

Precision 10KV High Voltage Interface Specifications

Author: Joe Evans

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Discussion:

The Precision High Voltage Interface (HVI-10KV) is an attachment for any Precision tester. It allows the Vision operating system to control High Voltage Amplifiers (HVAs) and execute tests at voltages up to 10,000V. The Precision 10KV HVI will control two independent HVAs of different voltage ratings plus it has a separate auxiliary pair of external connectors to connect the sample to a separate measurement instrument such as a network analyzer.



The second primary function of the HVI is to provide protection to the user from the high voltages present during tests. The maximum voltage rating for the Precision HVI is 10KV. All high voltage wires internal to the system have insulation with a DC breakdown specification greater than 40KV. During normal operation, when a test is not being performed, the high voltage DRIVE and RETURN outputs of the Precision HVI are disconnected from the HVA and connected directly to earth ground. The sample is connected to the HVA and the tester only during the execution of hardware task in the Vision operating system. The four high voltage isolation relays that execute the switch matrix function are rated for 12KV.

Safety:

High Voltage ceramic samples routinely breakdown during high voltage testing creating a strong chance of damage to the test system measurement circuits. To prevent this damage, the HVI has four layers of protection. The first is a voltage limiting circuit on the HVI RETURN input that prevents the HV RETURN from exceeding 2.1 Volts. For voltages greater than 2.1V, all current is routed to the earth ground and away from the tester inputs. This prevents the excess voltage and current during a sample breakdown from exceeding the current canceling capability of the virtual ground circuitry on the tester input.

The second form of protection is a slower circuit in the HVI RETURN input that will open the isolation relays and ground the sample if the shorted condition persists for longer than 17ms.

The third safety layer for the HVI lies in its digital communications channel with the Precision tester. Through this communications interface, the tester can control the state of the HVI and detect a fault condition. As well, the High Voltage Amplifier must have an Identification Module (ID Module) attached that holds the specifications of the HVA. The Vision operating system will not allow a test to proceed if the specifications of the HVA do not match those specified for a test. This feature prevents inadvertent application of excess high voltage to the sample.

Finally, the 10KV HVI has a safety interlock system that allows the researcher to connect the HVI to a door, lid, or other physical barrier. The high voltage function in the HVI is disabled unless the safety interlock is activated.

HVI Specifications:

Channels:	Two HVAs plus an auxiliary input
Maximum International Voltage Rating	10KV (AC)
Power:	110V or 220V switch selectable
High Speed Protection Current Rating	10 Amps
High Speed Protection Trigger Voltage	2.1V
Low Speed Protection Delay Time:	17ms
Isolation Relay Switchable Voltage	12KV
Internal Insulation Rating:	>40KV DC

Origin of Voltage Limits

The DC voltage rating for high voltage insulation does not take into account RF coupling of high voltage AC Signals through the insulation to grounded objects. We have found that high voltage wire insulation must be de-rated by approximately a factor of four for the high voltage frequency levels used in Radiant's testers. For instance, to run a 10KV triangle wave at 1KHz requires insulation on the test cables with a DC rating of at least 40KV. Radiant normally supplies its customers with high voltage cables having ratings greater than 40KV for use with the 4KV HVI. Cables with ratings higher than 25KV can easily be recognized. They are encased in a sheath of rubber tubing. The tubing is actually rated to 50KV.

Of necessity, external panel mounted connectors have metal contacts exposed to ambient air deep inside the connector barrel. These exposed metal contacts will create corona in dry air (40% humidity for frequencies above 50Hz at voltage greater than 8KV). The corona is not exposed outside the interior confines of the connector and is not a safety issue. Nevertheless, Radiant recommends the use of silicon paste (Dow corning 5 compound) inside the HV connectors of the HVI during very high voltage operation to prevent arcing between the connector and the plug from oxidizing the contact.

Multiplexing HVIs:

The Precision Premier and Precision Workstation both have two COMM channel connectors capable of controlling either a 4KV or 10KV HVI. The COMM channel of choice is selectable from the menu page for each hardware task in Vision. Thus, a Premier or Workstation, using two 10KV HVIs, can control up to four HVAs during the execution of a Vision program. The Precision LC has only one COMM channel but it will function with either the 4KV or 10KV HVIs.