Input Limits	Minimum		Maximum	
Voltage - to + input	22		50	V
Current			1500	mA
0V to + or - input	-60		60	V

Output (typical)	+12V	+5V	-12V	
Current Capacity	2500	1500	600	mA
Efficiency	0.88	0.8	0.7	W/W
Noise (resistive load)	0.2	2.0	0.3	mV rms
5Hz to 20MHz	1.7	11.0	1.7	mV p-p
Load Regulation	0.6	0.1	0.7	%/A
Line Regulation	0.0013	0.0001	0.0001	%/V
Maximum Capacitance	>10,000	>10,000	>10,000	uF

Scaleable Power System

By separating power distribution and 0V distribution the scaleable power supply allows a eurorack system to grow through larger cases or across multiple cases easily. Powered from a 24V-48V source the power boards each have their own regulators for their supply rails and share a common 0V reference with the other boards within a case, or to other cases.

The power source for each case could be an external "brick" type power supply with a low voltage DC connection to the case, or an enclosed power supply fitted permanently inside the case with a mains connection. Both earthed (Class I) or double insulated (Class II) supplies are able to be used safely and interchangeably, but they must be wired correctly.

The DC power supply required for a case is calculated from the sum of:

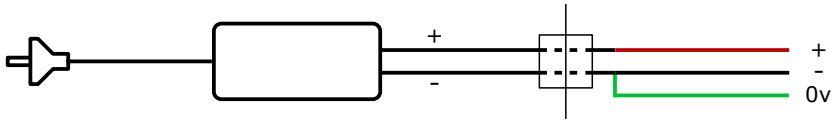
$$\text{Power Supply Required (W)} \geq \begin{array}{l} \text{(mA use total of +12V)/73} \\ + \text{(mA use total of +5V)/160} \\ + \text{(mA use total of -12V)/58} \end{array}$$

Wiring

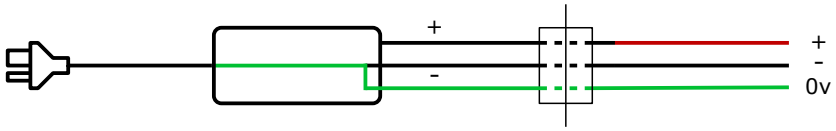
Power should be brought into the case by some type of connector chosen to match the power supply. There are 3 situations:

Mains Power Input: the protective earthing input should be connected directly from the input socket to the nearest metal part of the case, and all exposed metal parts of the case should be connected together. The 0V connection from the scaleable power supply distribution should connect only to the first earthing point in the case. The + and - supplies are connected to the DC output of the internal power supply. Suitable fuses are required between the input socket and the power supply input.

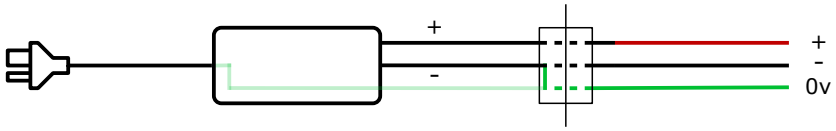
2 Wire DC input: Where the external supply only has 2 connections such as a "barrel" jack, the input socket should wire the + and - connections and also join the 0V distribution to the - connection at the input socket.



3 Wire DC input: (recommended) Where the DC power supply includes separate power and earth connections they should be wired to a suitable connector such as a 4 or 5 pin XLR so that they can be connected independently to the scaleable power system. If the separate earth wire is already is connected to + or - in the power supply then the earth is connected through to the 0V distribution and is not joined to either the + or - connections inside the case or the connector.



If the earth wire of the supply is only connected to the mains protective earthing pin or the supply has only two connections coming from it, the 0V and - connections should be connected together inside the input plug.

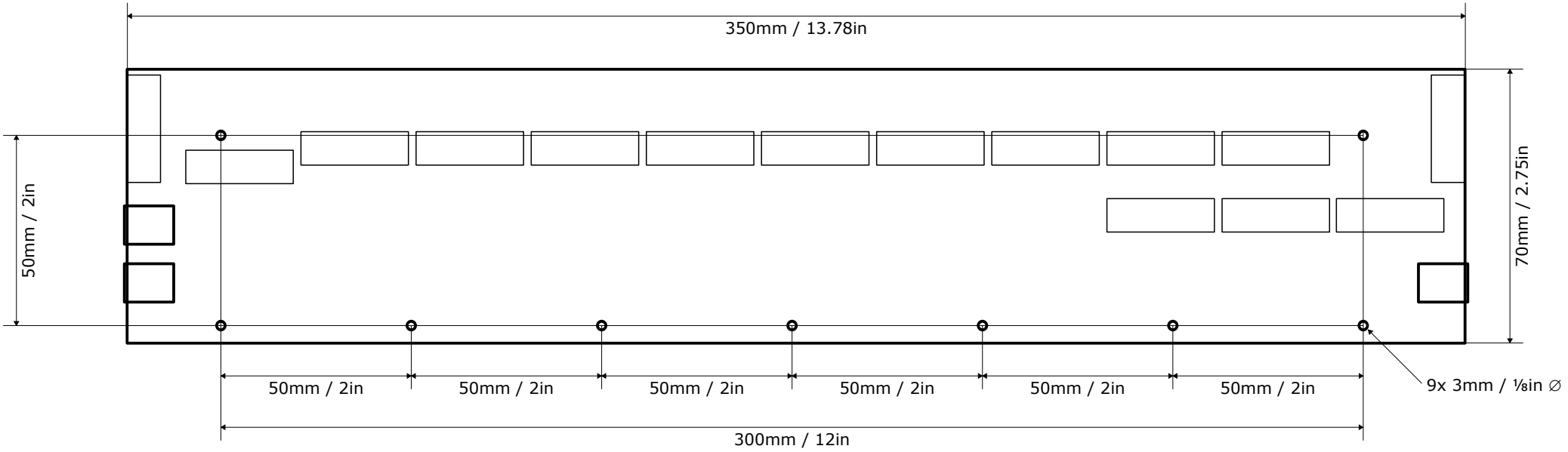


Mungo ENTERPRISES

Scaleable Power Supply

Dimensions (not to scale)

Thickness: 18mm / 0.7in
Weight: 180g / 6.5oz

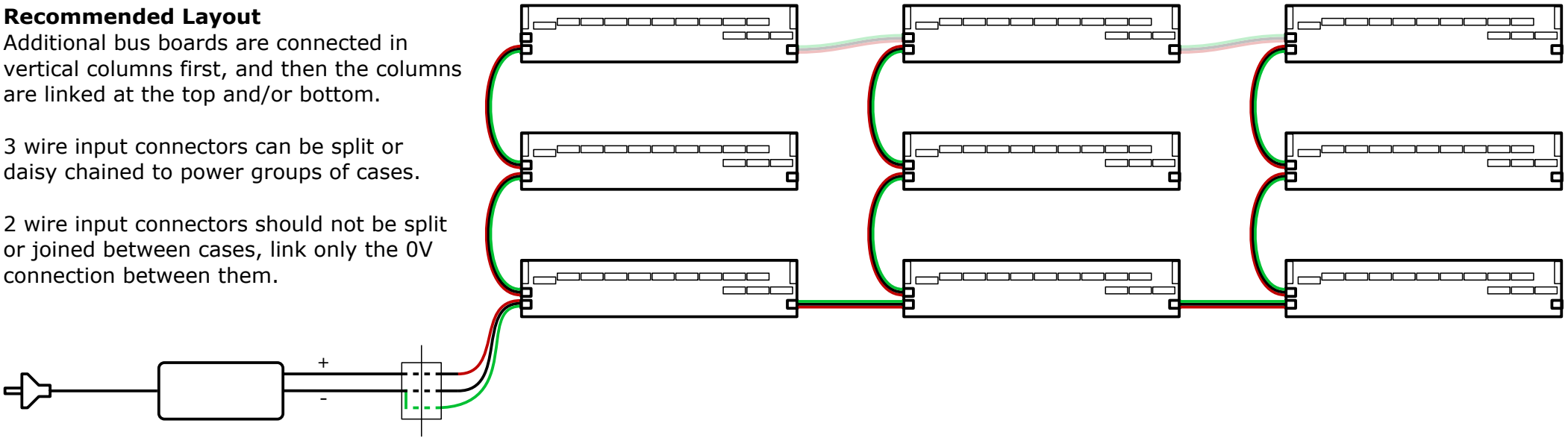


Recommended Layout

Additional bus boards are connected in vertical columns first, and then the columns are linked at the top and/or bottom.

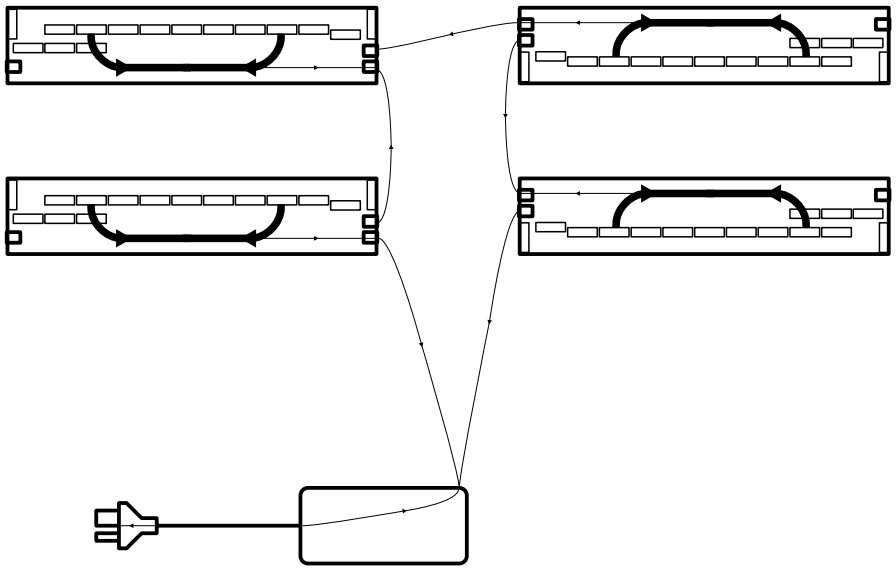
3 wire input connectors can be split or daisy chained to power groups of cases.

2 wire input connectors should not be split or joined between cases, link only the 0V connection between them.

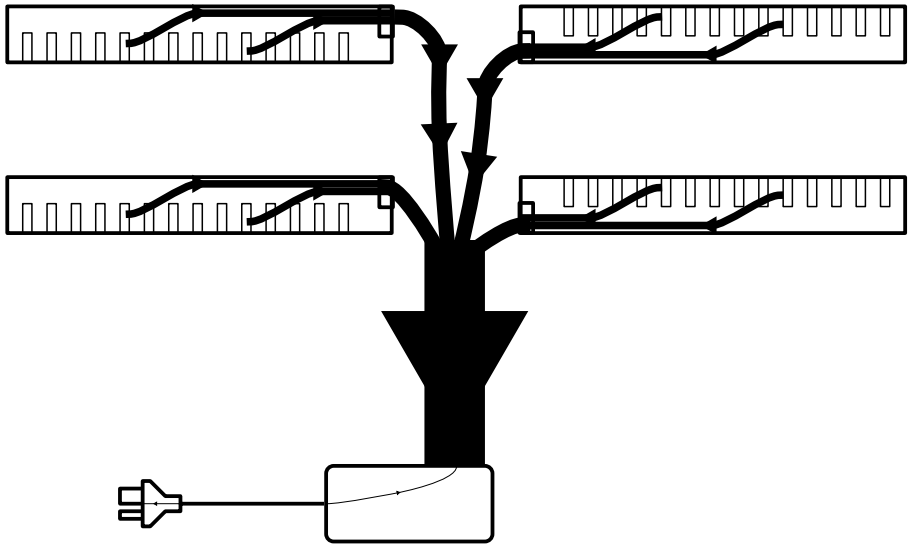


Current flow in 0V connection

Isolated design with
separated 0V and Power Supply



Conventional deisgn with
shared 0V and Power Supply



Where a module draws an unbalanced current from the positive and negative supplies it returns this extra current through the 0V connection. This may be a steady current draw which causes steady voltage offsets, or transient currents such as when components switch which causes noise and crosstalk/bleed. Shown graphically here are the 0V currents with the thickness of the line representing the amount of current, as the currents add to each other they become a large return travelling back to the power supply. The scaleable power supply instead has isolated regulators on each bus board to break the return current so only small signal currents flow between them.

Moving the regulators closer to the modules reduces distance the return current has to flow. Also the largest currents are confined to the bus board and not through the wiring or connectors, and the design of the bus boards increases copper area and thickness to reduce resistivity in the distribution system addressing the problem from every angle.

Ground Loops

Both of these example designs connect the 0V back through the power supply to the mains earth (ground reference). If a patch cable were connected between them then some of the currents shown would flow through the other system, onto the mains, and return back to the power supply where it originally went to. This forms the such named loop of current through the mains ground which can variously form hum, buzz, or noise even in other modules connected to the power system.

All products are sensitive to these ground loops to some extent, but unbalanced signals are particularly prone to this interference. Where it is impractical to use balanced connections such as between eurorack modules in different cases another alternative is to eliminate the other paths to ground and break the loops. Double insulated power supplies are a method to do this safely and allow simple interfacing with other grounded supplies or equipment.