

# A Comprehensive Technical Guide to the Symetrix Prism 8x8 DSP: Architecture, Dante Integration, and Professional Audio Engineering

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In the evolving landscape of professional audio integration, the transition from fixed-architecture hardware to open-architecture Digital Signal Processors (DSPs) has redefined how engineers approach system design. At the forefront of this shift is the **Symetrix Prism 8x8**, a high-performance audio processing unit designed to provide a balance between processing power, input/output flexibility, and cost-effectiveness. This article provides an exhaustive analysis of the Prism 8x8 ecosystem, exploring its hardware engineering, the nuances of the **Dante™** protocol integration, and the sophisticated logic-driven workflows enabled by the Symetrix Composer software.

## The Core Architecture of the Prism 8x8 DSP

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The Symetrix Prism 8x8 serves as the central nervous system for mid-to-large-scale audio installations. Architecturally, it is defined by its **8 analog mic/line inputs** and **8 analog line outputs**. Unlike lower-tier processors that utilize fixed signal paths, the Prism series utilizes an open-architecture DSP environment. This means that every stage of the signal chain—from the initial gain stage at the pre-amp to the final output limiter—is modular and configurable by the systems designer.

### High-Fidelity Analog Front-End

The quality of any DSP is ultimately limited by its **Analog-to-Digital (A/D)** and **Digital-to-Analog (D/A)** conversion stages. The Prism 8x8 utilizes industry-leading mic pre-amps with a focus on a low noise floor and high dynamic range. Key specifications of the analog front-end include:

- **Phantom Power:** Individual +48V DC software-controllable phantom power for condenser microphones.
- **Gain Range:** High-resolution gain steps that allow for precise calibration of various source levels, from low-output ribbon mics to high-level line sources.
- **Dynamic Range:** Typically exceeding 110 dB, ensuring that the nuances of the audio signal are preserved through the conversion process.
- **Total Harmonic Distortion (THD + N):** Measured at extremely low percentages, ensuring minimal coloration of the signal.

### Processing Power and SHARC DSP Technology

Under the hood, the Prism 8x8 utilizes **Analog Devices SHARC** processors. These Floating-Point processors are optimized for digital signal processing, allowing for complex algorithms such as **Acoustic Echo Cancellation (AEC)**, feedback suppression, and multi-band parametric equalization to run with near-zero latency. The efficiency of the SHARC architecture ensures that even with a high count of logic gates and signal processing modules, the system remains stable and responsive.

## Dante Networking: The 64x64 Digital Backbone

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Perhaps the most significant feature of the Symetrix Prism 8x8 is its integration of the **Dante™** (Digital Audio Guide through Ethernet) protocol. While the physical chassis provides 8x8 analog I/O, the digital capability expands to a

**64x64 Dante network audio capacity.** This allows the Prism 8x8 to act as a bridge between localized analog sources and a globalized digital network.

**Understanding Dante Latency and Synchronization**

Dante utilizes **Internet Protocol (IP)** based networking to transport uncompressed, multi-channel digital audio. For the Prism 8x8, this means integration into a Layer 3 network environment. One of the critical engineering metrics in this setup is **Deterministic Latency**. Through the Dante Controller, users can set latency intervals—typically ranging from 0.25ms to 5.0ms—depending on the network's switch hop count and traffic congestion.

**Redundancy and Reliability**

In mission-critical environments, such as corporate boardrooms or performance venues, audio reliability is non-negotiable. The Prism 8x8 supports high-bandwidth audio streaming over standard **Category 6 (Cat6)**cabling. By utilizing the 64x64 digital matrix, a single Prism unit can receive audio from a remote stage box, process it, and distribute it to multiple amplifiers or recording interfaces across the facility without the signal degradation associated with long analog cable runs.

**Technical Specifications and Metric Comparison**

To understand where the Prism 8x8 sits in the marketplace, it is essential to compare it against its siblings in the Prism family. The following table provides a breakdown of the hardware capabilities across the series.

| Feature        | Prism 4x4          | Prism 8x8        | Prism 12x12      | Prism 16x16      |
|----------------|--------------------|------------------|------------------|------------------|
| Analog Inputs  | 4 (Mic/Line)       | 8 (Mic/Line)     | 12 (Mic/Line)    | 16 (Mic/Line)    |
| Analog Outputs | 4 (Line)           | 8 (Line)         | 12 (Line)        | 16 (Line)        |
| Dante Channels | 64 x 64 (Optional) | 64 x 64          | 64 x 64          | 64 x 64          |
| Logic I/O      | No                 | Yes              | Yes              | Yes              |
| Display        | OLED Front Panel   | OLED Front Panel | OLED Front Panel | OLED Front Panel |
| Sample Rate    | 48 kHz             | 48 kHz           | 48 kHz           | 48 kHz           |

As evidenced by the data, the **Prism 8x8** represents the "sweet spot" for many installations, providing a balanced I/O count that fits standard equipment racks while maintaining the full 64x64 Dante capacity found in the larger 16x16 units.

## The Symetrix Composer Software Ecosystem

The hardware is only half of the equation; the **Symetrix Composers** software is where the actual system design occurs. Composer provides a Windows-based environment for the configuration of Symetrix DSPs. Unlike software that uses a fixed routing matrix, Composer allows for a "blank canvas" approach.

### Modular Signal Processing Blocks

Within Composer, designers can drag and drop specific processing modules, including:

- Dynamics: Compressors, Limiters, Expanders, and Gates. These include advanced look-ahead algorithms to prevent transient clipping.
- Equalization: From simple shelving filters to 31-band graphic EQs and surgical parametric EQs with adjustable Q-factors.
- Mixing and Routing: Matrix mixers (e.g., 8x8, 16x16, or custom sizes) that allow any input to be routed to any output with individual crosspoint gain control.
- Delay: Essential for time-aligning speakers in a large space to ensure phase coherency and localized imaging.

### Logic and Automation

The Prism 8x8 is not merely an audio processor; it is also a logic controller. By using **Logic Modules** (AND, OR, NOT gates, Flip-Flops, and Latches), an engineer can program the DSP to respond to external events. For example, a fire alarm system trigger can be wired to the Prism's General Purpose Inputs (GPI) to automatically mute all audio or trigger an emergency announcement stored in the unit's internal memory.

## Advanced Implementation: The Field Guide to Installation

Successfully deploying a Prism 8x8 requires careful consideration of the network infrastructure and physical environment. Follow these procedural steps for a professional installation:

### 1. Network Infrastructure Preparation

The Prism 8x8 requires a Gigabit Ethernet backbone for Dante stability. It is recommended to use **Managed Switches** with **Quality of Service (QoS)** capabilities. QoS should be configured to prioritize Dante clock

synchronization and audio packets over general data traffic. Furthermore, **Energy Efficient Ethernet (EEE)** or "Green Ethernet" must be disabled on all switches, as it can interfere with Dante clocking and cause audible dropouts.

## 2. Gain Staging and Calibration

Proper gain staging is critical to maintaining a high Signal-to-Noise Ratio (SNR). The process should follow these steps:

1. Set the input sensitivity in Composer to match the source device.
2. Adjust the mic-pre gain so that the average signal levels hover around -20 dBFS to -18 dBFS, allowing for sufficient headroom for peaks.
3. Utilize the Peak Limiter module at the output stage to protect downstream amplifiers and transducers.

## 3. External Control Integration

The Prism 8x8 supports a variety of control protocols, including **Symetrix ARC Wall Panels**, **ARC-WEB** (a browser-based interface), and third-party control systems like Crestron or Extron via **TCP/IP or UDP strings**. This allows end-users to adjust volume or select sources without needing access to the back-end configuration.

# Mathematical Foundations of DSP Processing

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To appreciate the precision of the Prism 8x8, one must look at the mathematical operations occurring thousands of times per second. Digital audio processing is fundamentally an exercise in **Discrete-Time Signal Processing**.

## The Nyquist-Shannon Sampling Theorem

The Prism 8x8 operates at a standard sample rate of **48 kHz**. According to the Nyquist-Shannon theorem, to accurately reconstruct a signal, the sampling frequency ( $f_s$ ) must be at least twice the highest frequency component ( $f_{\max}$ ) of the signal ( $f_s > 2f_{\max}$ ). With a 48 kHz sample rate, the Prism 8x8 can accurately process frequencies up to 24 kHz, which is well beyond the upper limit of human hearing (20 kHz), providing a safety buffer for anti-aliasing filters.

## Latency Calculation

The total latency ( $L_{\text{total}}$ ) in a Prism-based system is the sum of the conversion latency ( $L_{\text{conv}}$ ), the processing latency ( $L_{\text{proc}}$ ), and the network latency ( $L_{\text{net}}$ ).

$$L_{\text{total}} = L_{\text{conv}} + L_{\text{proc}} + L_{\text{net}}$$

On the Prism 8x8,  $L_{\text{conv}} + L_{\text{proc}}$  is typically sub-millisecond, often around 600 microseconds. When combined with a standard Dante latency of 0.25ms, the total system latency remains well below the threshold of human perception (typically considered to be 10-15ms for audio-to-video sync and even lower for monitoring).

# Troubleshooting and Performance Optimization

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Even with high-end hardware like the Symetrix Prism 8x8, issues can arise due to configuration errors or environmental factors. Below are common failure modes and their technical solutions.

## Issue: Dante Clock Jitter or Unmute Failures

**Diagnosis:** This is often caused by a conflict in the **Precision Time Protocol (PTP)**. If multiple devices are competing to be the "Grandmaster" clock without a clear hierarchy, synchronization will fail.

**Solution:** Use Dante Controller to manually assign a "Preferred Master" (ideally a device that is always on and has a stable internal clock, like the Prism 8x8). Ensure that the switch ports are not blocking PTP traffic (UDP ports 319

and 320).

### Issue: Excessive Noise or "Hiss" in the Signal

**Diagnosis:** This is usually a symptom of poor gain staging where a low-level signal is being boosted at a late stage in the digital path, effectively raising the noise floor.

**Solution:** Re-calibrate the input gain at the pre-amp stage. Ensure that the "Digital Trim" is not being used to compensate for a weak analog input signal. If the issue persists, verify that 48V phantom power is only active on channels that require it.

### Issue: Acoustic Echo in Conferencing

**Diagnosis:** Failure of the AEC algorithm to properly identify the "Reference" signal.

**Solution:** In Symetrix Composer, ensure the **AEC Reference** is correctly tapped from the far-end audio signal before it enters the local room's mixing matrix. Check that the room's RT60 (reverberation time) is within the AEC module's tail-length capability.

## The Future of Audio Processing with Prism

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The Symetrix Prism 8x8 occupies a critical niche in the AV industry. By combining robust analog I/O with the massive scalability of the Dante network, it provides a future-proof platform for audio distribution. As facilities move toward **AV-over-IP**, the ability of the Prism to handle 64 digital channels ensures it will remain relevant even as the physical needs of a space change. The integration of high-level logic, user-friendly control interfaces, and studio-grade audio quality makes it an essential tool for the modern technical writer, engineer, and systems designer.

In conclusion, the Prism 8x8 is more than just a processor; it is a comprehensive solution for signal management. Its design philosophy emphasizes transparency—both in its audio reproduction and its software interface—allowing the complex mathematics of digital signal processing to serve the ultimate goal of clear, impactful, and reliable communication.

## Baca Juga (Artikel Terkait)

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- [Comprehensive Technical Analysis and Restoration Guide for the AIWA NSX-D55 Hi-Fi System](http://123caramba.com/aiwa-nsx-d55-service-manual-technical-restoration-guide.pdf)

URL: <http://123caramba.com/aiwa-nsx-d55-service-manual-technical-restoration-guide.pdf>

- [A Comprehensive Engineering Analysis of Portable Audio Solutions: The Aiwa WAS and AW Series Technical Deep-Dive](http://123caramba.com/technical-analysis-aiwa-portable-audio-pa-systems.pdf)

URL: <http://123caramba.com/technical-analysis-aiwa-portable-audio-pa-systems.pdf>

- [The Engineering of High-Fidelity: A Technical Analysis of Audio Rankings and System Benchmarking](http://123caramba.com/engineering-high-fidelity-audio-rankings-technical-analysis.pdf)

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- [The Foundations of High Fidelity: A Comprehensive Technical Analysis of H.A. Hartley's Audio Design Principles](http://123caramba.com/technical-analysis-ha-hartley-audio-design-handbook.pdf)

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