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## SIMPLIFIED LOW COST MULTIPHASE AC POWER SOLUTION FOR 3D PRINTERS

HP INC

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## **Simplified Low Cost Multiphase AC Power Solution for 3D Printers**

**Abstract:** Installation of an electronic product having multiphase AC power capability is simplified by eliminating the need for the electrician to install jumpers at a 6-wire terminal block, thus reducing or eliminating the risk of damage from miswiring the product to the AC Mains.

This disclosure relates to the field of additive manufacturing.

A technique is disclosed that greatly simplifies the tasks required by the electrician who is wiring a 3D printer during installation by presenting to the electrician a consistent 4-wire interface at the input to the printer that reduces or eliminates the need for adding jumpers at the interface.

Some 3D printers utilize large amounts of energy from the AC Mains. Depending on geographic location, the AC Mains may be configured as either 3-phase Wye, 3-phase Delta, bi-phase, or single-phase sources. An electrician installing the printer at a particular location uses input jumpers to configure a multi-wire terminal block at the input of the printer to properly interface with that location's AC Mains. Internally, the printer has as many as three pairs of load connections that must be wired to the appropriate two, three, or four connections from the AC Mains. Given the number of combinations, this can be a challenge for the electricians. Significant damage to the printer will result if the input jumpers are incorrect, and as a result 400 volts, for example, is applied to printers expecting a 230-volt input.

According to the present disclosure, and as understood with reference to the Figure, the printer has a 4-wire terminal block instead of a 6-wire terminal block, and the electrician connects each of the 2, 3, or 4 wires of the AC Mains to specified terminals of the 4-wire terminal block 5. However, the electrician does not install any input jumpers at the terminal block 5, as has previously been required with a 6-wire terminal block. Instead, a Configuration Jumper Plug 15, 25 internal to the printer 1 (either pre-installed, or installable by the electrician) corresponds to the type of AC Mains 12, 22 which will power the printer 1, and adapts the printer's six internal power wires to the type of AC Mains.

In a 3-phase Wye system 10 (the typical configuration in Europe and much of the rest of the world), the AC Mains 12 is configured as three voltage sources with a common Neutral connection. The 4 Terminal Block connections are directly connected to each of the three AC Mains phases and Neutral. The jumpers of the 3-Phase Wye Configuration Jumper Plug 15 connect the 4 output lines from the switch and protection system to the printer's 6 load lines. The jumpers are implemented as individual wires on the plug 15, which is inserted into a mating receptacle of the printer 1.

In a 3-phase Delta configuration 20 (the typical configuration in North America), the AC Mains 12 is configured as three voltage sources connected directly to each other without a Neutral connection. The 3-Phase Delta Configuration Jumper Plug 25 eliminates a complex set of Input Jumpers that have multiple confusing Line-to-Neutral connections.

The disclosed technique is not limited to only 3-phase power systems. A 2-circuit configuration (not illustrated) supports two completely independent AC Mains sources with no Input Jumpers, using a 1 or 2 Circuit Configuration Jumper Plug. A 1-circuit configuration (not illustrated) uses the same 1 or 2 Circuit Configuration Jumper Plug,

but also requires two Input Jumpers at the terminal block to split the high current input load currents across the 4 conductors.

The disclosed technique advantageously eliminates the need for the electrician to install complex and confusing Input Jumpers at the terminal block 5 in order to interface the printer 1 with local AC Mains power. As a result, it avoids damage to the printer 1 due to miswiring. Different Multiphase Configuration Jumper Plugs allow connection to several different AC Mains systems. The jumpers in these plugs enable a 4-wire system to replace 6 wires to reduce both the cost (by as much as 33%) and the complexity of the AC power arrangement. The use of jumper plugs also enable a product to be shipped as a single worldwide SKU, with the ability to easily reconfigure it to the appropriate AC Mains system at a customer's site.

*Disclosed by David E. Smith, HP Inc.*

