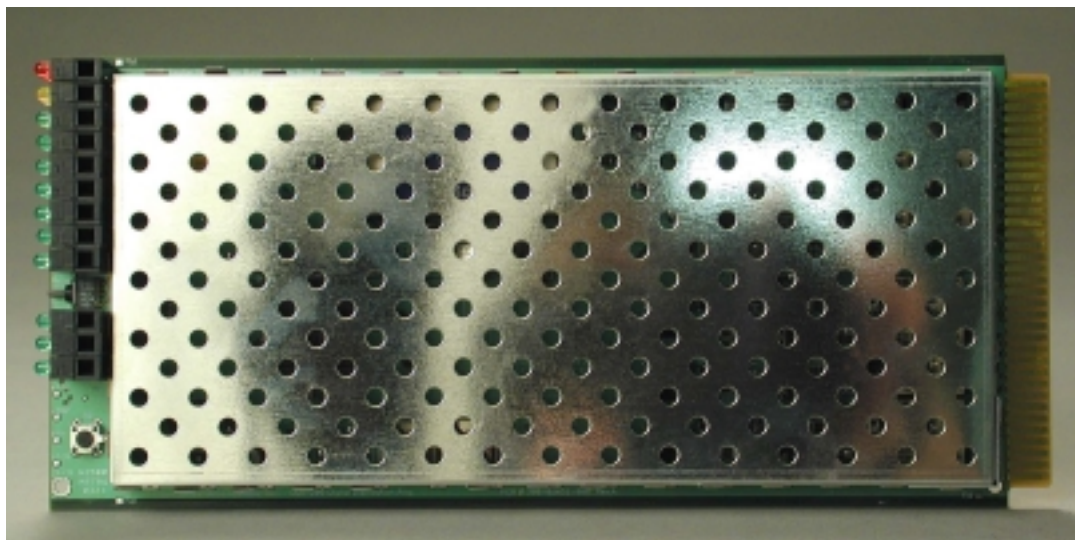


Benchmark Media Systems, Inc.

# DDA-205 Instruction Manual

(System1000™ AES 10-Output 24-bit 192-kHz  
Digital Audio Distribution Amplifier)



Shown with options: Four 9-segment digital meters with three-position meter function switch, and momentary switch

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## Revision History:

<u>Revision</u>	<u>Filename</u>	<u>Date</u>	<u>Author</u>
Rev A	DDA-205 - Manual - Draft A2.doc	05/30/03	Timothy Hunt
Rev B	DDA-205 - Manual - Rev B.doc	07/11/03	John Siau

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## SYSTEM OVERVIEW

The DDA-205 is a 10-output (dual 1x5 or single 1x10) AES digital audio distribution amplifier. Each digital audio distribution amplifier (DA) carries two audio channels (for a total of 4 audio channels). The card operates at sample rates between 32 and 192 kHz, at any word length up to (and including) 24 bits. The DDA-205 transparently passes all data bits, “channel status bits” (C), “validity bits” (V), and “user bits” (U) bits. The input-to-output delay is exactly one sample for data, C, V, and U bits. The DDA-205 is compatible with all Benchmark System1000™ card frames and may coexist with any combination of analog and digital cards.

### ***Digital Audio Inputs***

The DDA-205 has four transformer-isolated AES digital audio inputs that are individually configurable for 110-Ohm, 75-Ohm, or High-Z input impedances. These inputs drive the input side of a 4x2 digital audio router. AES digital audio carries two audio channels per signal. Each digital audio path in the DDA-205 carries two channels of audio.

### ***Digital Audio Input Routers***

The DDA-205 has an asynchronous 4x2 input router. The outputs from this router drive two digital audio distribution amplifiers. The router is controlled from two 3-pin connectors on the rear of the System1000™ card frame. Each digital distribution amplifier can be driven from any one of the four digital audio inputs. By default, amplifier 1 is driven from input 1, and amplifier 2 is driven from input 3. All four digital audio inputs may be asynchronous to each other. The distribution amplifiers will follow the sample rate of the selected input. The router can be used to configure the DDA-205 as a 1x10 digital DA.

### ***Digital Audio Distribution Amplifiers***

The DDA-205 has two fully independent digital distribution amplifiers. All audio data bits, channel status bits (C), user bits (U), and validity bits (V) pass transparently. The amplifiers may be used with either AES/EBU (professional) or SPDIF (consumer) data formats. The two amplifiers may be operated at different sample rates, word lengths, and data formats.

### ***Digital Audio Outputs***

The DDA-205 has ten transformer-isolated AES digital audio outputs that are individually configurable for 75 or 110-Ohm operation. This gives the user the ability to drive any combination of 75 and 110-Ohm loads.

### ***Audio Level Meters***

The DDA-205 has four 9-segment LED meters for monitoring the audio levels on each of the four audio output channels (four audio channels on two AES signals). These meters have a 3-position toggle switch that controls both the meter scale and peak hold functions. When the switch is down, the meters have a 48-dB range with 6-dB steps. In the center position, the meters have a 20-dB range with 1-dB steps. In the up position, the meters have a peak-hold function, a 20-dB range, and 1-dB steps. The meters are driven digitally and have very accurate thresholds. The response time is fast enough to capture all single-sample events, and LEDs remain illuminated long enough for these events to be observed by the human eye.

### ***Status Display***

Each of the two output amplifiers has a 4-segment LED status display. This display indicates the sample rate of the digital audio signal, and alerts the user when an input signal is absent or contains errors.

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## ***Power Status Display***

Four LEDs show the status of the 3.3, 5, -15, and +15 volt supplies. The DDA-205 card is powered from the System1000™ +15 and -15-volt supply rails. The 3.3 and 5-volt supplies are local to the DDA-205 card. The 5-volt supply is derived from the +/- 15-volt supply rails using an isolated DC-to-DC converter. The 3.3-volt supply is derived from the 5-volt supply using a linear regulator. This configuration provides a high-efficiency solution that is compatible with the System1000™ analog audio supply rails.

## ***Hot-Plug Power Management***

The DDA-205 may be inserted or removed from the System1000™ cardframe at any time. Reset and soft-start circuits monitor the status of the +/- 15-volt inputs, and the local +5 and +3.3-volt supplies. Digital audio outputs are available within 500 msec after inserting the card. After the digital audio outputs are initialized and operational, a software ID code and LED test sequence is executed. This test sequence lasts for approximately 4 seconds, but does not interfere with the digital audio data. All System1000™ digital cards are designed to provide near-instantaneous operation when hot-plugged.

## ***Fallback/Audio Black Feature***

The DDA-205 will generate audio black when no input signal is present. This feature can minimize the probability of “pop” and “cracks” when a digital audio feed is momentarily interrupted. This feature also allows the DDA-205 to operate as a master clock generator. The sample rate of the digital audio black is jumper selected. The factory default is 48 kHz.

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## FRONT PANEL

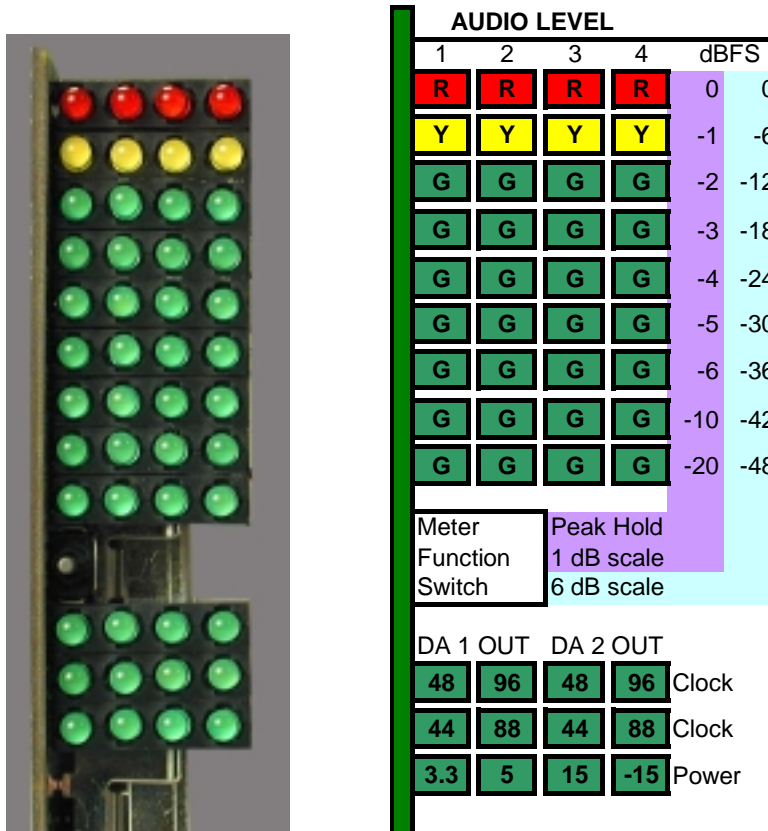


Photo 1 - Front Panel

### Meter Display

- Four 9-segment digital meters
- Display the audio levels on the 4 output channels
- Channels 1 and 2 are driven by digital distribution amp 1 (DA 1)
- Channels 3 and 4 are driven by digital distribution amp 2 (DA 2)

### Clock Status Display

- "44" – Green LED, On = Output sample rate is 44.1 kHz
- "48" – Green LED, On = Output sample rate is 48 kHz
- "88" – Green LED, On = Output sample rate is 88.2 kHz
- "96" – Green LED, On = Output sample rate is 96 kHz
- All 4 Green LED's Off = Output sample rate > 96 kHz, or < 44.1 kHz
- Flashing LED = No Input, or Input Error (Fallback/Audio Black feature active)
- Fallback sample rate is indicated by flashing LED

### Power Status Display

- "3.3" – Green LED, +3.3V supply is normal when lit
- "5" – Green LED, +5V supply is normal when lit
- "15" – Green LED, +15V supply is normal when lit
- "-15" – Green LED, -15V supply is normal when lit

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## ***Power Supply Test Points***

- One test point is provided for each of the four internal power rails.
- Test points consist of large vias at front edge of PCB.
- Vias are sized and located to provide convenient clip points for a scope or meter probe.
- One ground pad with a large hole is provided at the lower front corner of the card (to attach a scope or meter ground clip).
- Test points are adjacent to power status LEDs.

## ***Momentary Switch***

- No defined function at this time

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## TERMINATING DIGITAL AUDIO SIGNALS

Digital audio signals must be terminated in order to prevent reflections in the cables. Transmission errors may occur if a cable is not properly terminated (at each end). Proper termination and cable impedance are very important when cable lengths exceed 25 feet. Digital transmission systems tend to fail abruptly. Improperly terminated cables may appear to work properly, but may cause transmission failures at the worst possible moment. An improperly terminated cable may even pass data at one sample rate, and fail at another sample rate.

The DDA-205 digital inputs have an option for High-Z input impedance (to allow for loop-through and System1000™ bus applications). If looping is used, a termination must be applied at the end of the daisy chain.

### **Caution:**

Looping partially defeats the intended purpose of a distribution amplifier. Remember that a DA provides two functions; fan out, and isolation. Isolation is partially lost when the inputs to a DA are looped to another device. If the other device were to fail (or be turned off), it could corrupt the shared (looped) input signal.

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## REMOVING TOP COVER (for access to jumpers)

The DDA-205 has a removable shield cover. This cover prevents crosstalk between System1000™ modules, provides supplementary EMI shielding, and greatly reduces the chances of damaging ESD sensitive components.

It is necessary to remove the cover for access to the configuration jumpers. See Photo 2

1. Starting at one of the corners, pry the cover up about 1/16".
2. Proceed to an adjacent corner and pry it up about 1/16".
3. Proceed to the other two corners.
4. Repeat the process if necessary.

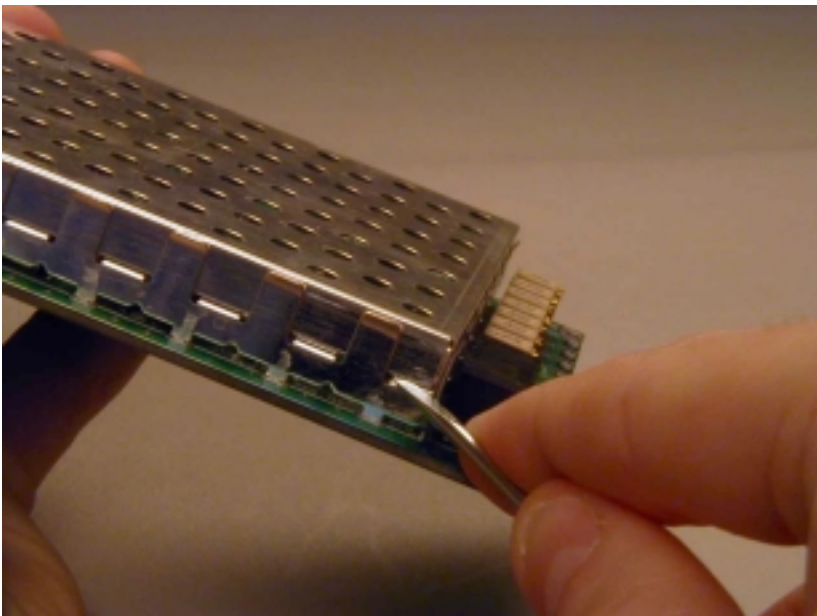


Photo 2 - Removing the Cover

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## JUMPERS



**Photo 3 – Jumper Locations (jumpers shown in default positions)**

The jumpers on the DDA-205 have the following functions:

- Input Impedance (per input)
- Output Impedance selection (per output)
- Audio Black fallback sample rate selection (per card)

Whenever possible, we recommend configuring all cards identically. This will prevent configuration errors if cards are swapped within a system. All System1000™ cards (including the DDA-205) are hot-pluggable. If all cards are configured identically, then cards can be swapped quickly and easily without the possibility of inadvertently changing the system configuration.

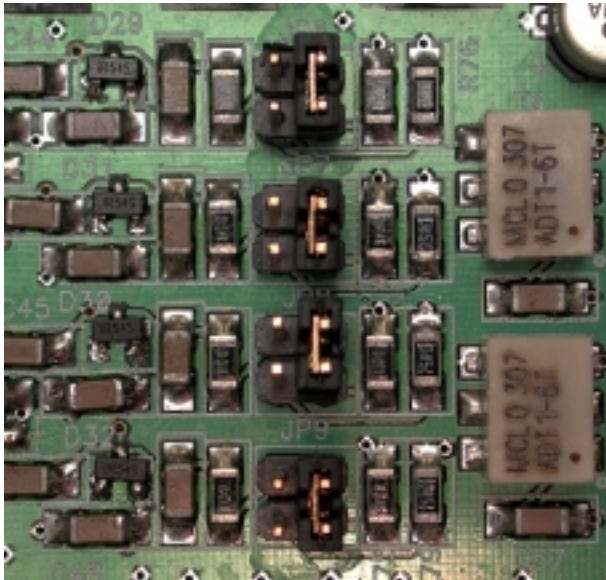
In many installations, all inputs and outputs can be set to the same impedance (either 75 or 110 Ohms). If you are installing a system with a mixture of 75 and 110-Ohm feeds, you may wish to configure certain inputs and outputs (on all cards) as 75 Ohms. All other inputs and outputs can remain at 110 Ohms.

When cards cannot be configured identically, we recommend applying a label to each card. Improperly terminated inputs and outputs may not immediately cause failures but will adversely affect the reliability of your installation. Great care must be taken in any installation that mixes 75 and 110-Ohm interconnects.

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## ***Input Impedance Jumpers (Headers JP6 thru JP9):***

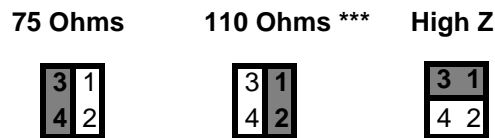
The 4 digital inputs on the DDA-205 can be configured for any combination of 110-Ohm, 75-Ohm, or High-Z input impedances. Each digital input has a 4-pin header and a 2-pin jumper plug for selection of the input impedance. The factory default is 110 Ohms on all inputs.



JUMPER NUMBER	INPUT NUMBER
JP6	AES INPUT 1
JP7	AES INPUT 2
JP8	AES INPUT 3
JP9	AES INPUT 4

**Photo 4 – Input Impedance Jumper Locations (shown in 110-Ohm default position)**

**Note:** JP6 is closest to top right of board, and JP9 is closest to center right of board (see **Photo 3**). On each header, pin 1 is the top right pin (see **Photo 4**).

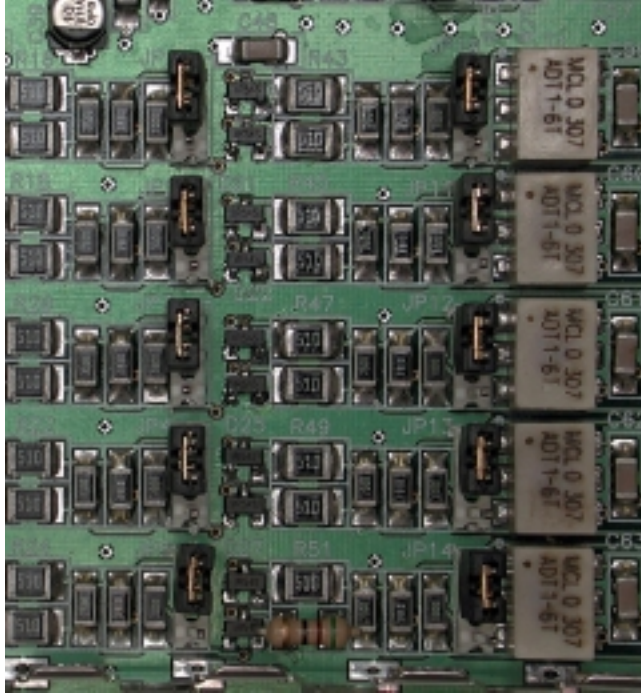


\*\*\* = Factory default input impedance is 110 Ohms

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## ***Output Impedance Jumpers (Headers JP1 thru JP5, and JP10 thru JP14):***

The 10 digital outputs on the DDA-205 can be configured for any combination of 110 and 75 Ohms. Each digital output has a 3-pin header and a 2-pin jumper plug for selection of the output impedance. The factory default is 110 Ohms for all outputs.



**Photo 5 - Output Impedance Jumper Locations (shown in 110-Ohm default position)**

JUMPER	OUTPUT	JUMPER	OUTPUT
JP1	110	JP10	110
	75		75
JP2	110	JP11	110
	75		75
JP3	110	JP12	110
	75		75
JP4	110	JP13	110
	75		75
JP5	110	JP14	110
	75		75

**Note:** JP1 is closest to center of board, and JP14 is closest to bottom right of board. On each header, pin 1 is closest to top of board (see **Photo 3**).

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## ***Fallback Sample-Rate Jumpers (Header P1 pins 11, 12, 13, and 14)***

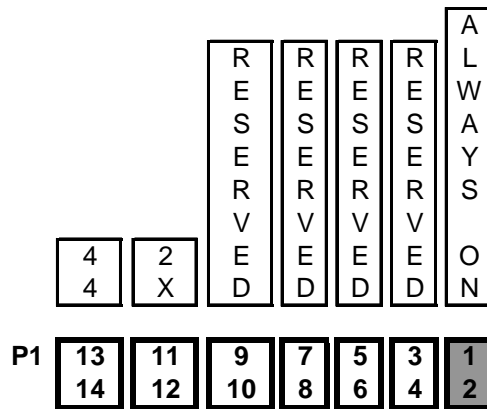
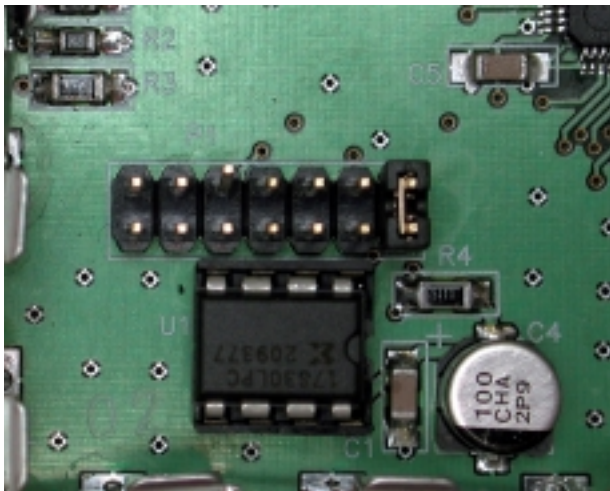
P1 is a 14-pin header that is used to set the “**Fallback Sample Rate**”. The DDA-205 will generate digital audio black when no input signal is present. The sample rate of the digital audio black is determined by the “Fallback Sample-Rate Jumpers”.

The **Fallback Sample Rate** is active when:

- No input signal is present
- The input signal is corrupt
- An inactive digital input is selected

In general, the **Fallback Sample Rate** should be set to match the sample rate that will be used most often. The factory preset for the **Fallback Sample Rate** is 48 kHz. At any fallback setting, the DDA-205 will pass digital audio for any sample rate between 32 kHz and 192 kHz. The fallback jumpers only determine the sample rate when no input signal is received.

The fallback frequency is common to both distribution amplifiers. The two digital audio distribution amplifiers independently switch to the fallback frequency.



**Photo 6 - Fallback Sample-Rate Jumper Locations (shown in default 48 kHz position)**

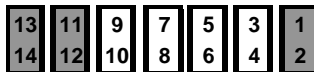
44.1 kHz



48 kHz (default)



88.2 kHz



96 kHz



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## SYSTEM1000™ PIN ASSIGNMENTS

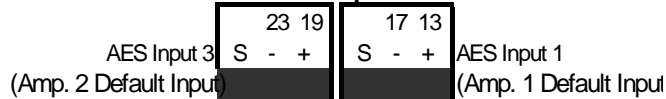
### DDA-205 Pin Assignments – WECO (WECO HSL) Card Frame

(As Seen from Rear of System1000™ WECO Card Frame)

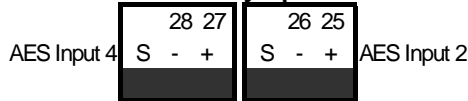
#### WECO HSL CONNECTORS

(S=Cable Shield, Chassis GND)

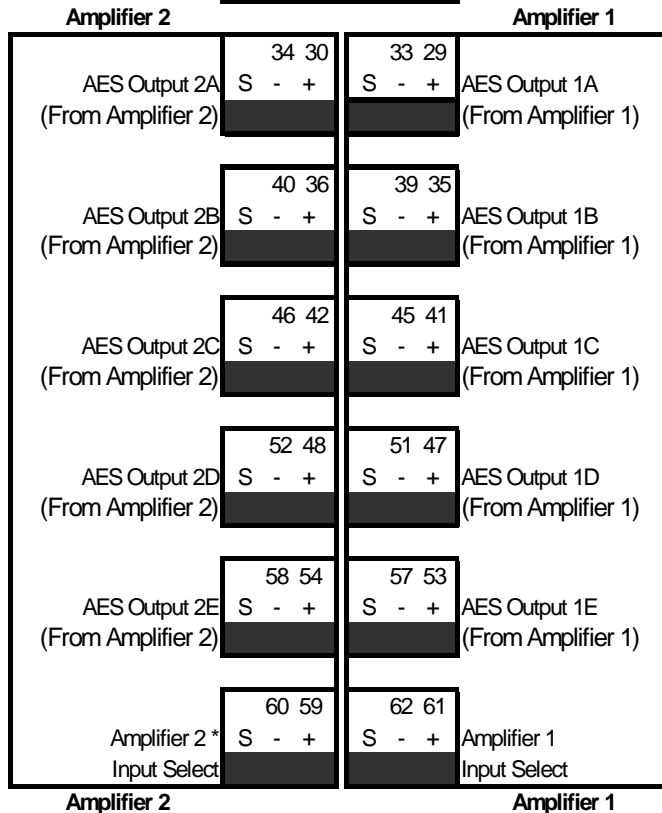
##### Default Inputs



##### Secondary Inputs



48V Phantom Jumper  ON  48 OFF MUST be installed in "OFF" position!



#### CARD EDGE CONNECTOR

GND	2	1	GND
GND	4	3	GND
+15 Volts	6	5	+15 Volts
+15 Volts	8	7	+15 Volts
-15 Volts	10	9	-15 Volts
-15 Volts	12	11	-15 Volts
NC	14	13	AES Input 1 +
NC	16	15	GND
NC	18	17	AES Input 1 -
NC	20	19	AES Input 3 +
NC	22	21	GND
NC	24	23	AES Input 3 -
AES Input 2 -	26	25	AES Input 2 +
AES Input 4 -	28	27	AES Input 4 +
AES Output 2A +	30	29	AES Output 1A +
GND	32	31	GND
AES Output 2A -	34	33	AES Output 1A -
AES Output 2B +	36	35	AES Output 1B +
GND	38	37	GND
AES Output 2B -	40	39	AES Output 1B -
AES Output 2C +	42	41	AES Output 1C +
GND	44	43	GND
AES Output 2C -	46	45	AES Output 1C -
AES Output 2D +	48	47	AES Output 1D +
GND	50	49	GND
AES Output 2D -	52	51	AES Output 1D -
AES Output 2E +	54	53	AES Output 1E +
GND	56	55	GND
AES Output 2E -	58	57	AES Output 1E -
AMP 2, Input Sel. LSB	60	59	AMP 2, Input Sel. MSB
AMP 1, Input Sel. LSB	62	61	AMP 1, Input Sel. MSB
NC	64	63	NC
NC	66	65	NC
NC	68	67	NC
NC	70	69	NC

#### Notes:

- **Digital Inputs are identified numerically.** Input 1 is the default input for amplifier 1. Input 3 is the default input for amplifier 2.
- **Any digital input can be routed to either amplifier.**
- **+48V Phantom jumper must be installed in "OFF" position.** Otherwise, AES Digital Input 2 will not work properly (input pin 26 is disabled unless phantom jumper is installed in "OFF" position).

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23 19	17 13	2	1
S - +	S - +	4	3
28 27	26 25	6	5
S - +	S - +	8	7
ON 48 OFF		10	9
34 30	33 29	12	11
S - +	S - +	14	13
40 36	39 35	16	15
S - +	S - +	18	17
46 42	45 41	20	19
S - +	S - +	22	21
52 48	51 47	24	23
S - +	S - +	26	25
58 54	57 53	28	27
S - +	S - +	30	29
60 59	62 61	32	31
S - +	S - +	34	33
		36	35
		38	37
		40	39
		42	41
		44	43
		46	45
		48	47
		50	49
		52	51
		54	53
		56	55
		58	57
		60	59
		62	61
		64	63
		66	65
		68	67
		70	69

**Photo 7 - WECO HSL Connectors and Associated Card Connector**

**Note the position of the 48V phantom jumper plug.** This jumper plug must be installed in the "OFF" position (as shown) in order for correct operation of AES Digital Input 2.

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## INPUT ROUTER CONTROL

The four digital audio inputs are routed through a 4x2 matrix to the two digital-audio distribution amplifiers. Each of the two distribution amplifiers has a 3-pin control port that is accessible from the System1000™ backplane (see Photo 7, and Photo 8). Each control port has a ground pin and two binary coded address pins. The address pins may be left floating (for default routing), or may be connected to the ground pin ("S") using a wire, or a contact closure. The address pins may also be driven directly from most 3.3 or 5-volt logic devices. The address pins are equipped with 10 kOhm pull-up resistors that pull non-connected inputs to 3.3 volts.

The default routing is:

- Input 1 to DA1
- Input 3 to DA2

All other routing selections require contact closures, wires to ground, or external drive from 3.3 or 5-volt logic.

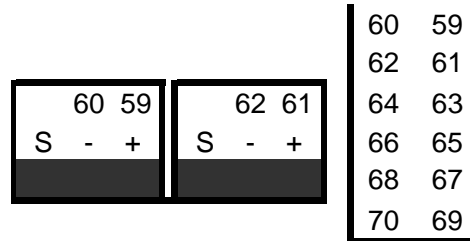
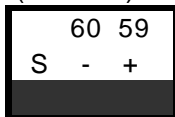


Photo 8 – Input Router Control Ports on WECO HSL Connectors

### INPUT SELECTION FOR DA2

Uses pins 60 & 59  
(WECO)

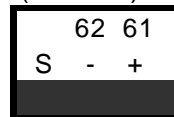


Wiring	DA 2 Output
NC	Input 3 (default)
"S" to "-"	Input 4
"S" to "+"	Input 1
"S" to "+" & "-"	Input 2

S = GND, NC = No Connect

### INPUT SELECTION FOR DA1

Uses pins 62 & 61  
(WECO)



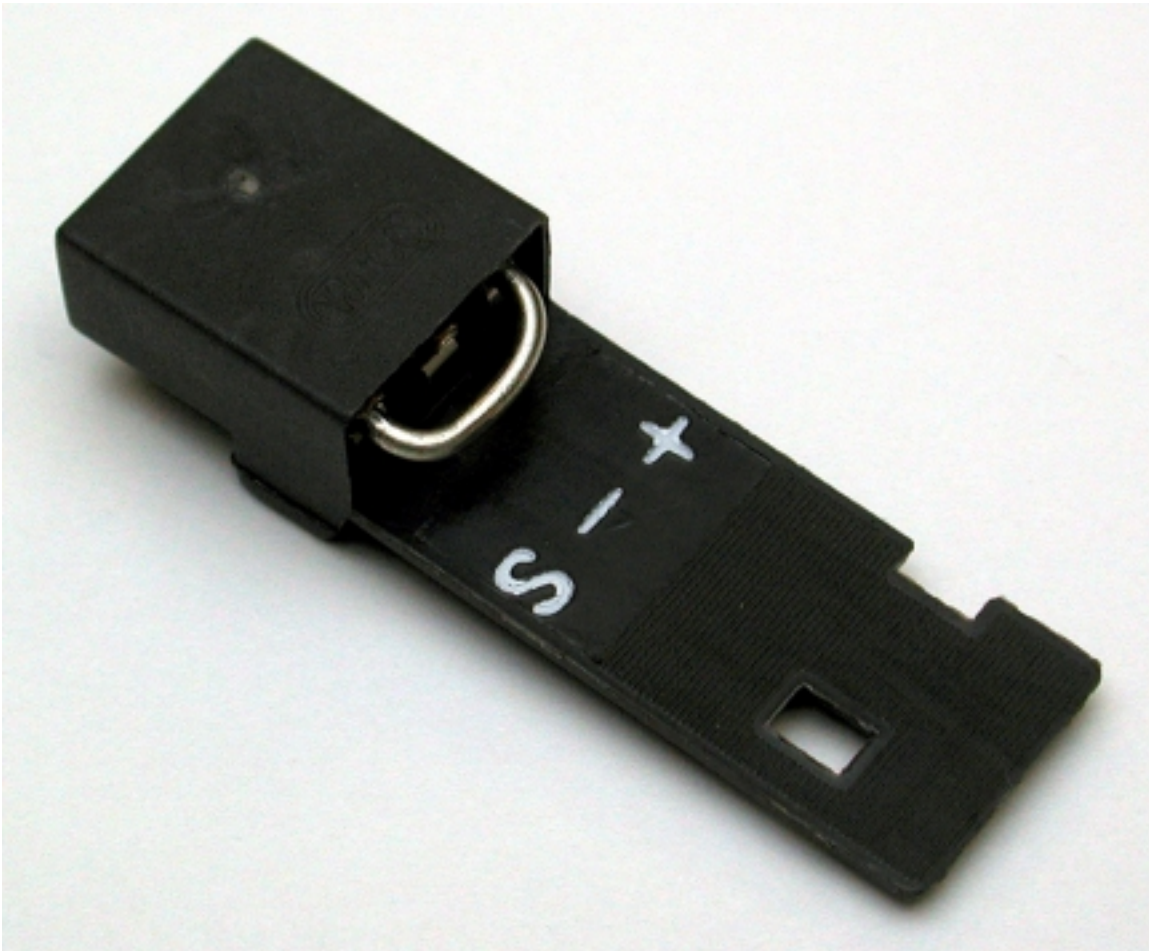
Wiring	DA 1 Output
NC	Input 1 (default)
"S" to "-"	Input 2
"S" to "+"	Input 3
"S" to "+" & "-"	Input 4

S = GND, NC = No Connect

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### ***Configuring the DDA-205 as a single 1x10 digital DA***

A single jumper wire on the DA2 control port will convert the DDA-205 from a dual 1x5 DA to a single 1x10 DA. Connect a jumper wire between "S" and "+" on a WECO 3-pin plug (see Photo 9). Insert this plug into the DA2 control port (pins 60 and 59). All 10 outputs will now be driven from Input 1.

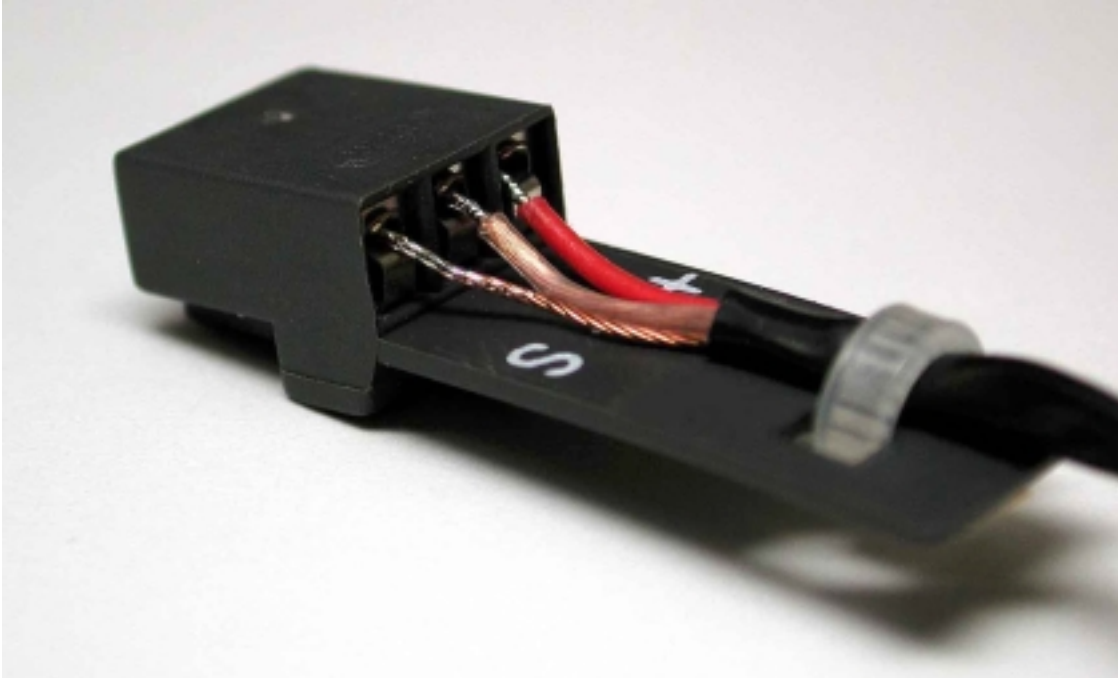


**Photo 9 - WECO Plug with shorting jumper between "S" and "+"**

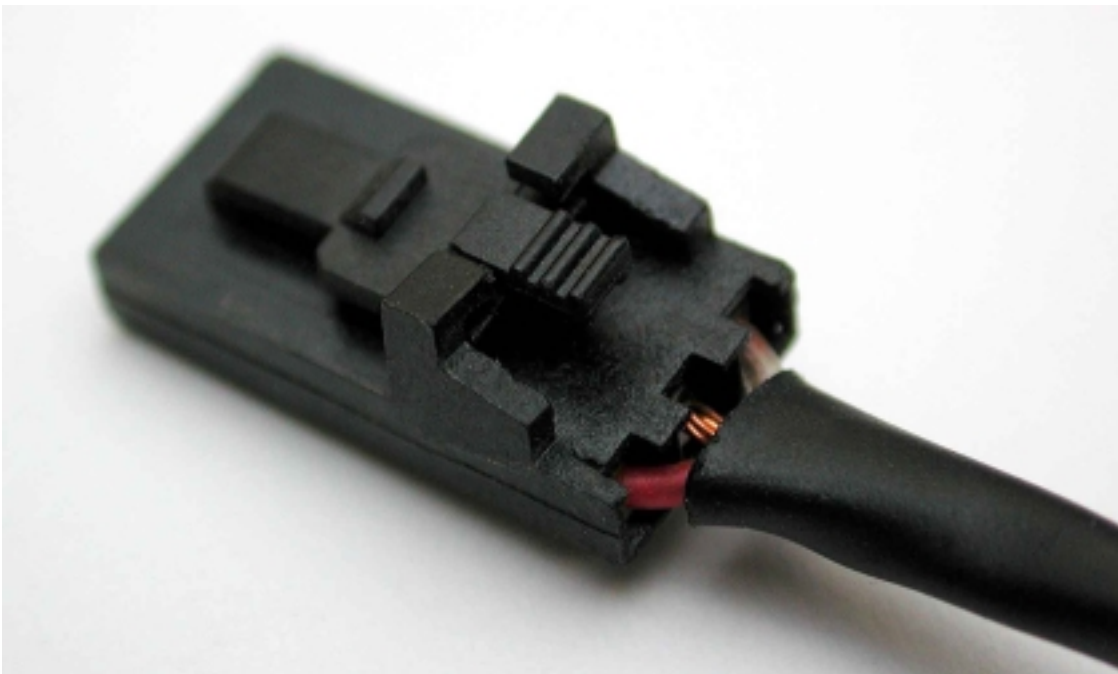
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## CONNECTOR WIRING INSTRUCTIONS

### *Wiring Example Photos:*



**Photo 10 - Balanced Digital I/O using WECO HSL Connectors**



**Photo 11 - Balanced Digital I/O using Molex SL Connectors**

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Photo 12 - Coaxial 75-Ohm Unbalanced Digital I/O using WECO HSLConnectors

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## ***Wiring System1000™ Digital I/O to 110 Ohm Balanced Digital I/O***

See Photo 10 for WECO HSL connectors.

See Photo 11 for Molex SL connectors.

Set impedance jumper to 110 Ohms (located on DDA-205 card)

Use 110-Ohm digital audio cable.

S = Shield \*\*\* (connect to pin 1 on XLR connectors, and connect to XLR shell)

+ = Positive Digital Out (connect to pin 2 on XLR connectors)

- = Negative Digital Out (connect to pin 3 on XLR connectors)

**\*\*\* Never lift ground on a digital input or output.** Digital shields should not be lifted at either end of a digital audio interconnect. Lifting a ground on a digital interconnect may produce EMI that exceeds allowable limits.

## ***Wiring System1000™ Digital I/O to 75 Ohm Unbalanced Digital I/O***

See Photo 12 for WECO HSL connectors.

Set output impedance jumper to 75 Ohms (located on DDA-205 card)

Use 75-Ohm coax.

S = Coax shield

+ = Coax center conductor

- = Coax shield \*\*\*\*

**\*\*\*\* Note that both the "S" and the "-" pins must be connected to the shield of the coax.** A short piece of bus wire can be used to tie the "-" pin to the "S" pin (see Photo 5). The DDA-205 digital outputs are transformer coupled. If the "-" pin is left floating little or no signal will be transmitted.

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## SPECIFICATIONS

### ***Digital Inputs***

Number of Digital Inputs	4
Number of Digital Audio Receivers	2
Minimum Digital Input Level	150 mV
Digital Input Impedance (Jumper Selected)	75, 110, or High Z
Transformer Coupled Digital Input	Yes
DC-Blocking Capacitor in series with Transformer Input	Yes
Transient and Over-Voltage Protection on Digital Input	Yes

### ***Digital Outputs***

Number of Digital Outputs	10 (5 per AES digital DA)
Number of Audio Channels	4 (2 per AES digital DA)
Output Sample Frequency Range	32 to 192 kHz
Maximum Output Word Length	24 bits
Digital Output Impedance (Jumper Selected)	75, or 110 (default = 110)
Transformer Coupled Digital Outputs	Yes
DC-Blocking Capacitors in series with Transformer Outputs	Yes
Transient and Over-Voltage Protection on Digital Outputs	Yes

### ***Analog Inputs***

Number of Analog Inputs	None
-------------------------	------

### ***Analog Outputs***

Number of Analog Outputs	None
--------------------------	------

### ***Digital Audio Input Routing***

Matrix	4x2 (AES digital audio)
Type	Asynchronous
Remote Control	Yes (binary coded parallel)

### ***LED Meter and Status Indicators***

LED Location	Front Edge of Card
Meter LEDs	36 (9 per channel)
Status LEDs (indicate sample rate and lock status)	8 (44.1, 48, 88.2, 96)
Power LEDs (on = power normal)	4 (+15, -15, 5, 3.3)

### ***Test Points***

Test Point Location	Front Edge of Card
Power	4 (one per voltage rail)
Ground	1

### ***Timing and System Initialization***

Lock Time – after Fs change	<40 msec
Turn On Time	<500 msec

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## **System Delay (Input to Output)**

Input-to-Output Delay

1 Sample  
0.0313 msec at 32 kHz  
0.0227 msec at 44.1 kHz  
0.0208 msec at 48 kHz  
0.0113 msec at 88.2 kHz  
0.0104 msec at 96 kHz  
0.0057 msec at 176.4 kHz  
0.0052 msec at 192 kHz

For other sample rates, the delay can be calculated using the following formula:

$$\text{Delay} = 1/F_s$$

(Where  $F_s$  = the sample rate in Hz)

## **Power Requirements**

Input Voltage

+/- 15 volts regulated

Minimum regulated input voltage

+/- 14 volts

Maximum regulated input voltage

+/- 20 volts

Typical Input Current at +/- 15 V

122 mA

Typical Power Dissipation

3.66 W

(Digital inputs and outputs active and terminated with 110 Ohms, any sample rate, all meter LEDs on)

Worst Case Input Current at +/- 15 V

135 mA

Worst Case Power Dissipation

4.05 W

(All outputs configured for 110 Ohms and shorted, all meter LEDs on)

Ground Current

< 0.1 mA

(Loads are balanced to better than 0.1%)

## **Fuse**

Fuse Type (2 required)

1.5A 250V 2AG FA

## **Dimensions**

(Standard System1000™ Card Dimensions)

220 mm x 100mm x 16mm

8.75" x 3.95" x 0.625"

(L x W x H)

# Benchmark Media Systems, Inc.

## COMPLIANCE and SAFETY INFORMATION

### ***FCC Class B Compliance***

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

### ***Safety Information***

Do NOT service or repair this product unless properly qualified. Only a qualified technician or authorized Benchmark Media Systems, Inc. distributor should perform servicing.

For continued fire hazard protection, fuses should be replaced ONLY with the exact value and type as indicated on the rear panel and on this page below.

Do NOT substitute parts or make any modifications without the written approval of Benchmark Media Systems, Inc. Doing so may create safety hazards.

## WARRANTY

### **The Benchmark 5 Year Warranty**

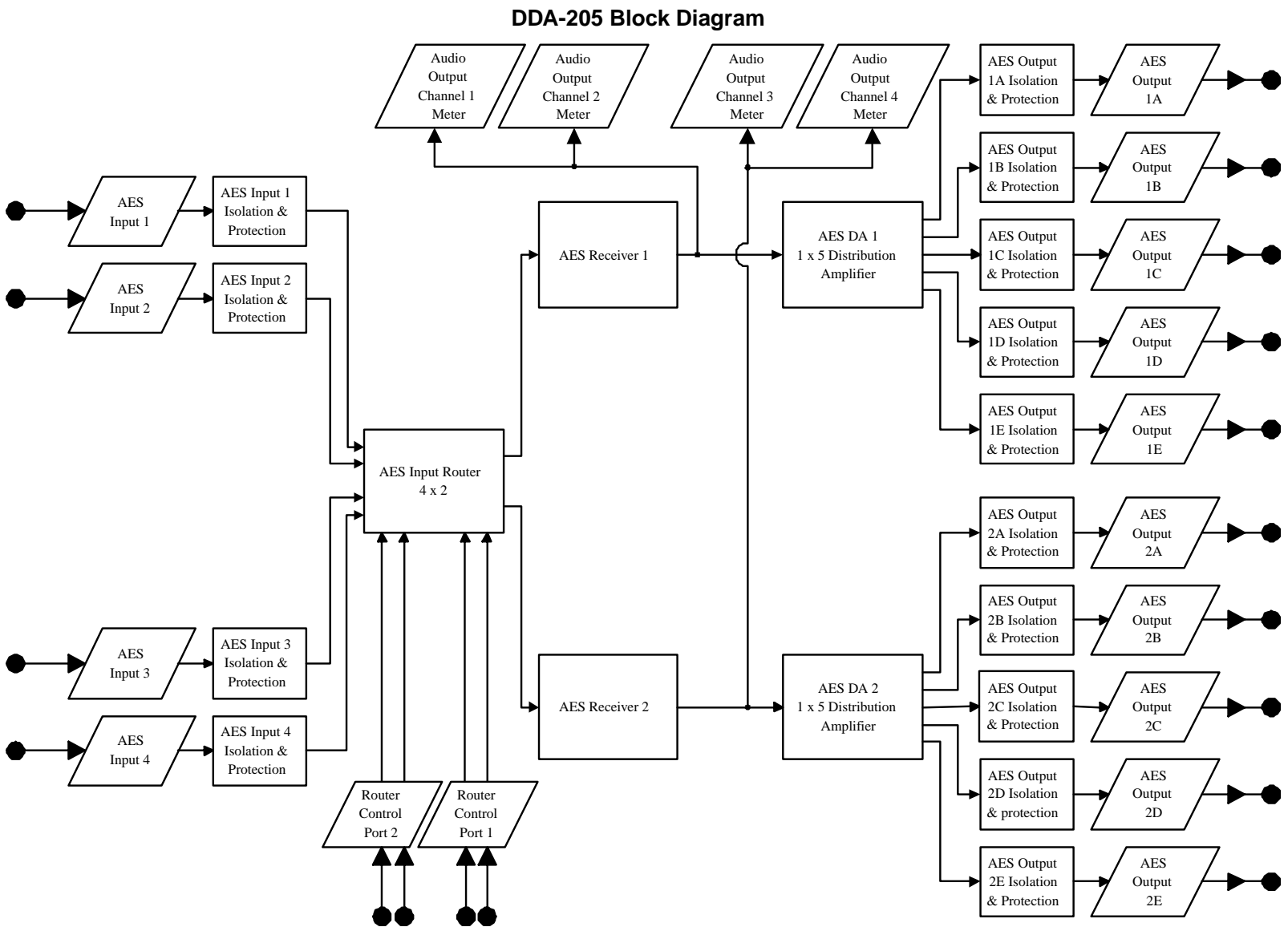
Benchmark Media Systems, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for a period of five years from the date of delivery. This warranty extends only to the original purchaser. This warranty does not apply to fuses, lamps, batteries, or any products or parts that have been subjected to misuse, neglect, accident, or abnormal operating conditions.

In the event of failure of a product under this warranty, Benchmark Media Systems, Inc. will repair, at no charge, the product returned to its factory. Benchmark Media Systems, Inc. may, at its option, replace the product in lieu of repair. If the failure has been caused by misuse, neglect, accident or abnormal operating conditions, repairs will be billed at the normal shop rate. In such cases, an estimate will be submitted before work is started, if requested by the customer.

The foregoing warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness or adequacy for any particular purpose or use. Benchmark Media Systems, Inc. shall not be liable for any special, incidental, or consequential damages. This limited warranty gives the consumer-owner specific legal rights, and there may also be other rights that vary from state to state.

A return authorization is required when sending products for repair. They must be shipped to Benchmark Media Systems, Inc. prepaid and preferably in their original shipping carton. A letter should be included addressed to the customer service department, giving full details of the difficulty.

**BLOCK DIAGRAM**



**DDA-205 Block Diagram**