Stacks Analog Deck DMM
Details of Operation

Introduction & Scope:

This document describes the use cases and details of operation for the Analog Deck DMM. It provides an overview of the hardware associated with the DMM and subsequent limitations. This document is not a substitute for the datasheet or Subinitial Python Library API documentation. This document is applicable to Analog Deck Rev B hardware.

Analog Deck Use Cases:

1. Basic
    a. DMM is used to measure standard voltages (fairly low-impedance sources, <1k)
    b. Measurements do not require high-speed.
    c. Measurements do not need to be taken simultaneously
2. Advanced
    a. DMM may be used to measure voltages with any source impedance
    b. Measurement may require high-speed and/or continuous data acquisition
    c. Setup may require fast channel switching
    d. Setup may require custom MUX connection/disconnection timing

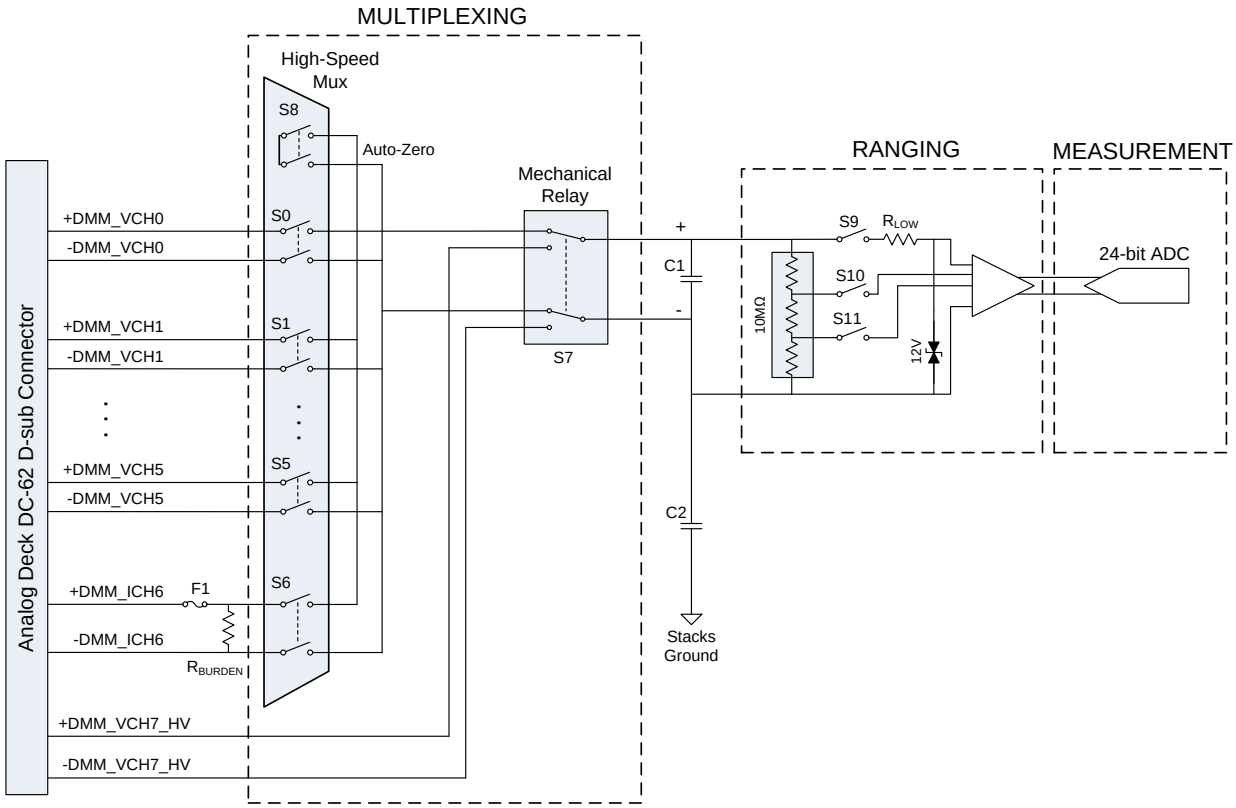

Figure 1: Simplified Analog Deck DMM Functional Diagram

Overview:

The DMM consists of one high-accuracy measurement unit (24-bit with low-drift reference) connected via ranging and muxing to 6 voltage channels and one current channel. Channels 0-5 are voltage channels that employ solid-state muxing for rapid channel switching. Channel 6 is a current channel that also employs solid-state muxing. Channel 7 employs a mechanical relay, which is slower and audible, but offers lower leakage and higher voltage. Figure 1 provides a simplified Analog Deck DMM functional diagram for reference.

Operation & Details:

In the basic use case, the DMM will be operating in “freerun mode” from power-up. In this mode, the DMM continuously gathers data from channels 0-6 in autoranging mode. See Figure 2 for the timing of the MUX. The switch labels “S0” through “S8” correspond to the switches in Figure 1. This cycle repeats indefinitely to ensure fresh data is available in the Analog Deck registers. See the datasheet for MUX transition times. The opposite of “freerun mode” is “trigger mode”, where the DMM must get a trigger before performing measurements.

Auto-zero is on by default (and should be left on to maintain accuracy specifications), and is the long pulse labeled “S8”. This corrects offset internally, but may be switched off in software for speed. Autoranging may also be disabled for speed by explicitly choosing the desired range for each active channel.

Notice switch “S8” turning on between each channel switch. This is not auto-zero, but this discharges any differential mode voltage stored on parasitic capacitances, represented by C1 in Figure 1, so that channel switching has a minimum effect on the DUT.

Common mode voltage stored on parasitic capacitances with respect to Stacks ground, represented by C2, should be considered when designing the test measurement setup. To reduce common mode capacitance issues, connecting the negative DMM terminal (i.e. “-DMM_VCH0”) to the lower-impedance node of the DUT.

If no leakage current can be tolerated, either use channel 7 due to its mechanical relay and galvanic isolation or provide relays external to the Analog Deck. Channels 0-6 have a finite leakage current as specified in the datasheet.

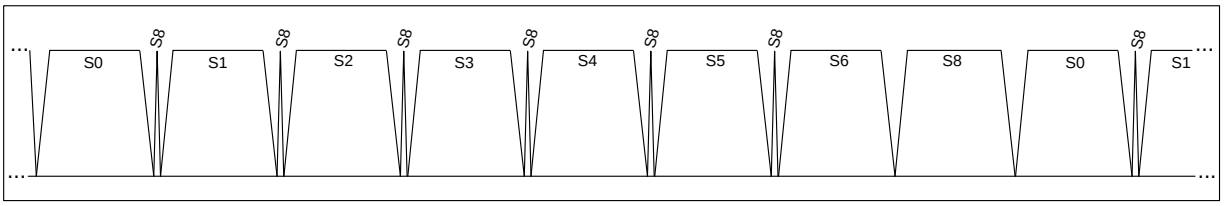

Figure 2: MUX Timing Diagram in Default Configuration