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 localized 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
## 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®, 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®, 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®, 6-pin
- **Connectors, Output**: 3.81 mm Phoenix Contact®, 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)

### 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® Designer™ software
- **Network Control**: Ethernet (RJ-45), 100Mb
- **Communications Ports**: RS-232 (DB9M, DTE), Bose CC-16 (3.81 mm Phoenix Contact®, 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

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
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

32 mm [1.2]

483 mm [19.0]

215 mm [8.5]
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.
- 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 60605, and have a CB report including all country deviations. The processor shall meet FCC Class A, CanadianICES-003 Class A and EN55103-1 and EN55103-2 EMC requirements.

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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 738675-0010
Dante™ Endpoint
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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