REEDHOLM

DATA SHEET

DS-11052

High Current SMU Module [HISMU]

- **Pulsed Voltage Output: 0 to ±10V**
- **Three Voltage Ranges: 2.5V, 5V, & 10V**
- **Peak Current Delivery:**
  Through Backplane Nodes & Matrix: ±2A
  Through Auxiliary Pins: ±5A
- **Indefinite Short Circuit Protection**
- **Output Current Measurement**
- **Kelvin Sensing to DUT**

The HISMU is a bipolar output voltage source capable of supplying load currents up to 5A. Its output is programmable between -10V and +10V over voltage ranges 2.5V, 5V, and 10V at full scale. As shown in Figure 1, the HISMU output can be connected to the probe card or DUT fixture via backplane nodes and matrix pins, or an auxiliary 8-pin cable. The latter is required for currents >2A.

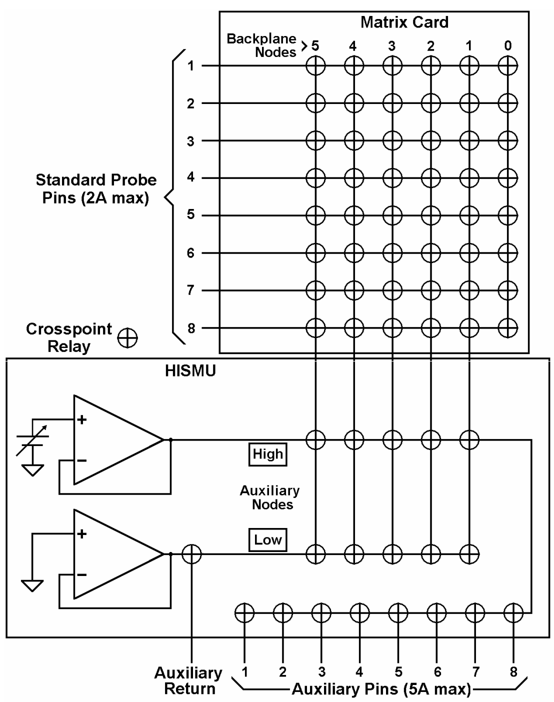

Figure 1 - HISMU Connection Options

Specifications

Mode	Range	Error		Resolution
		Offset	% of Value	
Current Measure	10A	2.5mA	0.10	2.5mA
Voltage Force	2.5V	2.5mV	0.05	1.25mV
	5V	5mV	0.05	2.5mV
	10V	10mV	0.05	5mV

Comments:

1) Four pulse widths: 30µsec, 100µsec, 200µsec, & 300µsec with pulse width uncertainty <1µsec.
2) Analog settling time is <5µsec to within 0.1%.
3) Gain factor (% of value) errors apply after running SelfCal with an ideal (<±10ppm uncertainty) transfer DMM. Actual performance is calculated using http://www.reedholmsystems.com/SuppNote/SN-115.pdf.
4) Accuracy of voltage forced on a given range is a function of the range offset error and the value forced, for example, forcing 1.25V on the 2.5V range results in:
   V_{out} = 1.25V ± (2.5mV + 0.05% of 1.25V)
   V_{out} = 1.25V ± 3.125mV
5) Accuracy of current measured is a function of the range offset error and the value measured, for example, measuring 1A on the 10A range results in:
   I_{out} = 1A ± (2.5mA + 0.1% of 1A)
   I_{out} = 1A ± 3.5mA
   1A ± 3.5mA

Current Output and Duty Cycle

The high currents provided by the HISMU would create severe overheating in most parametric measurement applications, so voltage is output in pulses settable to 30µsec, 100µsec, 200µsec, or 300µsec.

Via the auxiliary output pins, the HISMU can source up to ±5A, subject to the duty cycle relationship shown in Figure 2. This is not a practical limitation because the highest current in a 300µsec pulse allows measurements every 12msec, which is an order of magnitude faster than typical parametric measurement times.

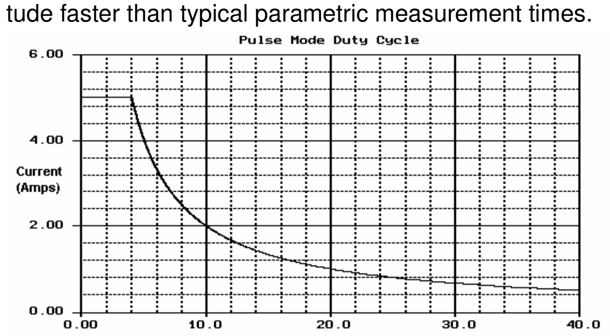

Figure 2 - Duty Cycle and Output Current

Relay Protection

Peak output current to the backplane nodes, and thus matrix cards, is inhibited by current limit circuitry to <±2A. This assures that the specified maximum current through matrix relays is never exceeded. In addition, the current limit circuitry prohibits currents <±5A through the auxiliary pins.

When current limit conditions occur, low level software requires that the HISMU voltage be set to zero and the load disconnected before testing will be allowed to resume.

Current Measurement

The return current to the Low node amplifier depicted in figure 1 flows through a precision current shunt. Voltage drop across the resistor is converted through a differential amplifier and digitized by a 12-bit A/D while the voltage pulse is applied.

Kelvin Sensing of Source Voltage

High current amplifiers on the high and low output nodes assure that accurate voltage is delivered unless there is excessive voltage drop down the force path.

Voltage Delivery Considerations

Voltage drops down the force line reduce the voltage available at the device under test. Care needs to be taken to minimize cable resistance, probe card resistance, and probe pin to pad resistance. In figure 3, typical and worst-case (minimum) relationships are shown based on HISMU component specifications and integration in the RI-2kV/5A test system. Matrix and auxiliary pin connections are made in that system.

The power amplifier typically outputs >±10V at 5A, but voltage drops across a 300mΩ precision shunt resistor, the 5A output relay, and 72mΩ in the auxiliary cable reduce typical voltage delivered to ±8.34V at 5A.

Voltage delivery is a direct function of the system ±15V supplies, so they are increased as necessary during installation to assure worst-case delivery of ±10V at 2A through the auxiliary pins.

Higher resistance through the 2A matrix connections do not affect the ability to typically deliver >±10V, but worst-case amplifier performance can drop delivery to ±8.62V.

Probe pin to pad contact resistance up to 500mΩ would permit worst-case delivery of 5A at ±5V, but such low resistance is difficult to accomplish. Multiple probe pins should be used for currents >200mA.

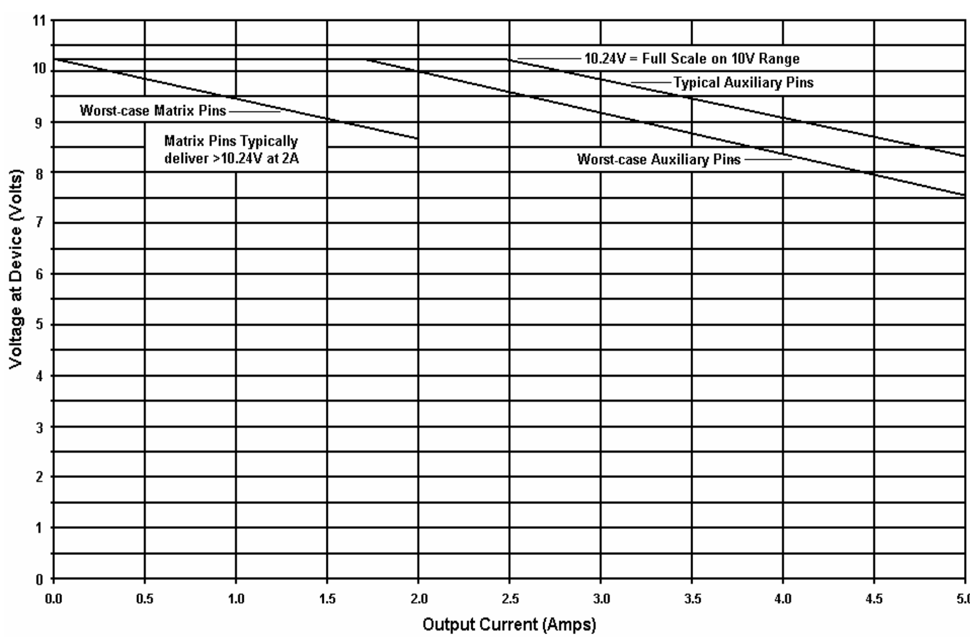

Figure 3 - Voltage Delivery in RI-2kV/5A Test System