

# ControlSpace® ESP-1600 engineered sound processor

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## Product Overview

The Bose® ControlSpace® ESP-1600 engineered sound processor is an open-architecture DSP with 16 analog inputs, an 8-channel ESPLink output and a rear-panel digital expansion slot offering IP-based network audio and control card options. This model meets today's strict requirements for high-quality signal processing and control in a cost-effective package. The ESP-1600 is designed for a wide variety of applications ranging from small self-contained projects to larger networked applications.

## Product Information

The ESP-1600 accommodates a total of 56 audio channels through analog audio connections (16 input), ESPLink (8 output), and when an optional Dante™ audio network card is used, an additional 32 channels (16 input, 16 output) are available for signal processing, routing and switching. Alternatively, a Network Control card is available for clean rear-panel control network connections. For standalone applications or convenient service access, a front panel Ethernet connector allows for local configuration and monitoring. Onboard connectivity includes Serial over Ethernet, RS-232, 5 control inputs and 5 control outputs.

Any of the elegant Bose wall-mounted user interfaces— including the programmable CC-64 and CC-16 controllers, GPIO room controllers and ControlSpace Remote app for iOS/Android devices — can be used to control all Bose networkable devices.

Open architecture configuration and control is enabled using Bose ControlSpace Designer™ software where an ever-expanding list of algorithms and improvements offers a high level of functionality for audio installations. Bose single-rack-space ESPs are designed for a wide variety of applications ranging from small self-contained projects to larger networked applications.

## Applications

- Auditoriums
- Houses of worship
- Resorts and hospitality venues
- Stage-box applications
- Schools and universities
- Health clubs

## Key Features

- **High-quality analog circuitry** offers both mic and line-level inputs with ultra-low noise and 115 dB dynamic range
- **Advanced digital signal processing** supports audio at 48 kHz sample rate/24-bit, uses a floating-point open architecture DSP and operates at low latencies for sound system precision
- **Expansion card slot** supports the use of accessory networking cards, allowing digital audio to be sent and/or received from other compatible products
- **Optional Dante™** network cards allow ESP processors to closely integrate with other product supporting Audinate®'s Dante audio networking solution
- **Bose® ControlSpace® Designer™ software** enables a large set of signal processing modules, such as automatic mic mixing, multiband graphic and parametric EQs, Bose loudspeaker libraries, signal generators, routers, mixers, AGCs, duckers, gates, compressors, source selectors and delays
- **Front panel RJ-45 Ethernet** connection enables localized configuration and monitoring, while enabling network passthrough when using a rear-panel network option card
- **Built-in Bose ESPLink output** sends up to 8 channels of uncompressed digital audio to ESPLink-equipped Bose PowerMatch® amplifiers
- **A variety of control options** – ControlSpace ESP products are compatible with the programmable Bose CC-64 and CC-16 controllers, GPIO control using the simplified Bose room controllers, and ControlSpace Remote, and iOS/Android™ control application for phones and tablets
- **Integration with industry-standard control systems** using a comprehensive serial protocol through onboard RS-232 and Ethernet ports

# ControlSpace<sup>®</sup> ESP-1600

engineered sound processor



## Technical Specifications

Integrated DSP	
Signal Processor	32-bit fixed/floating-point DSP + ARM, 456 MHz
Maximum Calculation	3.6 GIPS / 2.7 GFLOPS
Delay	43 s
Audio Latency	860 μs (analog in to analog out)
A/D and D/A Converters	24-bit
Sample Rate	48 kHz
Audio Performance Specifications	
Frequency Response	20 Hz - 20 kHz (+0.3 dB/-0.1 dB)
THD+N	0.002 % at +4 dBu (A-weighted/20 Hz – 20 kHz)
Channel Separation (Crosstalk)	< -105 dB at +4 dBu input and output level, 1 kHz
Dynamic Range	> 115 dB A-weighted 20 Hz – 20 kHz, analog through
Audio Inputs	
Input Channels	16 analog (balanced, mic/line level), 16 digital (via optional card)
Connectors	3.81 mm Phoenix Contact <sup>®</sup> , 6-pin
Input Impedance	12 kΩ @ 1 kHz (with or without phantom power active)
Maximum Input Level	+24 dBu
Equivalent Input Noise	<-119 dBu (22 - 20 kHz, 150 Ω input, 64 dB gain)
Phantom Power	+48 VDC, 10 mA, selectable per input
Gain settings	0/14/24/32/44/54/64 dB
Audio Outputs	
Output Channels	8 ESPLink, 16 digital (via optional card)
Control Inputs	
Inputs (Control)	5 analog or digital inputs, 2 kΩ internal pull-up resistor to 5 V, 3.81 mm Phoenix Contact <sup>®</sup> , 6-pin
Analog Input Voltage Range	0 V to 3.3 V (maximum 5 V)
Digital Input Voltage Range	0 V to 3.3 V (threshold voltage = 1.6 V)
Control Outputs	
Outputs (Control)	5 digital outputs, 3.81 mm Phoenix Contact <sup>®</sup> , 6-pin
Connectors, Output	5 digital outputs, 3.81 mm Phoenix Contact <sup>®</sup> , 6-pin
Output Voltage	High: 8 V (open circuit), 2.5 V @ 10 mA, Low: < 1 V @ 100 mA, push-pull
Output Current	10 mA source, 100 mA sink (24 VDC max external supply voltage)
Indicators and Controls	
LED Status Indicators	Power/Status, Signal, Ethernet, Serial (RS-232 + CC-16)
Audio Signal Indication	Green (-60 to -19 dBFS), Yellow (-20 to -2 dBFS), Red (-1 dBFS to Clip)
Electrical Specifications	
Mains Voltage	85 VAC-264 VAC 50/60 Hz
AC Power Consumption	37 VA typical, over all mains voltages
Mains Connector	IEC 60320-C14 (Inlet)
Power Dissipation	22 W (75 BTU/Hr, 19 kcal/hr)
Physical	
Dimensions	1.7" H x 19" W x 8.5" D (44 mm x 483 mm x 215 mm)
Net Weight	5.8 lb (2.6 kg)
Operating Temperature	32 °F - 104 °F (0 °C - 40 °C)
Cooling System	Passive, side venting
General	
PC Configuration Software	ControlSpace <sup>®</sup> Designer™ software
Network Control	Ethernet (RJ-45), 100Mb
Communications Ports	RS-232 (DB9M, DTE), Bose CC-16 (3.81 mm Phoenix Contact <sup>®</sup> , 3-pin)
Expansion Slots	1 control/audio network
Audio Channel Capacity	56 (16x0 analog, 8 ESPLink out, 16x16 digital with expansion card)

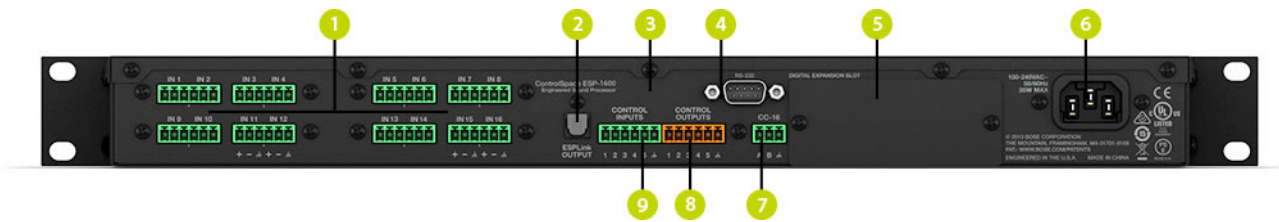
# ControlSpace® ESP-1600 engineered sound processor

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TECHNICAL DATA SHEET



1. **LED indicators** - Power, Signal, Ethernet and Serial indication
2. **Ethernet connector** - RJ-45 jack for front panel network connectivity
3. **Front rack-mount ears** - For use when securing into rack enclosures



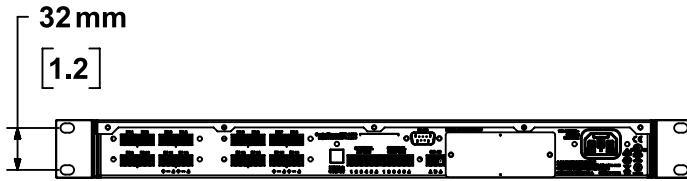
1. **Analog audio connectors** – Mic/line-level balanced input connectors
2. **ESPLink output connector** – For use with ESPLink card-equipped PowerMatch® amplifiers
3. **Chassis serial number** – Location for unit serial number
4. **RS-232** – 5-wire, RS-232-C (DTE) serial data interface connection
5. **Digital expansion slot** – Supports optional digital expansion cards
6. **AC Mains receptacle** – Power cord connection (IEC 60320-C14 inlet)
7. **CC-16 connector** – Allows Bose® CC-16 zone controller connections
8. **Control Outputs connector** – Five general-purpose control outputs
9. **Control Inputs connector** – Five general-purpose control inputs

# ControlSpace® ESP-1600

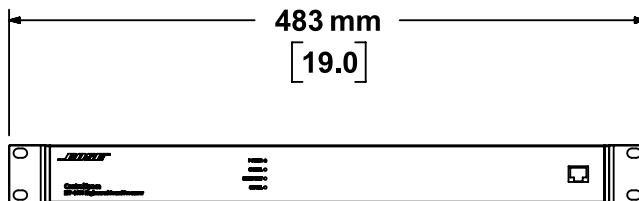
engineered sound processor



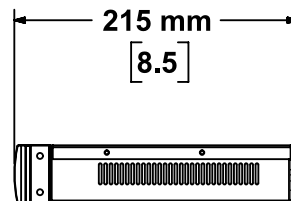
## Mechanical Diagrams



**Back View**



**Front View**



**Right View**

TECHNICAL DATA SHEET

# ControlSpace® ESP-1600 engineered sound processor



## Software Information

Bose® ControlSpace® Designer™ software is used for the design, configuration, real-time operation and monitoring of a system containing selected Bose system electronics and control centers. Using a standard drag-and-drop user interface, ControlSpace Designer software offers the flexibility to quickly and accurately configure signal processing functions within processors, and to develop complex control programming for system operation.

When actively connected to the system ControlSpace Designer software can be used to either control and operate the system in real time for system set-up and optimization, or may be used as a system monitor. When configured for monitor mode device parameters are protected and the system operator only has access to virtual control panels and amplifier monitor functions.

Parameter sets provide the ability to program and recall system settings ranging from an individual signal processing parameter to a complete system setup; while Group controls provide master volume control of multiple gains, or control of multiple instances of the same signal processing function type. Both Parameter set and Group programming functions are easily mapped to the physical controls of a Bose control center, or may be invoked remotely using a standard serial protocol or general purpose inputs.

Smart Simulation programming enables designers to test and modify system control programming while off-line, eliminating the need to connect to the actual system to configure and test system control programming. Virtual control centers are included to test system operation, and all parameter set, group and general purpose input and outputs may be tested using the Smart Simulation.

Integrated Dante routing, configuration and monitoring streamlines setup and control of optional Dante networked audio components.

### Minimum System Requirements

The following are the minimum system requirements for ControlSpace® Designer™ 4.2

#### Operating System:

Microsoft Windows® 7 and 8, x86 and x86-64 bit versions

#### Processor:

1GHz processor (or better)

#### RAM:

512MB of RAM available (1GB recommended)

#### Disc Space:

512MB of disk space available (1GB recommended)

#### Ports Required:

1 USB, 1 network port (Wired LAN, Ethernet, 100 Mb minimum, or wireless LAN 802.11g/n)

#### USB & Interfaces:

1 available USB port

A scroll-wheel mouse (highly recommended)

#### Network Port:

1 available network port (wired LAN, Ethernet, 100 MB minimum, or wireless LAN 802.11g/n)

## Expansion Cards

### ControlSpace® Fixed-I/O network control card

Adds a rear-panel network connection to fixed-I/O ControlSpace engineered sound processors.

**Product Code:** 359841-0010

### ControlSpace® Fixed-I/O Dante™ network card

Provides 16 input and 16 output channels of low-latency digital audio using the Dante audio networking solution from Audinate®.

**Product Code:** 359842-0020

## Architects' and Engineers' Specifications

The engineered sound processor shall be an open-architecture audio signal processor supporting 16 analog microphone/line inputs, 8 digital output channels (over optical ESPLink) and optional 32-channel audio network connectivity through one expansion card slot. The total channel capacity of the processor shall be 56 audio channels.

The digital signal processing shall be performed by a Texas Instruments® brand OMAP-L137 DSP+ARM chip running at 456 MHz, supporting both fixed and floating-point calculations at 6.4 GIPS / 4.8 GFLOPS, and utilizing a total of 64MB of RAM (42 seconds of buffer) for delay operations. All processing shall be done at 32-bit resolution, and audio sampling shall be at 48 kHz/24-bit. System latency, from input to output, shall not exceed 860 microseconds.

The front panel shall include LED indication for POWER, SIGNAL, ETHERNET, and SERIAL, as well as an Ethernet connection for standalone access or maintenance functions.

Design, configuration and real-time control/monitoring shall be provided through any active network port and Bose® ControlSpace® Designer™ software. The processor shall support the following minimum set of processing modules: Bose® Professional loudspeaker EQs, crossovers, graphic and parametric EQs, routers, delays, matrix mixers, automatic microphone mixer, signal generators, meters, compressor/limiters, duckers, automatic gain controls, gate and source selectors.

The engineered sound processor shall include external control capability by means of serial commands (RS-232), IP commands (over Ethernet port), five general-purpose control outputs and five general-purpose inputs. The engineered sound processor shall support up to 16 Ethernet-based CC-64 control centers, up to 15 Bose CC-16 zone controllers, up to 8 ControlSpace Remote apps (iOS or Android), and multiple volume and switch-based selector controllers using the onboard GPI connections.

All signal-processing modules, parameter sets and groups shall be directly controllable by Bose user interfaces, generic switches and 10k potentiometers, and third-party control systems (using a published serial protocol). The processor shall provide a real-time clock (RTC) by which automated events can be scheduled using the configuration software.

The processor shall be designed for 19-inch (483 mm) EIA-310 standard rack mounting; dimensions shall be 1.7 inches in height (44 mm, 1RU) and 8.5 inches (215 mm) in depth; 5.8 pounds (2.6 kg).

The processor shall have a universal auto switching power supply capable of accepting input voltages from 85 VAC to 264 VAC, 50 Hz to 60 Hz, and be able to operate in ambient temperatures up to 104°F (40°C). Power consumption shall be less than 25 W. Certifications shall include cUL, C-Tick, PSE and IEC/EN 60065, and have a CB report including all country deviations. The processor shall meet FCC Class A, Canadian ICES-003 Class A and EN55103-1 and EN55103-2 EMC requirements.

# ControlSpace® ESP-1600 engineered sound processor



The processor shall be the Bose ControlSpace® ESP-1600 engineered sound processor.

## Safety and Regulatory Compliance

The ControlSpace ESP-1600 engineered sound processor meets cUL (UL 60065 7th edition), C-Tick, PSE and IEC/EN 60065 7th edition, and has a CB report including all country deviations. It meets FCC Class A, Canadian ICES-003 Class A and EN55103-1 and EN55103-2 EMC requirements.

## Product Codes

### ESP-1600

ControlSpace ESP-1600 120V – US	359873-1120
ControlSpace ESP-1600 230V - EU	359873-2120
ControlSpace ESP-1600 100V – JPN	359873-3120
ControlSpace ESP-1600 230V – UK/ Sing	359873-4120
ControlSpace ESP-1600 240V – AU	359873-5120

## Accessories

ControlSpace CC-64 control center	041760
ControlSpace CC-16 zone controller	041761
ControlSpace CC-4 room controller	042023
ControlSpace® CC-PS1 universal power supply	371407-0010
Volume control with A/B switch user interface	041967
Volume control user interface	041966
ControlSpace® EP22-D 2In/2Out Dante™ Endpoint	738675-0010
ControlSpace® EP40-D 4 Input Dante™ Endpoint	738676-0010
ControlSpace® WP22B-D Dante™ Wall Plate	738677-0010
ControlSpace® WP22BU-D Dante™ Wall Plate	738678-0010

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