

# PXL-250 Transient Protection

The integrity and functionality of the PXL-250 Controller motherboard and SB-293 Satellite board are protected from transients and reverse-polarity voltages in five different areas.

## 1. Input Voltages

- A 3-amp power diode protects against reverse voltage.
- A 15-volt transorb protects against over voltage transients. This transorb clamps hard at approximately 18 volts.
- All input circuits are capable of withstanding transient input voltages well in excess of 18 volts for brief periods.

## 2. Output Relays

Both the Lock and Alarm relays are protected from damage from "inductive kick." Inductive kick is capable of generating hundreds of volts (sometimes even thousands), when inductive loads such as door strikes are turned off. This high voltage can arc across relay contacts, damaging or destroying the relay.

High voltage (39-volt) Metal Oxide Varistors (MOVs) are connected from the normally-open contacts to common, from the normally-closed contacts to common, and from the common contacts to ground. These MOVs clamp the high voltage generated by inductive kick to under 100 volts, protecting the contacts from high voltage arcing.

## 3. Communication Channels

Both the host communication channel (RS-232) and the network communication channel (RS-485) are protected by 12-volt bipolar transorbs.

By specification, RS-232 is capable of withstanding a continuous short to +25 volts, -25 volts, or ground. The 12-volt bipolar transorbs clamp transient voltages to well below this value.

RS-485 is not as tolerant of over-voltage conditions. The manufacturer of the RS-485 transceivers used by Keri Systems, however, has included transient protection on-chip. This protection is capable of withstanding 10,000-volt "human-model" transients. External 12-volt bipolar transorbs have been added to protect against higher voltage and non-human-model transients such as near-miss lightning strikes. Nothing protects against direct lightning strikes.

## 4. Switch Inputs

- All switch inputs are protected by 5-volt unipolar transorbs.
- Negative transients are clamped to less than 1 volt.
- Positive transients are clamped to no more than 8 volts.
- Current-limiting resistors are used on all inputs and internal transient-clamping diodes are present on all microprocessor inputs and outputs. These limit transients to no more than 0.6 volts above VCC or below ground, levels well within the allowable limits of the integrated circuit.

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## 5. Antennae Interface

- All output lines are driven by a high-voltage, high-current driver capable of withstanding 80 volts.
- The high-voltage, high-current driver has built-in high-current clamp diodes to prevent over-voltage in excess of 1 volt above VDD (12 volts).
- All output lines are protected by 15-volt unipolar transorbs that clamp at approximately 18 volts.
- Current limiting resistors protect all output lines.
- Antennae inputs are protected by 15-volt unipolar transorbs.
- Antennae inputs are connected to very low impedance circuits that effectively resist transients.
- The antenna input circuits use inactive filters that are nearly impervious to transients.

### Summary:

- The PXL-250 and SB-293 are as nearly "bullet-proof" as is economically feasible.
- Alternatives such as fuses can always be added externally, however they do not effectively protect against transients.
- Fuses take a finite time to "blow," but integrated circuits can be damaged or destroyed almost instantaneously. Transorbs and MOVs have sub-nanosecond response times.
- Fuses are best used for protecting against excess current. Integrated circuits, however, are sensitive to excess voltage, for which transorbs and MOVs provide better protection.