BOSE®
Better sound through research®

ControlSpace® ESP-880, ESP-1240, ESP-4120 and ESP-1600 Engineered Sound Processors

and CC-16 and CC-64 Controllers (US and non-US units)

includes Dante Wallplates and Endpoint Accessories

Service Manual

Reference Number 359862-SM Rev. 01

CONTENTS

SAFETY INFORMATION

1. Parts that have special safety characteristics are identified by the ⚠ symbol on schematics or by special notes on the parts list. Use only replacement parts that have critical characteristics recommended by the manufacturer.

2. Refer to the Hi-Pot and Ground Bond test information located on pages 106 and 107 of this service manual.

The Hi-Pot test MUST be performed on any unit where the repair required removal of the amplifier's top cover.

The ground bond test MUST be performed on any unit where the repair affects the ground wire connection inside the chassis.

These tests MUST be performed to ensure that the product is safe to return to the customer after a repair.

CAUTION: The Bose® ControlSpace® ESP-880, ESP-1240, ESP-4120 ESP-1600 Systems, CC-16 and CC-64 Controllers and Dante Wall Plates and Endpoints contain no user-serviceable parts. To prevent warranty infractions, refer servicing to warranty service stations or factory service.

WARRANTY

The Bose ControlSpace ESP-880, ESP-1240, ESP-4120, ESP-1600 Systems, CC-16 and CC-64 Controllers and Dante Wall Plates and Endpoints are covered by a limited 5-year transferable warranty.

PRODUCT DESCRIPTION

The Bose® ControlSpace® ESP-880, ESP-1240, ESP-4120 and ESP-1600 engineered sound processors are single-rack unit DSPs, available in analog I/O configurations of 8x8, 12x4, 4x12 and 16x0 (digital output only).

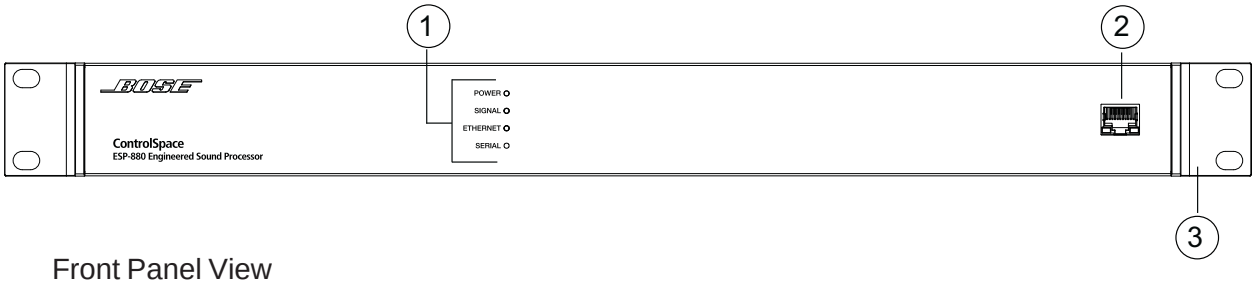
These cost effective models meet today's strict requirements for low latency audio processing with high-quality digital conversion and a powerful DSP.

Bose ControlSpace Designer™ software, available as a free download from pro.Bose.com, enables PC setup, control, and monitoring using standard Ethernet networks. A crossover network cable is supplied for direct-connection from PC to ESP-00 II. The *ControlSpace Designer Software Guide* can be downloaded as a PDF from pro.Bose.com or can found in the help system using ControlSpace Designer software.

Product Overview

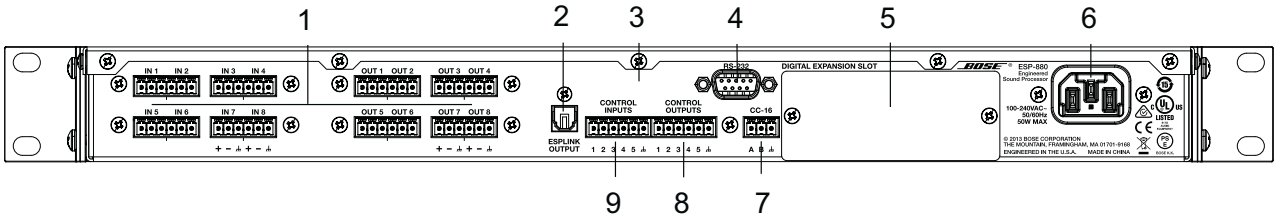
Front Panel

1. LED Indicators: Power, Signal, Ethernet and Serial indication
2. Ethernet Connector: RJ45 jack for front panel network connectivity
3. Front rack-mount ears: For use when securing into rack enclosures.



Front Panel View

Rear Panel
1. Analog audio connectors: Mic/Line-level balanced input and line-level output 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 interface connection
5. Digital expansion slot cover: 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 inputs



Rear Panel View

PRODUCT DESCRIPTION

Front Panel LED Indicators

Power LED Indicates power or fault state.
- Green: Power on
- Red: Fault error

Signal LED A general signal status indicator for all input and output channels.
- Green: Normal Signals on all channels
- Red: Clipping found on one or more channels. Connect using ControlSpace® Designer™ software for channel signal lever detail

Ethernet LED Indicates the connection status of the Ethernet control network.
Operating speed: 10BASE-T
- Green: Link established
- Yellow: Tx activity
- Red: Rx activity

Serial LED Indicates RS-232 or CC-64 serial command status. Does not indicate Serial over Ethernet activity.
- Green: RS-232 Rx/Tx activity
- Yellow: CC-16 controller command received
- Red: CC-16 controller command transmitted

Product Features:

- Bose® ControlSpace ESP-880/1240/4120/1600 engineered sound processors offer three analog I/O options with an open DSP architecture. ESP-1600 has 16 analog inputs and digital outputs, either 8 channels via the ESPLink jack or 16 via a plug-in digital output card.
- These single-rack unit models with different analog I/O options can more closely fit the requirements of both standalone and networked processing applications.
- High-quality analog circuitry offers both mic and line I/O, operates with ultra-low noise and > 113 dB dynamic range.
- Advanced digital signal processing converts audio at 48 kHz sample rate/24-bit, uses a floating-point open architecture DSP, and operates at low latencies for sound system precision.
- Front panel RJ-45 Ethernet connection enables localized configuration and control network access.
- Expansion Card Slot supports the use of accessory networking cards, allowing digital audio to be sent and/or received from other products and systems.
- Dante™ and AVB media networking cards allow the single-rack ESP products to closely integrate with Bose or other manufacturer's products and systems.
- Control and audio together on a single network cable. When using the accessory Dante and AVB network cards, all four ControlSpace ESP models utilize a single Ethernet network for both audio and control data, eliminating the need for two separate networks.
- A full suite of signal processing algorithms. Bose ControlSpace Designer software version 4.0 offers a large set of signal processing modules for Bose networked ESP products such as automatic mic mixing, multiband graphic and parametric EQs, Bose loudspeaker EQ libraries, signal generators, routers, mixers, AGCs, duckers, gates, compressors, source selectors and delays.
- Built-in Bose ESPLink output. Single-rack unit ESP models have integrated ESPLink optical outputs for sending up to 8 channels of uncompressed digital audio to ESPLink-equipped Bose PowerMatch® amplifiers.

PRODUCT DESCRIPTION

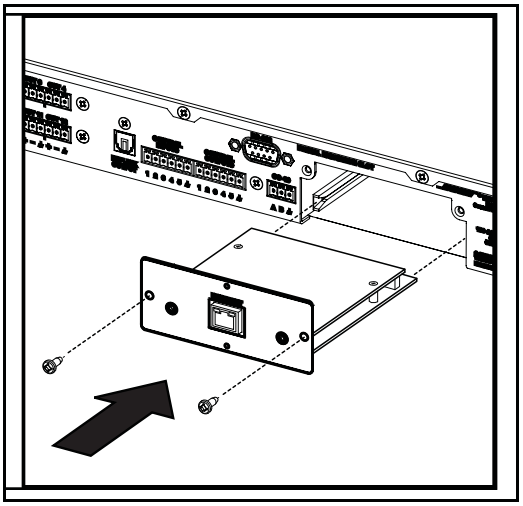
Product Features (continued):

- Integration with control systems and remote controls built by other manufacturers through built-in serial port (RS-232 and Ethernet) and GPIO capabilities.
- A variety of control options. ControlSpace® ESP products are compatible with all Bose® control centers and volume controls as well as potentiometers and switches built by other manufacturers.
- ControlSpace Designer™ version 4.0 software is used to configure both the signal processing and control capabilities of ControlSpace ESP processors. With the release of version 4.0 it is now possible to design, configure, control and monitor all Bose networked system electronics from a single application.
- One-Wire Networking using Expansion Cards. When using accessory Dante and AVB network cards, single-rack ESP models use a single Ethernet network for both control and audio data, eliminating the need for two separate networks. Combining both audio and control onto a single cable also reduces cost and allows for more efficient system design.

Available Accessories

Accessory Cards:

ControlSpace single-rack unit ESP processors offer network audio expansion from a single card slot on the rear panel.



Ethernet expansion cards

For further information on these cards, and to view new cards that are available, please visit pro.Bose.com.

- ControlSpace ESP-880/-1240/-4120/-1600 network control card PC 359841-0010
- ControlSpace ESP-880/-1240/-4120/-1600 Dante network card PC 359842-0020

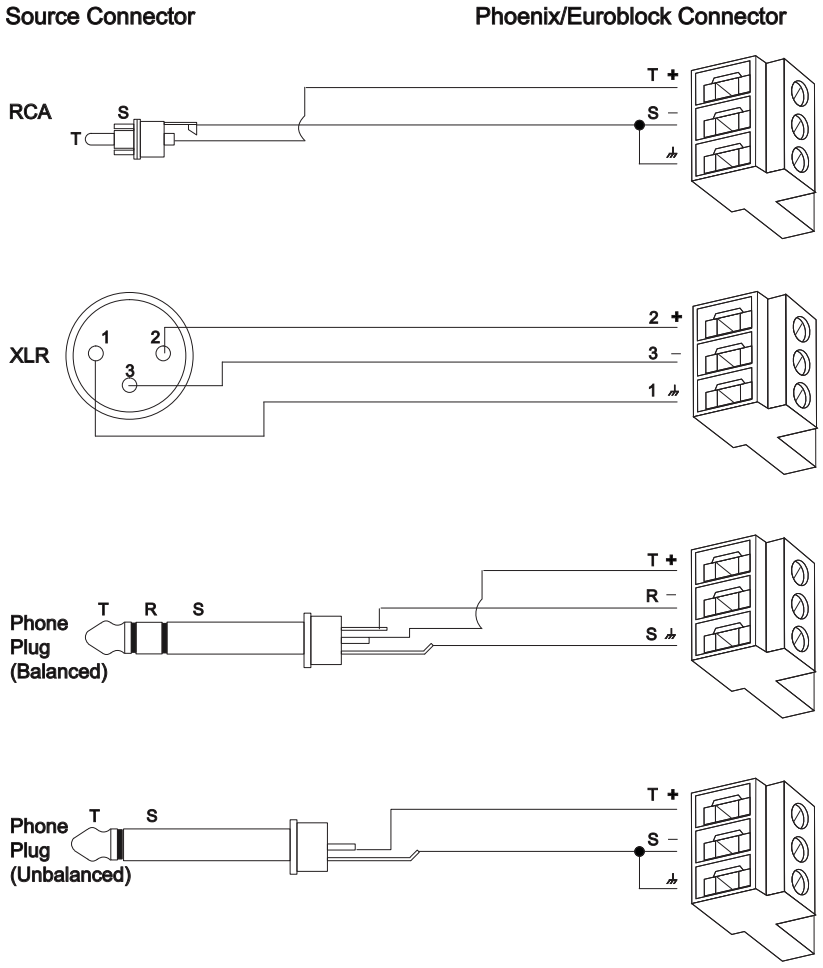
Control Interfaces:

The ControlSpace ESP-880, ESP-1240, ESP-4120 and ESP-1600 are compatible with all Bose control centers and volume controls. These devices can be associated with these units in the ControlSpace software to offer attractive, easy to operate end-user controls.

PRODUCT DESCRIPTION

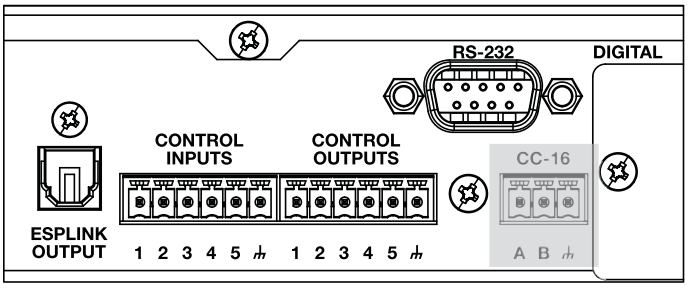
Audio Connections

All Phoenix/Euroblock connectors supplied with the single-rack ESP processor uses labeled Phoenix/Euroblock connectors to help with installations. Standard microphone or line level connections can be made to balanced.



CC-16, RS-232, and ESPLink connections

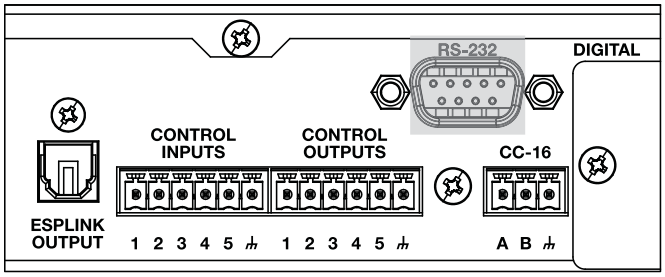
CC-16 Connector



CC-16 Connector
Phoenix/Euroblock 3-pin connector
Accomodates up to 15 CC-16 zone controllers
Max distance from ESP to any CC-16 is 2000 feet (610 m)

PRODUCT DESCRIPTION

CC-16, RS-232, and ESPLink connections (continued)

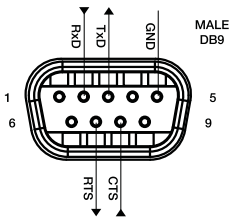


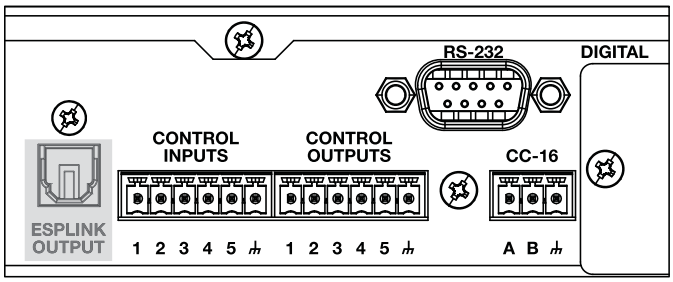
RS-232 Connector

Standard DB-9 male connector

Allows the ESP processor to send commands to other devices and receive commands intended to trigger parameter sets.

See DTE pinout below.





ESPLink Connector

Using TOSLINK connection, 8 channels of uncompressed low-latency audio can be distributed to one or many Bose PowerMatch amplifiers that are outfitted with ESPLink digital input cards.

Manufactured Versions

Product Description	Product Codes	No Fan / With Fan	# Analog Inputs	# Analog Outputs
ControlSpace ESP-880 120V – US	359868-1110	No Fan	8	8
ControlSpace ESP-880 230V – EU	359868-2110	No Fan	8	8
ControlSpace ESP-880 100V – JPN	359868-3110	No Fan	8	8
ControlSpace ESP-880 230V – UK/Sing	359868-4110	No Fan	8	8
ControlSpace ESP-880 240V – AU	359868-5110	No Fan	8	8
ControlSpace ESP-1240 120V – US	359869-1110	No Fan	12	4
ControlSpace ESP-1240 230V – EU	359869-2110	No Fan	12	4
ControlSpace ESP-1240 100V – JPN	359869-3110	No Fan	12	4
ControlSpace ESP-1240 230V – UK/Sing	359869-4110	No Fan	12	4
ControlSpace ESP-1240 240V – AU	359869-5110	No Fan	12	4
ControlSpace ESP-4120 120V – US	359870-1110	No Fan	4	12
ControlSpace ESP-4120 230V – EU	359870-2110	No Fan	4	12
ControlSpace ESP-4120 100V – JPN	359870-3110	No Fan	4	12
ControlSpace ESP-4120 230V – UK/Sing	359870-4110	No Fan	4	12
ControlSpace ESP-1240 240V – AU	359870-5110	No Fan	4	12

Note: Early versions of these products did not include a fan inside the chassis.

Continued on next page --->

PRODUCT DESCRIPTION

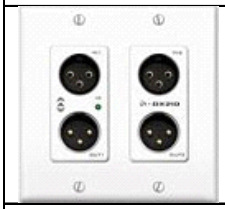
Manufactured Versions (continued)

Product Description	Product Codes	No Fan / With Fan	# Analog Inputs	# Analog Outputs
ControlSpace ESP-880 120V – US	359868-1120	With Fan	8	8
ControlSpace ESP-880 230V – EU	359868-2120	With Fan	8	8
ControlSpace ESP-880 100V – JPN	359868-3120	With Fan	8	8
ControlSpace ESP-880 230V – UK/Sing	359868-4120	With Fan	8	8
ControlSpace ESP-880 240V – AU	359868-5120	With Fan	8	8
ControlSpace ESP-1240 120V – US	359869-1120	With Fan	12	4
ControlSpace ESP-1240 230V – EU	359869-2120	With Fan	12	4
ControlSpace ESP-1240 100V – JPN	359869-3120	With Fan	12	4
ControlSpace ESP-1240 230V – UK/Sing	359869-4120	With Fan	12	4
ControlSpace ESP-1240 240V – AU	359869-5120	With Fan	12	4
ControlSpace ESP-4120 120V – US	359870-1120	With Fan	4	12
ControlSpace ESP-4120 230V – EU	359870-2120	With Fan	4	12
ControlSpace ESP-4120 100V – JPN	359870-3120	With Fan	4	12
ControlSpace ESP-4120 230V – UK/Sing	359870-4120	With Fan	4	12
ControlSpace ESP-1240 240V – AU	359870-5120	With Fan	4	12
ControlSpace ESP-1600 120V – US	359873-1120	With Fan	16	0
ControlSpace ESP-1600 230V – EU	359873-2120	With Fan	16	0
ControlSpace ESP-1600 100V – JPN	359873-3120	With Fan	16	0
ControlSpace ESP-1600 230V – UK/Sing	359873-4120	With Fan	16	0
ControlSpace ESP-1600 240V – AU	359873-5120	With Fan	16	0

Accessories

Description	Product Code
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

- 2 Dante wall-plates: WP22B-D (balanced) & WP22BU-D (balanced/unbalanced)
- 2 Dante rack/cabinet endpoints (EP22, EP40in)

WP22B-D	WP22B/U-D	EP22-D	EP40-D
			
2x2 wall plate Balanced PoE	2x2 wall plate Bal/Unbal PoE	2x2 rackmount Balanced I/O PoE	4 in rackmount Balanced PoE

PRODUCT DESCRIPTION

CC-16 Zone Controller

The Bose® ControlSpace® CC-16 zone controller is an elegant wall-mounted device designed to provide end-user control of ControlSpace systems. Custom programming allows the CC-16 to control a variety of the system elements, from switching audio sources to selecting “scenes” or system configurations. The CC-16 features a bitmap LCD and four buttons for displaying and controlling the system settings.

The CC-16 connects to the ControlSpace Engineered Sound Processor (ESP-88) at the RS-485 port. Up to fifteen CC-16 units can be used per each ESP-88 to provide localized control of the system. The maximum distance from ESP-88 to CC-16 is 2000 feet. As a networked device, remote reprogramming is possible at any time.

Features and Functions

- 122 x 32 pixel backlit blue LCD
- LCD displays volume level and source/scene/preset setting
- Select up/down buttons for selecting sources or scenes
- Volume up/down buttons for controlling one or more gain controls
- IR receiver (for IR remote controls)
- RS-485 network supports up to fifteen CC-16 units per ESP-88
- DIP-switch for specifying network address and termination
- Universal mounting bracket
- UL and CE listed

CC-64 Control Center

The Bose ControlSpace CC-64 control center is an elegant, programmable, networked controller that provides users with a simple and logical interface to their ControlSpace system. Because the controller is completely programmable, you can customize the ControlSpace system, making only certain controls available, and simplifying user interaction with the system.

The CC-64 provides four rotary encoders with circular LED arrays for a userfriendly method of managing gain settings or scene selections. A fifth encoder provides control over programmed “scenes” or presets. Four bank switch buttons redefine the four Gain/Selector control knobs, providing quick access for up to 16 system gain controls or selectors. A large, 2-line by 40-character backlit LCD provides the user with the names of the system elements they are controlling (gains, presets, etc.).

Using custom programming, the CC-64 can manage a variety of system elements, including audio sources, scene selection settings, and specific system configurations. Each gain control can be ganged so that a single control can be mapped to as many as sixteen system gains. The CC-64 also supports a “custom mode” – intended for installers, not end users – in which any parameter in the system can be viewed and changed using the LCD display and control knobs.

PRODUCT DESCRIPTION

CC-64 Control Center (continued)

The CC-64 is a 10Base-T Ethernet device. Up to sixteen CC-64s can be used per ControlSpace® system.

Features

- 2-line by 40-character backlit LCD
- Sixteen Gain/Selector controls (four banks of four)
  - Four rotary encoders for changing the gain level or selecting scenes/sources
  - Each encoder includes a 15-segment LED array for indicating the control's current level or state
  - The encoders feature push buttons for muting gain controls or making selections
  - Ten character descriptions of the gain controls appear on the LCD above the encoder
- Four bank switch buttons with label area
- Lock function in software prevents local changes
- 10Base-T Ethernet network based
- Sixteen CC-64s per ControlSpace system
- Power over Ethernet cable or separate cable
- LEDs for status, link and network transmit/receive
- Fits standard 5-gang electrical box
- UL6500 listed and CE approved

Functions

1. LCD
2. Preset/Scene selector
   - Rotate to view presets. Push to select.
   - Push and hold for 5 seconds to enter Custom mode.
3. Network link indicator
4. Network receive indicator
5. Network transmit indicator
6. Bank select buttons (4). Press to select one of four bank controls
7. Bank select indicators (4). Indicates the currently selected bank
8. Bank select label area. 1.25" (31.75 mm) x .35" (9 mm) area for custom labels.
   - Accepts standard 3/8" (9 mm) label stock.
9. Gain/Selector control knob. Rotary encoder (no stops). Push to mute.
10. Gain/Selector level indicators (15 levels/selections)

SPECIFICATIONS

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	4 to 16 analog, depending on model (balanced, mic/line level), 16 digital (via option 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	4 to 12 analog, depending on model (balanced, line level), 8 ESPLink, 16 digital (via optional card)) ESP-1600 is digital output only.
Connectors, Output	3.81 mm Phoenix Contact®, 6-pin (analog), EIAJ optical (ESPLink)
Output Impedance	66 Ω
Maximum Output Level	+24 dBu
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
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® 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 (8x8 analog, 8 ESPLink out, 16x16 digital with expansion card)

ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICE HANDLING

This unit contains ESDS devices. We recommend the following precautions when repairing, replacing or transporting ESDS devices:

- Perform work at an electrically grounded work station.
- Wear wrist straps that connect to the station or heel straps that connect to conductive floor mats.
- Avoid touching the leads or contacts of ESDS devices or PC boards even if properly grounded. Handle boards by the edges only.
- Transport or store ESDS devices in ESD protective bags, bins, or totes. Do not insert unprotected devices into materials such as plastic, polystyrene foam, clear plastic bags, bubble wrap or plastic trays.

PART LIST NOTES

1. The individual parts located on the PCBs are listed in the Electrical Part List.

2. This part is referenced for informational purposes only. It is not stocked as a repair part. Refer to the next higher assembly for a replacement part.

3. ⚠ This part is critical for safety purposes. Failure to use a substitute replacement with the same safety characteristics as the recommended replacement part might create shock, fire and/or other hazards.

PACKAGING PART LIST

ControlSpace® ESP-880, ESP-1240, ESP-4120 and ESP-1600 Systems

Item Number	Description	Part Number	Qty	Note
1	PACKING CUSHION, PE FOAM, ESP	373551-0010	2	
2	POLY BAG, L420Xw550, ROHS	-	1	
3	CARTON, CONTROLSPACE ESP ESP-880 ESP-1240 ESP-4120 ESP-1600	 370967-0010 370967-0020 370967-0030 370967-0040	1	
4	GUIDE, INSTALL	372643-0010	1	
5	ANTI-STATIC BUBBLE BAG, W150xL250MM, ROHS	-	1	
6	CONN, BRD-CBL, 3.81mm, SCR, 6 POS, ORG, AUD OUT ESP-880 ESP-1240 ESP-4120 ESP-1600	362015-0010	 4 2 6 0	
7	POLY BAG, L100Xw70MM, SELF LOCK, ROHS	-	1	
8	CONN, BRD-CBL, 3.81mm, SCR, 6 POS, GRN, AUD IN ESP-880 ESP-1240 ESP-4120 ESP-1600	362014-0010	 4 6 2 8	
9	POLY BAG, W100xL150MM, SELF LOCK, ROHS	-	1	
10	CABLE TIE, CV-100, ROHS	-	11	
11	CONN, BRD-CBL, 3.81mm, SCR, 6 POS, ORG, GEN P	362015-0020	1	
12	CONN, BRD-CBL, 3.81mm, SCR, 6 POS, GRN, GEN P	362014-0020	1	
13	CONN, BRD-CBL, 3.81mm, SCREW, 3 POS, GRN, CC-16	362016-0010	1	

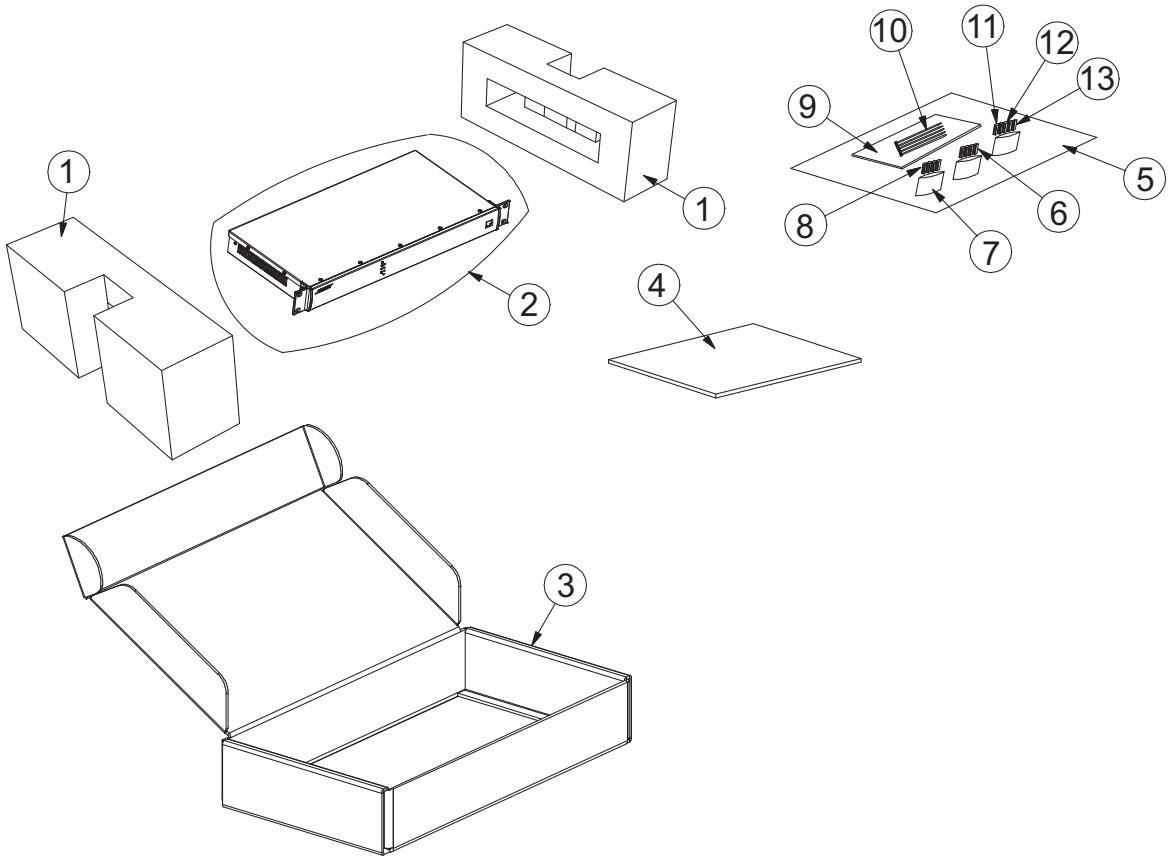


Figure 1. System Packing View

MAIN PART LIST

ControlSpace® ESP-880, ESP-1240, ESP-4120 Chassis (see Figure 2)

Item Number	Description	Part Number	Qty	Note
1	FRONT PANEL, ALUM, ESP-880 FRONT PANEL, ALUM, ESP-1240 FRONT PANEL, ALUM, ESP-4120 FRONT PANEL, ALUM, ESP-1600	359848-001S 359848-002S 359848-003S 359848-004S	1	
2	BRACKET, RACK EAR, BLACK	359849-0110	2	
3	LIGHT GUIDE, SLEEVE	369634-0110	1	
4	LIGHT GUIDE	361338-0010	1	
5	PCB ASSY, FRONT PANEL LED, SVCE	359836-001S	1	2
6	CABLE, FFC, MAIN LED, 5 COND, 70mm	370436-0010	1	
7	SCREW, M4X0.7X8MM, PAN, XREC, BLACK ZINC	370494-0110	4	
8	COVER, EXPANSION PORT, BLACK	359852-0110	1	
9	INSULATOR SHEET, POWER SUPPLY, LEXAN	370439-0010	1	3 ⚠
10	CABLE, MAIN-LAN, 5 COND	370438-0010	1	
11	HARNESS, DB9, 40mm	370441-0010	1	
12	PCB ASSY, POWER SUPPLY, SVCE	359832-001S	1	2
13	SCREW, M2.6X6MM, STPB, BLK ZINC	370492-0110	1	
14	SCREW, SI, MSB, M3x6. (+)C, STEEL W/WASHER	-	22	
15	SCREW, M3X0.5X6MM, PAN, XREC, BLACK ZINC	370493-0110	20	
16	PCB ASSY, MAIN DIGITAL, SVCE	359833-001S	1	2
17	PCB ASSY, OUTPUT, 4CH, SVCE ESP-880 ESP-1240 ESP-4120 ESP-1600	359835-001S	 2 1 3 0	2
18	PCB ASSY, MIC/LINE INPUT, 4CH, SVCE ESP-880 ESP-1240 ESP-4120 ESP-1600	359834-001S	 2 3 1 4	2
19	PCB ASSY, FRONT PANEL NETWORK, SVCE	359837-001S	1	2
20	HARNESS, PS-MAIN, 22AWG, 10COND	370437-0010	1	
21	STANDOFF, M/F, M3, 14MM LG, 5MM HEX	370491-0010	6	
22	TOP COVER, BLACK	359850-0110	1	
23	SCREW, M3X0.5X6MM, FLAT, XREC, BLACK	370495-0110	5	
24	CABLE, FFC, I/O BOTTOM SHORT, 40 COND, 46mm	370435-0010	1	
25	CABLE, FFC, I/O BOTTOM LONG, 40 COND, 80mm	370435-0020	1	
26	CABLE, FFC, I/O TOP SHORT, 40 COND, 140mm	370435-0030	1	
27	CABLE, FFC, I/O TOP LONG, 40 COND, 176mm	370435-0040	1	
28	FAN, 5VDC, 40MM	715907-001S	1	

Note: Early version ESP-880, ESP-1240 and ESP-4120 units do not have the fan.

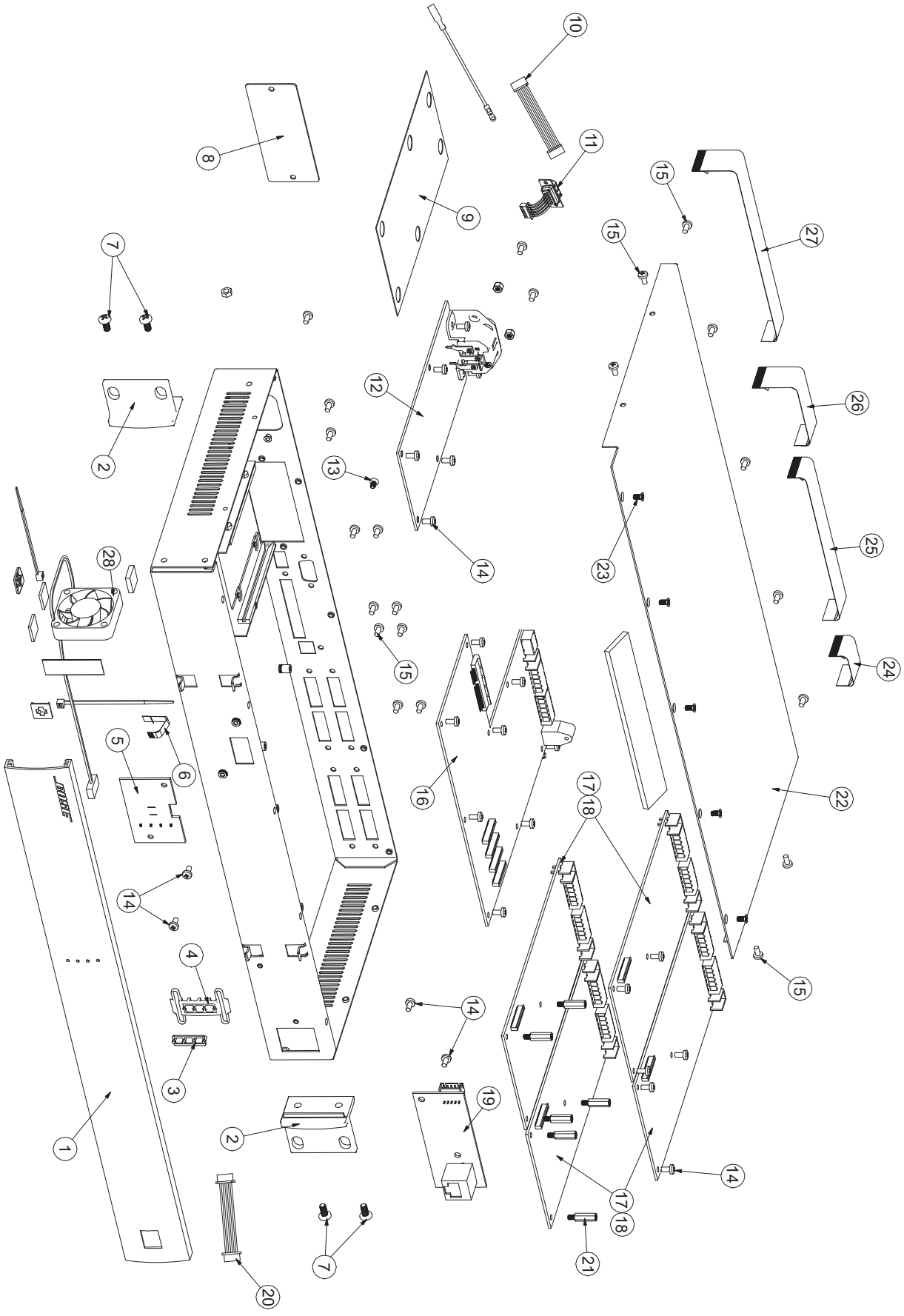


Figure 2. ControlSpace® ESP-880, -1240, -4120 and -1600 Chassis Exploded View

PACKAGING PART LIST

ControlSpace® CC-16 Controller

Item Number	Description	Qty.	Part Number	Note
1	Foam, White EPE	1	-	4
2	CC-16 Controller	1	041761	2
3	Anti-static bag, 150 x 180 x 0.03MM	1	-	4
4	Paper Tray	1	-	4
5	Installation Manual, English Language	1	285042	
6	White box	1	-	4
7	Screw, #6-32x0.7", Phillips, ZINC (US/Japan)	4	-	4
8	Bag, Poly, 40 x 60MM	2	-	4
9	Screw, M4.0x18, Phillips, ZINC (Europe)	4	-	4
-	Power Supply, 15VDC, 5W, 100-240VAC Input (not packaged w/CC-16)	1	041762	3 ⚠

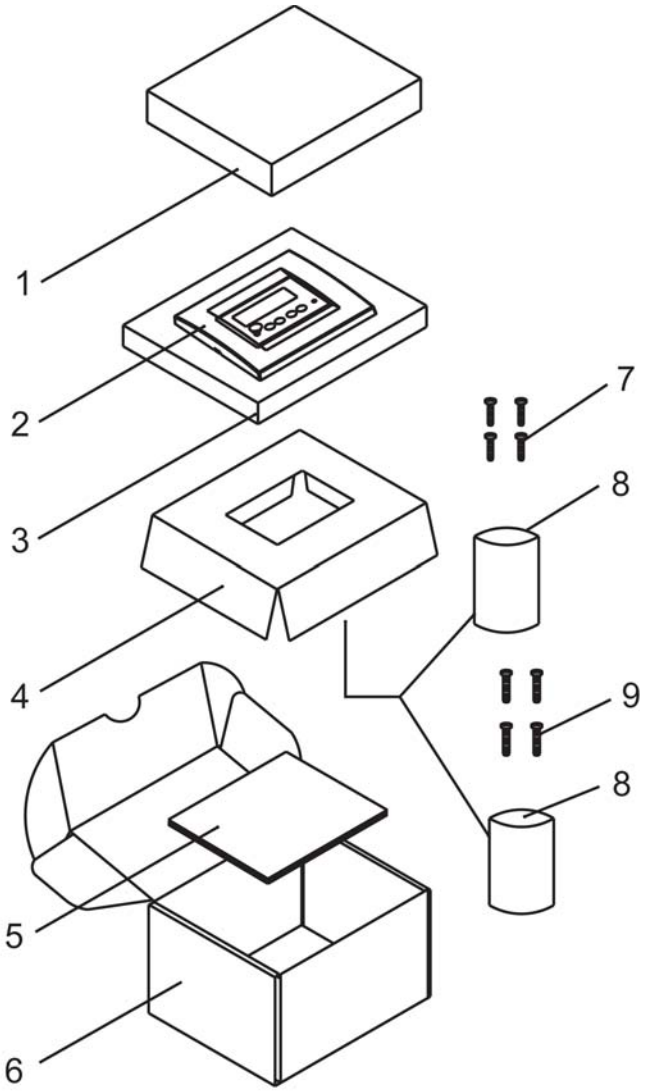


Figure 3. CC-16 Controller Packing View

PACKAGING PART LIST

ControlSpace® CC-64 Controller

Item Number	Description	Qty.	Part Number	Note
1	Install Guide, CC-64	1	285041	
2	EPE Foam, 330X180X15MM	1	-	4
3	Bag, PE, Anti-Static, 330X180X0.03MM	1	-	4
4	CC-64 Controller	1	041760	2
5	Screw, US, MSF, #6-32X0.7, MS, ZN-WH	4	-	4
6	Bag, Poly, 40X60MM	1	-	4
7	Tray, Foam, EPE, 330x180x45MM	1	-	4
8	Terminal Block, 2P, P5.08, 2ESDV-02P	1	-	4
9	Bag, Poly, 100X60MM	1	-	4
10	White Box, W9B	1	-	4
11	Computer UTP LAN Cable, 2M, CAT 5	1	-	4
-	Power Supply, 15VDC, 5W, 100-240VAC Input (not packaged w/CC-64)	1	041762	3 ⚠

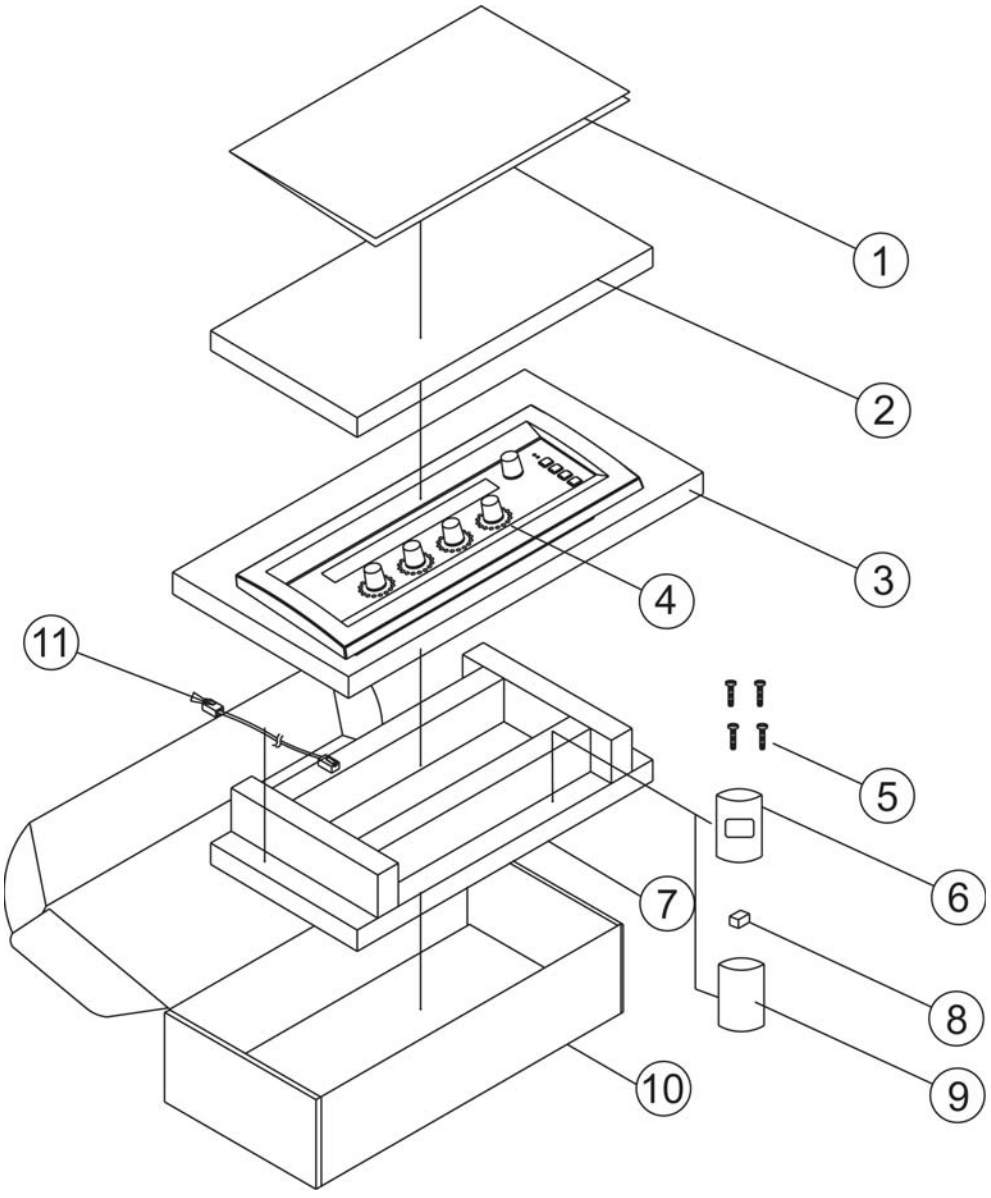


Figure 4. CC-64 Controller Packing View

MAIN PART LIST

ControlSpace® CC-16 Controller

Item Number	Description	Qty.	Part Number	Note
1	Front plate, PC, GE, LEXAN, 241R, White	1	275432	
2	Overlay, PC sheet, w/adhesive, 0.18mm	1	277488	
3	Insert, plate, PC, GE, LEXAN, 241R, White	1	275434	4
4	LCD PCB Assembly	1	275817-002	
5	Mounting Frame, PC, GE, LEXAN, 241R, White	1	275433	4
6	Main PCB Assembly	1	275817-001	

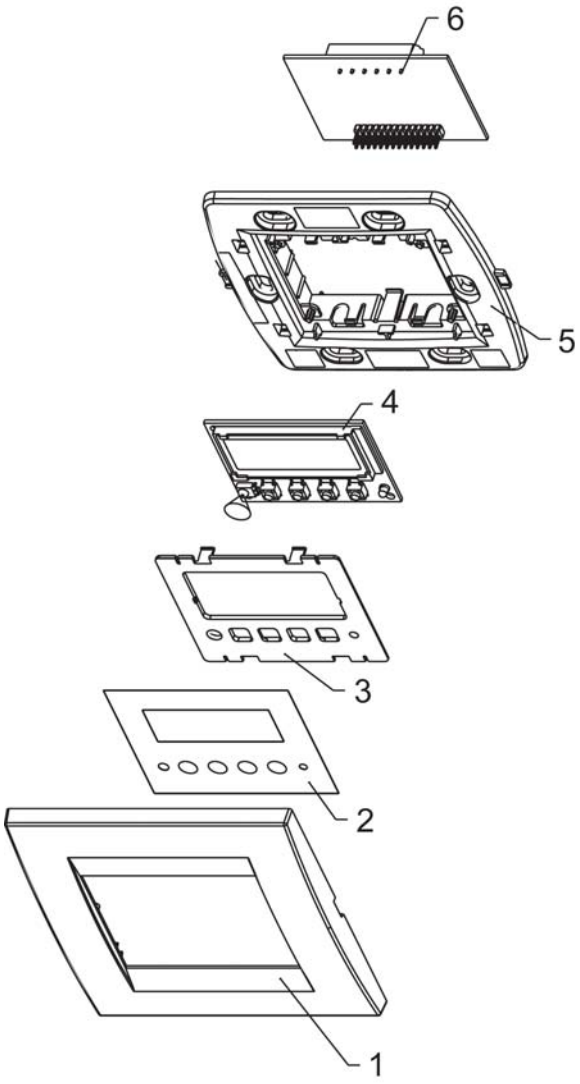


Figure 5. ControlSpace CC-16 Controller Exploded View

MAIN PART LIST

ControlSpace® CC-64 Controller

Item Number	Description	Qty	Part Number	Note
1	Metal EMC Shield, Case, SECC-T1, T=0.50MM	1	275816	4
2	Front Panel	1	275814	4
3	Knob	5	278523-002	
4	Nylon Washer, OD=6.1MM, ID=2.95MM, T=2MM	6	-	4
5	Keyboard Overlay, Plastic, W/S, Adhesive	1	277485	
6	LCM Module, STN, Blue, 12 Clock, YMC402-11AAABUCL	1	323977-001S	
7	LED PCB Assembly	1	278524-001	
8	Main PCB Assembly	1	278523-001	
9	Metal Panel, Aluminum	1	275815	4
10	Screw, SI, MSP, M3X11.5MM	4	-	4
11	Screw, MSB, M3X6, NI	14	-	4
12	Spacer, Support, K33-7	4	-	4
13	Sponge	1	-	4
14	PVC Washer, ID=3.1MM, T=0.3MM	4	-	4

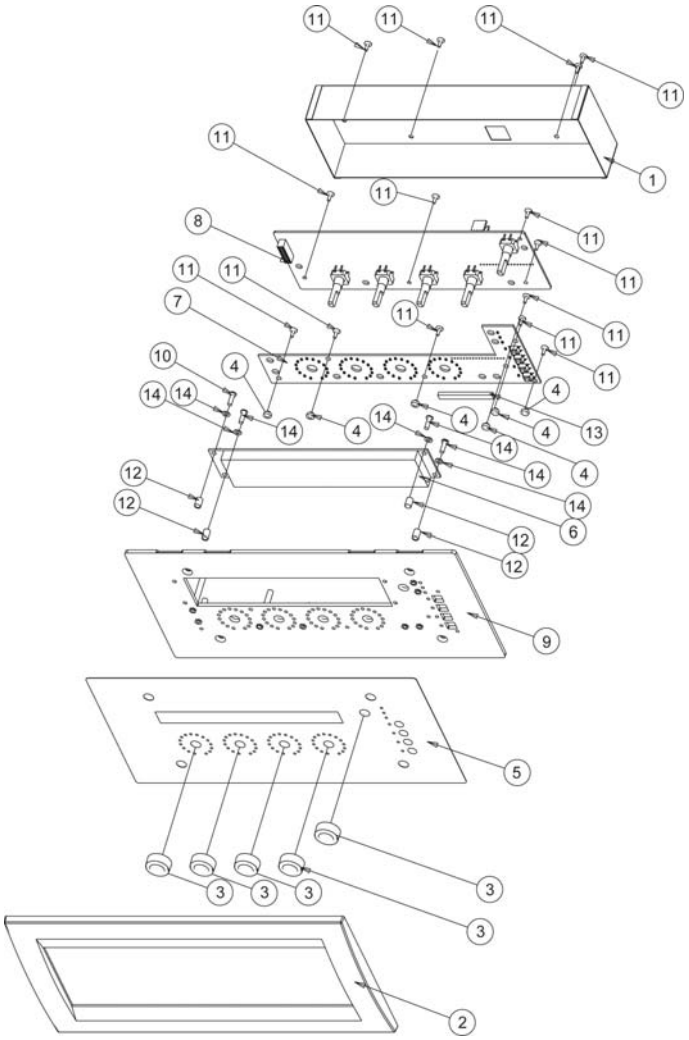


Figure 6. ControlSpace CC-64 Controller Exploded View

ELECTRICAL PART LIST

Main PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R107	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R108	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R109	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R111	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R112	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R113	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R114	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R120	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R121	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R122	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R123	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R124	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R125	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R127	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R128	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R129	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R130	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R131	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R132	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R137	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R138	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R139	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R154	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R155	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R156	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R157	2.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2001X	
R158	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R159	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R160	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R161	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R162	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R163	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R164	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R165	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R166	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R167	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R168	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R169	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R171	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R172	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R173	2.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2001X	
R174	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R176	2.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2001X	
R177	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R178	2.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2001X	
R179	2.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2001X	
R201	15.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1502X	
R202	24.9 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF24R9X	
R203	24.9 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF24R9X	
R204	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R207	15.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1502X	
R210	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R212	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R242	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R246	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R247	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R248	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	

ELECTRICAL PART LIST

Main PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R249	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R250	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R251	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R252	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R253	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R255	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R260	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R270	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R271	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R272	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R273	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R274	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R275	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R276	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R277	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R278	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R279	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R280	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R281	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R282	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R283	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R284	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R285	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R286	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R287	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R288	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R289	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R302	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R306	165 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1650X	
R310	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R311	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R312	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R313	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R314	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R315	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R317	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R371	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R372	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R373	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R375	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R401	120 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1200V	
R403	1.2K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1201V	
R404	1.2K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1201V	
R433	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R435	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R436	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R442	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R443	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R455	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R456	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R460	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R461	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R462	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R463	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R464	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R465	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R466	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	

ELECTRICAL PART LIST

Main PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R467	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R468	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R469	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R470	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R471	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R472	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R473	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R474	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R475	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R476	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R477	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R478	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R479	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R480	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R481	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R482	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R483	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R485	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R501	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R502	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R513	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R514	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R525	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R526	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R541	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R542	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R565	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R566	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R567	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R568	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R569	33.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF33R0X	
R574	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R575	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R617	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R655	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R655	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R656	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R656	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R657	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R657	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R658	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R658	100 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1000X	
R660	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R661	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R662	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R663	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R664	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R667	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R668	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R669	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R701	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R702	5.1K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5101X	
R703	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R704	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R705	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R706	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R710	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	

ELECTRICAL PART LIST

Main PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R711	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R712	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R713	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R714	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R715	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R718	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R719	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R720	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R721	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R722	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R723	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R724	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R725	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R726	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R731	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R732	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R733	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R734	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R735	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R736	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R737	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R738	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R739	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R740	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R741	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R742	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R743	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R744	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R746	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R747	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R748	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R749	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R750	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R752	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R753	200K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2003V	
R754	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R802	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R805	15.4K, OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1542V	
R806	22.1K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2212V	
R808	22.1K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2212V	
R809	73.2K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF7322V	
R810	110K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1103V	
R811	110K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1103V	
R812	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R837	124K, 1/8W, 1%, 0805, SMD	Panasonic	ERJ-6ENF1243V	
R839	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R840	22.1K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2212V	
R841	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R842	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R843	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R844	110K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1103V	
R845	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
R861	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R865	470 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2GEJ471X	
R901	330 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3300V	
R902	330 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3300V	
R903	330 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3300V	

ELECTRICAL PART LIST

Main PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R904	330 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3300V	
R905	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R906	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R907	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R908	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R909	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R911	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R912	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R913	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R914	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R915	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R916	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R917	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R918	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R919	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R920	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R921	20.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF2002X	
R927	470 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF4700V	
R928	10 OHM, 1%, 1/8W, 0603, SMD	Panasonic	RNCP0603FTD10R0	
R929	10 OHM, 1%, 1/8W, 0603, SMD	Panasonic	RNCP0603FTD10R0	
R930	10 OHM, 1%, 1/8W, 0603, SMD	Panasonic	RNCP0603FTD10R0	
R931	10 OHM, 1%, 1/8W, 0603, SMD	Panasonic	RNCP0603FTD10R0	
R932	10 OHM, 1%, 1/8W, 0603, SMD	Panasonic	RNCP0603FTD10R0	
R934	470 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF4700V	
R936	470 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF4700V	
R938	470 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF4700V	
R942	470 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF4700V	
R943	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R944	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R945	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R946	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R947	10.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1002X	
R949	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R950	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R951	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R952	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R953	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R954	1.50K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1501V	
R955	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R956	51.0K, OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF5102X	
R957	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R958	22.0 OHM, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF22R0X	
R959	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R960	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R961	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R962	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R963	1.0K, 1/10W, 1%, 0402, SMD	Panasonic	ERJ-2RKF1001X	
R968	0.0 OHM, 1/10W, 0402, SMD	Panasonic	ERJ-2GE0R00X	
RN231	RES ARRAY, 22 OHM, 8 RES, 1506	Panasonic	EXB-2HV220JV	
RN232	RES ARRAY, 22 OHM, 8 RES, 1506	Panasonic	EXB-2HV220JV	
RN270	RES ARRAY, 22 OHM, 8 RES, 1506	Panasonic	EXB-2HV220JV	
RN271	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN272	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN273	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN274	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN275	RES ARRAY, 22 OHM, 8 RES, 1506	Panasonic	EXB-2HV220JV	
RN351	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN352	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN353	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	
RN354	RES ARRAY, 10 OHM, 8 RES, 1506	Panasonic	EXB-2HV100JV	

ELECTRICAL PART LIST

Main PCB Assembly

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C202	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C203	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C204	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C205	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C207	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C208	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C209	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C211	0.22uF, CER, 10V, 10%, X7R, 0603	Murata	GRM188R71A224KA01D	
C212	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C213	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C214	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C215	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C219	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C220	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C221	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C223	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C224	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C230	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C231	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C232	18pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H180JZ01D	
C233	18pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H180JZ01D	
C234	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C236	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C237	22pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H220JZ01D	
C238	22pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H220JZ01D	
C239	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C251	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C252	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C253	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C254	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C255	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C256	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C258	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C271	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C272	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C273	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C274	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C275	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C276	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C277	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C278	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C279	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C280	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C281	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C282	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C283	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C284	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C285	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C286	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C287	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C288	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C289	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C290	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C291	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C292	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C293	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C294	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	

ELECTRICAL PART LIST

Main PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C295	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C296	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C297	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C298	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C299	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C300	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C301	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C302	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C303	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C304	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C305	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C306	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C307	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C308	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C309	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C310	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C311	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C312	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C313	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C314	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C315	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C351	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C353	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C354	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C355	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C356	22uF, TANT, 6.3V, 10%, 1206	Kemet	T491A226K006AT	
C357	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C358	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C359	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C360	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C361	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C362	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C363	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C364	22uF, TANT, 6.3V, 10%, 1206	Kemet	T491A226K006AT	
C365	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C366	22uF, TANT, 6.3V, 10%, 1206	Kemet	T491A226K006AT	
C367	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C368	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C371	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C372	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C401	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C402	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C403	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C405	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C406	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C407	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C408	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C411	68uF, TANT, 6.3V, 10%, 1206	Kemet	T491A686K006AT	
C412	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C413	68uF, TANT, 6.3V, 10%, 1206	Kemet	T491A686K006AT	
C431	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C432	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C451	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C452	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C453	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C454	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C455	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	

ELECTRICAL PART LIST

Main PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C456	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C457	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C458	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C459	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C561	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C563	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C564	68uF, TANT, 6.3V, 10%, 1206	Kemet	T491A686K006AT	
C565	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C601	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C651	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C652	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C653	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C654	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C655	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C657	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C658	10000pF, CER, 25V, 10%, X7R, 0402	Murata	GRM155R71E103KA01D	
C701	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C702	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C703	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C704	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C705	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C706	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C707	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C731	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C732	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C733	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C734	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C735	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C801	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C802	3300pF, CER , 100V, 10%, X7R, 0402	Murata	GRM155R72A332KA01	
C803	22uF, CER, 25V, X5Ru 10%u 1210	Murata	GRM32ER61E226KE15L	
C804	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C805	3300pF, CER , 100V, 10%, X7R, 0402	Murata	GRM155R72A332KA01	
C806	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C807	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C808	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C809	33pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H330JZ01D	
C810	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C813	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C814	33pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H330JZ01D	
C815	22uF, CER, 25V, X5Ru 10%u 1210	Murata	GRM32ER61E226KE15L	
C816	33uF, TANT, 6.3V, 20%, 1206	Kemet	T491A336M006AT	
C817	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C819	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C831	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C832	3300pF, CER , 100V, 10%, X7R, 0402	Murata	GRM155R72A332KA01	
C833	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C834	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C835	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C836	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C837	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C838	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C839	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C840	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C841	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C842	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C843	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	

ELECTRICAL PART LIST

Main PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C844	22uF, CER, 25V, X5Ru 10%u 1210	Murata	GRM32ER61E226KE15L	
C845	10uF, CER, 16V, 20%, X5R, 1206	TDK	C3216X5R1C106M	
C846	33pF, CER, 50V, 5%, NP0, 0402	Murata	GRM1555C1H330JZ01D	
C848	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C863	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C864	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C867	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C868	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C869	68uF, ALUM, 35V, 20%, SMD	UCC	EMVY350ADA680MF80G	
C870	68uF, ALUM, 35V, 20%, SMD	UCC	EMVY350ADA680MF80G	
C871	22uF, ALUM, 63V, 20%, SMD	UCC	EMVA630ADA220MF80G	
C873	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C874	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C875	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C876	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C877	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C878	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C879	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C880	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C881	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C882	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C883	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C884	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C885	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C886	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C887	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C888	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C889	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C890	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C891	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C892	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C893	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C894	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C895	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C896	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C897	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C898	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C899	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C900	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C901	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C902	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C903	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C904	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C905	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C906	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C908	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C910	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C911	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C912	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C915	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C916	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C917	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C920	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C921	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C922	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C923	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C924	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	

ELECTRICAL PART LIST

Main PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C925	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C926	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C927	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C928	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C929	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C930	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C931	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C932	0.1uF, CER, 16V, 10%, X7R, 0402	Murata	GRM155R71C104KA88D	
C933	68uF, TANT, 6.3V, 10%, 1206	Nichicon	F950J686KAAAQ2	
C934	68uF, TANT, 6.3V, 10%, 1206	Nichicon	F950J686KAAAQ2	
C935	68uF, TANT, 6.3V, 10%, 1206	Nichicon	F950J686KAAAQ2	
C936	68uF, TANT, 6.3V, 10%, 1206	Nichicon	F950J686KAAAQ2	
C937	1uF, CER, 25V, X7R, 10%, 0603	Murata	GRM188R71E105KA12D	
C938	1000pF, CER, 25V, 10%, X7R, 0603	Murata	GRM033R71E102KA01D	

Inductors and Ferrite Beads

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
L201	SMT, FERRITE BEAD, 25%, 2A, 0805, BLM21PG221SN1D	Murata	BLM21PG221SN1D	
L251	CHIP EMI FILTER	Murata	BLM31P500SPT	
L252	CHIP EMI FILTER	Murata	BLM31P500SPT	
L401	SMT, FERRITE BEAD, 25%, 2A, 0805, BLM21PG221SN1D	Murata	BLM21PG221SN1D	
L801	Power inductor, shielded, 1.5uH, 30%, SMT	Coilcraft	MSS1038-152NLB	
L802	Power inductor, shielded, 2.5uH, 30%, SMT	Coilcraft	MSS1038-252NLB	
L831	Power inductor, shielded, 3.8uH, 30%, SMT	Coilcraft	MSS1038-382NLB	
L832	SMT, FERRITE BEAD, 25%, 2A, 0805, BLM21PG221SN1D	Murata	BLM21PG221SN1D	
F201	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F202	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F203	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F204	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F401	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F402	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F404	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F405	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F406	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F407	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F651	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F652	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F653	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F654	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F655	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F656	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F657	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F658	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F659	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	
F660	EMI/RFI Suppressors & Ferrites	Murata	NFM21CC222R1H3D	

ELECTRICAL PART LIST

Main PCB Assembly

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
D1	TVS, 24V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ24A	
D2	TVS, 24V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ24A	
D3	TVS, 24V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ24A	
D4	TVS, 24V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ24A	
D5	TVS, 24V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ24A	
D6	TVS, 5.0V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ5.0A	
D7	TVS, 5.0V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ5.0A	
D8	TVS, 5.0V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ5.0A	
D9	TVS, 5.0V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ5.0A	
D10	TVS, 5.0V, 400W, UNI, 5%, SMA	Littlefuse	SMAJ5.0A	
D801	SWITCH, 100V, 400MW, SOD123	DIODES	1N4148W-7-F	
D861	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D862	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D863	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D873	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D875	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D877	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D879	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
D883	SMT, DIODE, SCHOTTKY BARRIER, SC-59	Toshiba	1SS294S,LF	
DS901	LED, GREEN/CLEAR, 1206, SMD	Lite-on	LTST-C150GKT	
DS902	LED, GREEN/CLEAR, 1206, SMD	Lite-on	LTST-C150GKT	
DS903	LED, GREEN/CLEAR, 1206, SMD	Lite-on	LTST-C150GKT	
DS904	LED, GREEN/CLEAR, 1206, SMD	Lite-on	LTST-C150GKT	

Transistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
Q1	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q2	NPN, GP, SOT-23	Fairchild	MMBT5550	
Q3	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q4	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q5	NPN, GP, SOT-23	Fairchild	MMBT5550	
Q6	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q7	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q8	NPN, GP, SOT-23	Fairchild	MMBT5550	
Q9	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q10	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q11	NPN, GP, SOT-23	Fairchild	MMBT5550	
Q12	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q13	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	
Q14	NPN, GP, SOT-23	Fairchild	MMBT5550	
Q15	MOSFET, N-CH, 60V/200mA, SC59, T&R	Vishay	2N7002K-T1-E3	

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U101	XOMAPL137DZKB4, DSP, CORE CONSIGN	TI	XOMAPL137DZKB4	
U102	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U351	SDRAM, 256MBIT, 133MHZ, 54VFBGA	Micron	MT48LC16M16A2BG-7E:G	
U352	SDRAM, 256MBIT, 133MHZ, 54VFBGA	Micron	MT48LC16M16A2BG-7E:G	
U371	Flash, Serial, 3V, 512M-Bit, 16-Pin, SOP-II	Micron	N25Q512A13GSF40F	
U372	256K-Bit, I2C, Serial, CMOS EEPROM	ON	CAT24C256WI-GT3	
U401	TXRX, DUAL RS232, 3-5.5V, 16 SOIC	Intersil	ICL3232EIBNZ-T	
U402	DIFF BUS TRANSCEIVER, 8-SOP	TI	SN75176B	
U403	BUFF/DVR, TRI-ST, 8 BIT, 20TSSO	TI	SN74LVC541APW	
U451	BUFF/DVR, TRI-ST, 8 BIT, 20TSSO	TI	SN74LVC541APW	
U452	BUFF/DVR, TRI-ST, 8 BIT, 20TSSO	TI	SN74LVC541APW	

ELECTRICAL PART LIST

Main PCB Assembly

Integrated Circuits (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U453	BUFF/DVR, TRI-ST, 8 BIT, 20TSSO	TI	SN74LVC541APW	
U454	OSC, 24.5760 MHZ, 3.3V +-25 PPM, SMD	Conner Winfield	CWX813-024.576M	
U455	2-1LINE DATA SELECT/MUX, SM8	TI	SN74LVC2G157DCTR	
U456	BUS, TRANSCEIVER, DUAL, 20TSSOP	TI	SN74LVCH245APWR	
U457	BUS, TRANSCEIVER, DUAL, 20TSSOP	TI	SN74LVCH245APWR	
U458	BUS, TRANSCEIVER, DUAL, 20TSSOP	TI	SN74LVCH245APWR	
U459	BUS, TRANSCEIVER, DUAL, 20TSSOP	TI	SN74LVCH245APWR	
U561	BUFF/DVR, TRI-ST, 8 BIT, 20TSSO	TI	SN74LVC541APW	
U601	I/O EXPANDER, I2C, 8B, 16TSSOP ROHS	NXP	PCA9534PW,118	
U651	ADC, SERIAL, 8BIT, 8CH, 16-QSOP	Maxim	MAX11602EEE+	
U701	I/O EXPANDER, I2C, 40B, 56TSSOP	NXP	PCA9505DGG,118	
U702	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U703	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U704	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U705	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U732	LEVEL TRANSLATOR, 8TSSOP	NXP	PCA9306DP,118	
U733	I2C BUS REPEATER, 8-TSSOP	NXP	PCA9515ADP,118	
U801	REG, BUCK SYNC, ADJ, 3A, 14HTSSOP	TI	TPS54326PWP	
U802	REG, BUCK SYNC, ADJ, 3A, 14HTSSOP	TI	TPS54326PWP	
U832	REG, LDO, 1.8V, .15A, SOT-25	Torex	XC6204B182MR-G	
U833	VOLT SUPERVISOR, 1.8V, SOT23-6	TI	TPS3808G18DBVR	
U834	REG, BUCK SYNC, ADJ, 3A, 14HTSSOP	TI	TPS54326PWP	
U835	SINGLE POSITIVE AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U836	I2C, HUB, 5 CH EXPANDBL, 20-TSSOP	NXP	PCA9518PW,118	
U837	ADAT, OPTICAL ENCODER	Wavefront	AL1401AG	
U838	REG, LDO, 1.2V, 10MA, TSOT23-5	Micrel	MIC5232-1.2YD5	
U839	BD48K60G-TL, SSOP3	Rohm	BD48K60G-TL	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
BT1	BATTERY, COIN, LITHIUM, BR-2477A/HBN	Panasonic	BR-2477A/HBN	3 ⚠
H9	MNTG BKT, BSE30A1, 4-40 THREAD	Keystone	7790	
J201	CONN, HEADER, XH, TOP, 5 POS, 2.5MM	JST	B5B-XH-A(LF)(SN)	
J202	CONN, HEADER, XH, TOP, 5 POS, 2.5MM	JST	B5B-XH-A(LF)(SN)	
J230	BERGSTIK HDR, 14 POS, .100", DR, SMT	FCI	54102-T0807LF	
J231	CONN, HEADER, 10 POS, .100, STR, 15AU	FCI	68002-210HLF	
J232	CONN, HEADER, 10 POS, .100, STR, 15AU	FCI	68002-210HLF	
J401	Header, 3 POS, 3.81 mm, Green, R/A ROHS	Phoenix	1803280	
J402	CONN, HEADER, XH, TOP, 5 POS, 2.5MM	JST	B5B-XH-A(LF)(SN)	
J501	CONN, FFC, 40 POS, VERTICAL, SMT	JST	40FLT-SM2-TB	
J502	CONN, FFC, 40 POS, VERTICAL, SMT	JST	40FLT-SM2-TB	
J503	CONN, FFC, 40 POS, VERTICAL, SMT	JST	40FLT-SM2-TB	
J504	CONN, FFC, 40 POS, VERTICAL, SMT	JST	40FLT-SM2-TB	
J561	IC, OPTICAL, TX, 650NM, FIBER MODULE	Everlight	PLT133/T9	
J651	Header, 6 POS, 3.81 mm, Green, R/A ROHS	Phoenix	1803316	
J731	CONN, FMN HSNG, 6 POS, STAG, NOR, SMD	JST	06FMN-BMTTN-A-TF(LF)(SN)	
J861	CONN, XH, 8 pos, 2.5mm, shrouded	JST	B8B-XH-A (LF)(SN)(P),	
J861	CONN, XH, 8 pos, 2.5mm, shrouded	JST	B8B-XH-AM(LF)(SN)	
J901	CONN, PCI, EXPRESS, 64 POS, VERT, PCB	Sullins	NWE32DHRN-T941	
J902	Header, 6 POS, 3.81 mm, Orange, R/A ROHS	Phoenix	1701044	
JP10	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	
JP11	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	

ELECTRICAL PART LIST

Main PCB Assembly

Miscellaneous (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
JP12	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	
JP14	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	
JP101	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	
JP831	UNSHROUDED, STRT THRU HOLE, 2 POS	FCI	77311-124-02LF	
Y1	CRYSTAL, 32.768KHZ, 12.5PF, SMD	Abracon	ABS13-32.768kHz	
Y2	OSC, CLOCK, 24.000000 MHZ, 3.3V, SMD	CTS	636L3C024M00000	

Analog Input PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R101	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R101	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R103	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R104	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R106	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R107	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R111	200K, 1/8W, 1%, 0805, SMD	Panasonic	ERJ-6ENF2003V	
R112	100 OHM, THICK, FC, 1/8W, 0805, 1%	Panasonic	ERJ6ENF1000V	
R113	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R114	200K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2003V	
R115	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R116	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R117	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R118	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R119	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R120	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R121	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R122	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R123	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R124	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R126	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R128	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R129	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R151	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R152	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R153	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R154	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R155	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R156	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R157	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R158	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R159	2.7K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2701V	
R201	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R202	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R203	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R204	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R206	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R207	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R211	200K, 1/8W, 1%, 0805, SMD	Panasonic	ERJ-6ENF2003V	
R212	100 OHM, THICK, FC, 1/8W, 0805, 1%	Panasonic	ERJ6ENF1000V	
R213	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R214	200K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2003V	
R215	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R216	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R217	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R218	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R219	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R220	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R221	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R222	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R223	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R224	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R226	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R228	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R229	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R251	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R252	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R253	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R254	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R255	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R256	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R257	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R258	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R259	2.7K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2701V	
R301	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R302	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R303	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R304	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R306	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R307	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R311	200K, 1/8W, 1%, 0805, SMD	Panasonic	ERJ-6ENF2003V	
R312	100 OHM, THICK, FC, 1/8W, 0805, 1%	Panasonic	ERJ6ENF1000V	
R313	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R314	200K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2003V	
R315	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R316	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R317	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R318	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R319	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R320	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R321	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R322	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R323	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R324	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R326	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R328	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R329	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R351	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R352	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R353	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R354	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R355	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R356	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R357	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R358	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R359	2.7K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2701V	
R401	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R402	6.8K, THICK, FC, 1/4W, 1210, 1%	Panasonic	ERJ14NF6801U	
R403	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R404	39.0K, CHIP, 1/10W, 1%, 0603	Panasonic	ERJ3EKF3902V	
R406	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R407	3.3K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF3301V	
R411	200K, 1/8W, 1%, 0805, SMD	Panasonic	ERJ-6ENF2003V	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R412	100 OHM, THICK, FC, 1/8W, 0805, 1%	Panasonic	ERJ6ENF1000V	
R413	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R414	200K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF2003V	
R415	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R416	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R417	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R418	820 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF8200V	
R419	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R420	220 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF2200V	
R421	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R422	82.5 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF82R5V	
R423	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R424	19.1 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF19R1V	
R426	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R428	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R429	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R451	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R452	1.96K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1961V	
R453	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R454	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R455	4.99K, THICK, 1/10W, 1%, 0603	Panasonic	ERJ3EKF4991V	
R456	330 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF3300V	
R457	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R458	91 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF91R0V	
R459	2.7K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2701V	
R507	100K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1003V	
R516	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R517	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R518	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R522	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R524	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R606	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R607	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R608	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R609	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R610	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R711	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R712	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R715	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R716	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R726	20.0 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF20R0V	
R727	20.0 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF20R0V	
R728	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R729	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R730	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R731	100K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1003V	
R732	100K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1003V	
R733	100K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1003V	
R737	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R738	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R739	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R740	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R741	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R742	0 OHM, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-070RL	
R745	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R746	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R747	11.3K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1132V	
R748	11.3K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1132V	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C101	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C102	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C103	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C104	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C105	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C106	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C107	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C108	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C109	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C110	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C111	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C112	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C113	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C114	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C115	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C116	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C117	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C118	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C119	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C151	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C152	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C153	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C154	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C155	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C156	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C201	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C202	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C203	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C204	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C205	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C206	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C207	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C208	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C209	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C210	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C211	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C212	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C213	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C214	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C215	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C216	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C217	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C218	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C219	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C251	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C252	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C253	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C254	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C255	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C256	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C301	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C302	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C303	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C304	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C305	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C306	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C307	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C308	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C309	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C310	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C311	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C312	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C313	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C314	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C315	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C316	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C317	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C318	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C319	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C351	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C352	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C353	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C354	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C355	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C356	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C401	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C402	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C403	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C404	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C405	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C406	100pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H101JA01D	
C407	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C408	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C409	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C410	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C411	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C412	100uF, SMD, E CAP, 10V, 20%, +85-40C	Panasonic	EEE-1AA101SP	
C413	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C414	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C415	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C416	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C417	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C418	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C419	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C451	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C452	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C453	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C454	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C455	47pF, CHIP, NPO, 50V, 5%, 0603	Murata	GRM1885C1H470JA01D	
C456	820pF, CHIP, COG, 50V, 5%, 125-55C, 0603	Murata	GRM1885C1H821JA01D	
C501	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C502	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C503	2.2uF, SMD, E CAP, 50V, 20%	NIPPON	EMVY500ADA2R2MD55G	
C504	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C505	2.2uF, SMD, E CAP, 50V, 20%	NIPPON	EMVY500ADA2R2MD55G	
C506	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C507	33uF, SMD, E CAP, 25V, 20%, -55°C ~ 105°C	Panasonic	EEE-FT1E330AR	
C508	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C509	2700pF, CHIP, CER, 50V, 5%, NP0, 0603	MURATA	GRM1885C1H272JA01D	
C510	2700pF, CHIP, CER, 50V, 5%, NP0, 0603	MURATA	GRM1885C1H272JA01D	
C511	2700pF, CHIP, CER, 50V, 5%, NP0, 0603	MURATA	GRM1885C1H272JA01D	
C512	2700pF, CHIP, CER, 50V, 5%, NP0, 0603	MURATA	GRM1885C1H272JA01D	
C513	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C514	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C515	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C516	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C517	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C518	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C519	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C520	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C521	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C601	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C602	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C603	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C701	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C702	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C703	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C704	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C705	22uF, SMD E CAP, 63V, 20%, +85-40C	NIPPON	EMVA630ADA220MF80G	
C706	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C707	10uF, CER, 25V, Y5V, 1210	Kemet	C3225Y5V1E106Z/1.30	
C708	10uF, CER, 25V, Y5V, 1210	Kemet	C3225Y5V1E106Z/1.30	
C709	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C710	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C711	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C712	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C713	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C714	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C715	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C716	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	

Inductors and Ferrite Beads

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
FB101	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB102	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB103	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB201	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB202	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB203	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB301	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB302	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB303	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB401	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB402	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	
FB403	CHIP EMI FILTER, 0603, TAIYOYUDEN		BK1608HS102-T	

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
D102	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D103	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D202	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D203	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D302	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D303	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D402	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D403	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D601	SMT DIODE RECTIFIER, 1SR154-400TE25, SOD-106	ROHM	1SR154-400	

ELECTRICAL PART LIST

Analog Input PCB Assembly

Transistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
Q101	SMT, TR, PNP, 60V, 600mA, SOT-23, MMBT2907ALT1G	ON Semi	MMBT2907ALT1G	
Q102	SMT, TR, NPN, 60V, 100MA, SOT-23, MMBT2484LT1G	ON Semi	MMBT2484LT1G	
Q201	SMT, TR, PNP, 60V, 600mA, SOT-23, MMBT2907ALT1G	ON Semi	MMBT2907ALT1G	
Q202	SMT, TR, NPN, 60V, 100MA, SOT-23, MMBT2484LT1G	ON Semi	MMBT2484LT1G	
Q301	SMT, TR, PNP, 60V, 600mA, SOT-23, MMBT2907ALT1G	ON Semi	MMBT2907ALT1G	
Q302	SMT, TR, NPN, 60V, 100MA, SOT-23, MMBT2484LT1G	ON Semi	MMBT2484LT1G	
Q401	SMT, TR, PNP, 60V, 600mA, SOT-23, MMBT2907ALT1G	ON Semi	MMBT2907ALT1G	
Q402	SMT, TR, NPN, 60V, 100MA, SOT-23, MMBT2484LT1G	ON Semi	MMBT2484LT1G	

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U101	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U102	ADG451BRUZ, SWITCH, QUAD	ADI	ADG451BRUZ-REEL7	
U103	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U201	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U202	ADG451BRUZ, SWITCH, QUAD	ADI	ADG451BRUZ-REEL7	
U203	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U301	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U302	ADG451BRUZ, SWITCH, QUAD	ADI	ADG451BRUZ-REEL7	
U303	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U401	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U402	ADG451BRUZ, SWITCH, QUAD	ADI	ADG451BRUZ-REEL7	
U403	OP-AMP, NJM4580E-TE1-#ZZZB, EMP8	JRC	NJM4580E-TE1-#ZZZB	
U501	AK5388	AKM	AK5388	
U502	SN74LVC541ADW	TI	SN74LVC541ADW	
U601	PCA9505DGG	NXP	PCA9505DGG	
U602	SINGLE 2-INPUT AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U701	TA7805AF	TOSHIBA	TA7805AF	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
H101	MNTG BKT, 4-40 THREAD	Keystone	7790	
H401	MNTG BKT, 4-40 THREAD	Keystone	7790	
J106	FLT CONN, 40FLT-SM2-TB	JST	40FLT-SM2-TB	
J108	HEADER, 1803316	PHOENIX	1803316	
J109	HEADER, 1803316	PHOENIX	1803316	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R101	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R102	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R103	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R104	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R105	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R106	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R107	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R108	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R109	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R110	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R111	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R112	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R113	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R114	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R115	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R116	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R121	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R122	47K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF4702V	
R123	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R124	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R125	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R126	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R127	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R128	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R129	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R151	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R152	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R153	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R154	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R155	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R156	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R157	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R158	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R159	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R160	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R162	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R163	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R164	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R165	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R166	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R167	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R168	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R169	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R177	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R178	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R201	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R202	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R203	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R204	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R205	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R206	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R207	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R208	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R209	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R210	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R211	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R212	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R213	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R214	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R215	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R216	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R221	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R222	47K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF4702V	
R223	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R224	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R225	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R226	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R227	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R228	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R229	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R251	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R252	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R253	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R254,	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R255	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R256	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R257	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R258	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R259	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R260	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R262	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R263	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R264	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R265	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R266	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R267	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R268	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R269	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R277	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R278	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R301	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R302	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R303	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R304	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R305	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R306	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R307	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R308	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R309	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R310	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R311	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R312	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R313	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R314	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R315	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R316	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R321	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R322	47K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF4702V	
R323	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R324	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R325	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R326	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R327	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R328	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R329	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R351	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R352	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R353	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R354	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R355	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R356	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R357	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R358	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R359	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R360	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R362	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R363	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R364	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R365	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R366	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R367	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R368	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R369	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R377	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R378	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R401	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R402	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R403	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R404	33 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF33R0V	
R405	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R406	10 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF10R0V	
R407	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R408	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R409	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R410	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R411	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R412	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R413	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R414	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R415	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R416	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R421	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R422	47K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ-3EKF4702V	
R423	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R424	4.99K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF4991V	
R425	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R426	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R427	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R428	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R429	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R451	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R452	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R453	130 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1300V	
R454	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R455	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R456	1.69K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1691V	
R457	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R458	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R459	549 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF5490V	
R460	3.30K, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF3301V	
R462	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Resistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R463	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R464	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R465,	866 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF8660V	
R466	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R467	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R468	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R469	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R477	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R478	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R501	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R505	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R509	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R512	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R514	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R518	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R519	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R520	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R521	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R522	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R523	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R605	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R608	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R614	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R816	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R818	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R819	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R820	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R821	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R822	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R823	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R824	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R825	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R826	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R827	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R828	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R829	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R830	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R831	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
R842	10K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1002V	
R843	20K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF2002V	
R844	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R845	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R846	100K, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF1003V	
R847	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	
R861	47 OHM, THICK, FC, 1/10W, 0603, 1%	Panasonic	ERJ3EKF47R0V	
R862	1.00M, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1004V	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C101	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
C102	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C103	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C104	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C105	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C106	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C107	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C108	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C109	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C110	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C111	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C112	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C113	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C116	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C118	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C119	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C120	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C131	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C132	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C151	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C152	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C153	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C154	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C155	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C156	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C157	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C158	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C159	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C160	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C161	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C162	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C163	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C164	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C201	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
C202	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C203	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C204	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C205	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C206	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C207	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C208	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C209	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C210	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C211	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C212	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C213	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C216	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C218	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C219	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C220	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C231	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C232	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C251	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C252	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C253	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C254	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C255	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C256	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C257	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C258	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C259	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C260	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C261	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C262	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C263	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C264	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C301	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
C302	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C303	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C304	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C305	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C306	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C307	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C308	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C309	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C310	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C311	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C312	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C313	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C316	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C318	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C319	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C320	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C331	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C332	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C351	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C352	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C353	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C354	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C355	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C356	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C357	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C358	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C359	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C360	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C361	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C362	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C363	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C364	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C401	0 OHM, THICK, FC, 1/10W, 0603	Panasonic	ERJ3GEY0R00V	
C402	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C403	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C404	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C405	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C406	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C407	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C408	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C409	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C410	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C411	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C412	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C413	22pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H220JA01D	
C416	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C418	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C419	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C420	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C431	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C432	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C451	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C452	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C453	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C454	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C455	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C456	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C457	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C458	1800pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H182JA01D	
C459	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C460	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C461	3600pF, CER, 50V, 5%, NP0, 0603	Murata	GRM1885C1H362JA01D	
C462	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C463	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C464	0.012uF, CER, 25V, 5%, NP0, 0603	Kemet	C0603C123J3GACTU	
C502	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C503	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C504	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C505	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C506	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C507	10uF, SMD, E CAP, 16V, 20%	NIPPON	EMVY160ADA100MD55G	
C508	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C509	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C510	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C511	470uF, SMD, E CAP, 16V, 20%	Nichicon	UCL1C471MNL1GS	
C512	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C513	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C514	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C515	470uF, SMD, E CAP, 16V, 20%	Nichicon	UCL1C471MNL1GS	
C516	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C601	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C602	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C603	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C604	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C701	33uF, SMD, E CAP, 25V, 20%, +85-40C	Nippon	EMVA250ADA330ME55G	
C702	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C703	100nF, CHIP, X7R, 25V, 10%, +125-55C, 0603	Murata	GRM188R71E104KA01D	
C704	10uF, SMD, E CAP, 16V, 20%	Nippon	EMVY160ADA100MD55G	
C709	10uF, CER, 25V, Y5V, 1210	TDK	C3225Y5V1E106Z/1.30	
C710	10uF, CER, 25V, Y5V, 1210	TDK	C3225Y5V1E106Z/1.30	
C841	330uF, SMD, E CAP, 25V, 20%, ROH	Nippon	EMVA250ADA331MHA0G	
C842	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C843	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C844,	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	
C845	100nF, CHIP, X7R, 50V, 10%, +125-55C, 0603	Yageo	CC0603KRX7R9BB104	

Inductors and Ferrite Beads

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
FB101	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB102	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB103	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB201	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB202	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB203	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB301	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB302	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB303	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB401	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB402	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	
FB403	CHIP EMI FILTER, 0603	Taiyoyuden	BK1608HS102-T	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
D101	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D102	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D103	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D201	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D202	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D203	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D301	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D302	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D303	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D401	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D402	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D403	SMT, SW, BAV99LT1G, SOT-23, ON SEMI	ON Semi	BAV99LT1	
D701	SMT, SW, BAV70	NXP	BAV70, 235	
D841	SMT, SW, BAV70	NXP	BAV70, 235	
D842	SMT, SW, BAV70	NXP	BAV70, 235	
D843	SMT, SW, BAV70	NXP	BAV70, 235	
D844	SMT, SW, BAV70	NXP	BAV70, 235	
D845	SMT, SW, BAV70	NXP	BAV70, 235	
D846	SMT, SW, BAV70	NXP	BAV70, 235	

Transistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
Q101	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q102	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q103	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q104	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q105	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q106	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q107	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q108	SMT, TR, PNP, 40V, 200MA, MMBT3906LT1G, SOT-23	ON Semi	MMBT3906LT1G	
Q110	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q111	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q112	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q201	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q202	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q203	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q204	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q205	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q206	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q207	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q208	SMT, TR, PNP, 40V, 200MA, MMBT3906LT1G, SOT-23	ON Semi	MMBT3906LT1G	
Q210	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q211	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q212	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q301	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q302	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q303	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q304	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q305	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q306	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q307	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q308	SMT, TR, PNP, 40V, 200MA, MMBT3906LT1G, SOT-23	ON Semi	MMBT3906LT1G	

ELECTRICAL PART LIST

Analog Output PCB Assembly

Transistors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
Q310	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q311	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q312	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q401	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q402	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q403	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q404	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q405	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q406	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q407	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q408	SMT, TR, PNP, 40V, 200MA, MMBT3906LT1G, SOT-23	ON Semi	MMBT3906LT1G	
Q410	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q411	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q412	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q842	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	
Q843	SMT, MOSFET, N-CH, 60V/200mA, SC59	Vishay	2N7002K-T1-E3	

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U101	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U151	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U152	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U201	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U251	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U252	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U301	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U351	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U352	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U401	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U451	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U452	OP-AMP, NJM4580E-TE-#ZZZB, EMP-8	NJR	NJM4580E-TE-#ZZZB	
U501	AK4413EQ	AKM	AK4413EQ	
U502	SN74LVC541ADW	TI	SN74LVC541ADW	
U601	PCA9534PW	NXP	PCA9534PW	
U602	SINGLE 2-INPUT AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U603	SINGLE INVERTER, SN74LVC1G04DCKR, SC70_5	TI	SN74LVC1G04DCKR	
U604	SINGLE 2-INPUT AND GATE, SC-70	TI	SN74LVC1G08DCKR	
U701	TA7805AF(TE16L1,NQ	Toshiba	TA7805AF(TE16L1,NQ	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
H101	MOUNTING BKT, 4-40 THD	Keystone	7790	
H401	MOUNTING BKT, 4-40 THD	Keystone	7790	
J106	CONNECTOR, 40FLT-SM2-TB	JST	40FLT-SM2-TB	
J108	HEADER, 1701044	PHOENIX	1701044	
J109	HEADER, 1701044	PHOENIX	1701044	

ELECTRICAL PART LIST

LAN PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R1	49.9 OHM, THICK, FC, 1/16W, 0402, 1%	Panasonic	ERJ-2RKF49R9X	
R2	49.9 OHM, THICK, FC, 1/16W, 0402, 1%	Panasonic	ERJ-2RKF49R9X	
R3	49.9 OHM, THICK, FC, 1/16W, 0402, 1%	Panasonic	ERJ-2RKF49R9X	
R5	49.9 OHM, THICK, FC, 1/16W, 0402, 1%	Panasonic	ERJ-2RKF49R9X	
R6	12K, 1/10W, 5%, 0402, SMD	Panasonic	ERJ-2GEJ123X	
R7	0 OHM, THICK, FC, 1/10W, 0402	Panasonic	ERJ-2GE0R00X	
R8	12K, 1/10W, 5%, 0402, SMD	Panasonic	ERJ-2GEJ123X	
R24	10K, THICK, FC, 1/10W, 0402, 5%	Panasonic	ERJ-2GEJ103X	
R28	150 OHM, THICK, FC, 0402, 1%	Panasonic	ERJ-2RKF1500X	
R29	150 OHM, THICK, FC, 0402, 1%	Panasonic	ERJ-2RKF1500X	
R30	100K, THICK, FC, 1/10W, 0402, 5%	Panasonic	ERJ-2GEJ104X	
R31	150 OHM, THICK, FC, 0402, 1%	Panasonic	ERJ-2RKF1500X	
R32	150 OHM, THICK, FC, 0402, 1%	Panasonic	ERJ-2RKF1500X	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C1	0.022uF, CER, 50V, 10%, X7R, 0805	Kemet	C0805C223K5RACTU	
C5	30pF, CHIP, COG, 50V, 5%, +125-55C, 0603	Murata	GRM1885C1H300JA01D	
C6	30pF, CHIP, COG, 50V, 5%, +125-55C, 0603	Murata	GRM1885C1H300JA01D	
C7	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C8	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C9	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C10	4700pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C472K5RACTU	
C11	1500pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C152K5RACTU	
C12	4700pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C472K5RACTU	
C16	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C17	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C18	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C19	4700pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C472K5RACTU	
C20	4700pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C472K5RACTU	
C21	1500pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C152K5RACTU	
C22	10000pF, CER, 50V, Y5V, 0402	Murata	GRM155F51H103ZA01D	
C23	10000pF, CER, 50V, Y5V, 0402	Murata	GRM155F51H103ZA01D	
C24	4700pF, CER, 50V, 10%, X7R, 0402	Kemet	C0402C472K5RACTU	
C27	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C33	10uF, CER, 25V, Y5V, 1210	Kemet	C3225Y5V1E106Z/1.30	
C34	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C35	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C36	47pF, CER, 50V, 20%, NP0, 0402	Johanson Dielectrics	500X07N470MV4T	
C37	47pF, CER, 50V, 20%, NP0, 0402	Johanson Dielectrics	500X07N470MV4T	
C38	10uF, CER, 25V, Y5V, 1210	Kemet	C3225Y5V1E106Z/1.30	
C39	0.1uF, CHIP, X7R, 16V, 10%, +125-55C, 0402	Murata	GRM155R71C104KA88D	
C40	10000pF, CER, 50V, Y5V, 0402	Murata	GRM155F51H103ZA01D	
C41	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C42	47pF, CER, 50V, 20%, NP0, 0402	Johanson Dielectrics	500X07N470MV4T	
C43	47pF, CER, 50V, 20%, NP0, 0402	Johanson Dielectrics	500X07N470MV4T	

ELECTRICAL PART LIST

LAN PCB Assembly

Inductors and Ferrite Beads

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
FB1	FERRITE CHIP, 120 OHM, 500MA 0603	TDK	MMZ1608S121A	
FB2	FERRITE CHIP, 120 OHM, 500MA 0603	TDK	MMZ1608S121A	
FB3	FERRITE CHIP, 120 OHM, 500MA 0603	TDK	MMZ1608S121A	

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U1	USB 2.0-10/100, ETH CRTL, 56QFN	SMSC	LAN9500A-ABZJ	
U2	EEPROM, 256x8, -1.8V	Microchip	93AA56AT-I/OT	
U3	RESET CIRCUIT, 2.88VPP, SOT-23	ST	STM1815SWX7F	
U4	REG, LDO, 3.3V, .2A, SOT23-5	TI	TPS73033DBVR	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
J3	CONN, HEADER, XH, SIDE, 5 POS, 2.5MM	JST	S5B-XH-A(LF)(SN)	
Y1	CRYSTAL, 25.000 MHZ, 18pF, HC49US	TXC	9B-25.000MAAJ-B	
T1	CONN, VERT, RJ45, Magnetics, GRN/YEL	XFMRS	XFATM9-CVGY1-2M	

LED PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R1	150 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1500V	
R3	150 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1500V	
R5	150 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1500V	
R7	150 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF1500V	
R2	750 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF7500V	
R4	750 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF7500V	
R6	750 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF7500V	
R8	750 OHM, 1/10W, 1%, 0603, SMD	Panasonic	ERJ-3EKF7500V	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C1	1uF, CER, 16V, 10%, X5R, 0603	Kemet	C0603C105K4PACTU	
C2	10000pF, CER, 50V, Y5V, - 20 % + 80%, 0402	Murata	GRM155F51H103ZA01D	
C3	10000pF, CER, 50V, Y5V, - 20 % + 80%, 0402	Murata	GRM155F51H103ZA01D	
C4	10uF, CER, 25V, Y5V, -20% +80%, 1210	Kemet	C3225Y5V1E106Z/1.30	

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
D1	LED, GREEN/RED, SMD, 1.6X.8MM	Kingbright	APHB1608ZGSURKC	
D2	LED, GREEN/RED, SMD, 1.6X.8MM	Kingbright	APHB1608ZGSURKC	
D3	LED, GREEN/RED, SMD, 1.6X.8MM	Kingbright	APHB1608ZGSURKC	
D4	LED, GREEN/RED, SMD, 1.6X.8MM	Kingbright	APHB1608ZGSURKC	

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U1	I/O EXPANDER I2C, 8B, 16TSSOP	NXP	PCA9534PW,118	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
J1	CONN, FMN, HSNG, 6 POS, SIDE ENT, SMD	JST	06FMN-SMT-A-TF(LF)(SN)	

ELECTRICAL PART LIST

Power Supply PCB Assembly

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R1	560 OHM, THICK, FC, 1/4W, 1206, 5%	SEI	RMCF1206JT560R	
R2	22 OHM, THICK, FC, 1/4W, 1206, 5%	SEI	RMCF1206JT22R0	
R3	20 OHM, THICK, FC, 1W, 2512, 1%	Vishay	CRCW251220R0FKEG	
R4	10K, Thick Film, 1W, 5%, 2512	KOA-Speer	RM73B3AT103J	
R5	22K, Thick Film, 1W, 2512, 5%	Vishay-Dale	CRCW251222K0JNEG	
R6	22K, Thick Film, 1W, 2512, 5%	Vishay-Dale	CRCW251222K0JNEG	
R7	2M, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12062M00FKEA	
R8	2M, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12062M00FKEA	
R9	5.11 OHM, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12065R11FNEA	
R10	390R, SMT, 5%, 1/4W, 1206	SEI	RMCF1206JT390R	
R11	390R, SMT, 5%, 1/4W, 1206	SEI	RMCF1206JT390R	
R12	1K, THICK, FC, 1/4W, 1206, 1%	KOA-Speer	RK73H2BT1001F	
R13	4.99K, THICK, FC, 1/4W, 1206, 1%	KOA-Speer	RK73H2BT4991F	
R14	4.99K, THICK, FC, 1/4W, 1206, 1%	KOA-Speer	RK73H2BT4991F	
R15	9.09K, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-079K09	
R16	4.99K, THICK, FC, 1/10W, 0603, 1%	SEI	RMCF0603FG4K99	
R17	6.81 OHM, 1%, THICK FC, 1/10W, 0603	YAGEO	RC0603FR-076R81L	
R18	1K, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-071KL	
R19	1.69K, THICK, FC, 1/10W, 0603, 1%	Yageo	RC0603FR-071K69L	
R20	30.9K, THICK, FC, 1/10W, 0603, 1%	SEI	RMCF0603FG30K9	
R21	4.99K, THICK, FC, 1/10W, 0603, 1%	SEI	RMCF0603FG4K99	
R22	1 OHM, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12061R0FKEA	
R23	1 OHM, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12061R0FKEA	
R26	249 OHM, THICK FC, 1/10W, 0603, 1%	Yageo	RC0603FR-07249RL	
R27	249 OHM, THICK FC, 1/10W, 0603, 1%	Yageo	RC0603FR-07249RL	
R28	1M, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12061M00FKEA	
R29	1M, THICK, FC, 1/4W, 1206, 1%	Vishay-Dale	CRCW12061M00FKEA	
R30	22K, Thick Film, 1W, 2512, 5%	Vishay-Dale	CRCW251222K0JNEG	
R31	22K, Thick Film, 1W, 2512, 5%	Vishay-Dale	CRCW251222K0JNEG	
R32	20 OHM, THICK, FC, 1W, 2512, 1%	Vishay	CRCW251220R0FKEG	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C1	0.0022uF, Ceramic, Safety-Rated, Y1	TDK	CD12-E2GA222MYNS	3 ⚠
C2	0.0022uF, Ceramic, Safety-Rated, Y1	TDK	CD12-E2GA222MYNS	3 ⚠
C3	0.0022uF, Ceramic, Safety-Rated, Y1	TDK	CD12-E2GA222MYNS	3 ⚠
C4	0.47uF, MET, PPS, 305V +/-20% +110C, BULK	Epcos	B32922C3474M000	3 ⚠
C5	470pF, CHIP, NPO, 50V, 5%, +125-55C, 0805	Kemet	C0805C471J5GACTU	
C6	47pF, MLCC, NP0, 1kV, 10%	Kemet	C1206C470KDGACTU	
C7	22uF, SMD, E CAP, 63V, +/-20%	Panasonic	EEE-FK1J220XP	
C8	100uF, Electrolytic, SMT, 63V ±20%	Panasonic	EEE-FK1J101P	
C9	150uF, Elec, Snap-In Can, 400V, 10mm, LS	UCC	EKMQ401VSN151MQ25S	
C10	3300pF, CHIP, X7R, 1KV, 10%, +125-55C, 1206	Murata	GRM31BR73A332KW01L	
C11	10uF, SMD, E.CAP, 35V +/-20%, -40°C ~ 105°C, D5X5.2	UCC	EMVE350ADA100ME55G	
C12	10uF, SMD, E.CAP, 35V +/-20%, -40°C ~ 105°C, D5X5.2	UCC	EMVE350ADA100ME55G	

ELECTRICAL PART LIST

Power Supply PCB Assembly

Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C13	0.1uF, Ceramic, Radial, 630V	Kemet	C1808W104KBRACTU	
C14	1500uF, Electrolytic, Low-Z, Radial, 25V, 20%	Nichicon	UPW1E152MHD6	3 ⚠
C15	1500uF, Electrolytic, Low-Z, Radial, 25V, 20%	Nichicon	UPW1E152MHD6	3 ⚠
C16	27pF, CHIP, NPO, 50V, 5%, 0805	Kemet	C0805C270J5GACTU	
C17	27pF, CHIP, NPO, 50V, 5%, 0805	Kemet	C0805C270J5GACTU	
C18	220uF, SMD, E.CAP, 25V, +/-20%	Nichicon	UCL1E221MNL1GS	
C19	220uF, SMD, E.CAP, 25V, +/-20%	Nichicon	UCL1E221MNL1GS	
C20	100uF, Electrolytic, SMT, 25V, ±20%	Nichicon	UCL1E101MCL1GS	
C21	100uF, Electrolytic, SMT, 25V, ±20%	Nichicon	UCL1E101MCL1GS	
C22	100uF, Electrolytic, SMT, 25V, ±20%	Nichicon	UCL1E101MCL1GS	
C23	0.1uF, CHIP, X7R, 50V +/-10%, 0603	Kemet	C0603C104K5RACTU	
C24	47uF, Electrolytic, SMT, 35V, 20%	Nichicon	UUD1V470MCL1GS	
C25	330NF, X7R, 50V, 10%, +125-55C, 0805	Murata	GRM219R71H334KA88D	
C26	4.7uF, X7R, 25V, 10%, +85-55C, 1206	Kemet	C1206C475K3RACTU	
C27	4.7uF, X7R, 25V, 10%, +85-55C, 1206	Kemet	C1206C475K3RACTU	
C28	1uF, X7R, 25V, 10%, +125-55C, 0805	Kemet	C0805C105K3RAC	
C29	1uF, X7R, 25V, 10%, +125-55C, 0805	Kemet	C0805C105K3RAC	
C30	47pF, MLCC, NP0, 1kV, 10%	Kemet	C1206C470KDGACTU	

Inductors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
L1	Inductor, Common Mode B82732R2142B30	Epcos	B82732R2142B30	
L2	3.3uH, Inductor, Shielded, SMT, 6A, 20%	TDK	SLF10165T-3R3N5R83PF	
L3	3.3uH, Inductor, Shielded, SMT, 2A, 20%	TDK	VLC5020T-3R3N	
L4	3.3uH, Inductor, Shielded, SMT, 2A, 20%	TDK	VLC5020T-3R3N	

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
BR1	SMT DIODE RECTIFIER, DF06S-T	Diodes, Inc	DF06S-T	
D1	SMT DIODE RECTIFIER	Vishay-GenSemi	US1G-E3/61T	
D2	SMT DIODE RECTIFIER	Vishay-GenSemi	ES1D-E3/61T	
D3	SMT DIODE, FAST RECOVERY, SMB	Vishay-GenSemi	US1MHE3/61T	
D4	SMT DIODE, Rectifier, Schottky, 5A, 60V, SMPC PKG	Diodes, Inc	PDS560-13	
D5	SMT DIODE RECTIFIER	Vishay-GenSemi	ES1D-E3/61T	
D6	SMT DIODE RECTIFIER	Vishay-GenSemi	ES1D-E3/61T	
D7	ZENER, SMT, 20V, 300mW, 5%, SOT-23	Diodes, Inc / Digi-Key	BZX84C20-7-F	
D8	Schottky, 1A, 40V, SOD-123	ST Micro	STPS140Z	
D9	Schottky, 1A, 40V, SOD-123	ST Micro	STPS140Z	

ELECTRICAL PART LIST

Power Supply PCB Assembly

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U1	1-Chip Flyback Regulator, FET,(must be date code of 1133 or later)	Power Integrations	TOP268KG	
U2	Opto-Coupler, Transistor Out, 4-pin	Fairchild	FOD817DSD	
U3	Voltage Regulator, 3-terminal Adjustable, DPAK, LM317M	ON semi	LM317MDTRKG	
U4	Voltage Reg, Negative 3-terminal, Adjustable, DPAK, LM337M	ST Micro	LM337MDT-TR	
VR1	Shunt Regulator, Adjustable, SOT-23 PKG	TI	TL431AQDBZR	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
F1	Subminiature Fuse	Littelfuse	37211250411	3 ⚠
MOV1	VARISTOR, 300V	Littlefuse	V300LA10P	3 ⚠
NTC1	Thermistor, NTC, Inrush Current Limiting	Epcos	B57153S0100M000	3 ⚠
PL1	Connector, JST, XH, 2.5mm, Male, PCB, Header, 8-pin	JST	B8B-XH-AM(LF)(SN)	
SK1	Connector, IEC Line Cord, Chassis+PCB Mount	Schurter	GSP1.9113.1	
TR1	XFMR, REDLINE, TOPSW +/-18V, +8V, +48V, 40W	Renco Electronics	RL-10173 / S005110	3 ⚠

ELECTRICAL PART LIST

CC-64 Control Center

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R100	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R101	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R102	47 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-0747R	
R103	47 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-0747R	
R104	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R105	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R106	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R107	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R108	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R109	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R200	330 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07330R	
R201	47 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-0747R	
R202	47 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-0747R	
R203	330 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07330R	
R204	330 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07330R	
R205	100 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07100R	
R206	100 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07100R	
R208	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R209	4.7K, 0603, 1/10W, 1%	Yageo	RC0603FR-074K7	
R210	330 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07330R	
R212	47 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-0747R	
R216	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R300	56K, 0603, 1/10W, 1%	Yageo	RC0603FR-0756K	
R400	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R401	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R402	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R403	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R404	0 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-07R00	
R500	0 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-07R00	
R501	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R502	0 OHM, 0603, 1/10W, 5%	Yageo	RC0603JR-07R00	
R505	10K, 0603, 1/10W, 1%	Yageo	RC0603FR-0710K	
R506	1K, 0603, 1/10W, 1%	Yageo	RC0603FR-071K	
R509	680 OHM, 0603, 1/10W, 1%	Yageo	RC0603FR-07680R	
RA100	NETWORK, 10K, 10 PIN/8R, 5%	Yageo	YC158TJR-0710K	
RA400	NETWORK, 10K, 10 PIN/8R, 5%	Yageo	YC158TJR-0710K	
RA401	NETWORK, 10K, 10 PIN/8R, 5%	Yageo	YC158TJR-0710K	
RA500	NETWORK, 10K, 10 PIN/8R, 5%	Yageo	YC158TJR-0710K	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	
C100	12pF, 0603, NPO, 50V, 125C, 5%	Samsung	CL10C120JBNC	
C101	12pF, 0603, NPO, 50V, 125C, 5%	Samsung	CL10C120JBNC	
C102	10uF, SMD E CAP, 16V, 105C, 20%	Nichicon	UZT1C100MCR1GB	
C103	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C104	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	

ELECTRICAL PART LIST

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Capacitors (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	
C105	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C106	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C107	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C108	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C109	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C110	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C200	1000pF, CER, Y5P, 2KV, 125C, 10%	Panasonic	ECKD3D102KBP	
C201	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C202	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C203	12pF, 0603, NPO, 50V, 125C, 5%	Samsung	CL10C120JBNC	
C204	12pF, 0603, NPO, 50V, 125C, 5%	Samsung	CL10C120JBNC	
C205	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C206	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C207	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C208	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C209	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C210	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C211	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C213	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C214	1000pF, CER, Y5P, 2KV, 125C, 10%	Panasonic	ECKD3D102KBP	
C300	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C301	22pF, 0603, NPO, 50V, 125C, 5%	Samsung	CL10C220JBNC	
C302	10uF, SMD E CAP, 16V, 105C, 20%	Nichicon	UZT1C100MCR1GB	
C400	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C401	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C402	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C403	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C404	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C405	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C406	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C407	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C408	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C409	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C410	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C411	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C412	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C413	0.01uF, 0603, X7R, 50V, 125C, 10%	Samsung	CL10B103KBNC	
C500	220uF, SMD E CAP, 10V, 105C, 20%	Nichicon	UWT1A221MCL1GS	
C501	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C502	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C503	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C504	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C505	220uF, SMD E CAP, 10V, 105C, 20%	Nichicon	UWT1A221MCL1GS	
C507	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C508	0.1uF, 0603, Y5V, 50V, 85C, 20%	Samsung	CL10F104ZBNC	
C509	10uF, E CAP, 16V, 105C, 20%	Nichicon	UZT1C100MCR1GB	

ELECTRICAL PART LIST

CC-64 Control Center

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	
D100	SWITCHING, KDS181, SOT-23	KEC	KDS181	
D101	SWITCHING, KDS181, SOT-23	KEC	KDS181	
D102	SWITCHING, KDS181, SOT-23	KEC	KDS181	
D200	LED, YELLOW, SMD, 0805	Everlight	17-21 UYC/S530-A2/TR8	
D201	LED, AMBER, SMD, 0805	Everlight	17-21 UYOC/S530-A2/TR8	
D202	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D300	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D301	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D302	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D303	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D304	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D305	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D306	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D307	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D308	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D309	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D310	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D311	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D312	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D313	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D314	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D315	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D316	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D317	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D318	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D319	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D320	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D321	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D322	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D323	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D324	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D325	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D326	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D327	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D328	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D329	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D330	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D331	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D332	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D333	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D334	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D335	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D336	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D337	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D338	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	

ELECTRICAL PART LIST

CC-64 Control Center

Diodes (continued)

Reference Designator	Description	Vendor Name	Vendor Part Number	
D339	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D340	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D341	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D342	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D343	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D344	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D345	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D346	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D347	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D348	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D349	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D350	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D351	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D352	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D353	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D354	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D355	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D356	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D357	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D358	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D359	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D400	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D401	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D402	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D403	LED, GREEN, SMD, 0805	Everlight	17-21 VGC/TR8	
D500	TVSSMAJ5.0CA-TR, SMA, ST	ST	SMAJ5.0CA-TR	
D501	TVSSMAJ5.0CA-TR, SMA, ST	ST	SMAJ5.0CA-TR	

Inductors

Reference Designator	Description	Vendor Name	Vendor Part Number	
L200	10-BASE T LOW PASS FILTER	YCL	20F001N	
L200	10-BASE T LOW PASS FILTER	BEL-FUSE	A556-2006-02	
L201	CHIP, EMI FILTER, 50V/2A, 20%	Panasonic	EXCCET103U	
L202	CHIP, EMI FILTER, 50V/2A, 20%	Panasonic	EXCCET103U	
L502	CHIP, EMI FILTER, 50V/2A, 20%	Panasonic	EXCCET103U	
L503	CHIP, EMI FILTER, 50V/2A, 20%	Panasonic	EXCCET103U	

Transistors

Reference Designator	Description	Vendor Name	Vendor Part Number	
Q100	PNP, 50V, 100mA, SOT-23	KEC	KRA102S	
Q101	PNP, 50V, 100mA, SOT-23	KEC	KRA102S	
Q102	PNP, 50V, 100mA, SOT-23	KEC	KRC102S	
Q103	PNP, 50V, 100mA, SOT-23	KEC	KRA102S	
Q202	PNP, 60V, 1A, SOT-89, KTA1668	KEC	KTA1668Y	
Q500	PNP, 50V, 100mA, SOT-23	KEC	KRC102S	

ELECTRICAL PART LIST

CC-64 Control Center

Integrated Circuits

Reference Designator	Description	Vendor Name	Vendor Part Number	
M100	QUAD 2-INPUT AND, TSSOP14	ON Semi	MC74VHC08DT	
M101	CMOS, SRAM, TSOP44	Samsung	K6R1016C1D-TC10	
M102	MCU, FLASH, UNPROG, FP-100B	Hitachi	HD64F3069RF25	
M200	HEX INVERTER, TSSOP14	ON Semi	MC74VHC04DT	
M201	EEPROM, DIP8, ATMEL	ATMEL	AT93C46-10PI-2.7	
M202	ETHERNET CONT, PQFP-100	Realtek	RTL8019AS	
M300	LED DISPLAY DRIVER, QSOP16	MAXIM	MAX6951CEE	
M400	DECODER, TSSOP16	ONSEMI	MC74VHC138DT	
M401	OCTAL BUFFER DRIVER, TSSOP20	ON Semi	MC74VHC541DT	
M402	OCTAL BUFFER DRIVER, TSSOP20	ON Semi	MC74VHC541DT	
M403	OCTAL D-TYPE F-F, TSSOP20	ON Semi	MC74VHC574DT	
M404	IDENTITY COMP, TSSOP20	Fairchild	74ACT521MTC	
M500	DC/DC CONVERTER, DIP-24	Cincon Elec	EC5A-12S05	
M501	VOLTAGE DETECTOR, TSOP-5	ONSemi	NCP303LSN47T1	
M501	VOLTAGE DETECTOR, SOT-23-5	Seiko	S80947CNMC-G9H-T2	
M503	OCTAL BUFFER DRIVER, TSSOP20	ON Semi	MC74VHC541DT	
M504	OCTAL D-TYPE FLIP-FLIP, TSSOP20	ON Semi	MC74VHC574DT	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	
CN100	CONNECTOR, 6POLE, P2.5MM	Neltron	2317SJ-06	
CN200	MODULAR JACK, 7006-8P8C-M-01	Neltron	7006-8P8C-M-01	
CN501	WIRE TO BOARD HEADER, P5.08MM, 2POLE, 2EHDVC-02P	Dinkle	2EHDVC-02P	
CN503	PCB SOCKET, DUAL ROW, P2.54MM, 16POLE, H=7.1MM	Neltron	2214S-16G	
E400	ENCODER, SW, 5P, 5V/10mA	ALPS	EC11E15244EF	
E401	ENCODER, SW, 5P, 5V/10mA	ALPS	EC11E15244EF	
E402	ENCODER, SW, 5P, 5V/10mA	ALPS	EC11E15244EF	
E403	ENCODER, SW, 5P, 5V/10mA	ALPS	EC11E15244EF	
E404	ENCODER, SW, 5P, 5V/10mA	ALPS	EC11E15244EF	
JP500	HEADER, P2.54MM, 3PIN, H=6.0MM	Neltron	2211S-03G	
JP501	HEADER, P2.54MM, 3PIN, H=6.0MM	Neltron	2211S-03G	
LCM	HEADER, P2.54MM, 16PIN, H=6.0MM	Neltron	2213S-16G	
SW400 SW401 SW402 SW403	TACT SW, SMT, 12V/50mA, 160g, H=5MM, TD-06XA	Wealth Metal	TD-06XAX	
XTAL100	20.000MHz +/-30ppm, 20pF, HC-49/S	Raltron	AS-20.000-20	
XTAL200	20.000MHz +/-30ppm, 20pF, HC-49/S	Raltron	AS-20.000-20	
/JP500	JUMPER, CAP, 2 PIN, 6MM	Computime	22Z02-0611	
/JP501	JUMPER, CAP, 2 PIN, 6MM	Computime	22Z02-0611	
/LED PCB	FLAT CABLE, 18P, 2651, #26AWG, L=39MM, GREY, UL&CSA	Computime	3618BA00396K0Z04	

ELECTRICAL PART LIST

CC-16 Zone Controller

Resistors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
R1	715 OHM, 0603, 1/10W, 1%	Yageo Corporation	RC0603FR-07715R	
R2	240 OHM, 0603, 1/10W, 1%	Yageo Corporation	RC0603FR-07240R	
R3	100K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-07100K	
R4	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R5	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R8	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R6	120 OHM, 1206, 1/4W, 5%	Yageo Corporation	RC1206JR-07120R	
R7	1.2K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-071K2	
R9	1.2K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-071K2	
R11	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R12	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R13	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R14	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R15	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R16	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R17	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R18	10K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0710K	
R10	47K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-0747K	
R22	4.7K, 0603, 1/10W, 5%	Yageo Corporation	RC0603JR-074K7	

Capacitors

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
C1	47uF, 50V, SMD, ECAP, +105/-55C, 20%, D6.3x7.7	Nichicon Corp	UUD1H470MCR1GS	
C2	100uF, 16V, SMD, ECAP, +105/-55C, 20%, D6.3X5.4	Nichicon Corp	UWT1C101MCR1GB	
C3	20pF, 0603, 50V, NPO, 5%	Teamyoung Corp	0603N200J500BB	
C4	20pF, 0603, 50V, NPO, 5%	Teamyoung Corp	0603N200J500BB	
C5	220pF, 0603, 50V, NPO, 5%	Teamyoung Corp	0603N221J500BB	
C6	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C7	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C8	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C9	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C10	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C11	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	
C12	0.1uF, 0603, X7R, 16V, 10%	Teamyoung Corp	0603B104K160BB	

Diodes

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
-	RECT, 400V/1A, SOD-106	Rohm Semi	1SR154-400	
D1	SCHOTTKY BARR, SOD-80C	Philips Semi	BAS85	
D2	SCHOTTKY BARR, SOD-80C	Philips Semi	BAS85	
D3	SCHOTTKY BARR, SOD-80C	Philips Semi	BAS85	
D4	SCHOTTKY BARR, SOD-80C	Philips Semi	BAS85	

ELECTRICAL PART LIST

CC-16 Zone Controller

Integrated Circuits

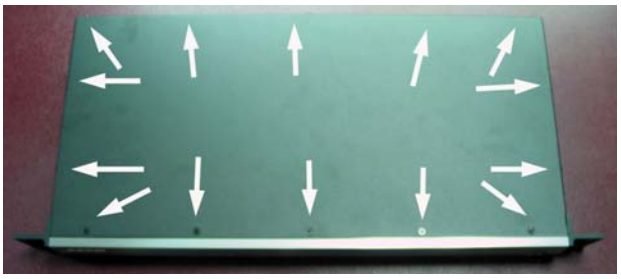
Reference Designator	Description	Vendor Name	Vendor Part Number	Note
U1	REG, 1.5A, TO-263 NS	National Semi	LM317S	
U2	XCVR, SO-8, MAXIM	Maxim Integrated	MAX485ECSA	
U3	EEPROM, 16Kx8, MSOP-8	Microchip Tech Inc	24LC128-I/MS	
U4	MCU, SSOP28, 10MHz	Microchip Tech Inc	PIC16F873A-I/SS	

Miscellaneous

Reference Designator	Description	Vendor Name	Vendor Part Number	Note
LCM	LCD MODULE, BSE002A, 122X32 DOT	ShanTou Goworld Co Ltd	SM4353	
CN1	TERMINAL BLOCK, 6P, ELK508A-06P, P=5.08MM	Dinkle Enterprise Co Ltd	ELK508A-06P	
CN2	HEADER, P2.54MM, DUAL, 20PIN, H7.5MM	Neltron Industrial Co Ltd	2213S-20G	
SW1	DIP SWITCH, 8 POLE, SPST, ON/OFF, DS-08B	Diptronics Manufacturing Inc.	DS-08B	
X1	CRYSTAL, 9.8304MHz +/- 30ppm, 20pF, HC-49/S	Raltron Electronics	AS-9.8304-20	

DISASSEMBLY PROCEDURES

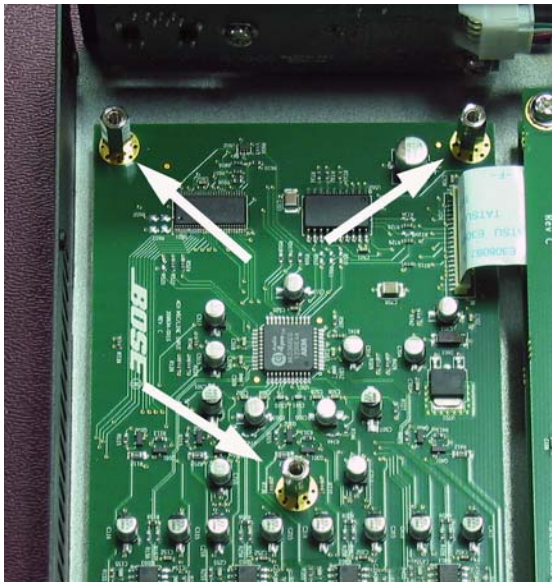
1. Top Cover Removal



1.1 Remove the fourteen screws that secure the top cover to the chassis.

1.2 Lift off the top cover.

2. Analog Input or Output PCB Removal



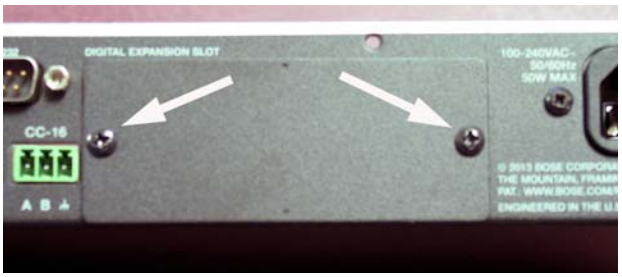
2.1 Remove the top cover.

2.2 Remove the three screws and/or stand-offs that secure the PCB in place.

2.3 Remove the four screws that secure the PCB to the rear of the chassis.

2.4 Unplug the ribbon cable from the PCB. Lift out the PCB.

3. Digital Expansion Card Removal



Note: If this card is installed, you will need to remove it before you can remove the Main PCB assembly.

The digital expansion card plugs into the Main PCB through the opening in the rear of the chassis. If no card is installed, this opening is covered by a plate.

3.1 Remove the two screws that secure the digital expansion card to the rear panel.

3.2 Slide the card out of the chassis.

DISASSEMBLY PROCEDURES

4. Main PCB Assembly Removal

4.1 Remove the top cover.

4.2 Unplug the four ribbon cables that connect to the analog input and output PCB's.

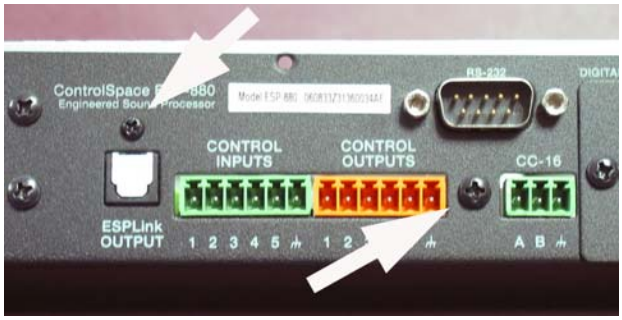
4.3 Unplug the wiring harness that runs to the LAN PCB at J202.

4.4 Unplug the wiring harness that runs to the RS-232 connector at J402.

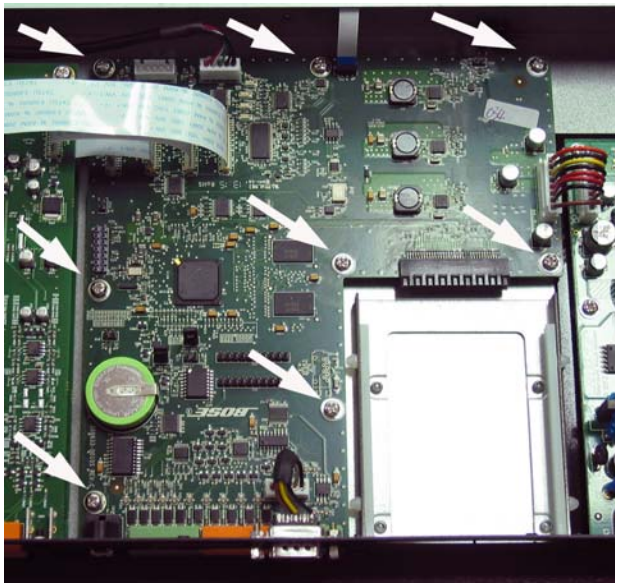
4.5 Unplug the wiring harness that runs to the power supply at J861.

4.6 Unplug the small ribbon cable that runs to the LED PCB at J731.

4.7 Remove the two screws that secure the board to the rear of the chassis.



4.8 Remove the eight scews that secure the board to the bottom of the chassis. Lift out the board.



DISASSEMBLY PROCEDURES

5. Power Supply PCB Removal.

5.1 Remove the top cover.

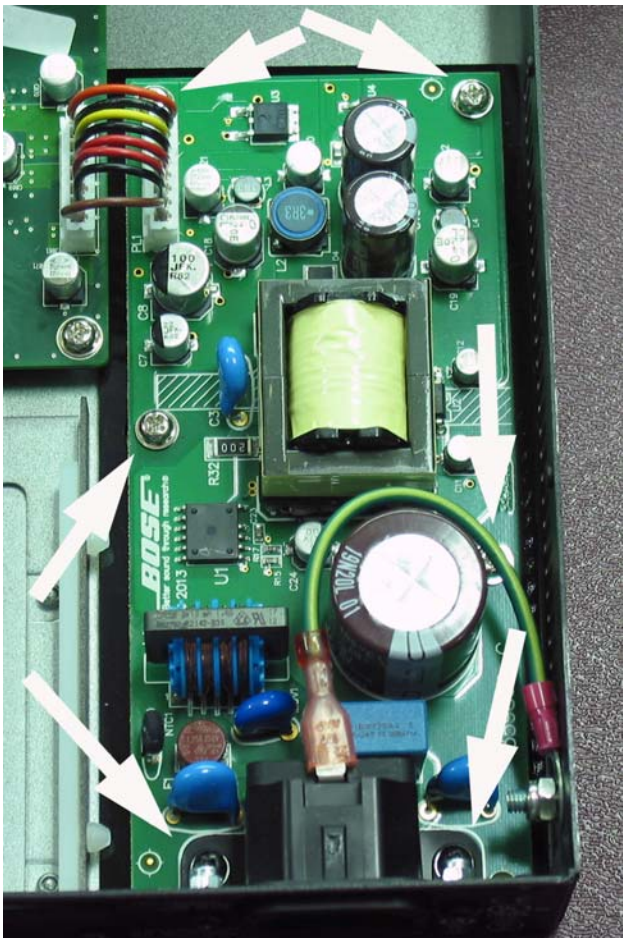
5.2 Unplug the wiring harness that runs to the main PCB at PL1.

5.3 Disconnect the green/yellow ground wire from the back of the AC input IEC connector.

5.4 Remove the six screws that secure the boar to the bottom of the chassis. Two of the screws are black and are secure the AC jack to the bottom of the chassis.

5.5 Remove the two screws that secure the AC input connector to the rear of the chassis. Take care to not lose the lock nuts on the back of the connector.

5.6 Lift out the board. Be sure to retain the insulating sheet under the board for re-installation.



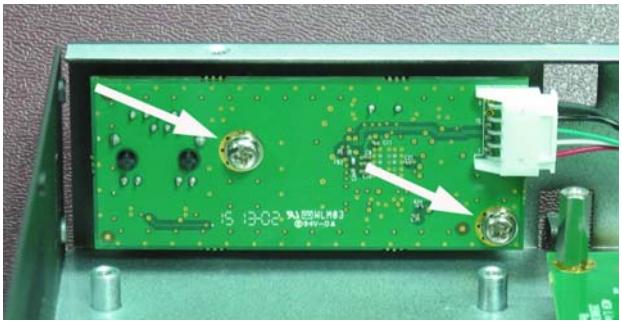
6. LAN PCB Assembly Removal

6.1 Remove the top cover.

6.2 Remove the two input or output PCB assemblies that are located directly behind the LAN PCB using procedure 2.

6.3 Remove the two screws that secure the LAN PCB to the front panel. Lift out the board.

6.4 Unplug the wiring harness from the LAN PCB at the JST connector.



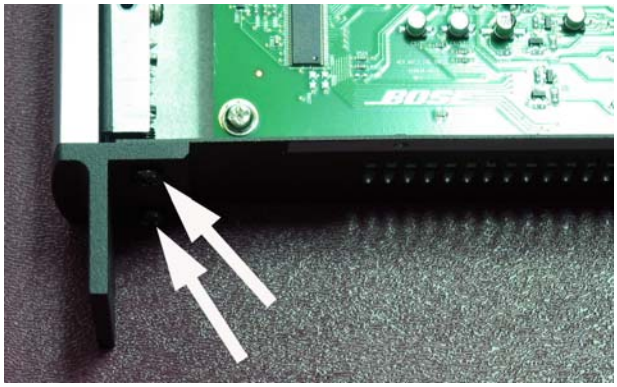
DISASSEMBLY PROCEDURES

7. Front Panel Removal

Note: In order to remove the LED PCB, you must first remove the front panel.

7.1 Remove the top cover.

7.2 Remove the four screws that secure the rack ears to the sides of the chassis. Lift off the rack ears.



7.3 Carefully pull the front panel straight off the the front of the chassis. It is secured in place by four retaining tabs.

8. Light Pipe Removal

8.1 Remove the front panel.

8.2 Located on the back of the front panel, you will see the black light pipe holder with the light pipes installed.

8.3 Using a small flat tip screwdriver or tool, compress one of the end loops of the light pipe holder and remove the light pipe assembly. Take care to not lose the light pipe. It is not secured to the light pipe holder.

Re-assembly Note: Be sure that the shorter tabs on the light pipe face toward the front panel. They will extend into the front panel holes when reinstalled and should be flush with it if properly installed.

9. LED PCB Removal

9.1 Remove the top cover.

9.2 Remove the front panel.

9.3 Unplug the ribbon cable from the Main PCB at J731.

9.4 Remove the two screws that secure the LED PCB to the front panel. Lift off the board.

TEST PROCEDURES

Software Required:

- ControlSpace® Designer™, Rev 4.2 or later
- ESP-88F Firmware V1.140 build 1 or later
- ESP-88F DSP firmware version DSP: 1.2.0 build 0 or later
- ESP88C_Test_Macro_Rev_21b.atsb
- RedlineAudioPerformanceTestingModule01a.atsb
- RedlinePhantomTestingModule.atsb
- Other items are described following part.
- These files are for other products. Recommended to locate same folder.
  – ESP_ESP-00II_AcommandII01.atsb
  – ESP_GPIO-II.atsb
  – ESP_INPUT-II+OUTPUT-II
  – PMAES3IN.atsb

Test Overview

This test procedure is used for light-up-and-play testing of the ControlSpace ESP-880 , ESP-1240, ESP-4120 and ESP-1600.

This test use the DNC-R card for testing of expansion slot.

Definitions and Abbreviations

Definition

Term	Definition
ESP-880	Digital audio processor with 1U chassis 3.5mm pitch connectors. 8 analog inputs / 8 analog outputs.
ESP-1240	Digital audio processor with 1U chassis 3.5mm pitch connectors. 12 analog inputs / 4 analog outputs.
ESP-4120	Digital audio processor with 1U chassis 3.5mm pitch connectors. 4 analog inputs / 12 analog outputs.
ESP-1600	Digital audio processor with 1U chassis 3.5mm pitch connectors. 16 analog inputs / 0 analog outputs. All outputs are digital, either 8 channels via ESPLink or 16 channels via plug-in Dante card.

These products do not include an expansion card. The card slot ships empty and is covered with a blank panel.

Acronyms

Term	Definition
ESP	ControlSpace Engineered Sound Processor with 2U chassis and 8 slot expandable type.
CSD	ControlSpace Designer software
NIC	PC Ethernet Network Interface Card
MAC	Media Access Control address – unique identifier/physical address
DUT	Device Under Test
Expansion Slot	The space for the optional function modules.
Expansion card	The unit that provides optional function for ESP88F series.
Dante Controller	The setting software for Dante network.

TEST PROCEDURES

Introduction

A known good ESP-88F/ESP-00/ESP-00 II chassis is used as part of the test equipment for this test series.

This test consists of an analog I/O section and a digital system section.

The analog I/O section of the test checks the audio performance of the system.

This ESP-88F/ESP-00/ESP-00 II chassis has expansion slots for several kinds of expansion cards. These cards will not be tested as part of this test series.

In this testing, the ControlSpace® ESP-880/-1240/-4120/-1600 a known good Dante network card will be utilized for testing of the expansion slot in the UUT chassis.

Setup

Hardware Setup - Refer to Figures 6 through 10.

Equipment Requirements

Equipment	Manuf.	Notes	
ESP-880	Bose	DUT	
ESP-1240	Bose	DUT	
ESP-4120	Bose	DUT	
ESP-1600	Bose	DUT	
ATS-2	Audio Precision		
ATS-2 I/F card	Audio Precision	Install in test PC. USB interface also possible to use.	
Switcher	AuBit	Switcher MS101	
		Switcher MS111	
ESP	Bose	10	Phantom Voltage checker
		9	GPIO CARD
		0	DSP MAIN CARD
		1	DNC-E CARD
		2	Open Slot
		3	Open Slot
		4	Open Slot
		5	Open Slot
		6	Open Slot
		7	ADAT-IN audio card
		8	AES3OUT audio card
CC16 Emu	AuBit	CC-16 emulator. (1U type or ESP built-in type)	
USB hub	Various	With USB cable for PC and AC adaptor	
PC	Various	ATS 1.60 software compatible.	
Ethernet switch	Various	5 ports or greater. Specific to DNC-R card test. *	
Ethernet Router	Various	When the DHCP function will be tested, the Ethernet router is required.	
DNC-R	Bose	The expansion card for reference. *	

Note: *DNC-R can be connected by a crossover cable to the DNC-E card on ESP-88 or ESP-00 without an Ethernet hub. To use a Dante controller, a hub will be needed.

TEST PROCEDURES

Cable Requirements

From	To	Qty	Type	Notes
PC	ATS-2	1	ATS-2 cable	AP-IB interface card and cable
ATS-2	Switcher	4	XLR type	
Switcher	ESP88F series	2	XLR - Phoenix	CH1 to Ch8 multi cable
Switcher	ESP88F series	2	XLR - Phoenix	CH9 to CH16 multi cable
PC NIC	Eth. Switch	1	Cat-5	
ESP LAN	Eth. Switch	1	Cat-5	ESP88F chassis
USB port	ESP88F	1	USB-RS232C	ESP88F control
ESP88F GPIO	--	1	GPIO Loop back unit	GPIO Loop back unit
ESP88F	CC16 Emu	1	Phoenix - XLR	For CC16 connection
ESP88F	ADAT-IN card	1	Optical cable	For PMESPLink test
AES3 out card	ATS-2	1	Phoenix - XLR	For PMESPLink test
Switcher	Switcher	2	XLR - XLR	Inter connection of Switcher
Switcher	Phantom Indicator	1	XLR – XH(PCB)	Same for other ESP88F tests (This unit is not used when voltage checker is used.)
Switcher	Phantom Voltage checker	1	Same above.	Connect XH connector to convert board to Euro-9 pin connector.
DNC-R	DNC-E	1	Cat-5 crossover cable	*

Test Setup Wiring Diagrams - begin on next page

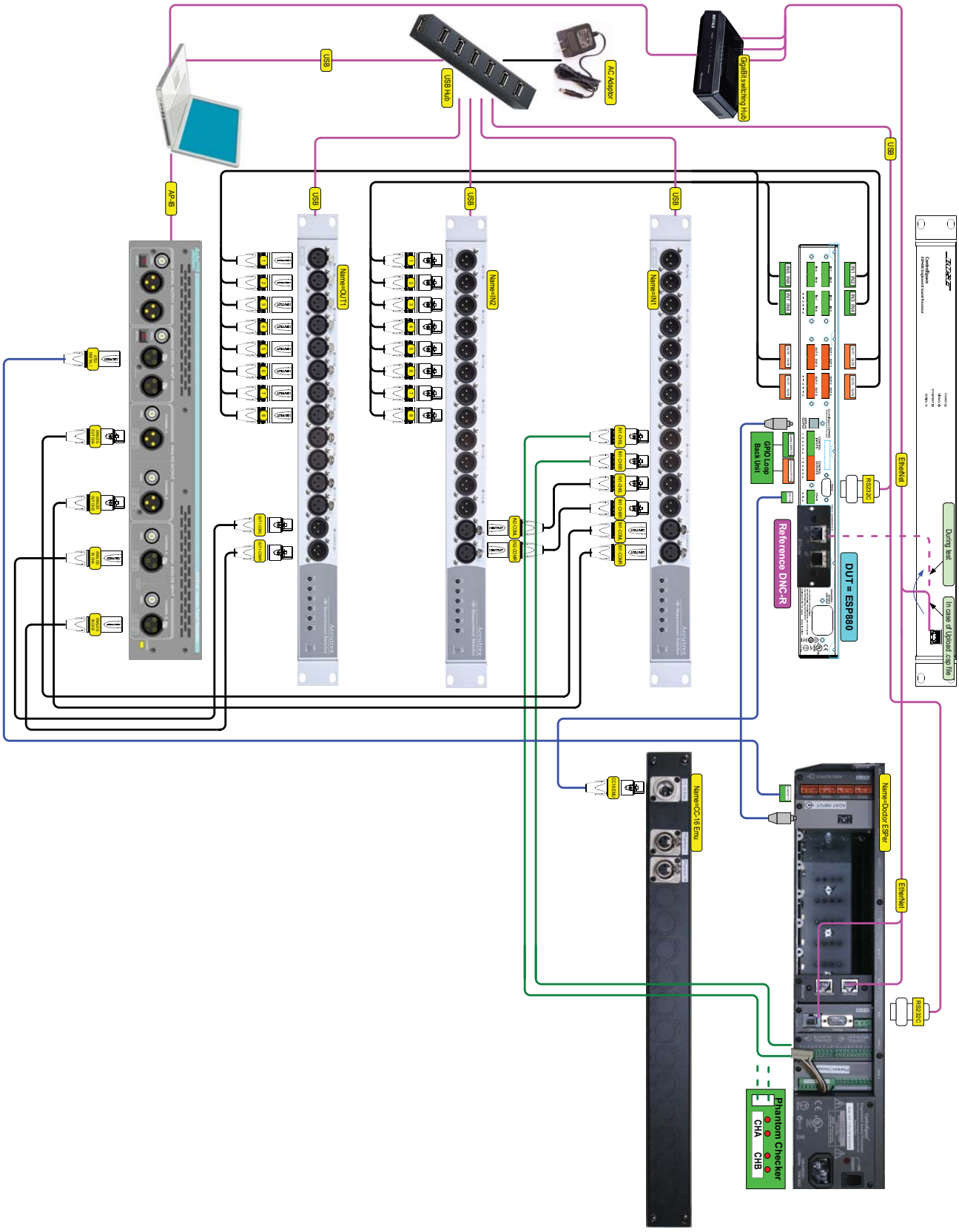


Figure 7. ESP-880 Chassis Test Setup Wiring Diagram

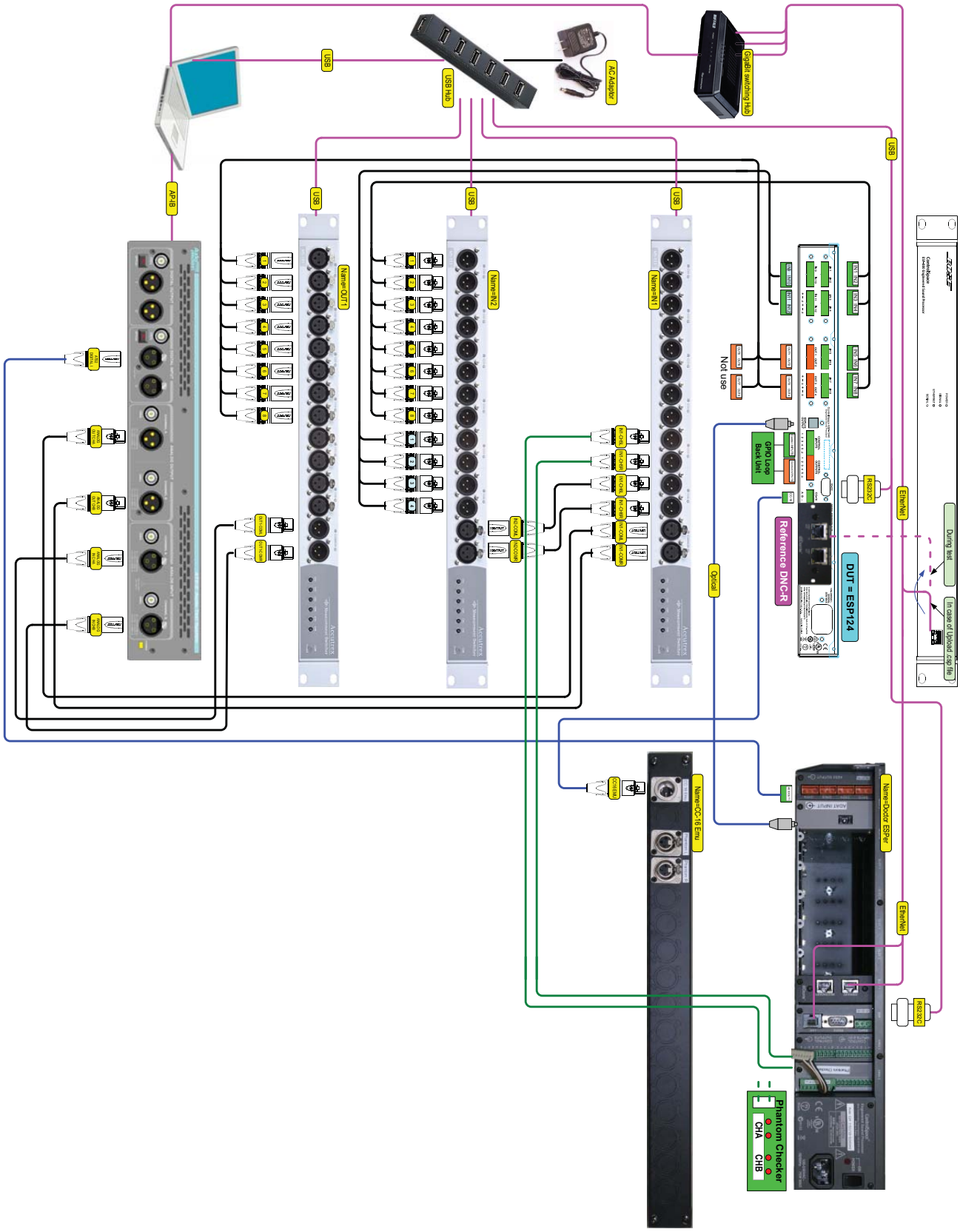


Figure 8. ESP-1240 Chassis Test Setup Wiring Diagram

TEST PROCEDURES

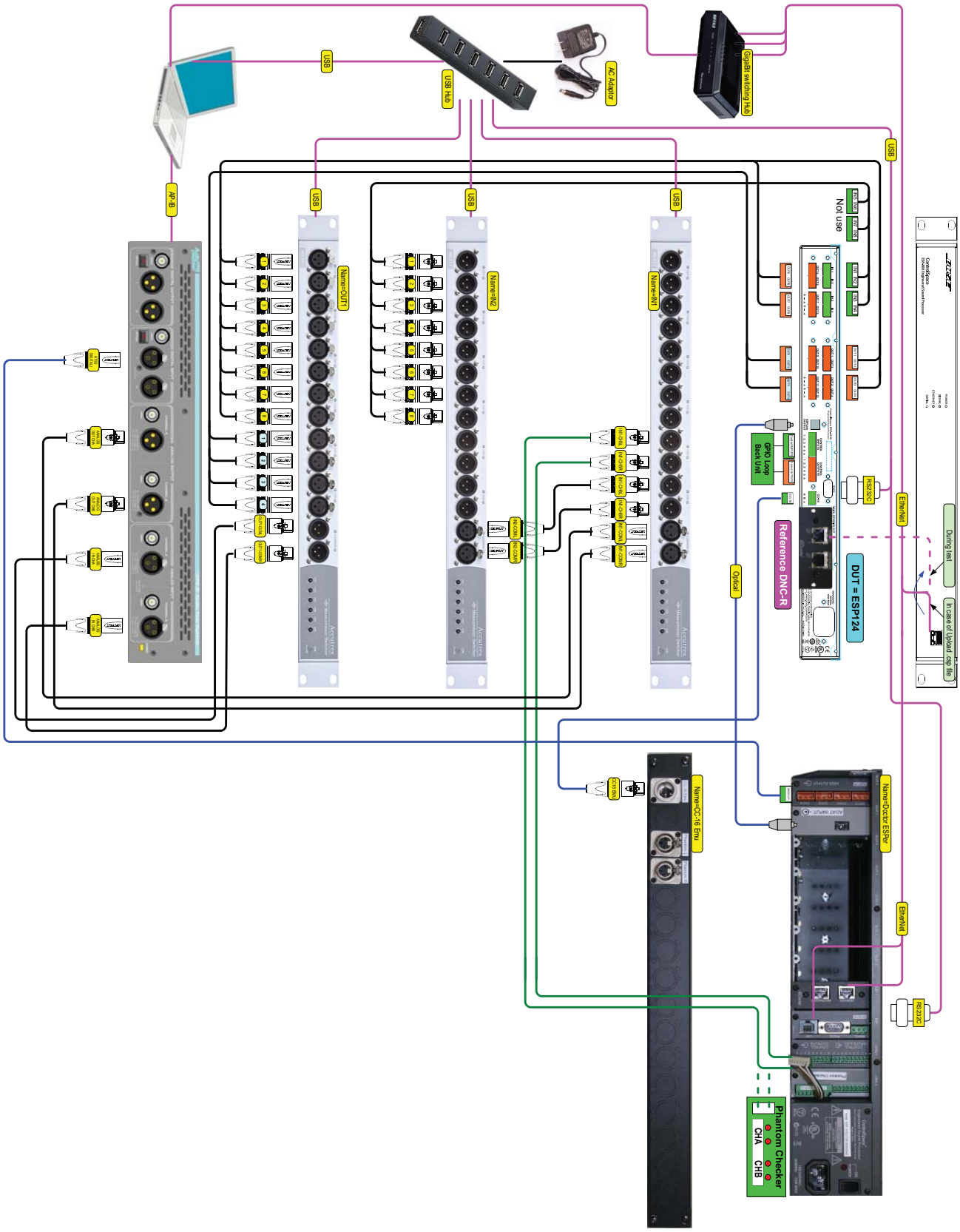


Figure 9. ESP-4120 Chassis Test Setup Wiring Diagram

TEST PROCEDURES

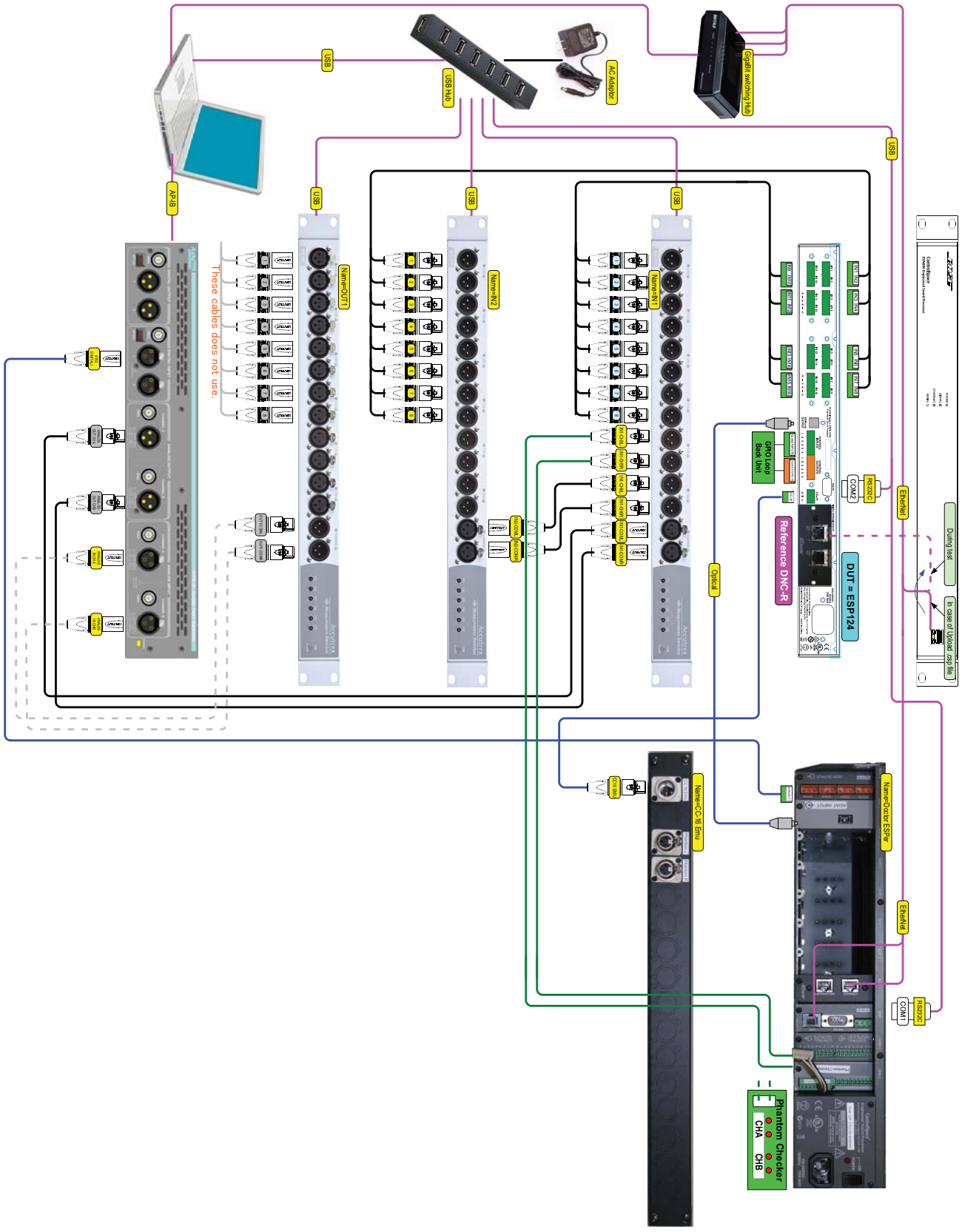


Figure 10. ESP-1600 Chassis Test Setup Wiring Diagram

TEST PROCEDURES

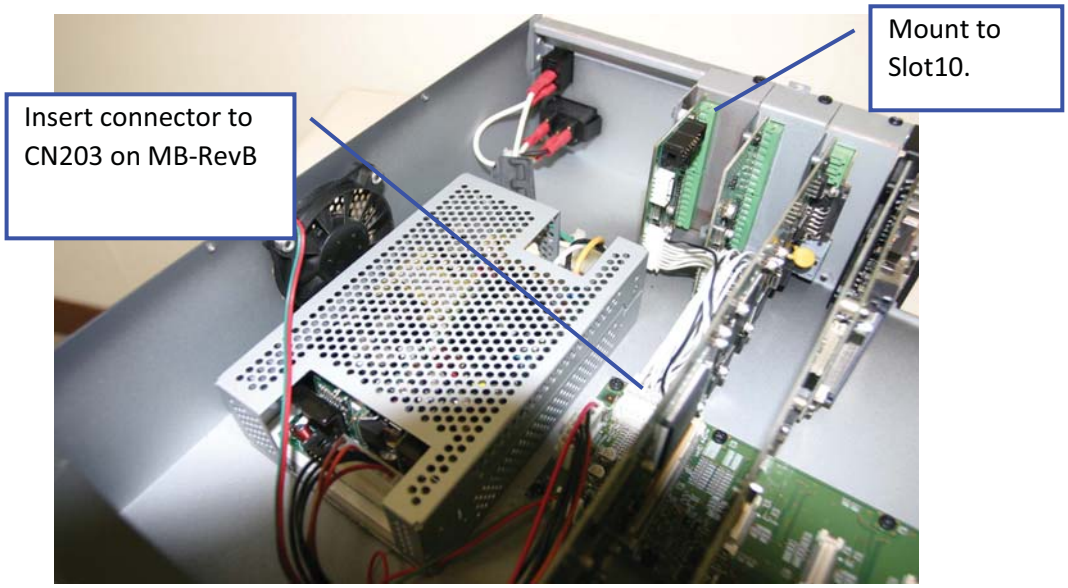
ESP-88/00/00 II for PSP Link to AES3 Converter Configurations

ESP-88/00/00 II Chassis Configuration

The ESP-xx chassis must be configured for these tests using known good plug-in cards. The chassis is used as part of the test equipment. Refer to the table below.

ESP Chassis	Card	Notes
Slot 1	DNC-E	Reference set
Slot 2	Not used	
Slot 3	Not used	
Slot 4	Not used	
Slot 5	Not used	
Slot 6	Not used	
Slot 7	ADAT-IN card	Reference set
Slot 8	AES3OUT card	Reference set
GPIO 1		
GPIO 2	Phantom Voltage checker	

Placement of the phantom voltage checker



TEST PROCEDURES

PC/ESP-xx Chassis/ATS-2/Switcher Connections for ESP-880 Test (refer to Figure 7)

Switcher Name=IN1 connections (to Phantom & ATS-2) for ESP-880

Switcher	ESP/ATS-2	Label
OUT CH1L	NC	
OUT CH1R	NC	
OUT CH2L	NC	
OUT CH2R	NC	
OUT CH3L	NC	
OUT CH3R	NC	
OUT CH4L	NC	
OUT CH4R	NC	
OUT CH5L	Phantom Voltage checker or Phantom indicator	IN1-CH5L
OUT CH5R	Phantom Voltage checker or Phantom indicator	IN1-CH5R
OUT CH6L	Switcher Name=IN2 COM-L	IN1-CH6L
OUT CH6L	Switcher Name=IN2 COM-R	IN1-CH6R
COM-L	ATS2 ANALOG OUT CHA	IN1-COM-L
COM-R	ATS2 ANALOG OUT CHB	IN1-COM-R

Switcher Name=IN2 connections (to DUT & Switcher IN1) for ESP-880

Switcher	ESP/ATS-2	Label
OUT CH1L	ESP880 IN1	1
OUT CH1R	ESP880 IN2	2
OUT CH2L	ESP880 IN3	3
OUT CH2R	ESP880 IN4	4
OUT CH3L	ESP880 IN5	5
OUT CH3R	ESP880 IN6	6
OUT CH4L	ESP880 IN7	7
OUT CH4R	ESP880 IN8	8
OUT CH5L	NC	
OUT CH5R	NC	
OUT CH6L	NC	
OUT CH6L	NC	
COM-L	Switcher Name=IN1 CH5L	IN2-COM-L
COM-R	Switcher Name=IN1 CH5R	IN2-COM-R

TEST PROCEDURES

Switcher Name=OUT1 connections (to ESP & ATS-2) for ESP-880

Switcher	ESP/ATS-2	Label
IN CH1L	ESP880 OUT1	1
IN CH1R	ESP880 OUT2	2
IN CH2L	ESP880 OUT3	3
IN CH2R	ESP880 OUT4	4
IN CH3L	ESP880 OUT5	5
IN CH3R	ESP880 OUT6	6
IN CH4L	ESP880 OUT7	7
IN CH4R	ESP880 OUT8	8
OUT CH5L	NC	
OUT CH5R	NC	
OUT CH6L	NC	
OUT CH6L	NC	
COM-L	ATS2 ANALOG IN CHA	OUT1-COM-L
COM-R	ATS2 ANALOG IN CHB	OUT1-COM-R

PC/ESP/ATS-2/Switcher Connections for ESP-1240 (refer to Figure 8)

Switcher Name=IN1 connections (to Phantom & ATS-2) for ESP-1240

Switcher	ESP/ATS-2	Label
OUT CH1L	NC	
OUT CH1R	NC	
OUT CH2L	NC	
OUT CH2R	NC	
OUT CH3L	NC	
OUT CH3R	NC	
OUT CH4L	NC	
OUT CH4R	NC	
OUT CH5L	Phantom Voltage checker or Phantom indicator	IN1-CH5L
OUT CH5R	Phantom Voltage checker or Phantom indicator	IN1-CH5R
OUT CH6L	Switcher Name=IN2 COM-L	IN1-CH6L
OUT CH6L	Switcher Name=IN2 COM-R	IN1-CH6R
COM-L	ATS2 ANALOG OUT CHA	IN1-COM-L
COM-R	ATS2 ANALOG OUT CHB	IN1-COM-R

Note: Same connections as for ESP-880

TEST PROCEDURES

Switcher Name=IN2 connections (to DUT & Switcher IN1) for ESP-1240

Switcher	ESP/ATS-2	Label
OUT CH1L	ESP880 IN1	1
OUT CH1R	ESP880 IN2	2
OUT CH2L	ESP880 IN3	3
OUT CH2R	ESP880 IN4	4
OUT CH3L	ESP880 IN5	5
OUT CH3R	ESP880 IN6	6
OUT CH4L	ESP880 IN7	7
OUT CH4R	ESP880 IN8	8
OUT CH5L	ESP880 IN9	1
OUT CH5R	ESP880 IN10	2
OUT CH6L	ESP880 IN11	3
OUT CH6R	ESP880 IN12	4
COM-L	Switcher Name=IN1 CH5L	IN2-COM-L
COM-R	Switcher Name=IN1 CH5R	IN2-COM-R

Switcher Name=OUT1 connections (to ESP & ATS-2) for ESP-1240

Switcher	ESP/ATS-2	Label
IN CH1L	ESP880 OUT1	1
IN CH1R	ESP880 OUT2	2
IN CH2L	ESP880 OUT3	3
IN CH2R	ESP880 OUT4	4
IN CH3L	NC	
IN CH3R	NC	
IN CH4L	NC	
IN CH4R	NC	
OUT CH5L	NC	
OUT CH5R	NC	
OUT CH6L	NC	
OUT CH6L	NC	
COM-L	ATS2 ANALOG IN CHA	OUT1-COM-L
COM-R	ATS2 ANALOG IN CHB	OUT1-COM-R

TEST PROCEDURES

PC/ESP/ATS-2/Switcher Connections for ESP-4120 (refer to Figure 9)

Switcher Name=IN1 connections (to Phantom & ATS-2) for ESP-4120

Switcher	ESP/ATS-2	Label
OUT CH1L	NC	
OUT CH1R	NC	
OUT CH2L	NC	
OUT CH2R	NC	
OUT CH3L	NC	
OUT CH3R	NC	
OUT CH4L	NC	
OUT CH4R	NC	
OUT CH5L	Phantom Voltage checker or Phantom indicator	IN1-CH5L
OUT CH5R	Phantom Voltage checker or Phantom indicator	IN1-CH5R
OUT CH6L	Switcher Name=IN2 COM-L	IN1-CH6L
OUT CH6L	Switcher Name=IN2 COM-R	IN1-CH6R
COM-L	ATS2 ANALOG OUT CHA	IN1-COM-L
COM-R	ATS2 ANALOG OUT CHB	IN1-COM-R

Note: Same connections as for ESP-880

Switcher Name=IN2 connections (to DUT & Switcher IN1) for ESP-4120

Switcher	ESP/ATS-2	Label
OUT CH1L	ESP880 IN1	1
OUT CH1R	ESP880 IN2	2
OUT CH2L	ESP880 IN3	3
OUT CH2R	ESP880 IN4	4
OUT CH3L	NC	
OUT CH3R	NC	
OUT CH4L	NC	
OUT CH4R	NC	
OUT CH5L	NC	
OUT CH5R	NC	
OUT CH6L	NC	
OUT CH6L	NC	
COM-L	Switcher Name=IN1 CH5L	IN2-COM-L
COM-R	Switcher Name=IN1 CH5R	IN2-COM-R

TEST PROCEDURES

Switcher Name=OUT1 connections (to ESP & ATS-2) for ESP-4120

Switcher	ESP/ATS-2	Label
IN CH1L	ESP880 OUT1	1
IN CH1R	ESP880 OUT2	2
IN CH2L	ESP880 OUT3	3
IN CH2R	ESP880 OUT4	4
IN CH3L	ESP880 OUT5	5
IN CH3R	ESP880 OUT6	6
IN CH4L	ESP880 OUT7	7
IN CH4R	ESP880 OUT8	8
OUT CH5L	ESP880 OUT9	1
OUT CH5R	ESP880 OUT10	2
OUT CH6L	ESP880 OUT11	3
OUT CH6L	ESP880 OUT12	4
COM-L	ATS2 ANALOG IN CHA	OUT1-COM-L
COM-R	ATS2 ANALOG IN CHB	OUT1-COM-R

PC/ESP/ATS-2/Switcher Connections for ESP-1600 (refer to Figure 10)

Switcher Name=IN1 connections (to Phantom & ATS-2) for ESP-1600

Switcher	ESP/ATS-2	Label
OUT CH1L	ESP880 IN9	1
OUT CH1R	ESP880 IN10	2
OUT CH2L	ESP880 IN11	3
OUT CH2R	ESP880 IN12	4
OUT CH3L	ESP880 IN13	5
OUT CH3R	ESP880 IN14	6
OUT CH4L	ESP880 IN15	7
OUT CH4R	ESP880 IN16	8
OUT CH5L	Phantom Voltage checker or Phantom indicator	IN1-CH5L
OUT CH5R	Phantom Voltage checker or Phantom indicator	IN1-CH5R
OUT CH6L	Switcher Name=IN2 COM-L	IN1-CH6L
OUT CH6L	Switcher Name=IN2 COM-R	IN1-CH6R
COM-L	ATS2 ANALOG OUT CHA	IN1-COM-L
COM-R	ATS2 ANALOG OUT CHB	IN1-COM-R

Note: Same connections as for ESP-880

TEST PROCEDURES

Switcher Name=IN2 connections (to DUT & Switcher IN1) for ESP-1600

Switcher	ESP/ATS-2	Label
OUT CH1L	ESP880 IN1	1
OUT CH1R	ESP880 IN2	2
OUT CH2L	ESP880 IN3	3
OUT CH2R	ESP880 IN4	4
OUT CH3L	ESP880 IN5	5
OUT CH3R	ESP880 IN6	6
OUT CH4L	ESP880 IN7	7
OUT CH4R	ESP880 IN8	8
OUT CH5L	NC	1
OUT CH5R	NC	2
OUT CH6L	NC	3
OUT CH6R	NC	4
COM-L	Switcher Name=IN1 CH5L	IN2-COM-L
COM-R	Switcher Name=IN1 CH5R	IN2-COM-R

Switcher Name=OUT1 connections (to ESP & ATS-2) for ESP-1600

Switcher	ESP/ATS-2	Label
IN CH1L	NC	
IN CH1R	NC	
IN CH2L	NC	
IN CH2R	NC	
IN CH3L	NC	
IN CH3R	NC	
IN CH4L	NC	
IN CH4R	NC	
OUT CH5L	NC	
OUT CH5R	NC	
OUT CH6L	NC	
OUT CH6L	NC	
COM-L	ATS2 ANALOG IN CHA	OUT1-COM-L
COM-R	ATS2 ANALOG IN CHB	OUT1-COM-R

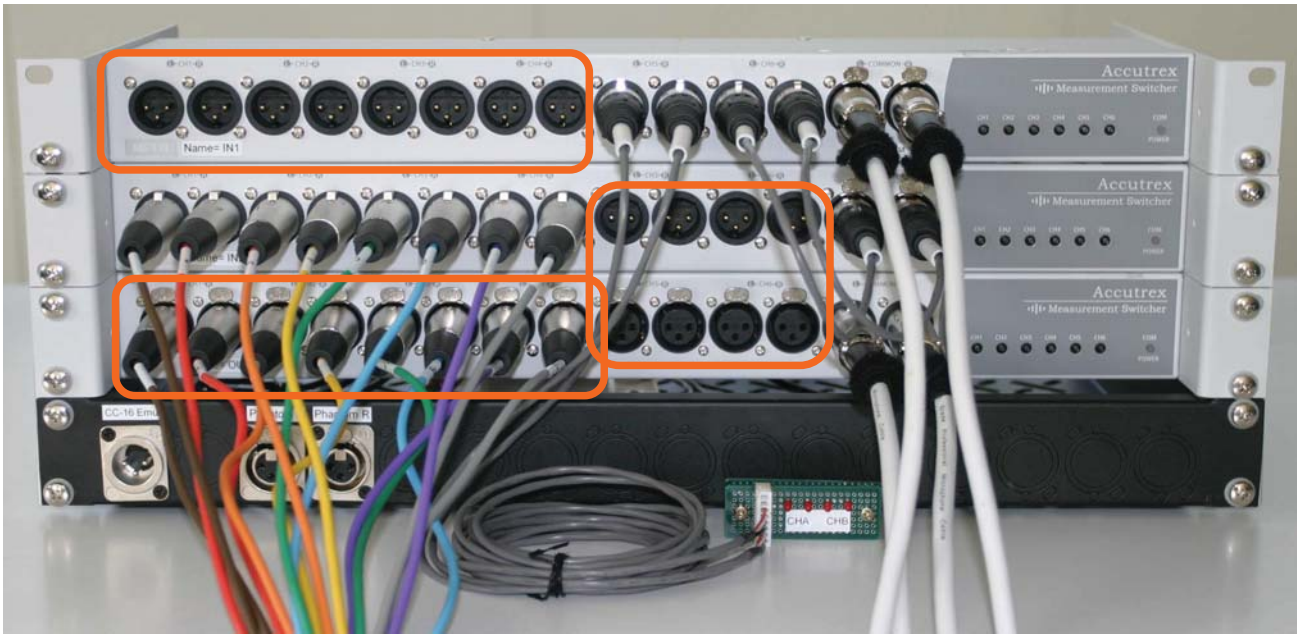
TEST PROCEDURES

PC/ESP/ATS-2/Switcher Connections (example photograph)

ESP-880 Connections

Note: Analog input and output connections are different for the ESP-880, ESP-1240, ESP-4120 and ESP-1600 chassis.

Switcher Connections

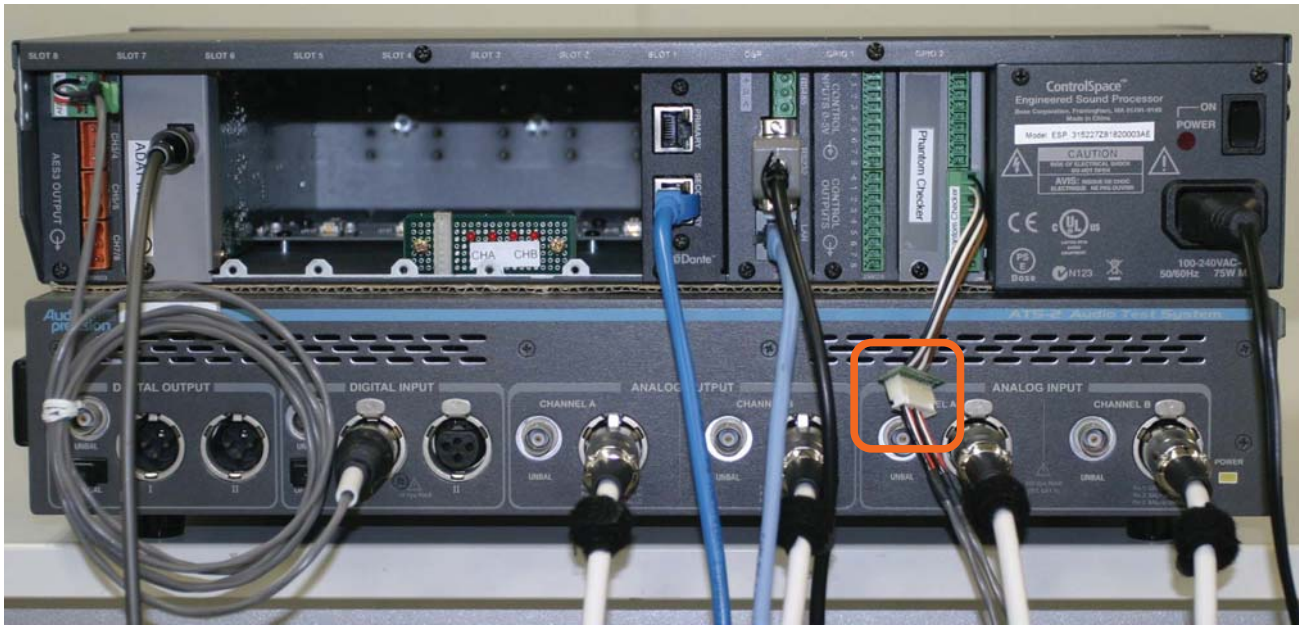


Note: Marked connectors are different each ESP-xxxx chassis type and configuration.

TEST PROCEDURES

ATS-2 and ESP Connections

Connect XH connector to converter PCB for Phantom voltage checker.



PC Software Setup

The test PC must be loaded with software compatible with this version of the test. The software needs to be installed only once. **Note:** ControlSpace® software for testing this card may be different from the version used for other cards or the ESP.

Software	From	Ver.	Notes
ControlSpace Designer	Bose	4.2 or later	
Measurement Switcher	AuBit	1.0.9 or later	Same for all tests
ATS	Audio Precision	1.60	Same for all tests
Dante Controller	Audinate	v3.5.4.1	Note: This function is included in CSD V4.1 or later.

Install the above software on the test PC. Measurement Switcher should be installed to the following path: C:\Program Files\AuBit\LTD\MeasurementSwitcher\MeasurementSwitcher.exe

ESP-xx Chassis Test Setup

Use the ControlSpace Designer™ software to install the appropriate firmware into the ESP-88F, set the unit to DHCP mode, and to upload the necessary design file. The design file establishes the proper routing of audio signals within the ESP-88F. If the design file is not loaded, AP errors such as “input out of range” will result as the audio will path from the AP output to the AP input will not be properly established.

TEST PROCEDURES

IP Addresses

In the ControlSpace® Designer™ software, ensure the ESP-880 / ESP-1240 / ESP-4120 / ESP-1600 chassis is set to static IP address 192.168.0.160.

Ensure that the ESP-88/00/00 II chassis with ADAT-IN and AES3-OUT card is sent to static IP address 192.168.0.165.

Files Needed

Device Under Test (DUT) Firmware

Software	File	Ver.	Notes
ESP88F Firmware	espf v1.140.frm	1.140	included with CSD v4.2

For ESP-88F series files with ESP-88 as test fixture (CSD design files).
In case of DNC-E card has Dante card ID. This configuration will update DUT and fixture.

Type	File
ESP-880	ESP880+ESP+DNCR-TestConfiguration01(ESP88+Dante16).csp
ESP-1240	ESP124+ESP+DNCR-Test Configuration01(ESP88+Dante16).csp
ESP-4120	ESP412+ESP+DNCR-Test Configuration01(ESP88+Dante16).csp
ESP-1600	ESP160+ESP+DNCR-Test Configuration01(ESP88+Dante16).csp

Firmware Upgrade

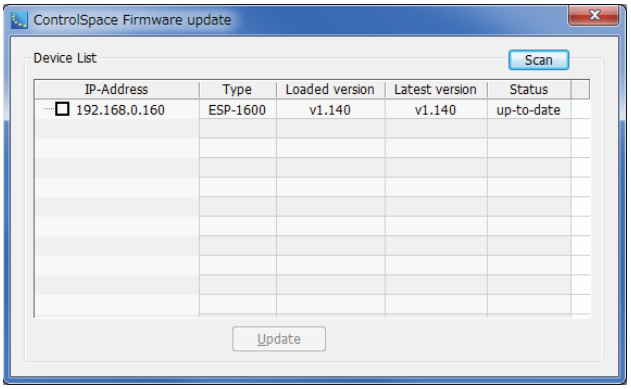
Use ControlSpace Designer (CSD) to install the v1.140 firmware into the DUT if needed.

Verify CSD version

Open CSDesigner software. Click “Help”, “About ControlSpace Designer…”.
Verify you see v4.2 like this figure.

Check Firmware Version for DUT

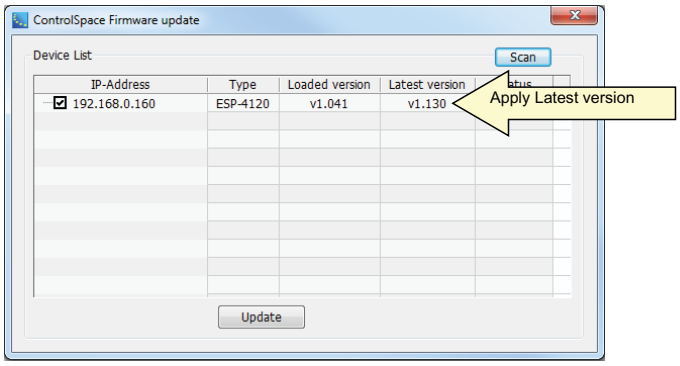
With DUT powered up and Ethernet connected, click “System”, “Update Firmware”. The Type field will show the DUT type. The example below is for ESP-1600.
Verify FW pre-loaded to v1.140 like this figure.
If already at v1.140, go to step “Enabling DHCP”.



TEST PROCEDURES

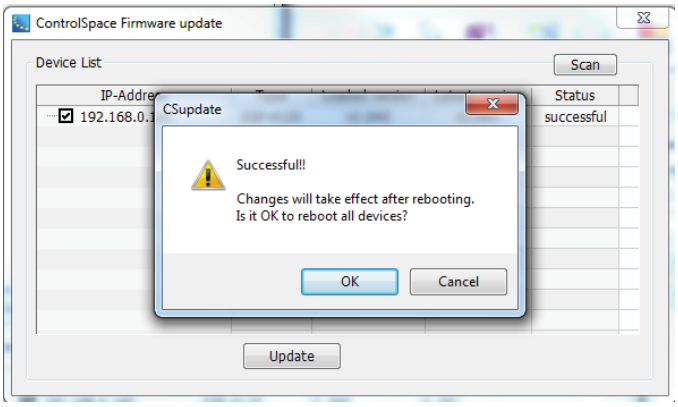
Check Firmware version for DUT (continued)

If FW is from a previous version, you will see something like this figure:



Click “Update” and wait for the dialog box shown at right, indicating the update was successful. Do not power off the DUT during this procedure.

Click “OK”. Wait for the DUT to reboot and report the correct firmware version. Only then continue to next step.



Enabling DHCP

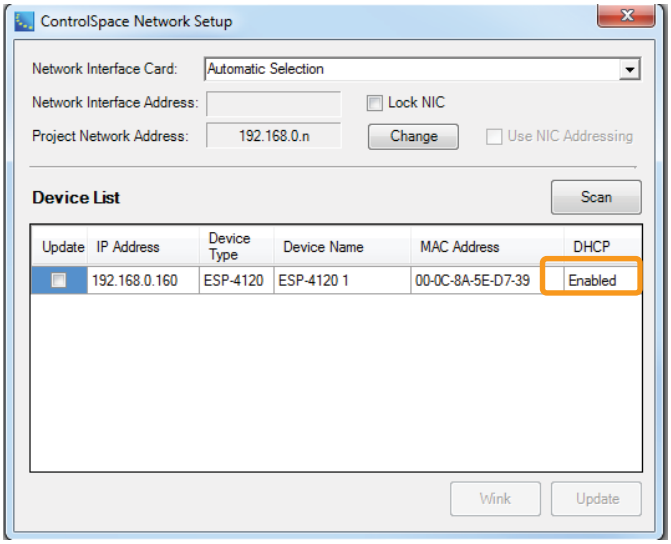
All ESP-880/1240/4120/1600 units should leave the factory with DHCP mode selected. Verify DHCP mode is enabled.

With DUT powered up and connected to Ethernet, click “System” and “Network Setup”.

If DUT shows DHCP as “Enabled” as in the screen below, then proceed to the Dante setup step on the next page.

Otherwise, enable DHCP as follows:

Click the check-box in the Update column. The “Update” button in the lower right will become available to use.

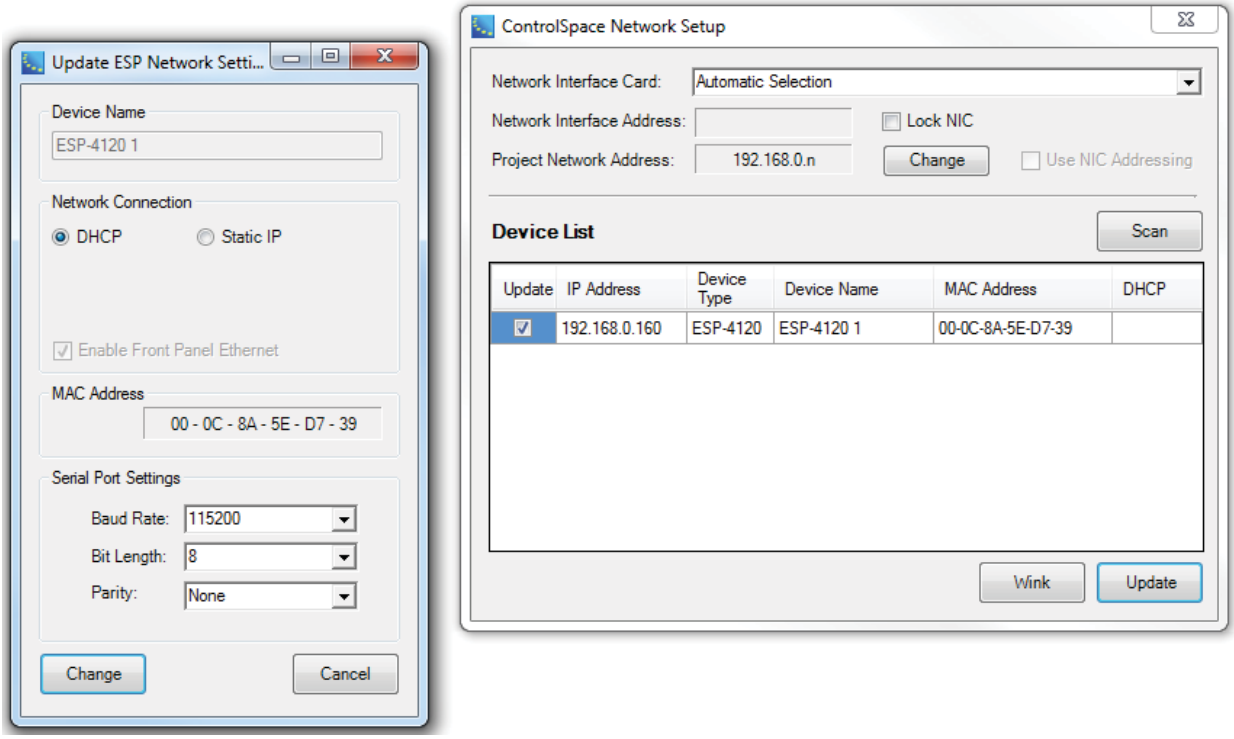


Click on the “Update” button. This will open the Network Setting dialog.

Select “DHCP” by clicking on it.

Then click “Change”, then click “OK” to the next dialog. The unit will reboot and is now set to DHCP correctly.

TEST PROCEDURES



Note: When the DHCP is set, the IP address of the predefined .csp file needs to change the IP address to that shown in above dialog box.

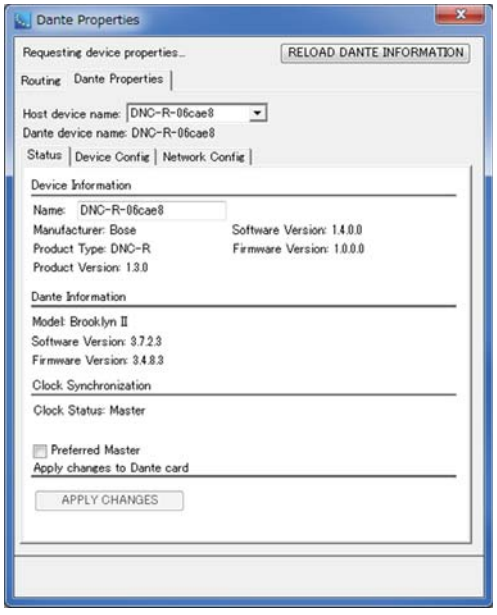
To avoid this, it is recommended to not use the Ethernet router because the ESP-88F series has a DHCP time out function.

Above setup connection drawing is intending to use the Ethernet hub. In this case, PC IP address shall be set to meet with ESP-88F series.

Dante Setup

CSD V4.1 or later version has the Dante properties function instead to the Dante controller.
To use this function, use CSD menu [System – Dante properties].

To setup the routing in Dante, choose [Routing] tab on the Dante properties dialog.



TEST PROCEDURES

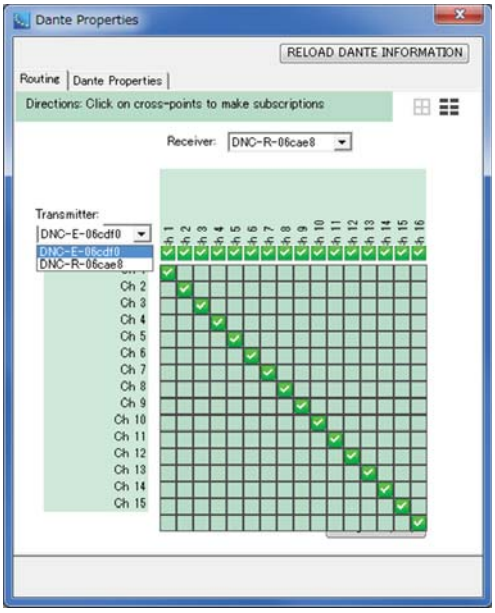
When the Routing tab is chosen, this dialog can be seen.

To set the proper routing for this test, assign the routing as shown at right.

The Transmitter and Receiver setting are two separate settings corresponding to DNC-R and DNC-E.

Choose [DNC-R] on transmitter list box and set the routing, next, choose [DNC-E] and set the routing.

After setting the routing, close the dialog box.



DUT Setup

Upload CSD Design

Use CSD to upload the test configuration.csp file or equivalent configuration file to the DUT.
This configuration shall be uploaded to each DUT for this test.
The configuration file shall meet with the DUT type.

DUT type	Configuration file name
ESP-880	ESP880+ESP+DNCR-TestConfiguration01(ESP88+Cobra16).csp
ESP-1240	ESP124+ESP+DNCR-Test Configuration01(ESP88+Cobra16).csp
ESP-4120	ESP412+ESP+DNCR-Test Configuration01(ESP88+Cobra16).csp
ESP-1600	ESP160+ESP+DNCR-Test Configuration01(ESP88+Dante16).csp

Note 1: These files are the same as previous the version but the way CSD handles the DNC-E card was changed, the card name for DNC-E is revised. This DNC-E card name depends on the CC-E card firmware. Please use the proper .csp files.
Note 2: The PC that is running CSD and upload is recommended to be the same PC as is used for the ATS macro. In the following test, the time of DUT has will be compared with the time in the PC. To minimize the time difference between DUT and PC, using the same PC is recommended.
Note 3: For the proper testing, uploading the .csp file must use front Ethernet port. See below.

Turn off the DUT

To ensure the Real Time Clock (RTC) backup function of DUT, the DUT shall be turned off after uploading the configuration file.

Turn on the DUT

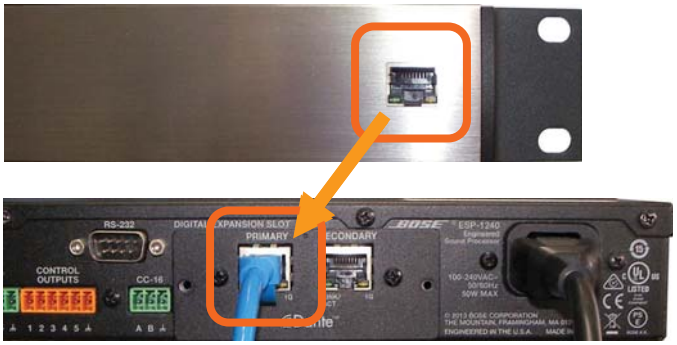
After at least 5 seconds re-apply AC power to the DUT to perform the following tests.

TEST PROCEDURES

Cable Connection to the DUT During Boot-up

The DUT needs a period of time to boot up. To shorten the total test time, an Ethernet cable connection is recommended during the boot up sequence.

The CAT-5 cable must be moved from the front ethernet port to the rear expansion port. See at right.



ATS2 Macro

Preparation of Test

MeasurementSwitcher.exe
Measurement Switcher

Run the Measurement Switcher.exe.

ATS.exe
ATS
Audio Precision, Inc.

Once the measurement switcher program is open, Run the ESP88C_Test_Macro_Rev_21b.atsb test macro. Choose the test type as shown below.

DUT Type	Test type
ESP-880	ESP88F(Redline)
ESP-1240	ESP88F 12x4 Version
ESP-4120	ESP88F 4x12 Version
ESP-1600	ESP88F 16x0 Version

Choose Phantom test type

Phantom test Type	Test type
LED indicator	Manual testing by using LED indicator.
Volt checker	Automated testing by using phantom voltage checker.

Input Fixture Comm port number

This automated test needs the connection between PC and ESP88 as a test fixture.
This Comm port number shall be different for [DUT Comm Port] and [Fixture Comm Port].

If the [LED indicator] was selected, the [Fixture Comm Port] will not used, but a dummy COM port number is required.

Input serial number, lot, and tester's name.
Press "Start Test".
The dialog box for saving the log file will come up. Select a file name for the test results.

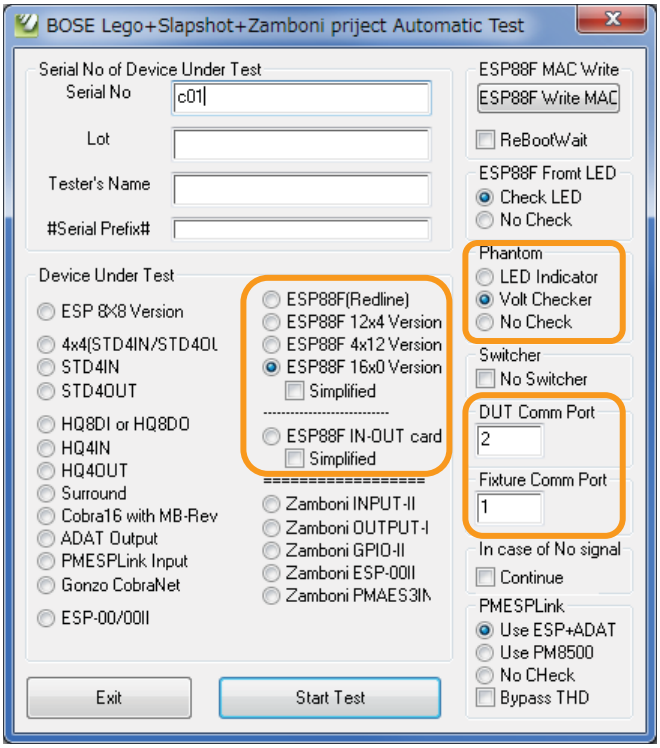
TEST PROCEDURES

1. Start of Test

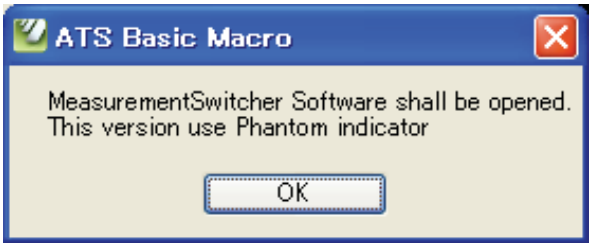
1.1 Start Test

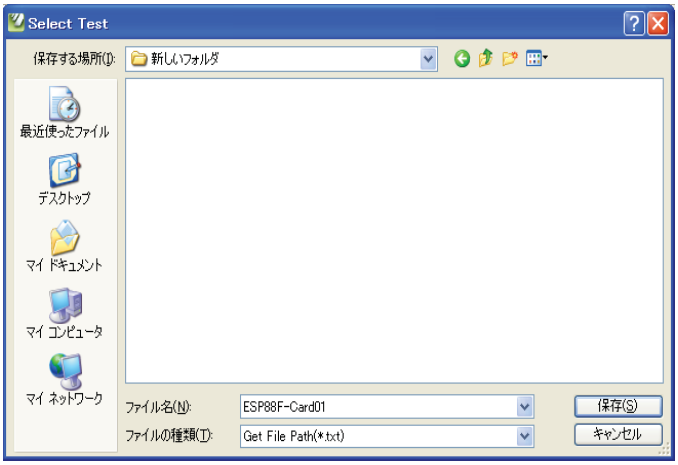
Push “Start Test” button. (Test will not start if the required data is not filled in.)

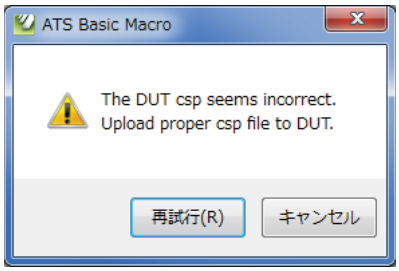
The file saving dialog will come up.
Push Save button after choosing directory and file name.
The file name is applied the serial number field.
Default file name is the serial number that inputted in the “Serial No” text box.



The notification message box will come up. Click the OK button.







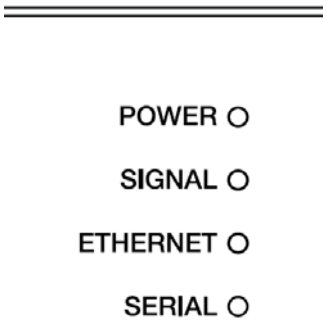
When the uploaded csp file does not have a “Gain 1” module as a dummy, the dialog box at left will come up.
Upload the proper .csp file before pushing [Retry] button.
If the .csp file is correct, the test will proceed to next step.

If [Cancel] is pushed, test will proceed with current uploaded csp file.

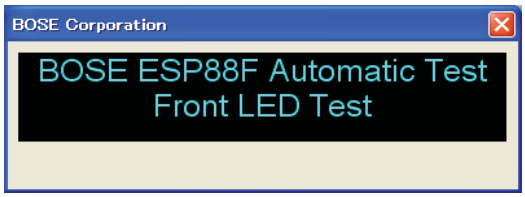
TEST PROCEDURES

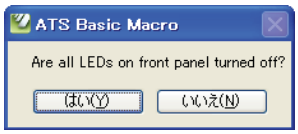
1.2 Front LED Test

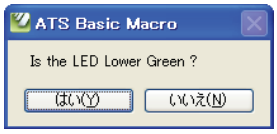
The led color and indication will be checked by viewing the front LEDs and clicking yes (Y) or no (N) as appropriate. The below series of dialog boxes will increment you through these tests. These tests start with all LED's off, proceed to the Serial LED (lower) and then through the lower middle (Ethernet) to the upper middle (Signal) and to the upper (Power).

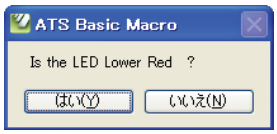


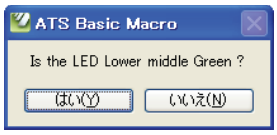
Front Panel LED Layout

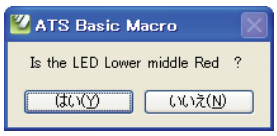


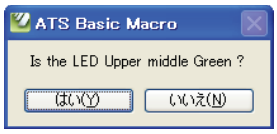


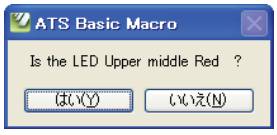


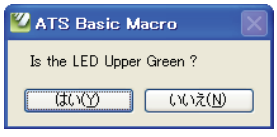


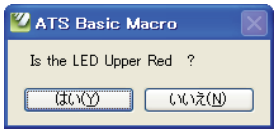






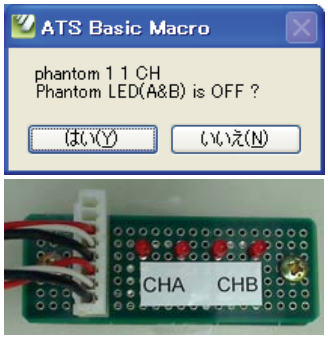






TEST PROCEDURES

1.3 Phantom Power Test



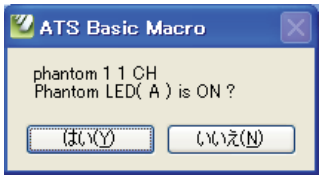
(In Case of Manual testing by choosing [LED indicator])

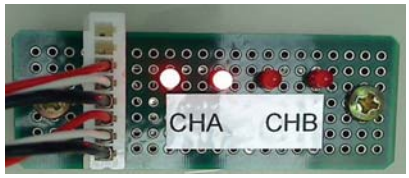
The phantom testing dialog box will come up.

Look at the Phantom indicator and choose the yes (Y) or no (N) button according to the LED on the Phantom indicator.

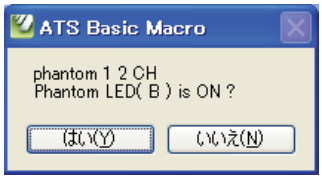
In case of this dialog, it informs this test is applied to the slot 1 ch1 phantom function, and requests the confirmation of both channels of LED is turned off.

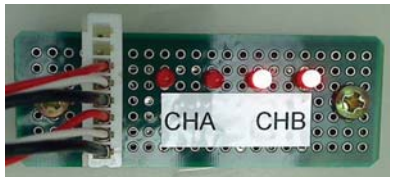
In this case the LEDs are off, click the OK button.





According to the progress of the Phantom testing, LED will be turned on.
In case of the dialog requests LED(A) is on, push the OK button when the CHA 2 LEDs are lights on.

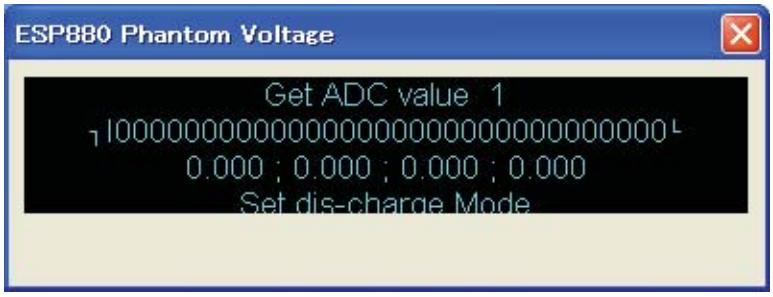




In case of the dialog requests LED(B) is on, push the OK button when the CHB 2 LEDs are lights on.

This tests will continue for 2 input cards 8 channels including LED (A&B) off state.

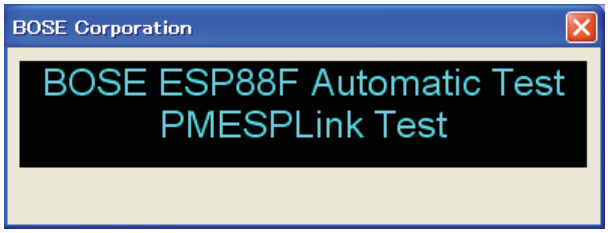
(In Case of Automated testing by choosing [Volt checker])
The Phantom voltage checker dialog will come up and the testing will done by automatically.

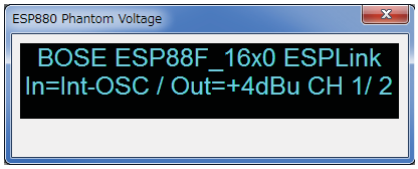


TEST PROCEDURES

1.4 PMESPLink Test

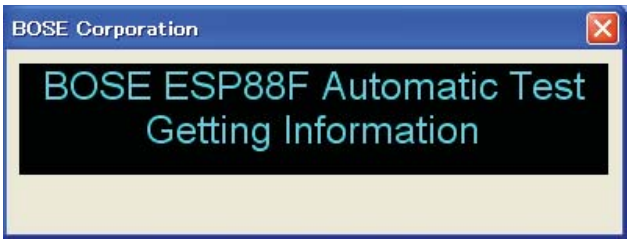
The PMESPLink test will be performed by automatically by using ADAT-IN and AES3OUT card on the optional ESP. The audio performance at GV=0dB will be recorded.





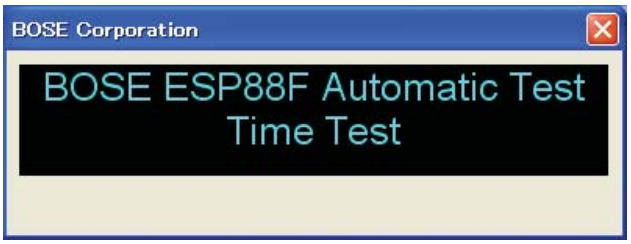
1.5 Getting Information

To identify the DUT the information retrieved from the DUT will be recorded.



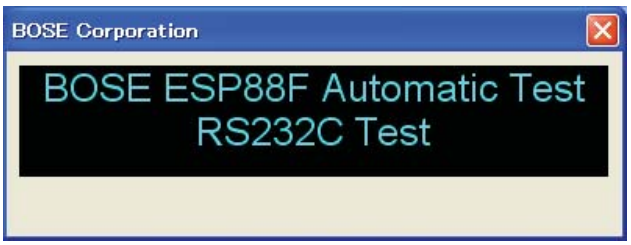
1.6 Time Test

The time that IS running in the DUT by its Real Time Clock (RTC) is recorded and compared with the PC's time that running the test macro.



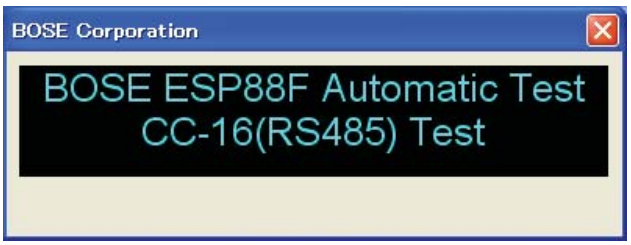
1.7 RS232C Test

The communication between the PC to the DUT is performed by RS232C line. The test macro records it is passed or failed.



1.8 RS485 Test

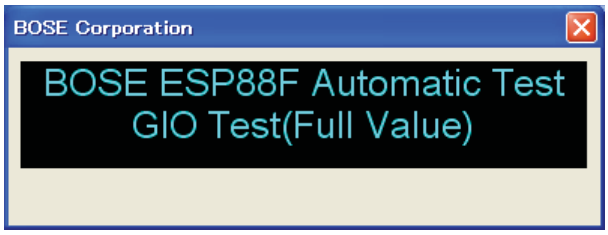
By inquiring the connection of CC-16 to the DUT, the RS485 connection is tested. To get a pass result, CC-16 emulator or CC-16 controller must be connected to the DUT.

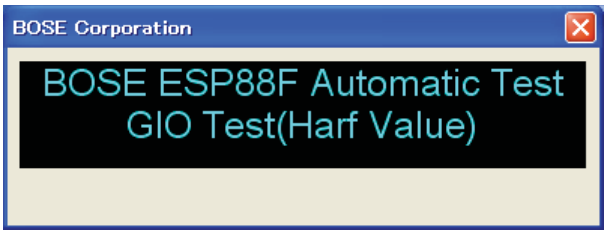


TEST PROCEDURES

1.9 GPIO Test

By using “GPIO loop back unit”, GPIO test will be performed.





2. Audio performance Testing

After previous testing, the Audio Testing dialogs will appear.
If the measured level is not within the criteria, the “Out of range” dialog will appear.

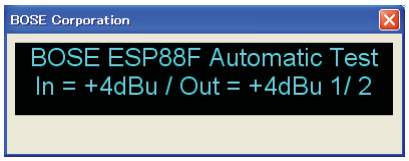
If you need terminate this test, choose “Abort”.
If you retry this test, choose “Retry”.
If you need to continue and record without retry, choose “Ignore”.

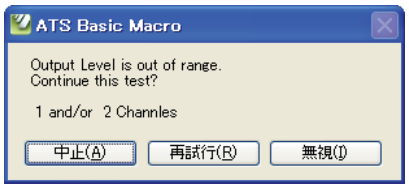
Before retry, check all connections.
This error is usually the result of:

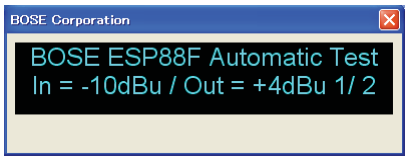
- Incorrect wiring
- Loose connection
- ESP-88F not uploaded with design file
- ESP-88F not booted-up
- Expansion outside connection is missed

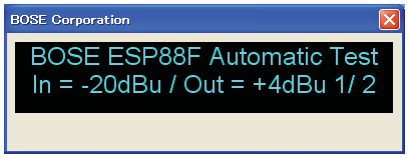
If the connections are correct, the DUT has a problem.

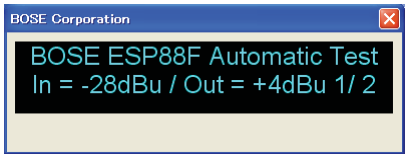
The audio performance test will be done at each gain setting.

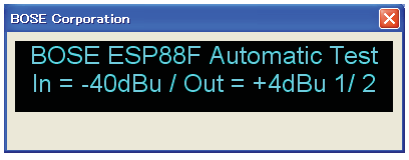












2.1 Debug Message Suppression

At end of this testing, the command to suppress the boot message “kerv 0” is issued to the DUT.
The returned value is recorded to the logged .txt file.

m25p80 spi0.0: SE:addr_width = 3, to = 00050000, ear = 00 /cmd success

or

cmd success

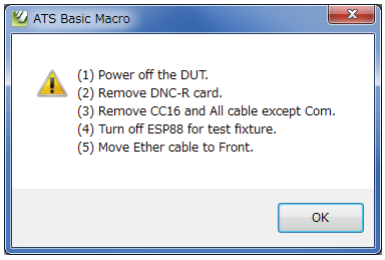
will be recorded.

TEST PROCEDURES

2.2 Upload Blank Setting

Before returning the unit to the customer, the DUT must be cleared of the testing configuration.
To clear the testing configuration, do the following procedure to upload the blank setting.
The ATS test macro supports the record of blank setting and shipping configuration.

When the required test is finished, this dialog will come up.



According to the message in the dialog box, perform the following steps.

2.2.1 Power off the DUT.

2.2.2 Remove DNC-R card

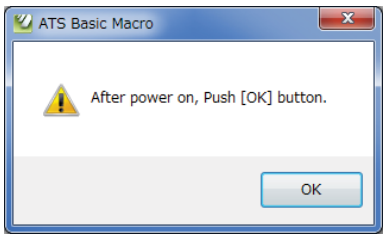
2.2.3 Remove CC-16 and all cables.
Note: The COM cable shall remain connected.

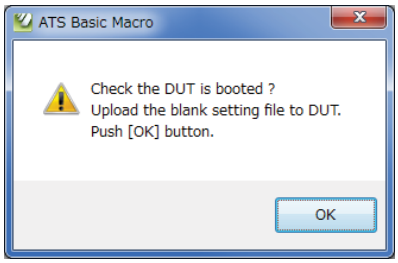
2.2.4 Turn off the ESP-88/00/00 II chassis that is used as part of the test fixture.

2.2.5 On the DUT, move the Ethernet cable to the front panel Ethernet port connector.

After these items are done, click the OK button.

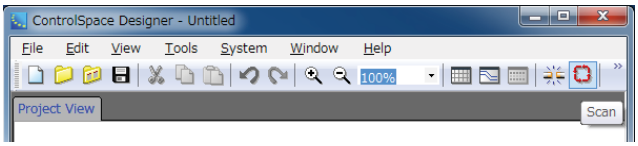
2.2.6 The requesting power on dialog will come up. Click the OK button.





TEST PROCEDURES

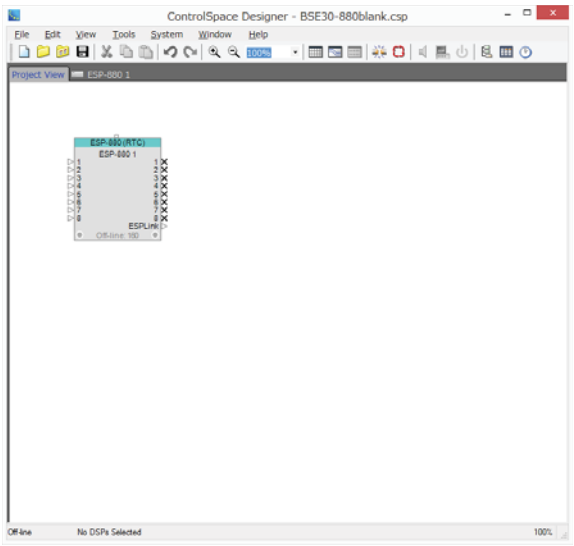
2.2.7 When the prompting the “Blank” file upload message will comes up, upload the blank file.

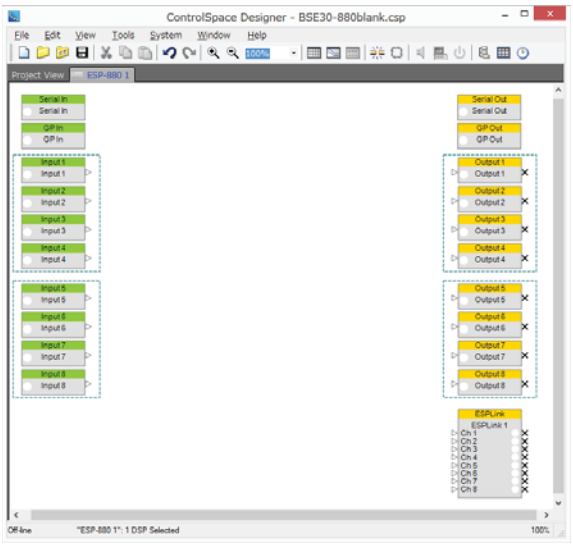


2.2.8 Load the proper blank csp file to CSD-V4.2 according to DUT.

No.	Model	Blank csp file
1	ESP-880	BSE30-880blank.csp
2	ESP-1240	BSE31-1240blank.csp
3	ESP-4120	BSE32-4120blank.csp
4	ESP-1600	BSE3x-1600blank.csp

2.2.9 Go ON-LINE and Upload. (Refer to the below example)





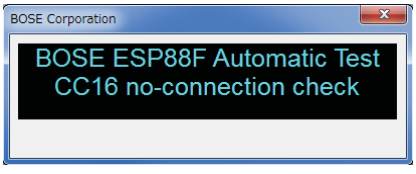
2.2.10 Push GO OFF-LINE button.

2.2.11 The expansion slot blank test will start automatically.

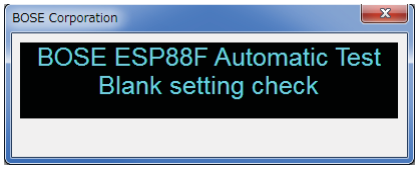
If an error is detected, the [Retry] and [Cancel] Dialog box will come up.

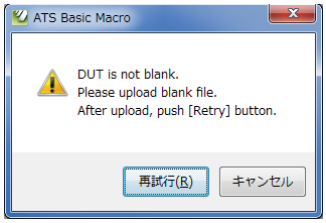
Correct the error (ex: unplugged the DNC-R) and power cycle if required.

2.2.12 CC-16 no-connection test will be started automatically.



2.2.13 The Blank setting check test will be started.





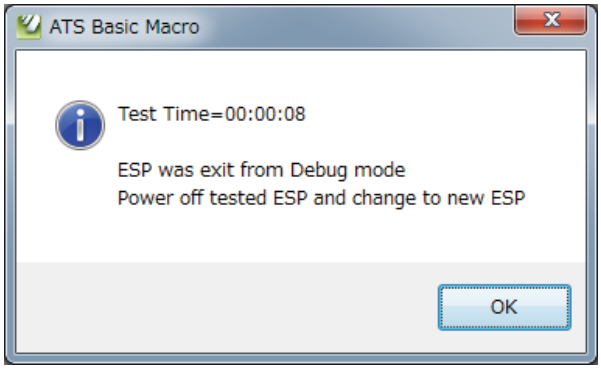
The results of all of the previos tests are recorded to the log file and they are applied to the test macro's decision to pass or fail the DUT.

3. End of Test

The ATS procedure will set the DUT for "Exit debug mode" to set the HOST mode of ESP-880 / ESP-1240 / ESP-4120 / ESP-1600.

At the end of this procedure, it sends the krev0 and exit debug mode command.

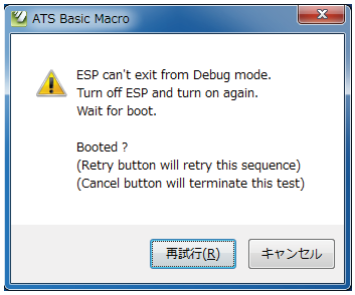
If the DUT can exit the debug mode normally, the dialog box at right will open.

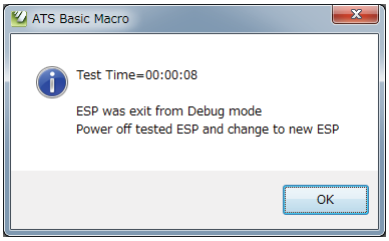


This dialog box indicates that exiting debug mode had been performed successfully.

Turn off the DUT and replace INPUT and OUT-PUT card with a new one, if applicable.

If the DUT failed the exit debug mode step, the below dialog box will open.

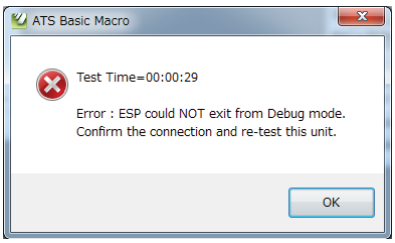




In this case, it may be that the ESP had turned off, causing the failure, or that the RS232C cable had disconnected. In this case, turning on the ESP or connecting RS232C cable will resolve it.

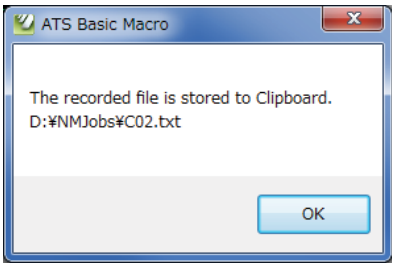
When the exiting debug mode has failed 10 times or if the CANCEL button is clicked, the dialog box at right will come up, indicating that the unit has failed.

This information is recorded into the log file and will show up in the Excel macro test report sheet.



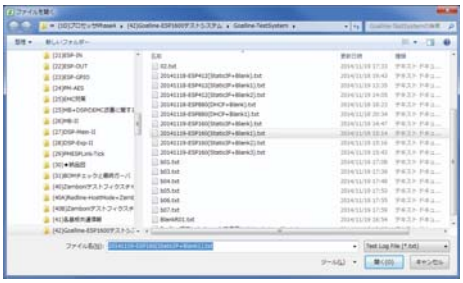
TEST PROCEDURES

After the information is recorded by the ATS-2 test macro, the recorded file name and path is copied to PC's clip-board.



This information is used in following Excel macro test report output screen. See below.

The filename (Full path) can be pasted into the following Excel macro procedure file opening dialog.

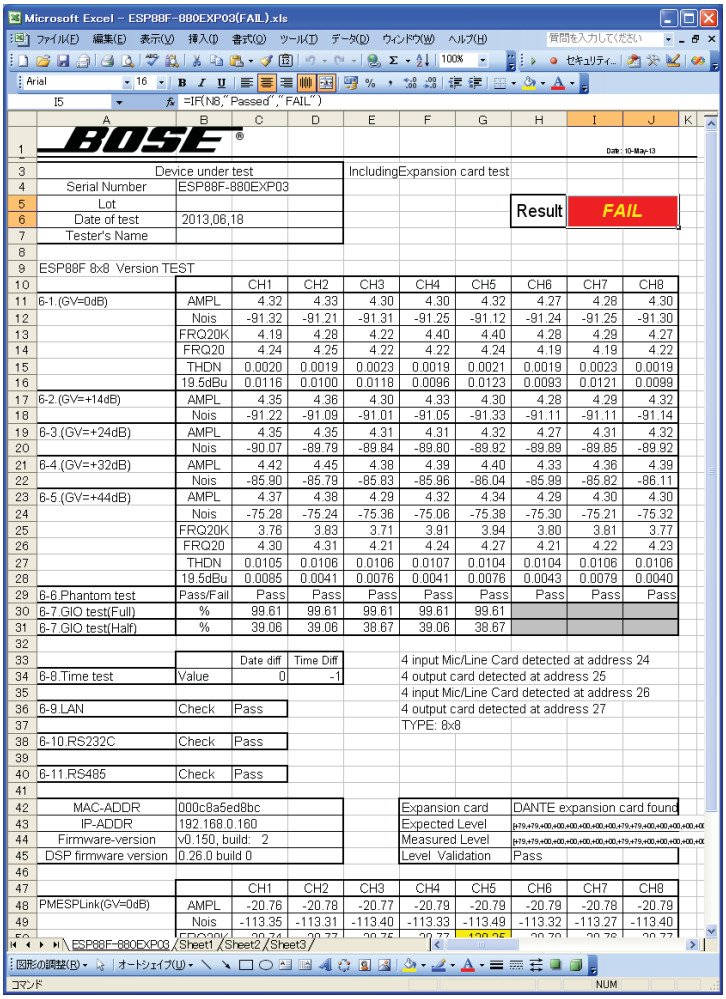


Paste this file name to the "File name" field.

4. Pass/Fail Evaluation and Test Report

After retrieving the log file for the test (using the TestLogOpen macro in the ControlSpace_Test_Report_form_Rev_21b.xls file) the, pass/fail evaluation is done automatically. If the result cell indicates "FAIL", this DUT cannot be returned to the customer without further troubleshooting and a passed re-test.

An example of a failed test is shown at right.



Microsoft Excel – ESP88F-880EXP03(FAIL).xls

	BOSE								
	Device under test			Including Expansion card test					
	Serial Number	ESP88F-880EXP03							
	Lot						Result	FAIL	
	Date of test	2013,06,18							
	Tester's Name								
	ESP88F 8x8 Version TEST								
			CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
6-1.(GV=0dB)	AMPL	4.32	4.33	4.30	4.30	4.32	4.27	4.28	4.30
	Nois	-91.32	-91.21	-91.31	-91.25	-91.12	-91.24	-91.25	-91.30
	FRQ20K	4.19	4.28	4.22	4.40	4.40	4.28	4.29	4.27
	FRQ20	4.24	4.25	4.22	4.22	4.24	4.19	4.19	4.22
	THDN	0.0020	0.0019	0.0023	0.0019	0.0021	0.0019	0.0023	0.0019
	19.5dBu	0.0116	0.0100	0.0118	0.0096	0.0123	0.0093	0.0121	0.0099
6-2.(GV=+14dB)	AMPL	4.35	4.36	4.30	4.33	4.30	4.28	4.29	4.32
	Nois	-91.22	-91.09	-91.01	-91.05	-91.33	-91.11	-91.11	-91.14
6-3.(GV=+24dB)	AMPL	4.35	4.35	4.31	4.31	4.32	4.27	4.31	4.32
	Nois	-90.07	-89.79	-89.84	-89.80	-89.92	-89.89	-89.85	-89.92
6-4.(GV=+32dB)	AMPL	4.42	4.45	4.38	4.39	4.40	4.33	4.36	4.39
	Nois	-85.90	-85.79	-85.83	-85.96	-86.04	-85.99	-85.82	-86.11
6-5.(GV=+44dB)	AMPL	4.37	4.38	4.29	4.32	4.34	4.29	4.30	4.30
	Nois	-75.28	-75.24	-75.36	-75.06	-75.38	-75.30	-75.21	-75.32
	FRQ20K	3.76	3.83	3.71	3.91	3.94	3.80	3.81	3.77
	FRQ20	4.30	4.31	4.21	4.24	4.27	4.21	4.22	4.23
	THDN	0.0105	0.0106	0.0106	0.0107	0.0104	0.0104	0.0106	0.0106
	19.5dBu	0.0085	0.0041	0.0076	0.0041	0.0076	0.0043	0.0079	0.0040
6-6.Phantom test	Pass/Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
6-7.GIO test(Full)	%	99.61	99.61	99.61	99.61	99.61			
6-7.GIO test(Half)	%	39.06	39.06	38.67	39.06	38.67			
		Date diff	Time Diff		4 input Mic/Line Card detected at address 24				
6-8.Time test	Value	0	-1		4 output card detected at address 25				
					4 input Mic/Line Card detected at address 26				
6-9.LAN	Check	Pass			4 output card detected at address 27				
					TYPE: 8x8				
6-10.RS232C	Check	Pass							
6-11.RS485	Check	Pass							
MAC-ADDR	000c8a5ed8bc				Expansion card	DANTE expansion card found			
IP-ADDR	192.168.0.160				Expected Level				
Firmware-version	v0.150, build: 2				Measured Level				
DSP firmware version	0.26.0 build 0				Level Validation	Pass			
		CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
PMESPLink(GV=0dB)	AMPL	-20.76	-20.78	-20.77	-20.79	-20.79	-20.79	-20.78	-20.79
	Nois	-113.35	-113.31	-113.40	-113.33	-113.49	-113.32	-113.27	-113.40

Passed Test Report

If the test result cell indicates "Passed", the unit can be returned to the customer once it has also passed Hi-Pot and Ground Bond testing.

This passed test output shown at right is for the ESP-880 chassis. When the unit is a ESP-1240 , ESP-4120 or ESP-1600, the report will indicate 12 or 16 channel format.

Microsoft Excel – ESP88F-880EXP04(Sample)(Passed).xls

I5 =IF(N8,"Passed","FAIL")

	A	B	C	D	E	F	G	H	I	J
1	BOSE®								Date: 10-May-13	
3	Device under test				IncludingExpansion card test					
4	Serial Number	ESP88F-880EXP04								
5	Lot							Result	Passed	
6	Date of test	2013,06,19								
7	Tester's Name									
8										
9	ESP88F 8x8 Version TEST									
10			CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
11	6-1.(GV=0dB)	AMPL	4.31	4.33	4.29	4.30	4.32	4.27	4.28	4.30
12		Nois	-91.23	-91.16	-91.21	-91.13	-91.16	-91.16	-91.23	-91.17
13		FRQ20K	4.18	4.28	4.22	4.40	4.39	4.28	4.29	4.27
14		FRQ20	4.23	4.25	4.21	4.22	4.23	4.19	4.19	4.22
15		THDN	0.0021	0.0019	0.0024	0.0019	0.0024	0.0019	0.0021	0.0019
16		19.5dBu	0.0117	0.0100	0.0121	0.0096	0.0121	0.0093	0.0120	0.0099
17	6-2.(GV=+14dB)	AMPL	4.35	4.36	4.29	4.33	4.30	4.28	4.29	4.32
18		Nois	-90.93	-90.89	-90.80	-90.97	-91.03	-91.00	-91.07	-91.12
19	6-3.(GV=+24dB)	AMPL	4.35	4.35	4.31	4.31	4.32	4.27	4.30	4.32
20		Nois	-89.98	-89.96	-89.70	-89.94	-89.97	-89.81	-89.86	-90.02
21	6-4.(GV=+32dB)	AMPL	4.42	4.45	4.38	4.38	4.40	4.32	4.36	4.39
22		Nois	-86.09	-85.95	-85.91	-85.99	-86.02	-86.02	-85.94	-85.95
23	6-5.(GV=+44dB)	AMPL	4.38	4.39	4.29	4.32	4.34	4.29	4.30	4.30
24		Nois	-75.43	-75.25	-75.34	-75.15	-75.34	-75.36	-75.26	-75.28
25		FRQ20K	3.77	3.84	3.71	3.92	3.94	3.81	3.81	3.77
26		FRQ20	4.31	4.31	4.21	4.24	4.27	4.21	4.22	4.23
27		THDN	0.0103	0.0104	0.0106	0.0105	0.0105	0.0105	0.0105	0.0105
28		19.5dBu	0.0082	0.0041	0.0078	0.0041	0.0077	0.0042	0.0079	0.0040
29	6-6.Phantom test	Pass/Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
30	6-7.GIO test(Full)	%	99.61	99.61	99.61	99.61	99.61			
31	6-7.GIO test(Half)	%	39.06	38.67	38.67	39.06	38.67			
32										
33			Date diff	Time Diff		4 input Mic/Line Card detected at address 24				
34	6-8.Time test	Value	0	-1		4 output card detected at address 25				
35						4 input Mic/Line Card detected at address 26				
36	6-9.LAN	Check	Pass			4 output card detected at address 27				
37						TYPE: 8x8				
38	6-10.RS232C	Check	Pass							
39										
40	6-11.RS485	Check	Pass							
41										
42	MAC-ADDR	000c8a5ed8bc				Expansion card		DANTE expansion card found		
43	IP-ADDR	192.168.0.160				Expected Level		[+79,+79,+00,+00,+00,+00,+00,+00,+79,+79,+00,+00,+00,+00,+00		
44	Firmware-version	v0.150, build: 2				Measured Level		[+79,+79,+00,+00,+00,+00,+00,+00,+79,+79,+00,+00,+00,+00,+00		
45	DSP firmware version	0.26.0 build 0				Level Validation		Pass		
46										
47			CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
48	PMESPLink(GV=0dB)	AMPL	-20.75	-20.77	-20.77	-20.79	-20.79	-20.78	-20.79	-20.79
49		Nois	-113.48	-113.33	-113.42	-113.34	-113.50	-113.41	-113.41	-113.42

ESP88F-880EXP04 / Sheet1 / Sheet2 / Sheet3

5. Testing Method and Criteria

This section describes the criteria of each test. Determining if the DUT passes each test is done automatically by the Excel Macro. For the ESP-88F INPUT and OUTPUT card, 6 sets of tests are performed to verify the audio performance.

ESP-880 / ESP-4120 / ESP-1240 is determined by the analog value. Because the ESP-1600 doesn't have an analog output, the digital output criteria will be applied as listed in the following tests.

5.1 GV=0dB Test

AMPL (1 kHz)

ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+3.9dBu	+2.9dBu

TEST PROCEDURES

Noise

ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-91dBu	-101dBu

FRQ20kHz

ATS2 Setting

Item	Setting
Frequency	20kHz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+0.5dB	-0.5dB

FRQ20Hz

ATS2 Setting

Item	Setting
Frequency	20Hz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+0.5dB	-0.5dB

THDN

ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+4dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.004%	0.001%

19.5dBu
ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+23.5dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.04%	0.005%

This test is performed on all analog input channels, 4 to 16 channels, depending on model.

5.2 GV=+14dB test

AMPL (1 kHz)
ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	-10dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+3.9dBu	+2.9dBu

Noise
ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-90dBu	-100dBu

5.3 GV=+24dB Test

AMPL (1 kHz)
ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	-20dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+3.9dBu	+2.9dBu

Noise

ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-89dBu	-99dBu

5.4 GV=32dB Test

AMPL (1 kHz)

ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	-28dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+4.0dBu	+3.0dBu

Noise

ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-84dBu	-94dBu

TEST PROCEDURES

5.5 GV=44dB Test

AMPL (1 kHz)
ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+40dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+4.0dBu	+3.0dBu

Noise
ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-74dBu	-84dBu

FRQ20kHz
ATS2 Setting

Item	Setting
Frequency	20kHz
Amplitude	+40dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+1dB	-1dB

FRQ20Hz
ATS2 Setting

Item	Setting
Frequency	20Hz
Amplitude	+40dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	+0.5dB	-0.5dB

TEST PROCEDURES

THDN

ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+40dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.022%	0.0035%

19.5dBu

ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	-16.5dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.046%	0.0027

5.6 Digital Output Criteria for ESP-1600

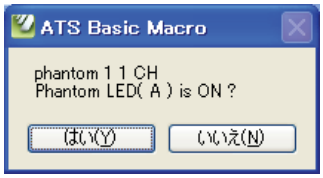
The ESP-1600 does not have an analog output, the measurement is performed in the digital domain. The below criteria are applied to the test output determination.

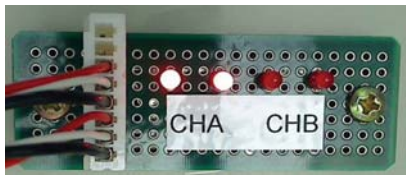
	Item	Max	Min	Unit
5.1.(GV=0dB)	AMPL	-19	-22	dBFS
	Noise	-115	-120	dBFS
	FRQ20K	0.75	-0.5	dBFS(Relative)
	FRQ20	0.5	-0.5	dBFS(Relative)
	THDN	0.004	0.0001	%
	19.5dBu	0.04	0.005	dBFS
5.2.(GV=+14dB)	AMPL	-19	-22	dBFS
	Noise	-115	-120	dBFS
5.3.(GV=+24dB)	AMPL	-19	-22	dBFS
	Noise	-113	-120	dBFS
5.4.(GV=+32dB)	AMPL	-19	-22	dBFS
	Noise	-109	-120	dBFS
5.5.(GV=+44dB)	AMPL	-19	-22	dBFS
	Noise	-99	-120	dBFS
	FRQ20K	1	-1	dBFS(Relative)
	FRQ20	0.5	-0.5	dBFS(Relative)
	THDN	0.022	0.0001	%
	19.5dBu	0.004	0.0001	dBFS

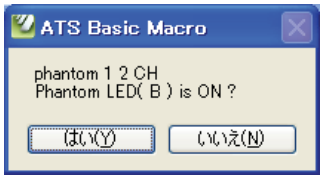
TEST PROCEDURES

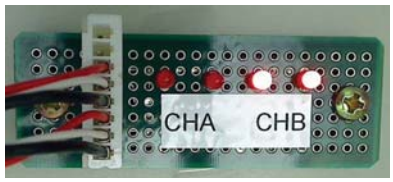
5.7 Phantom Power Test

(Case of Manual testing by choosing [LED indicator])
This Phantom test is performed with for Phantom indicator.
See Phantom test section.
When pushing Yes button, the phantom is recorded as Passed.









(Case of Automated testing by choosing [Volt checker])
The phantom voltage test will perform in automatically and records the voltage.
The voltage is judged in the ATS macro and report as Pass/Fail.

Item	Upper limit	Lower limit
Phantom ON	40V	35V
Phantom Off	+5V	-0.5V

5.8 GPIO Test

This GIO test will be done by ATS2 macro automatically.
This test needs the GIO 2.2k ohm loop back cable.

Criteria

Item	Upper limit	Lower limit
GIO test (Full)	100%	98%
GIO test (Half)	70%	35%

Perform this test on ports 0 through 5.

5.9 Time Test

This time test will be done by ATS2 macro automatically.
In this test, the time that is received from the DUT is compared with the PC time by ATS2 macro.

Criteria

Item	Upper limit	Lower limit
Date diff	0	0
Time diff	+5 sec	-5 sec

5.10 LAN Test

When the configuration file was uploaded to the DUT, the DUT Real Time Clock time was defined via Ethernet as PC time. Therefore, the time test was passed, the LAN function can be considered test and passed.

Criteria

Item	Pass	Fail
LAN	Time diff is lower than +/-120 sec	Time diff is over +/-120 sec

5.11 RS232C Test

The DUT setting and getting informations are done by using RS232C line.

Criteria

Item	Pass	Fail
RS232C	ATS2 macro can get status of DUT	ATS2 macro can't get status of DUT

5.12 RS485 Test

By checking for the CC-16 connection to the DUT, the DUT will respond the firmware version of the CC-16 that is connected CC-16 input jack at the RS485 connector. Test passes if the CC-16 is detected.

Criteria

Item	Pass	Fail
RS485	CC16 can be found	CC16 cannot be found

5.13 PMESPLink Test

PMESPLink is an ADAT format optical line.
By using ADAT-IN card on the ESP slot with AES3OUT card, PMESPLink audio signal can be measured by ATS2.

At GV=0dB setting on the DUT, the audio performance will be measured by digital domain.

AMPL (1 kHz)
ATS-2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	-20.232dBFS	-21.3dBFS

TEST PROCEDURES

Noise

ATS2 Setting

Item	Setting
Frequency	--
Amplitude	Off
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Level	-113dBFS	-120dBFS

FRQ20kHz

ATS2 Setting

Item	Setting
Frequency	20kHz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	-19.732 dBFS	-21.8 dBFS

FRQ20Hz

ATS2 Setting

Item	Setting
Frequency	20Hz
Amplitude	+4dBu
B/W	<10HZ / FS/2
Filter	None

Criteria

Item	Upper limit	Lower limit
Level	-19.732 dBFS	-21.8 dBFS

THDN

ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+4dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.005%	0.0005%

19.5dBu

ATS2 Setting

Item	Setting
Frequency	1kHz
Amplitude	+23.5dBu
B/W	22HZ / 22KHz LPF
Filter	“A” Weighting

Criteria

Item	Upper limit	Lower limit
Function(THD+N)	0.02%	0.004%

5.14 PMESPLink Test for ESP-1600

Because the ESPLink is a digital interface, the ESP-1600 ESPLink test is performed in the digital domain by using the oscillator located in the ESP-88 that’s used as part of the test fixture and this signal is transmitted to the ESP-1600 via Dante network. The criteria for ESP-1600 ESPLink test is applied these values.

	Item	Max	Min	Unit
7-1.(GV=0dB)	AMPL	-19	-21	dBFS
	Noise	-118	-130	dBFS
	FRQ20K	-19	-21	dBFS
	FRQ20	-19	-21	dBFS
	THDN	0.001	0.0001	%
	19.5dBFS	0.001	0.0001	%

Note: Because the oscillator is in the test fixture ESP88 chassis,the 19.5dBFS value is measured at 10010Hz for quick response. (Oscillator level = +12dB and Gain=+11.5)

5.15 Front LED Test

Each DUT front panel LED has 2 colors, red or green. By viewing the color, the test person selects pass or fail on the dialog boxes as they open for each LED test. Refer to the next page.

Item	Pass	Fail
All LED off	All LED off	Any LED on
Lower LED green	Green	Other color or off
Lower LED red	Red	Other color or off
Lower middle LED green	Green	Other color or off
Lower middle LED red	Red	Other color or off
Upper middle LED green	Green	Other color or off
Upper middle LED red	Red	Other color or off
Upper LED green	Green	Other color or off
Upper LED red	Red	Other color or off

5.16 DUT Information

MAC-ADDR	Record for evidence
IP-ADDR	Record for evidence
Firmware-version	Record for evidence
DSP firmware version	Record for evidence
ESP type	Record for evidence
Detect Analog IO card type	address 24
Detect Analog IO card type	address 25
Detect Analog IO card type	address 26
Detect Analog IO card type	address 27

The test type that is directed by user is also recorded.

5.17 Expansion Card Test

The ESP-880/1240/4120/1600 have an expansion slot for plug-in digital audio cards such as the DNC-R (Dante network audio card).
In this testing, this information is also recorded.

Expansion card	DANTE expansion card found
Expected Level	[+79,+79,+00,+00,+00,+00,+00,+00,+79,+79,+00,+00,+00,+00,+00,+00]
Measured Level	[+79,+79,+00,+00,+00,+00,+00,+00,+79,+79,+00,+00,+00,+00,+00,+00]
Level Validation	Pass

In case of ESP-1600, the oscillator in the test fixture ESP-88 chassis is also transmitted via the Dante module. The below values are applied.

Expansion card	DANTE expansion card found
Expected Level	[+120,+120,+00,+00,+00,+00,+00,+00,+80,+80,+80,+80,+80,+80,+80,+80]
Measured Level	[+120,+120,+00,+00,+00,+00,+00,+00,+80,+80,+80,+80,+80,+80,+80,+80]
Level Validation	Pass

Description

Expansion card	The information that reported from ESP880 by cards command.
Expected Level	The input level of Dante card. This signal is provided from ESP DNC-E card.
Measured Level	The output card of Dante card. This signal is provided from analog input and it is send to ESP DNC-E and looped back from ESP DNC-E card.
Level Validation	When the expected level and measured level is same, this test will be passed.

The level is measured by ESP-880/1240/4120/1600 and it is reported by the debug command.
When the ESP DNC-E is not used, a loop back signal is not present on the DUT ESP-880 /1240/ 4120/1600 unit. Therefore this test will be failed.
If the proper .csp file was not uploaded, this test will fail.
If the expansion card does not exist, this test will fail.
This expansion card test evaluates the validity of the setting of this testing.

TEST PROCEDURES

5.18 Blank Setting Upload

The last setting of the DUT ESP chassis under test is checked by these items.

Item name = passing condition.	description
UpBlank:Expansion =Pass , Not Found	Expansion slot is blank.
UpBlank:CC16 = Pass , Not Found	CC16 is not connected.
UpBlank:BlankCHK =Pass , Blank	Blank csp file is uploaded.

5.19 ESP Modes for Shipping

The unit under test must be put into factory default shipping mode before return to the customer.

Boot message: suppressed

Debug mode: Exit (= Host mode)

These are record and detected the pass/fail in following section.

Item	Criteria (Pass)	Criteria (Fail)
Boot Message suppression :	Pass kerv 0	Other record
Debug Mode :	+++Exit Debug mode	Other record
Ignore debug Mode command :	Pass	Other record

The “Boot Message suppression” is a record of kerv0 command. It is judged by ATS2 procedure.

The record of “Debug mode” is a response from DUT ESP chassis by using “+++” command. ATS2 procedure will try to get “+++Exit Debug mode” result 20 times until this result is received because this “+++” command is a toggle command.

The “Ignore debug Mode command” had been done in the ATS2 procedure by using “?(Help)” command after exiting debug mode. When the ESP exited from debug mode, the response of “?” command from ESP is only “?”(Echo back).

5.20 Record of the Testing

The ATS2 macro records the “***.txt” file.

The Excel macro reports the “***.xls” file.

The content of “***.txt” file will be copied to the end of Excel format report sheet.

6. Hi-Pot Test

THIS IS A MANDATORY TEST

Note: If an amplifier requires removal of the top cover for repair, it MUST be Hi-Pot tested before being returned to the customer to ensure that there is no potential shock hazard.

This test requires a Hi-Pot tester with a ground bond attachment to perform this test.
Connections:

The Hi-Pot tester connects to the device under test (DUT) by means of a wiring harness. The AC line cord of the DUT plugs into the Hi-Pot tester AC adapter box. The return line connects to an accessible chassis ground point using an alligator clip. There are no special cables required for this test.

TEST PROCEDURES

Hi-Pot Tester Settings:
All units - 2.120 KVDC, rise time = 1 sec., dwell = 1 to 4 seconds, current limit = 1.2 mA

6.1 Connect the AC mains cord to the back of the ESP chassis under test. Plug the other end of the AC cord into the Hi-Pot tester.

6.2 With the tester set to the above parameters, perform the test. If the unit fails, remove the top cover and repair the problem. Once the unit is repaired, repeat the Hi-Pot and the ground bond test to ensure the unit is safe to return to the customer.

7. Ground Bond Test

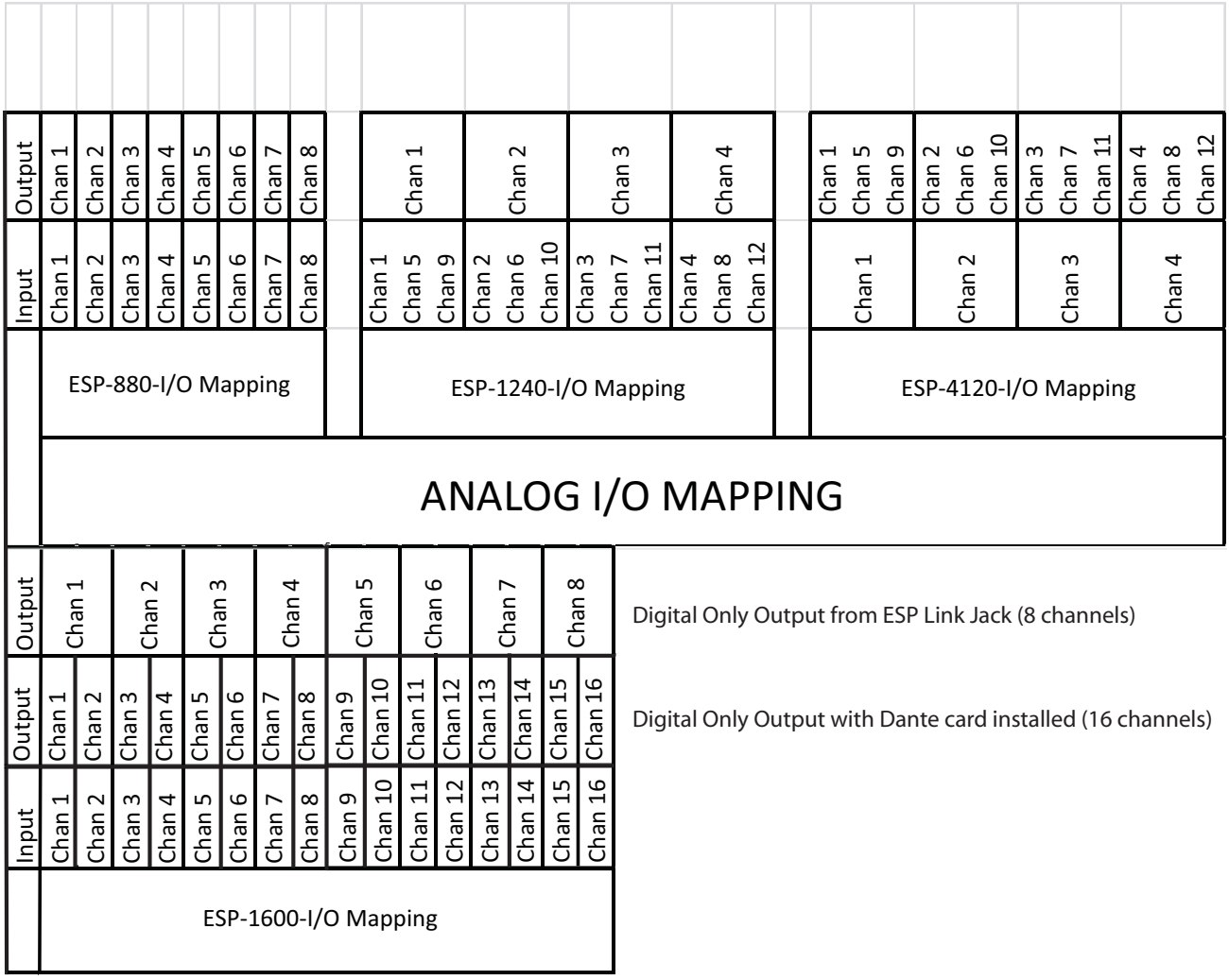
Note: This test only needs to be performed if the chassis ground wire from the AC IEC connector to the inside of the chassis of the amplifier has been removed or disturbed as part of a repair. If it has not, this test does not need to be performed. This test measures current handling capability between the ground blade on the AC inlet or mains plug and the earth bond point on the rear of the chassis.

Ground Bond Tester Settings:
10A, $\leq$ 12VAC open circuit, $\leq$ 0.1 Ohms from AC earth terminal on IEC connector in chassis, to earth bond point on rear of chassis.

7.1 Connect the AC mains cord to the back of the ESP chassis under test. Plug the other end of the AC cord into the ground bond test box.

7.2 With the tester set to the above parameters, perform the test. If the unit fails, remove the top cover and repair the problem. Once the unit is repaired, repeat the Hi-Pot and the ground bond tests to ensure the unit is safe to return to the customer.

Addendum A - Analog Port Mapping



SERVICE MANUAL REVISION HISTORY

Date	Revision Level	Description of Change	Change Driven By	Pages Affected
6/14	00	Document released at revision 00.	Service manual release	All
5/15	01	Added ESP-1600 information and added revised test procedures.	New version and tests	All

SPECIFICATIONS AND FEATURES SUBJECT TO CHANGE WITHOUT NOTICE

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