



## RVP-1

### Reverse Voltage Protection for your "1<sup>st</sup> Generation" Line6<sup>®</sup> Variax<sup>™</sup> Guitar (Battery Cable Replacement)

#### SYNOPSIS

For the "1<sup>st</sup> Generation" Variax<sup>™</sup> Guitar Models (300/500/600/700), primary power is supplied through an internal battery. Power is supplied to the Main Printed Circuit Board (MPCB) via a cable that incorporates a "9V Battery Snap" connection at one end to connect the battery, and a "JST-PH2" connector on the other end to connect to the MPCB. Battery Power is sourced from either a standard 9V battery or a cartridge that holds 6 standard AA batteries. The cartridge connects to the Battery Snap exactly the same way as a 9V battery. It is this connection (battery to Battery Snap) that can lead to catastrophic "Reverse Voltage" conditions that will damage your "1<sup>st</sup> Generation" Variax<sup>™</sup> Guitar.

H & H Guitars has developed a "Reverse Voltage Protection" device (RVP-1) that is incorporated into a replacement cable for the OEM battery connection. This results in a replacement cable (for damaged OEM cables) that also acts as primary protection to the internal circuits of your "1<sup>st</sup> Generation" Variax<sup>™</sup> Guitar. Also, as the RVP-1 is designed as a replacement for the OEM battery cable in any "1<sup>st</sup> Generation" Variax<sup>™</sup> Guitar, it is longer than the OEM cable, and can make exchanging the battery or cartridge significantly easier as a result.

#### DESCRIPTION

If the power source to the MPCB is reversed (even for a short period of time) a bad thing will happen; the current from the battery will flow in reverse through a diode on the

MPCB and potentially destroy the diode. This results in an "open circuit" that will prevent normal power from reaching the MPCB until this diode is replaced. Since this diode is a "surface-mount device" (SMD), it is not easily sourced or replaced without specific information and specialized equipment.

This can (and frequently does) occur as easily as briefly touching the "Battery Snap" to the battery or cartridge with the connectors misaligned (backward). There is nothing inside the "1<sup>st</sup> Generation" Variax™ Guitars to prevent this "Reverse Voltage" condition.

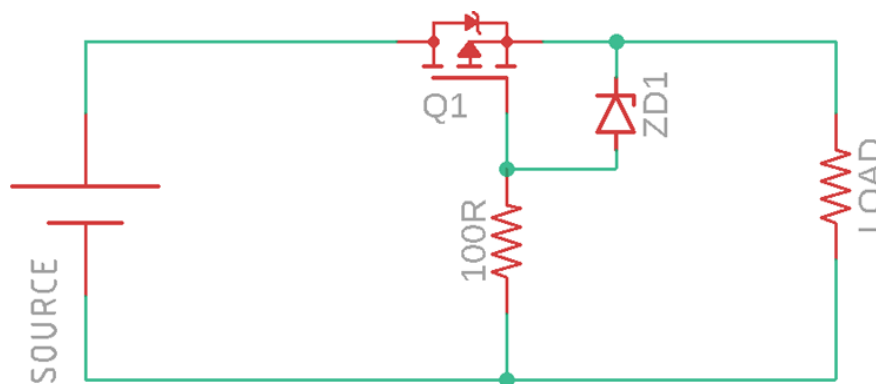
In the [RVP-1](#), we incorporated a **PMOSFET reverse voltage protection** circuit into the "Battery Snap" connector that is very efficient to protect "1<sup>st</sup> Generation" Variax™ Guitars from reverse polarity related damages. The circuit acts as a **battery polarity protection circuit**.

There are several options to protect the circuit from reverse polarity. For example, battery-operated devices can use special types of battery connectors that do not allow the battery connector to connect in reverse order. This is a mechanical reverse polarity protection for the circuit. This, however, requires changing the physical connectors in your "1<sup>st</sup> Generation" Variax™ Guitar. Not easy or inexpensive.

Another choice is to use a Schottky diode in the power rail but that is the least efficient way to protect the circuit from reverse polarity. Since "1<sup>st</sup> Generation" Variax™ Guitars already have a potential for being "under-supplied" from some of the possible power sources, this would potentially create instability in your "1<sup>st</sup> Generation" Variax™ Guitar.

Our design team believes that the best way to design a reverse polarity protection circuit is by incorporating a simple P-MOSFET, because PMOS cuts off the positive rail and the "reversed" circuit will not get any voltage.

## [P-MOSFET](#)



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The P-MOSFET is a type of transistor that uses an electric field to control the flow of current through it. FETs are devices with three terminals that are source, gate, and drain. FETs control the flow of current by the application of a voltage to the gate, which in turn alters the conductivity between the drain and source. This is the basic principle that is incorporated in using a P-MOSFET as a switch in reverse polarity protection.

## INSTALLATION

**Note:** This procedure may be considered difficult if one is not familiar with basic lutherie procedures and common electric guitar construction. If this is your case, [H & H Guitars](#) recommends taking the guitar (along with the [RVP-1](#)) to your technician for installation.

Installing the RVP-1 is as simple as replacing the OEM power cable. As previously stated, one end of this cable is located inside the Battery Compartment, and the other end attaches to the MPCB inside the guitar. As anyone who is familiar with "1<sup>st</sup> Generation" Variax™ guitars knows, some models are harder than others to access the MPCB, but others make it as easy as removing a rear cover on the guitar. The general procedure is:

- Locate the MPCB. Unplug the power connector and tie a thin 24"-36" string to the wires close to the MPCB connector. Secure the loose end of the string close to the MPCB if possible. Note: Dental Floss works well for this.
- Open the battery compartment. Pull the 9V Snap end of the cable up and out of the compartment, until the end of the string comes out of the battery compartment (do not pull the string completely out of the guitar). Untie the string.
- Tie the string to the MPCB connector of the [RVP-1](#). Pull the other end of the string until the 9V Snap end of the [RVP-1](#) is inside the battery compartment.
- Connect the MPCB to the RVP-1, and pull slack to the battery compartment.
- Reinstall any covers, etc. removed in steps 1 and 2.



# H & H Guitars, Etc.

Texarkana, AR 71854

[info@hhguitars.com](mailto:info@hhguitars.com)

[Service@hhguitars.com](mailto:Service@hhguitars.com)