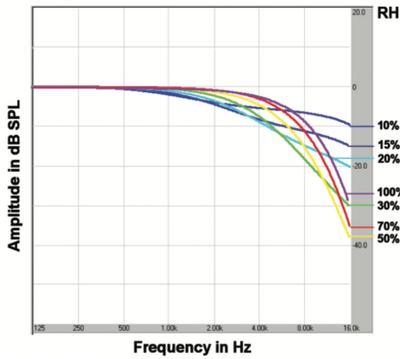
Air absorption of sound is a complex, non-intuitive function, of which temperature, humidity, and distance have the most effect, changing how well higher frequency sounds propagate through air. The graphs in Figure 38 indicate a multitude of attenuation scenarios for just a handful of distances.



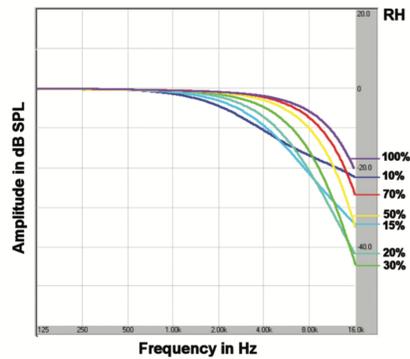
2.9. Sample atmospheric correction curves for the attenuation of sound in air at 10, 20, 40 and 80 meters.

Figure 38: Atmospheric Attenuation of Sound Scenarios

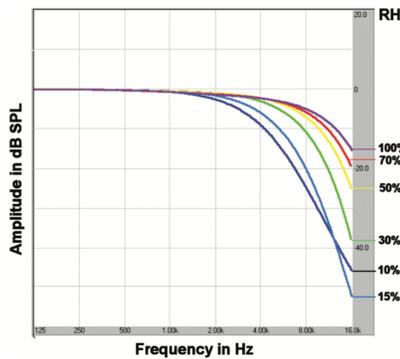
Figure 39 provides frequency attenuation curve examples for three different temperatures with a fixed distance of 100 meters, at seven values for relative humidity. Depending on the atmospheric conditions and the distance the array is throwing, the number of possible correction combinations can be quite large, but they are achievable with the GALAXY processor.



Air absorption for 10°C at 100 meters



Air absorption for 20°C at 100 meters



Air absorption for 30°C at 100 meters

Figure 39: Frequency Attenuation Curves: 3 Temperatures, all at 100 meters, and with Seven Relative Humidity Values

The GALAXY processor's Atmospheric Correction filter function is limited to a maximum of 14 dB of boost when the Atmospheric Gain Factor is set to 100%. Atmospheric Correction does not try to correct to the highest frequencies. It is constrained to the range of frequencies that can be practically corrected, preserving headroom, unlike using a shelving filter.

Figure 40 provides frequency response curves for four different natural environments. The red curve indicates the frequency absorption due to the location's atmospheric conditions if left uncorrected. (Note the roll-off at higher frequencies.) The green curve illustrates the frequency response of the atmospheric correction filters for that situation. The blue curve indicates the improved frequency response at higher frequencies for the resulting signal after applying atmospheric correction.



Figure 40: Atmospheric Correction Results for Four Different Scenarios.

## USING THE GALAXY PROCESSORS ENVIRONMENTAL CONDITIONS SETTINGS

To use the Atmospheric Correction function, the user must first set the environmental conditions. To do so:

1. Select a GALAXY processor in Compass
2. Select the Settings > Environment tab (Figure 41).

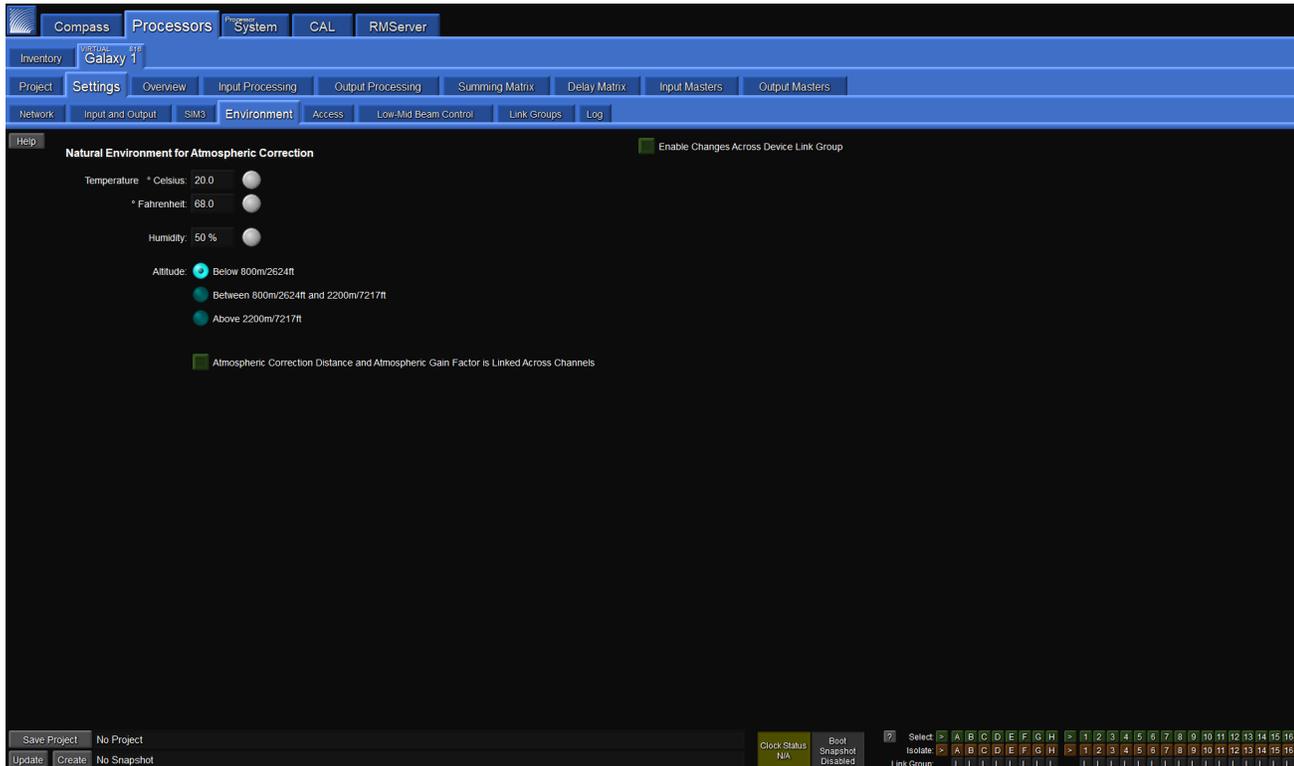


Figure 41: Environment Tab Settings

From this tab the user can enter the current temperature and humidity, and select the appropriate altitude range. These values are used to implement the correction filters when Atmospheric Correction is enabled. All three parameters will affect the frequency, bandwidth and gain of the correction filters. These parameters should be adjusted continuously to match the current real-world conditions.



**TIP:** The ability to control these parameters is also possible from the bottom of the Overview tab.

For example, if a system is calibrated in the morning with atmospheric correction enabled, the environmental parameters should be updated to reflect the actual temperature and humidity throughout the day, maintaining the system response without over-correcting or unnecessarily reducing available headroom of the system.



**TIP:** A good rule of thumb is to update temperature or humidity settings in the processor if they differ from actual conditions by more than 5° Fahrenheit or 5% humidity.

To apply Atmospheric Correction:

1. Select an output processing channel under the Output Processing tab. By default, the correction filters will not be shown in the plotter.
2. To make the filters visible, select the Response mini tab to the right of the plot, and check the box labeled “Atmos. Corr. Response.”

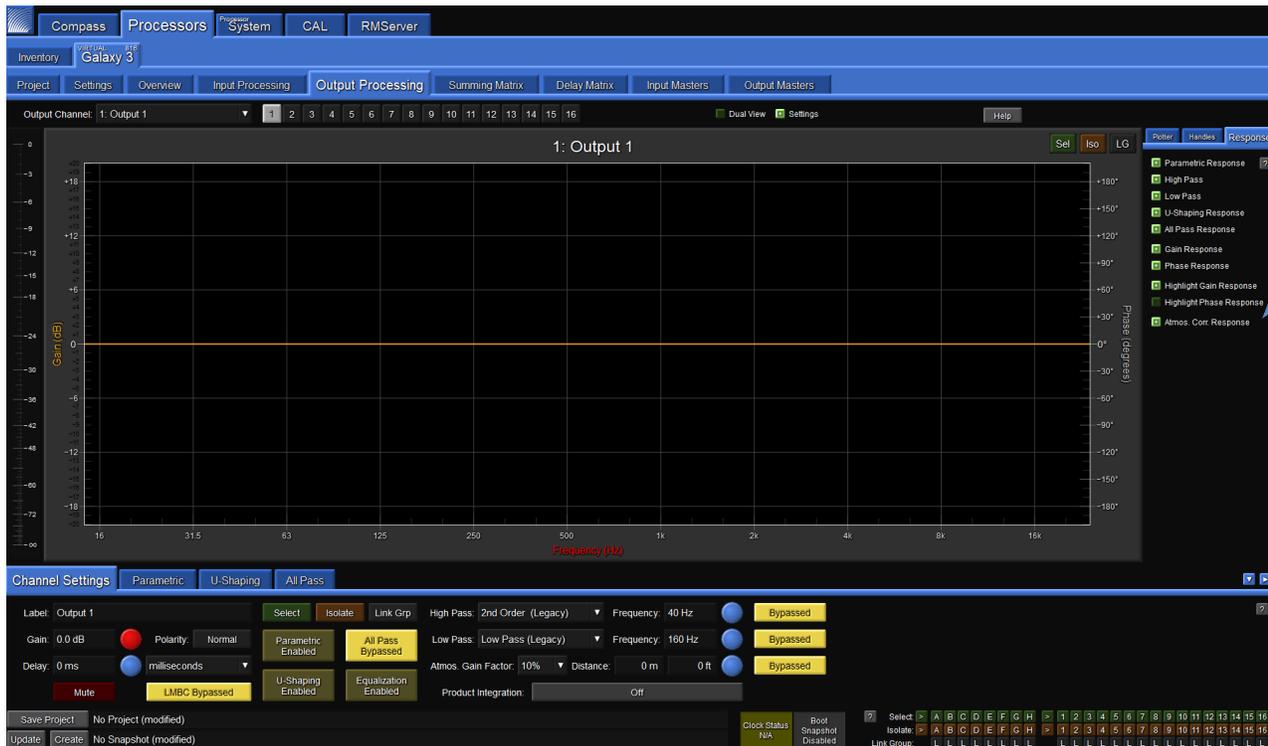


Figure 42: Atmospheric Correction Response enabled via Response mini tab within the Output Processing tab

3. At the bottom of the window click once on the Bypass/Enable toggle button on the bottom right, next to the Atmos. Gain Factor and Distance settings to enable Atmospheric Correction (Figure 43).

**NOTE:** Atmospheric Gain Factor limits the amount of makeup gain added. When set to 100%, the filters are constrained to 14 dB of gain. When set to 50%, correction is limited to 7 dB of gain. Increasing the Atmospheric Gain Factor will reduce headroom.

**NOTE:** The Distance parameter should be set to the on-axis distance between the loudspeaker and the nearest listener. For example, it is common for the top element in a line array to be aimed toward listeners further away than the bottom element in the array; different values should be entered accordingly depending on what element in the array is being driven by each output channel. The maximum distance that can be entered is 150 meters (492.1 feet).



Figure 43: Atmospheric Correction Enabled and Displayed

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## APPENDIX F: KEYBOARD SHORTCUTS

Keyboard shortcuts are available and summarized below.

### Interaction with Linking Modes

Global and local linking preferences affect which channels are modified by keyboard shortcuts:

- **Global Device Select-Linking Mode**—If the Global Device Select-Linking Mode is set to “All channels on the active GALAXY tab are always linked...,” then changes will also affect the same channels on any linked devices.
- **Gain Control Linking Mode and Delay Control Linking Mode**—Gain and Delay changes across linked channels will be affected differently depending on Absolute or Relative mode (selectable in Compass > GALAXY Preferences > Select, Isolate and Linking tab).

### Mouse or Typing

Press the indicated key to modify how a control is edited.

- If using a mouse, press the indicated key(s) while clicking and dragging the mouse.
- If using a keyboard only, press the indicated key while pressing the Enter key after a numeric value has been entered.

### Isolate Current Channel

- **Control (Command on Mac) = Current Channel.** Using this sequence isolates changes to the current channel, even if it is linked to other channels through Selects or Link Groups.

### Link Stereo Pairs

Changes made to one channel will affect the stereo pair. Inputs pairs: A–B, C–D, and E–F. Output pairs: 1–2, 3–4, 5–6, etc.

- **Shift = Stereo Pairs.** In the case of toggle buttons (Mute, Polarity, Bypass, etc.), pressing a button for one channel will set its stereo pair to the identical state.

Example 1: Channels A and B are both muted. Toggling Channel A while holding Shift will unmute both channels A and B.

Example 2: Channel A is muted and B is unmuted. Toggling Channel A while holding Shift will unmute Channel A but do nothing to Channel B.

In both cases, the result is Channels A and B are in the identical state: unmuted.

- **Alt-Shift = Stereo Pairs + Special Toggles.** This command sequence behaves in the same way as Shift for all settings that are not controlled by toggle buttons.

In the case of toggle buttons (Mute, Polarity, Bypass, etc.), toggling a button for one channel will toggle its stereo pair as well, regardless of whether their states match up.

Example 1: Channels A and B are both muted. Toggling Channel A while holding Alt-Shift will unmute both Channels A and B.

Example 2: Channel A is muted and Channel B is unmuted. Toggling Channel A while holding Alt-Shift will unmute Channel A and will mute Channel B.

In both examples, the end result is that Channels A and B independently toggle from one state to the other.

## Link All Channels

Changes made to one input channel will affect all input channels; the same controls apply for output channels.

- **Control-Shift (Command-Shift on Mac) = All Channels.** Changes made to all channels in a device.
- **Control-Alt-Shift (Command-Alt-Shift on Mac) = All Channels + Special Toggles.** This sequence behaves in the same manner as Control-Shift for all settings that are not controlled by toggle buttons. (See similar examples in “Link Stereo Pairs” on page 67.)

## APPENDIX G: GLOSSARY

The following defines some of the terms used in the Compass Control Software GALAXY processor User Interface.

AAF	AVTP (Audio Video Transport Protocol) Audio Format
AVB Listener	A device that is capable of receiving AVB streams from an AVB Talker. All available streams from all available AVB Talkers that have the same Group Name on the network will be selectable by the AVB Listener as inputs.
AVB Stream	An AVB Stream functions much like an analog multi-cable. Each stream can vary in the number of channels and formats, similar to AES3 and standard analog multi-cables. The difference is that many audio streams can flow down a single Ethernet cable. Unlike traditional multi-cables, AVB streams do not stay connected when the audio devices are turned off. An AVB software controller creates and maintains these connections running on a computer attached to the network or inside one of the audio devices being controlled. An AVB controller in the audio device will maintain persistent connections and remake connections after power cycle or other interruptions, such as the unplugging of an Ethernet link.
AVB Talker	A device that is an AVB source capable of transmitting AVB streams. This device will send AVB streams to an AVB Listener. When an AVB Talker is on the network, it advertises its presence and the streams it is able to transmit.
Channel	The Channel Name is used to identify a specific channel within an AVB stream.
CRF	Clock Reference Format
Cross-point	A point in the summing/delay matrix where the routing between inputs and outputs is assigned.
Device Settings	Current state of all control points (gain, EQ, delay, routing, etc.) of a GALAXY processor.
Entity Name	The Entity Name is used to uniquely identify an AVB entity. All entities must be unique within a Group.
Global Environment	Environmental settings (temperature, humidity and altitude) for all linked devices.
Global Project	File saved to a computer that includes all of the Projects from the selected processors and the current Device Settings for each processor.
Global Snapshot	A Snapshot, capturing all of the current Device Settings, which is stored in each processor, with the same name.
Group Name	Associates multiple AVB devices connected to the same network. The Group Name must be identical for an AVB Talker (Source) and AVB Listener (Sink) to establish AVB connections.
Media Status	Media Status indicates whether the Listener AVB stream is locked to the Media Clock rate of the AVB Talker.
MSRP	Multi-Stream Reservation Protocol
MSRP Accumulated Latency	The worst case amount of time it will take a signal to pass from the AVB Talker to the AVB Listener. This value is calculated when the Stream Reservation value is propagated from the AVB Talker to the AVB Listener.
Presentation Time	A timestamp an AVB Talker sends, set in the future with respect to the master clock time, for when the signal is to be 'presented' at the output of the AVB Listener. This approach ensures that signals are reproduced simultaneously at different AVB Listeners regardless of the varying path lengths a signal may have to traverse.
Project	A file saved to a computer that includes all of the Snapshots stored in the GALAXY processor and the current Device Settings.
Selected Device	Devices that are designated to be Globally Linked by clicking SELECT in the Link column of the Compass > Inventory tab. The ID selection from the adjacent column allows for multiple Global Link Groups of processors. There are three modes for Global Linking, selectable on the GALAXY Preferences> Global Linking tab.
SIM	Source Independent Measurement
Sink	An AVB Listener has at least one Sink, a virtual input. Each Sink can receive one AVB Stream.

Snapshot	A Snapshot contains all of the control point values captured, named, and stored in the GALAXY processor hardware. When Snapshots are recalled, all of the control point values of GALAXY processor are overwritten with the stored values, with the possibility to exclude some parameters via the confirmation dialog. Snapshots are listed in the Snapshot Library on the Project tab and are limited to a maximum of 255. Click on the Snapshot name to select, then click the desired function button on the right of Library list.
Source	An AVB Talker has at least one Source, a virtual output. Each Source makes one AVB Stream available on the network.
Stream Format	The combination of samples per frame, channels per frame, sample rate, and bit depth of a data stream, which is specified in the IEEE 1722-2016 Standard, Transport Protocol for Time-Sensitive Applications in Bridged Local Area Networks.
Stream Name	Identifies a specific AVB stream created by an AVB source.

## APPENDIX H: COMPLIANCE

### FCC DECLARATION OF CONFORMITY

Trade Name: Meyer Sound Laboratories  
Product Name: Loudspeaker Management System  
Product Model Numbers: Galileo Galaxy 408



2832 San Pablo Avenue  
Berkeley, California 94702  
USA

T: +1 510 486.1166  
F: +1 510 486.8356

info@meyersound.com  
www.meyersound.com

These devices comply with Part 15 of the FCC Rules  
Operation is subject to the following conditions:  
The devices may not cause harmful interference, and  
The devices must accept any interference received, including  
interference that may cause undesired operation

### RESPONSIBLE PARTY

Responsible Party's Name: Meyer Sound Laboratories  
Address: 2832 San Pablo Ave, Berkeley CA. 94702, USA  
Telephone: 510-486-1166

Signature: \_\_\_\_\_

A handwritten signature in blue ink, appearing to read "Alan Hutchinson", written over a horizontal line.

Date: 26 August 2016  
Printed Name: Mr. Alan Hutchinson, Regulatory Compliance Engineering Manager

### FCC Class B Notice

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

### ICES-003 Class B Notice - Avis NMB-003, Classe B

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

## FCC DECLARATION OF CONFORMITY

**Trade Name:** Meyer Sound Laboratories  
**Product Name:** Loudspeaker Management System  
**Product Model Numbers:** Galileo Galaxy 816, 816 AES, BLUEHORN 816



2832 San Pablo Avenue  
Berkeley, California 94702  
USA

T: +1 510 486.1166  
F: +1 510 486.8356

info@meyersound.com  
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**These devices comply with Part 15 of the FCC Rules  
Operation is subject to the following conditions:  
The devices may not cause harmful interference, and  
The devices must accept any interference received, including  
interference that may cause undesired operation**

### RESPONSIBLE PARTY

**Responsible Party's Name:** Meyer Sound Laboratories  
**Address:** 2832 San Pablo Ave, Berkeley CA. 94702, USA  
**Telephone:** 510-486-1166

**Signature:**  \_\_\_\_\_

**Date:** 13 March 2017  
**Printed Name:** Mr. Alan Hutchinson, Regulatory Compliance Engineering Manager

### FCC Class B Notice

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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