Tiptop Audio™

ZEUS Series Audio Grade Power Systems

For Version 2.1 Boards

ZEUS Series Powered & Passive Bus Boards

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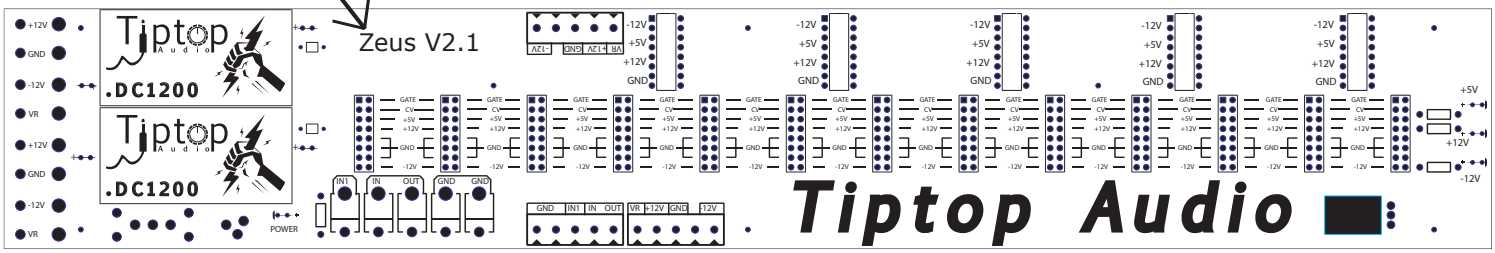
Tiptop™ Audio

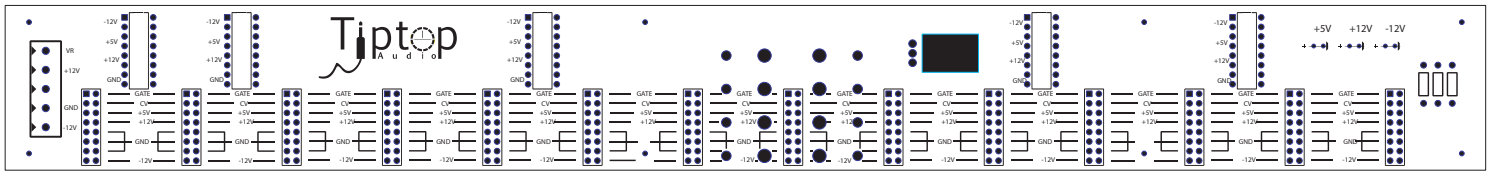
ZEUS Series Powered & Passive Bus Boards

Chapter 1
Introduction: The Advantages of ZEUS

Important:
Check for
Version 2.1!!

for more information
refer to Page 21 (Change Log)





The ZEUS power system for modular synthesizers was developed to bring the advantages of today's modern power technology to the modular synthesizer.

The ZEUS power system, in the most basic setup, will be comprised of an external wall or brick-style laptop power supply and a Zeus Powered Bus Board.

The safe and easy installation of ZEUS systems is its first and most obvious advantage. It is now possible to power a complete modular system from an external brick style universal power supply, the same power supply used to charge laptop computers. These external power supplies are extremely powerful and paired with the right combination of Powered Bus Boards, even very large systems can be run from a single laptop power supply at high audio quality power.

Using an external power supply ensures your system stays light-weight and clear of electromagnetic emissions produced by transformers. In essence your case stays cool, safe, and most importantly, removes any need to deal with hot AC main lines while installing the system.

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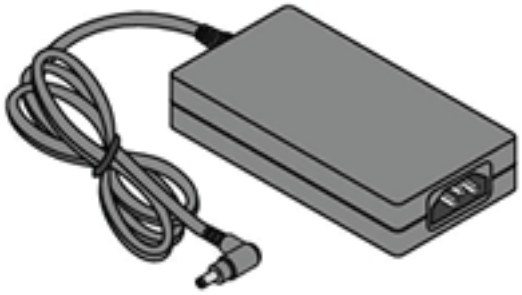
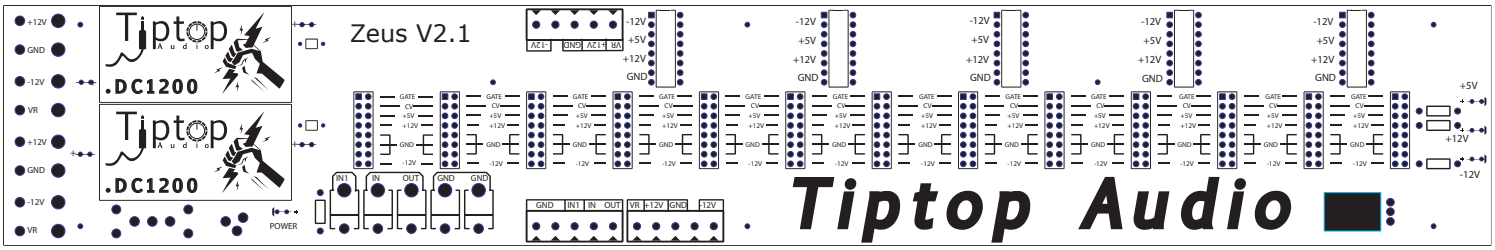
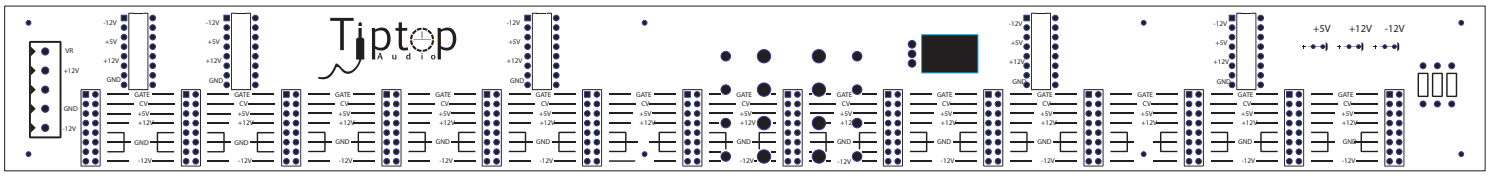
Chapter 1 (Continued)
Introduction: The Advantages of ZEUS







The technology used to achieve these mentioned benefits is known as **switching power**. In audio, the word "switching" means electrical noise, and noise is **not** something you want to have powering your audio gear. Therefore adopting this power technique for use in audio requires special care. The special care is taken by the DC1200 components used on our Powered Bus Board, this is a switching-type regulator that takes external power — either linear or switching — and transforms it into audio-grade switching power, strong and clean. These DC1200 regulators have a wide input range from 9V-16V with a constant +12V and -12V output.

This manual will guide you through the steps necessary for you to design the power system that meets your needs; taking into consideration the power consumption used by today's modern modules, mechanical assembly, cost, and ZEUS systems built with the intent of power/size expansion over time.

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Chapter 2
Understanding power consumption of analog and digital modules.

The power consumption requirements for today's crop of new and exciting modules varies from the prior needs of modules in the past. Before, the current draw was almost always even on both the positive and negative side of the rails. For instance, a 30mA module usually drew 15mA from the +12V rail and another 15mA from the -12V rail making for an even distribution of power consumption over the chain of power flow. This allowed the user to quickly calculate the necessary power supply specifications they would need to provide sufficient power to their systems.

Today this is not always the case. In modern modules there are far more digital technologies that require greater amounts of current drawn from the +12V power rail than what is drawn from the -12V power rail. With this in mind, the user can no longer take the summed mA total for granted and base their system's power on the status quo.

For Example: A Z3000 MKII Smart VCO requires 50mA from the +12V rail and 25mA from the -12V rail. A hypothetical system comprising of three Z3000 MKIIs would need to source 150mA from the +12V rail and 75mA from the -12v rail to function properly.

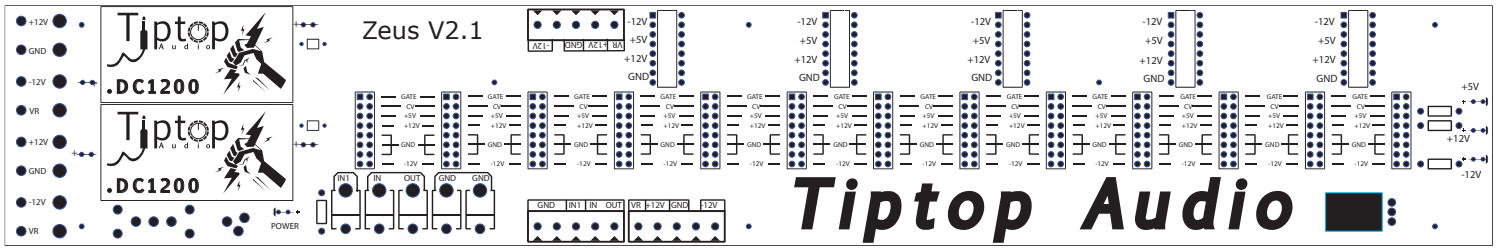
Once you know the amount of current you will need on your +12V and-12V, you can decide how many Zeus Powered Bus Boards you will need. Powered Bus Boards can supply up to 1200mA on the +12V regulator and 1200mA on the -12V regulator.

For Example: if you need 1150mA on the +12V and 730mA on the -12V, then you will need one Zeus Powered Bus Board. If you need 1450mA on your +12V and 1100mA on your -12V then you will need 2 Powered Bus Boards due to the 1200mA cap on both regulators.

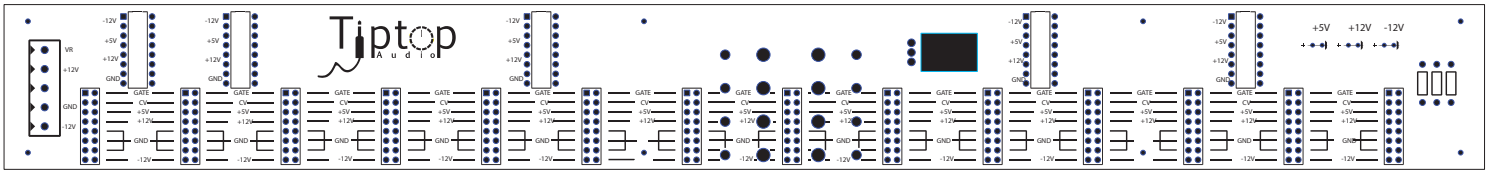
Chapter 3
Choosing The Right Combination Of Powered Bus Boards And Passive Bus Boards For Your Case.

The ZEUS Series Bus Boards come in two varieties: Powered and Passive.

Powered: This board is the heart of any system. It houses the power input terminals, dual Tiptop Audio's DC1200 switching regulators capable of producing up to **1200mA** for each of the +12V and -12V rails, 5V regulator capable of producing up to **500mA**, 13 Eurorack module connectors, 5 Analogue Systems-style module connectors, along with twin sets of both flat terminal and screw terminal power distribution channels. It also has the ability to pass the power along to more powered boards for larger systems which will be covered later on in this manual.



Passive: This board houses 14 Eurorack and 5 Analogue Systems-style module connectors and a 5V regulator capable of providing **500mA**. It has one screw terminal connection point and two sets of flat terminal connection points with the ability to pass power along to a second passive board if needed using the second set of flat terminals.



Next we have listed examples of how one can choose what boards their system might possibly need. These are merely examples and we strongly urge you to measure your system's total current draw to ensure you have the proper amount of power delivered to your case.

(Continued...)

Chapter 3 (Continued)
Choosing The Right Combination Of Powered Bus Boards And Passive Bus Boards For Your Case.

There are multiple wiring examples at the end of this manual, but the basic suggestions for 84HP systems are:

3U : (1) Powered Bus Board

6U : (1) Powered Bus Board (1) Passive Bus Board

9U : (1) Powered Bus Board (2) Passive Bus Boards

[or] : (2) Powered Bus Boards (1) Passive Bus Board

12U : (2) Powered Bus Boards (2) Passive Bus Boards

15U : (2) Powered Bus Boards (2) Passive Bus Boards

[or] : (3) Powered Bus Boards (2) Passive Bus Boards

18U : (2) Powered Bus Boards (4) Passive Bus Boards

[or] : (3) Powered Bus Boards (3) Passive Bus Boards

Chapter 4
Choosing The Right External Power Supply For Your Case.

The cornerstone of the case you are about to build will be its source of power. It is the lifeblood of your system and in most cases, it will define the sound quality and overall performance of your modular. Choosing the proper power supply will ensure that your system runs smoothly and quietly; taking into consideration that all modules are functioning properly, seated correctly, and all the steps covered in this manual have been followed accurately.

So now that you know the amount of current your modules consume on both the +12V and -12V, all you need to do in order to calculate the power rating of the external power supply is to sum the two rails together.

For Example: Your current consumption is 1150mA from the +12V and 730mA from the -12V, then your external power supply should be: 1150 + 730 = **1880mA**. You might want to give the power supply some headroom, so a 2Amp (2000mA) brick will do just fine.

As the example above mentions, you must sum both the positive and negative sides of the rails for you to be absolutely certain of the correct current needed from your case's power supply. You might be able to save cost by doing those numbers and finding the appropriate power supply. Keep in mind, that you might want your system to grow over time (modular is a hard drug) so it might be worth it to invest in a powerful power supply from the beginning.

The purpose of the DC1200 regulators on your Powered Bus Board is to ensure your modules receive stable, low noise, audio-grade power regardless of the quality of power supplied to them from the external power supply. As a result, the Powered Bus Boards can also be powered from any type of low cost Wall Adapter capable of supplying the sufficient current at a voltage ranging from 9-16VDC.

(Continued...)

Chapter 4 (Continued)
Choosing The Right External Power Supply For Your Case.

Modern switching power supplies however offer several advantages over wall adapters (transformers):

1. A large amount of current with a constant voltage output
2. Universal power, working with voltages from 100V to 220V
3. Lightweight

We recommend Cincon, a leading supplier of **switching power supplies*** for use with our power system. The power supplies listed here are set in order with recommendation per 84HP system size. Please note, these are only recommended numbers. For proper selection, please make sure to sum the amount of current used by your modules as recommended in this manual's previous chapters.

*All power supplies are universal and can be used with **100V to 220V**. No step-up or down transformer is needed. The only addition would be the correct country plug adapter.

√ It is good practice to power your ZEUS through a surge protecter.

<u>Recommended for 3-9U</u>

Cincon 12V 3.75Amp (3750mA) Part #: TRG45A120-12E01-Level-V

Mouser Part #: 418-TRG45A12-12-V

(Continued...)

Chapter 4 (Continued)
Choosing The Right External Power Supply For Your Case.

Recommended for large systems 9-14U

Cincon 12V 5.5Amp (5500mA) Part #: TRG70A120-12E01-Level-V

Mouser Part #: 418-TRG70A12-12-V

Recommended for very large systems (> 14U)

Cincon 12V 8.34Amp (8340mA) Part #: TRG100A120-12E12-Level-V

Mouser Part #: 418-TRG100A120-12-V

While the Cincon universal power supply is proven in powering hundreds of Zeus Systems worldwide with excellent results, a cheaper possible alternative, though not a household name, is the #CUP-45-12 available from Jameco Electronics. This power supply has been tested in our lab and is performing well at providing power to the Zeus Power System. We believe its build quality is not as high as a Cincon supply and might have a shorter life-span.

Jameco Reliapro 12V 3.75Amp (3750mA)

Jameco Part #: CUP-45-12

Chapter 5
Choosing The Right Power Socket, On/Off Switch, Wires & Connection Type For Your Case.

Do I Need A Fuse?

Not with the Zeus System. The ZEUS Series Powered Bus Board comes equipped with two (2) DC1200 switching regulators with an internal heat sink and built-in short circuit protection. The short circuit protection is made possible by the use of a Thermal Fuse. This fuse senses heat from a short, which in turn makes the fuse rise, disconnecting from the output and reconnect repeatedly(the cycle takes a few milliseconds to complete) until the short is fixed.

The wiring can be done in two ways; either by flat terminal or screw terminal connections. In either case, we recommend that you use 18AWG wire for all connections through-out your system. The two connections between the power supply and the Power Bus Board is the Positive Voltage IN and GND. The four connections from the Powered Bus Board to the Passive Bus Board are +12V, -12V, GND, and VR. (VR is the positive incoming voltage from the external power supplies distributed to the Passive Bus Boards to power the on board 5V regulators)

The **flat terminal** connections are the more professional choice for wiring up your case. They require a crimper to attach the male contacts to the wires. They have a wide, flat contact surface for better connections from the power supply to the board. The flat terminal connectors are mostly on the underside of both the Powered and Passive Bus Boards with exception to the Voltage In, GND, and Voltage Out connections. We designed them this way so that the wiring can be done cleanly and the connections stay out of sight for less visual confusion when dealing with module connections to the boards.

The **screw terminal** connections can be done without additional flat terminal male connectors on the end of your wires. This is an easier process for connection boards when you don’t have crimpers handy.

(Continued...)

Chapter 5 (Continued)
Choosing The Right Power Socket, On/Off Switch, Wires & Connection Type For Your Case.

When deciding on the right power socket and on/off switch for your case, you should always take into consideration the rating of the items you are going to be using. It is very easy to fry contacts and circuits by running more than the manufacturers' recommended rating of current through electronic components.

Below are some power sockets and on/off switches we recommend along with their power ratings and part numbers:

DC Power Connector: Mouser Part #502-712A

Power Switch (small size): Mouser Part #108-1AS1T1171-EVX

Power Switch (medium size): Mouser Part #691-2FB53-73/TABS

Power Switch (plastic lever): Mouser Part #103-4023-EV

Chapter 6
Basic Assembly Instructions.

One of the most important aspects of the case is making sure the bus boards are well isolated from any other surface. A good way to do this is to use standoffs to give them room for the wiring to be run below as well as ample space between the board and any surface that could possibly impede its performance. We recommend using standoffs with a minimum height of 8mm(.29”) when installing a Zeus Powered or Passive Bus Board.

The recommended screw size is #6. There are two aspects to the screw that the builder must be aware of: 1) length of the screw and 2) diamater of the screw head. The length is important because you don’t want it to surpass the space available for it to fit all included parts snuggly, leaving the board loose and moveable in the case. Secondly, the head diameter is important because if it is too small it might possibly slip through the provided hole space. Conversely, if it is too large it might touch important circuit contacts causing a possible short and damaging your system. Lastly, plastic washers are always a welcome addition for added isolation and protection for your bus boards.

Two very important aspects of the assembly are the gauge and polarity of the wires. 18AWG is what we recommend you use to wire your system’s connections. You will be dealing with four types of signals: +12V, -12V, 5V, and GND. The power supply will have +12V and GND going into your Powered Bus Board’s “IN” and “GND” input sockets. If you accidently connect these two wires backwards you WILL damage your Powered Bus Board. We recommend you use a Voltmeter to be absolutely sure you have the polarities correctly identified. The same goes for all four wires coming from the Powered Bus Board if you are connecting one or more Passive Bus Boards. The value indicators for the flat terminal connectors are located on the back of the Passive Bus Boards. Do not mistaken them for the Eurorack socket signal indicators.

(Continued...)

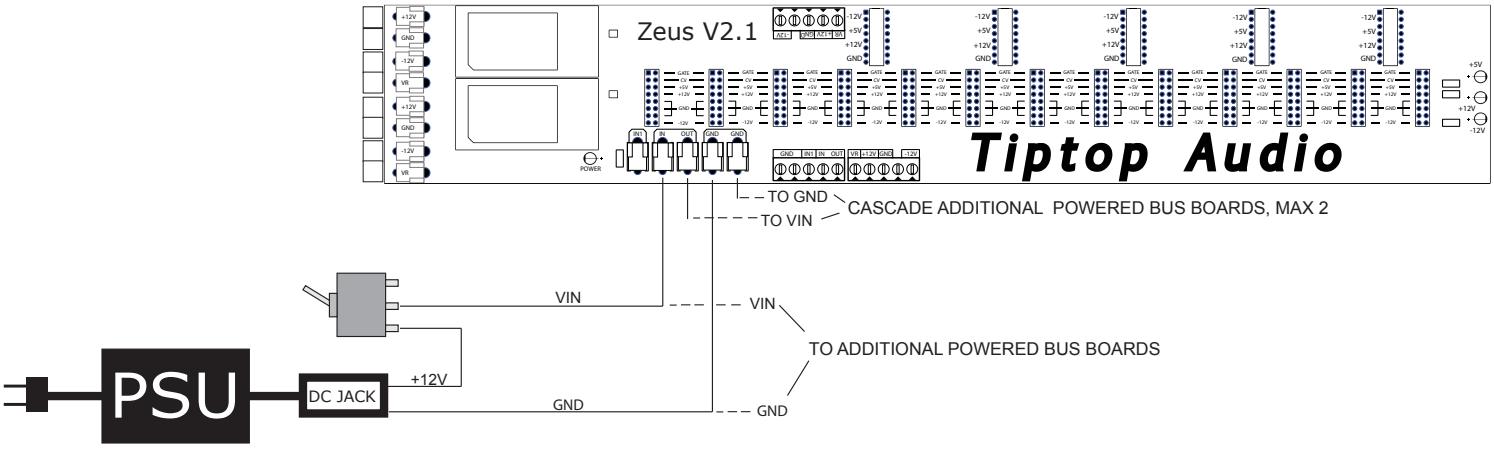
Chapter 6 (Continued)
Basic Assembly Instructions.

When powering on the bus board system for the first time it is recommened you check that all four LEDs light up together at once. Be sure to keep your hand on the switch. If for any reason one or more LEDs do not light up instantly upon flipping the power on, you should **IMMEDIATELY** return your system to its **OFF** state. Refer back to page 14 and recheck your wiring polarity.

Chapter 7
Wiring Diagrams

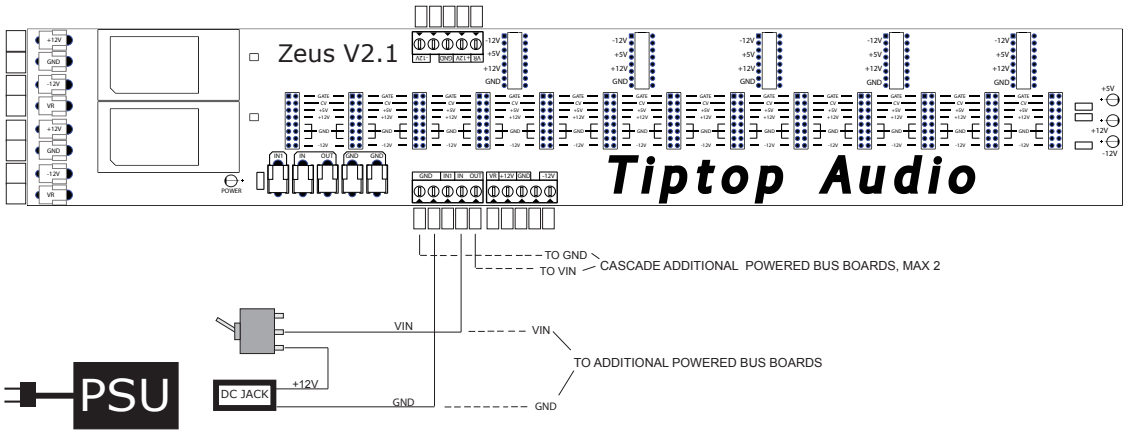
Basic System 1 - Using Flat Terminals.

1 x Powered Bus Board



Basic System 1 - Using Screw Terminals.

1 x Powered Bus Board



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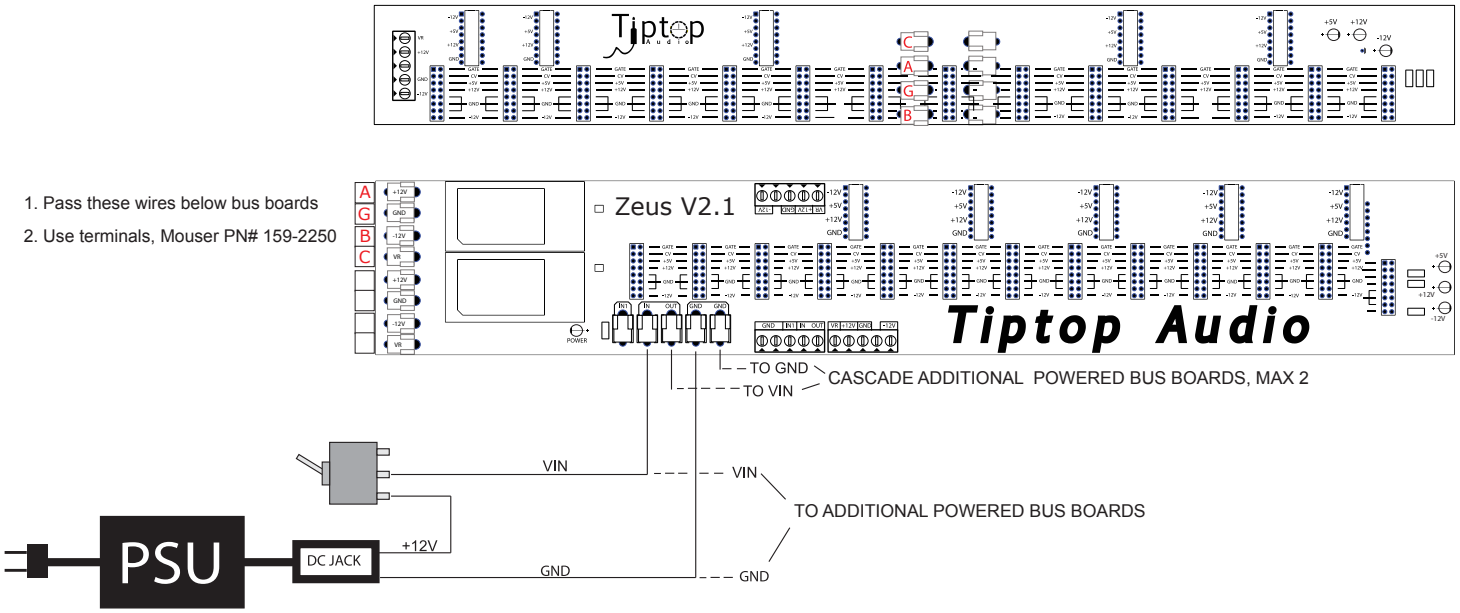
Chapter 7 (Continued)
Wiring Diagrams

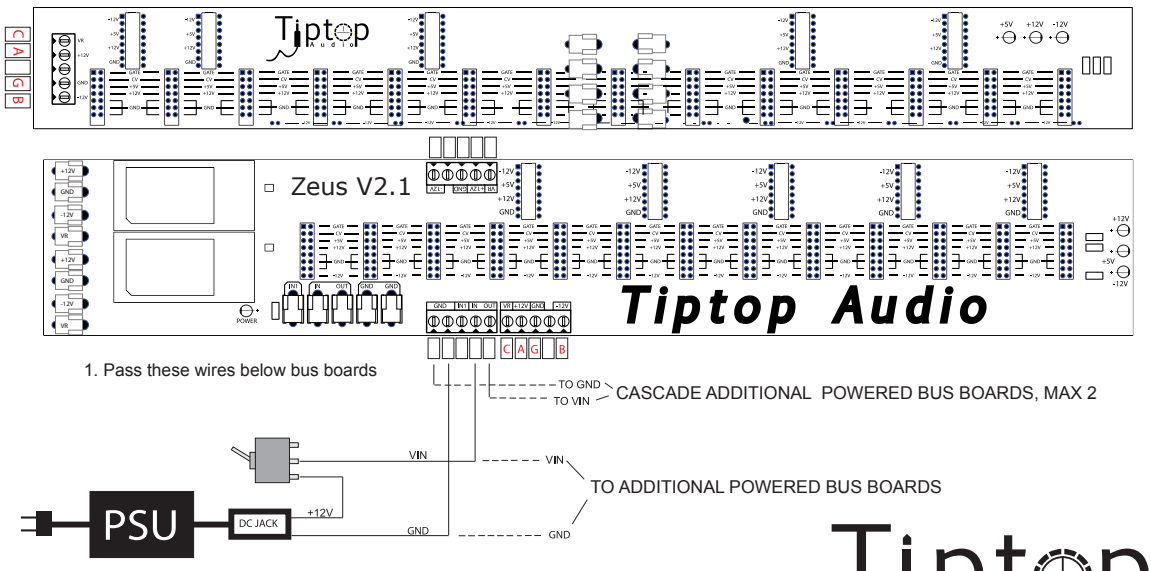
Basic System 2 - Using Flat Terminals.

1 x Powered Bus Board
1 x Passive Bus Board



Basic System 2 - Using Screw Terminals.

1 x Powered Bus Board
1 x Passive Bus Board



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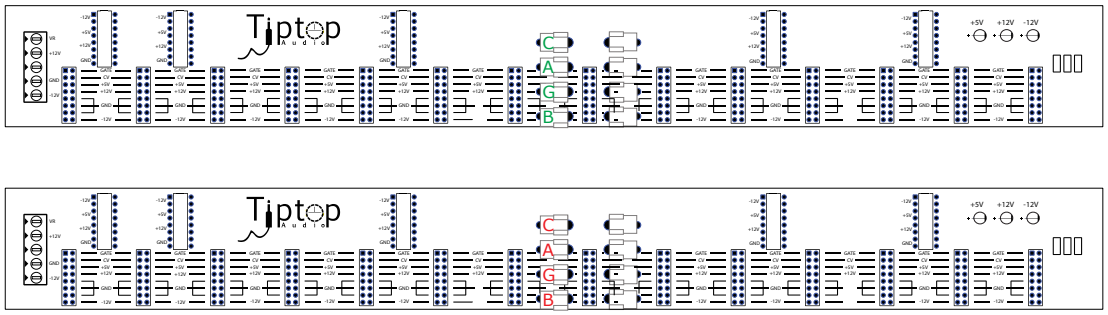
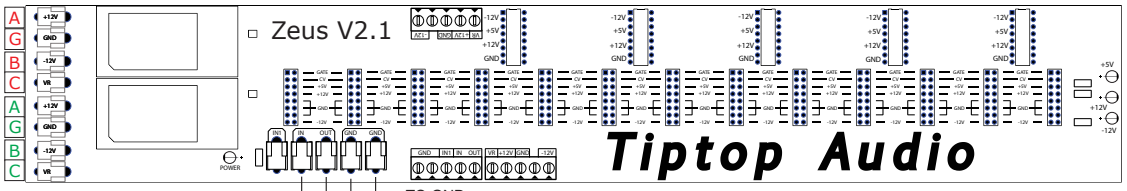
Chapter 7 (Continued)
Wiring Diagrams

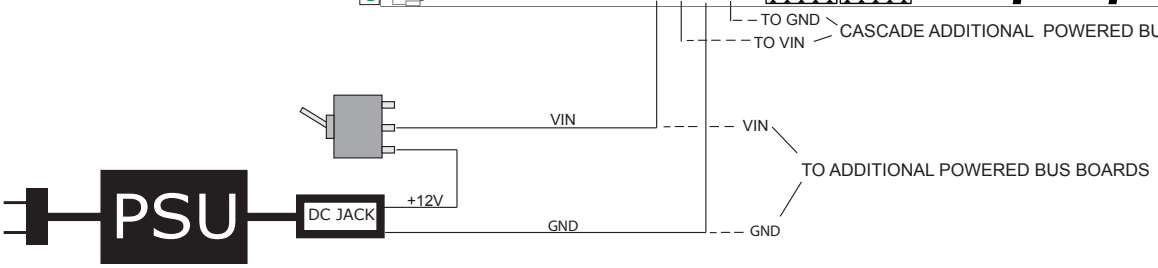
Basic System 3 - Using Flat Terminals.

1 x Powered Bus Board
2 x Passive Bus Boards



1. Pass these wires below bus boards
2. Use terminals, Mouser PN# 159-2250





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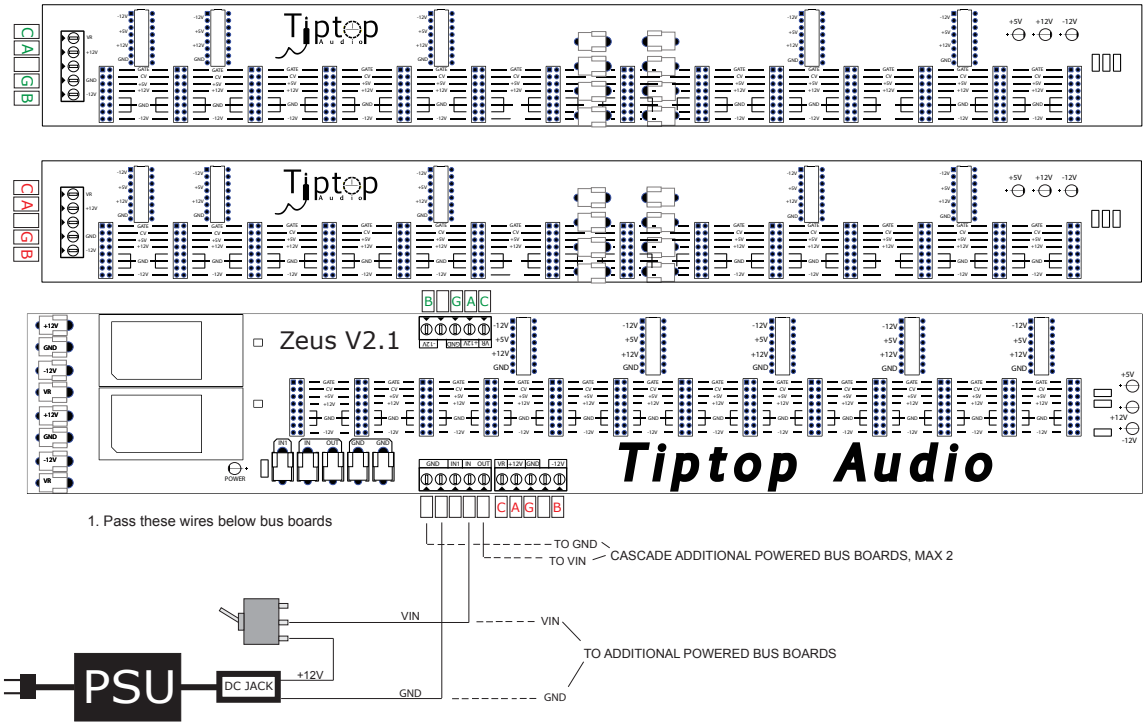
Chapter 7 (Continued)
Wiring Diagrams

Basic System 3 - Using Screw Terminals.

1 x Powered Bus Board
2 x Passive Bus Boards



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Chapter 8
Technical Specifications

ZEUS Series Powered Bus Board

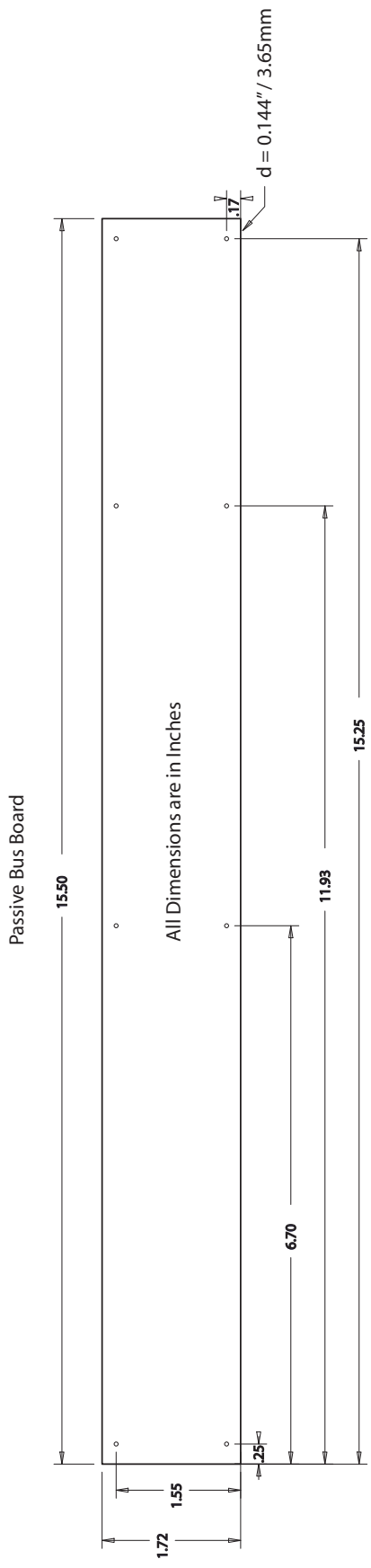
DC1200 Voltage Input: 9V-16VDC.
DC1200 +12V Output: 1200mA* max.
DC1200 -12V Output: 1200mA* max.
+5V Output: 500mA* max.
Eurorack Connectors: 13.
Analogue Systems Connectors: 5.
Flat Terminal Inputs: 1 set.
Screw Terminal Inputs: 1 set.
Flat Terminal Outputs: 2 sets.
Screw Terminal Outputs: 2 sets.

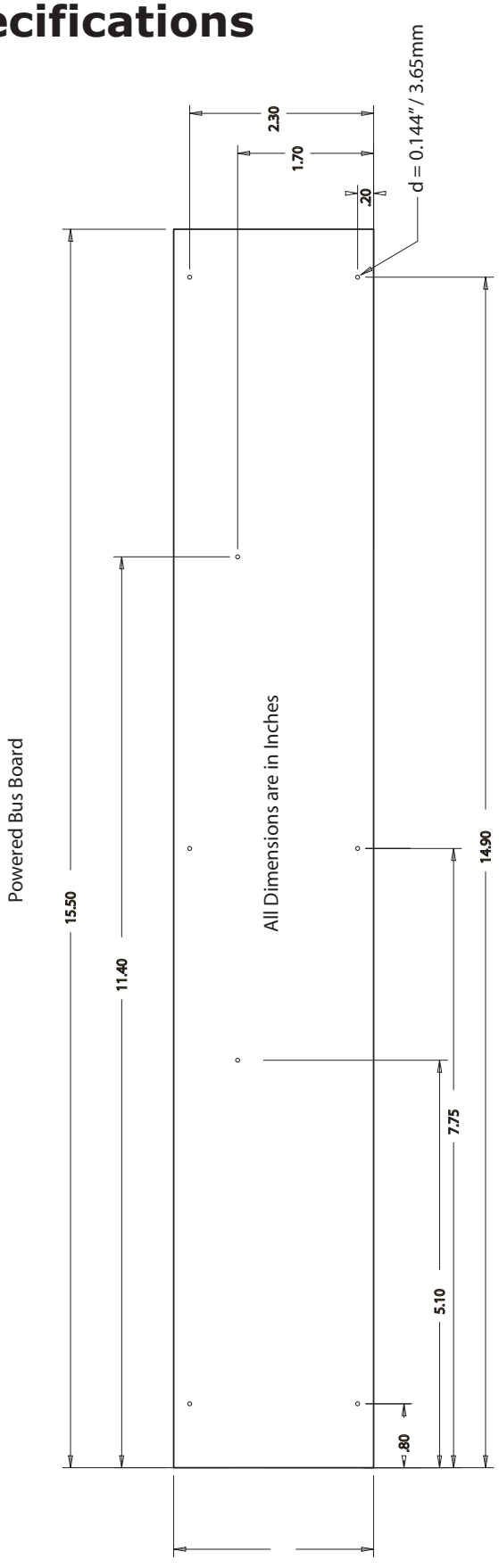
ZEUS Series Passive Bus Board

+5V Output: 500mA* max.
Eurorack Connectors: 14.
Analogue Systems Connectors: 5.
Flat Terminal Inputs: 1 set.
Screw Terminal Inputs: 1 set.
Flat Terminal Outputs: 1 set.

*These figures are tested and guaranteed with 12V power supplies.

Chapter 9
Mechanical Specifications





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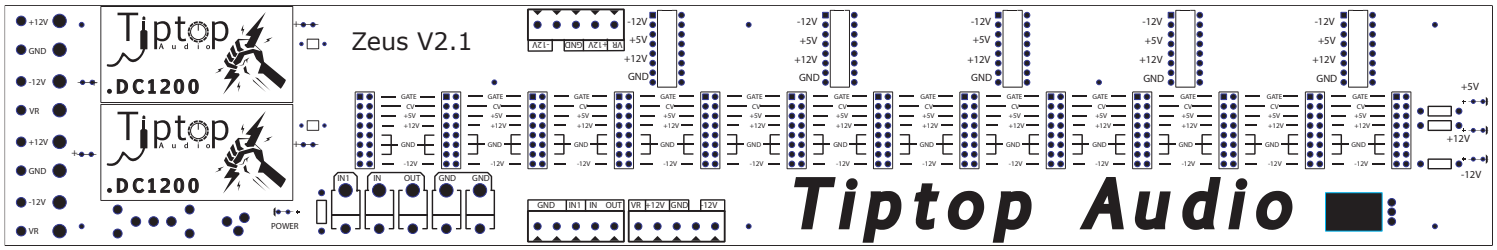
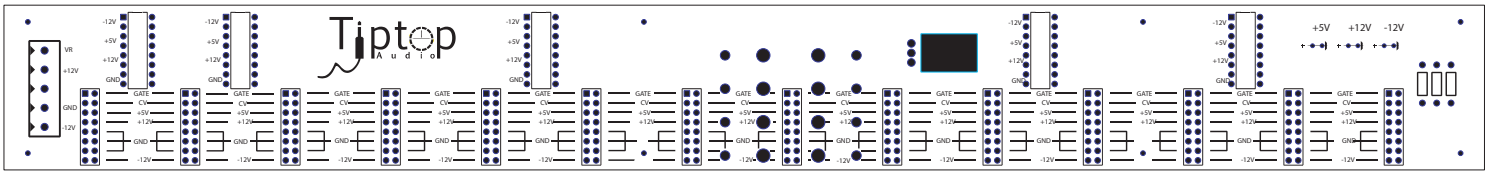
ZEUS Series Powered & Passive Bus Boards

For Version 2.1 Boards

Manual by Gur Milstein & Tomio Ueda





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Chapter 10
Change Log

Manual Revised March 2012

- Updated Mouser spade terminal part #
- Added minimum standoff height
- Updated Cincon power supply part #'s
- Added alternative Jameco power supply information

Changes from Version 1.0 -> Ver. 2.1 Boards

- Rearranged left terminals to minimize clutter
- '2.1' version printed on board
- Increased 5V power supply from 220mA to 500mA