Test Chassis Development for CAEN SY4527

Marc McMullen
Detector Support Group
08/06/19

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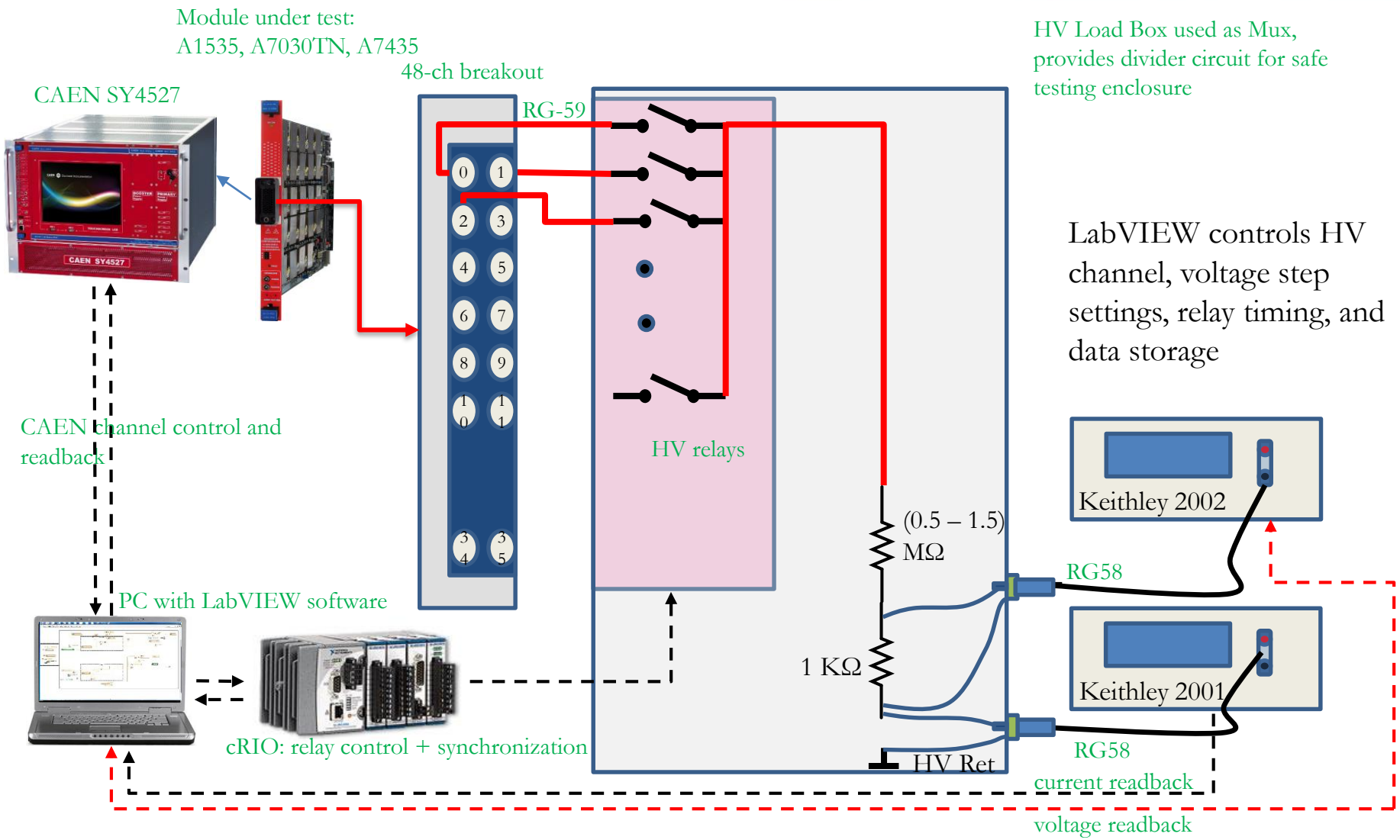
- Current HV Testing
- Instrumentation Development
  - Radiall 52-pin connector to SHV adapter
  - 2 MΩ load chassis
  - HV multiplexer

Current HV Testing

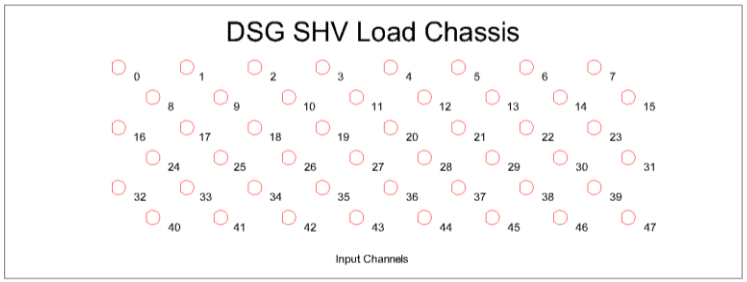
- Hall C's CAEN SY4527 mainframes and HV modules testing
  - System software development to test CAEN EPICS Server
    - Development and testing of user and expert interface screens using CSS Boy
    - Screens used to test EPICS Server
  - Module hardware testing
    - Functionality tests on HV modules using LabVIEW and external DMMs

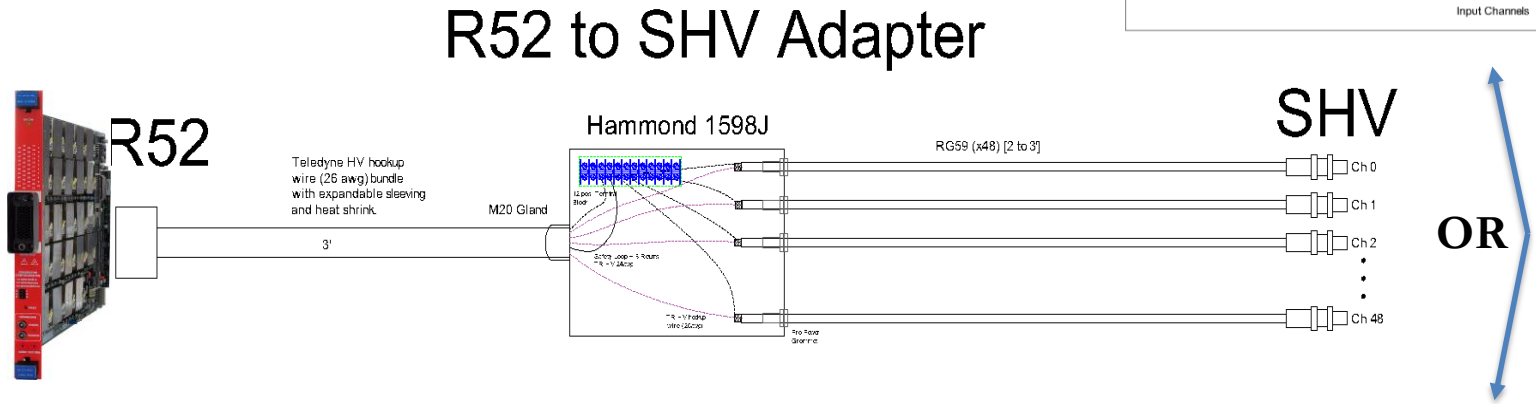
- Both methods have been instrumental in discovery of issues with CAEN internal software system (EPICS Server and GECO 2020) and HV board (A1535 and A7030TN)

HV Module Test Stand Setup

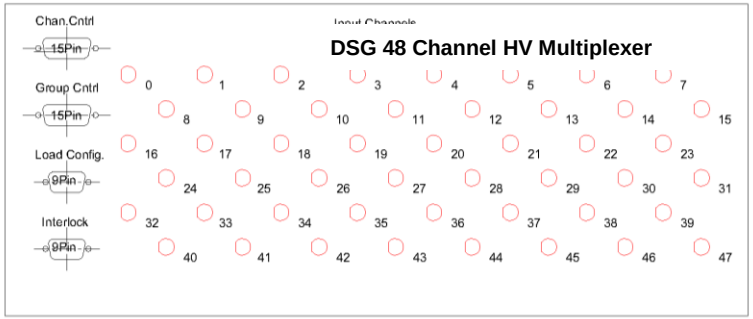


New Instrumentation: R52 to SHV Adapter



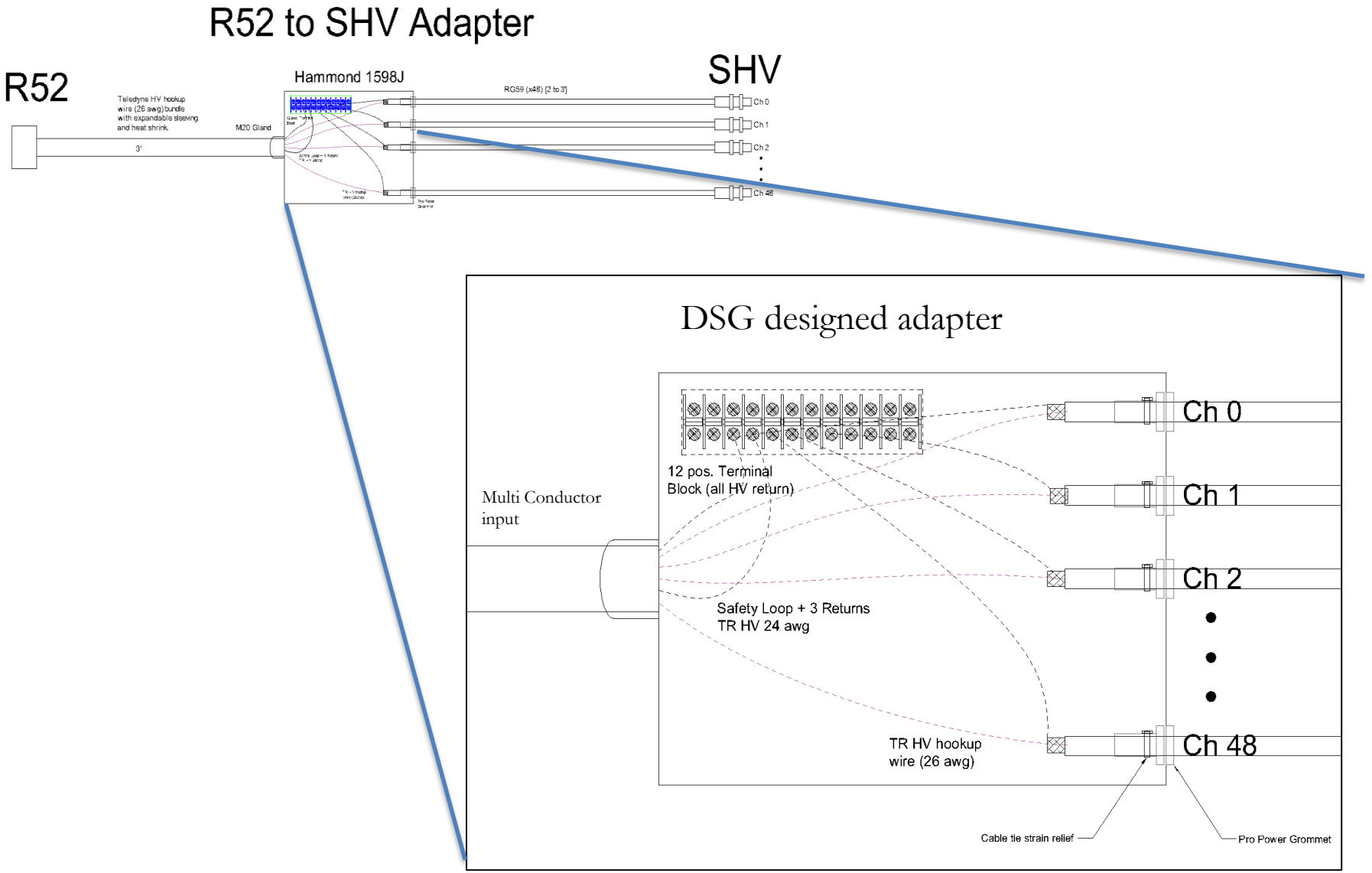


A7030TN 48-ch module

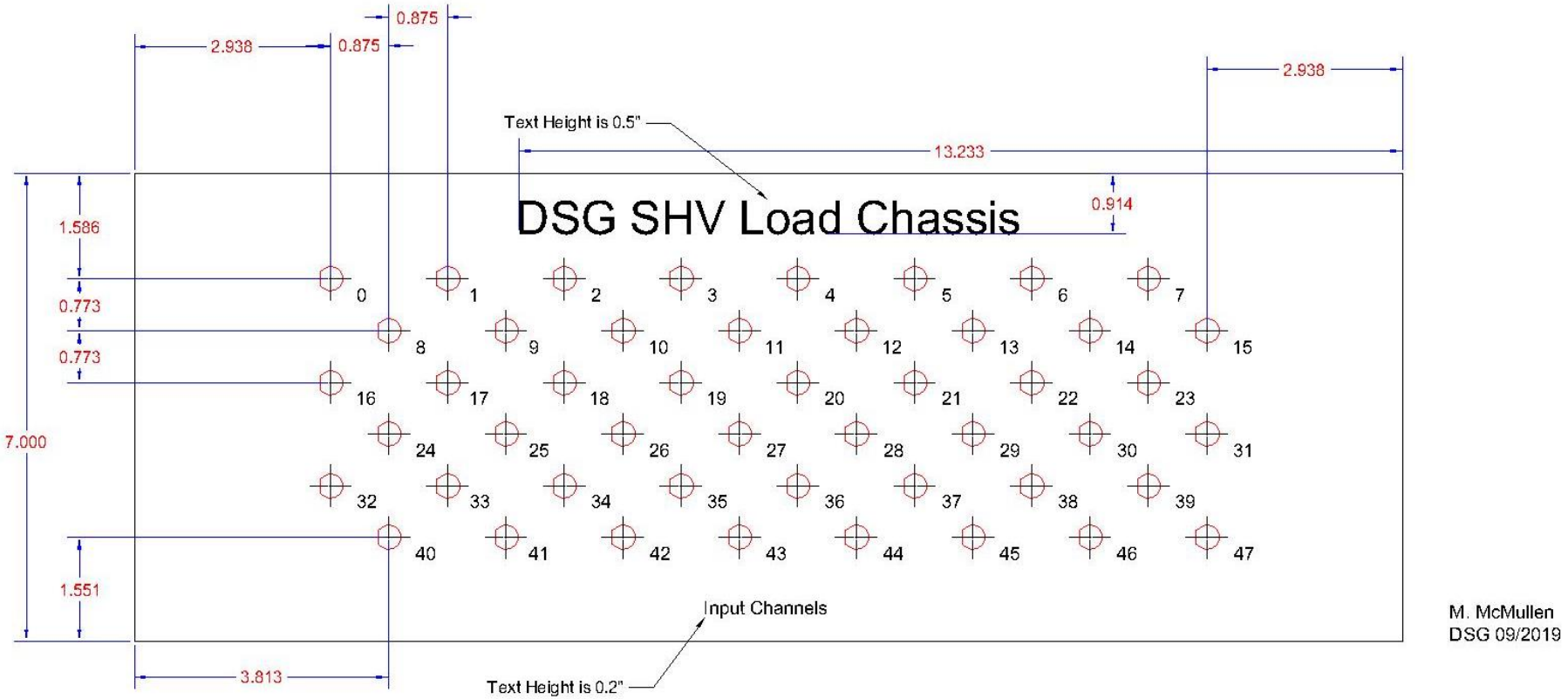


Adapts Radiall 52-pin connector to 48 SHV plugs to input into HV Load chassis **OR** Mux chassis

New Instrumentation: R52 to SHV Adapter



New Instrumentation: 2 MΩ HV Load Chassis

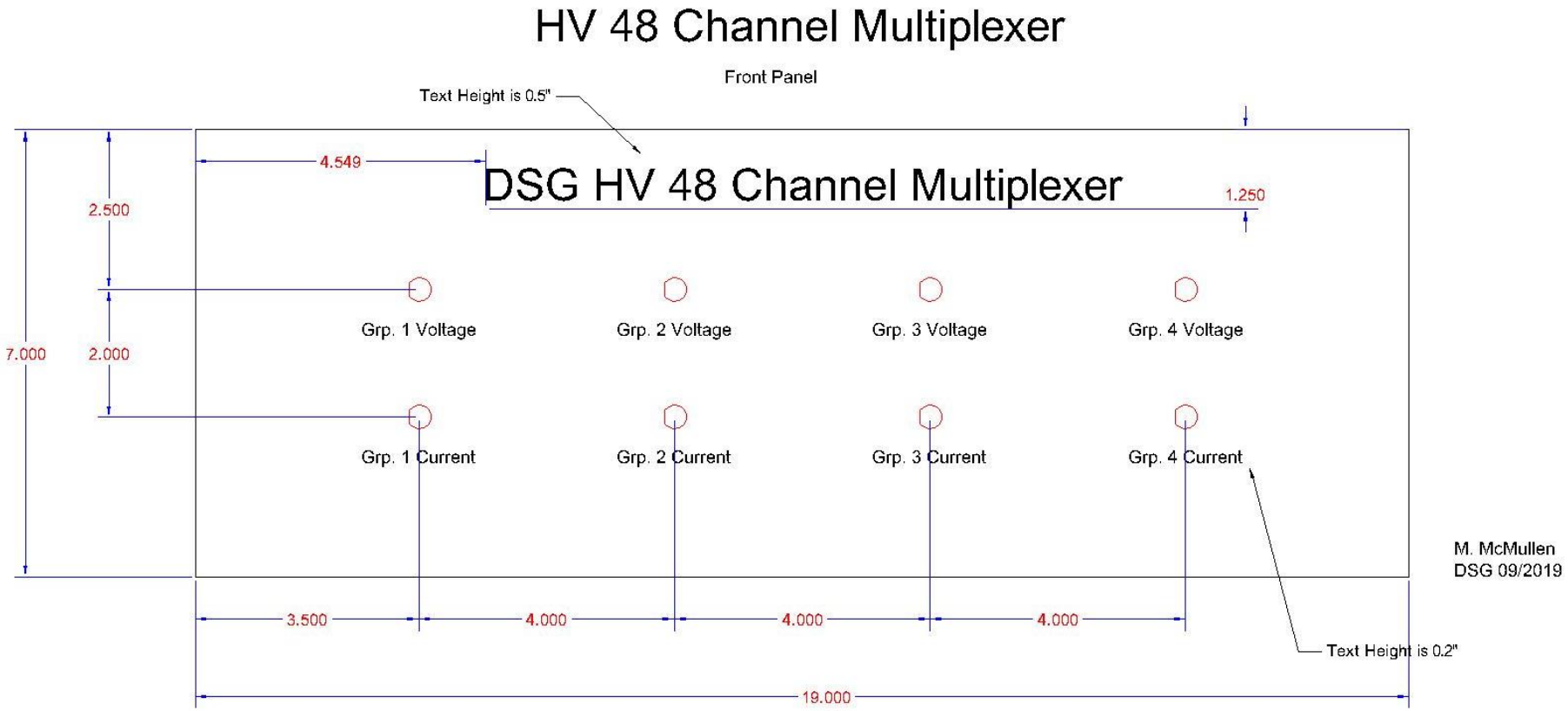


- SHV Load chassis will provide current testing capability to the software development project
- 48-channels each with 2 MΩ load
- SHV input connectors

HV Module Channel Multiplexer with Custom Load

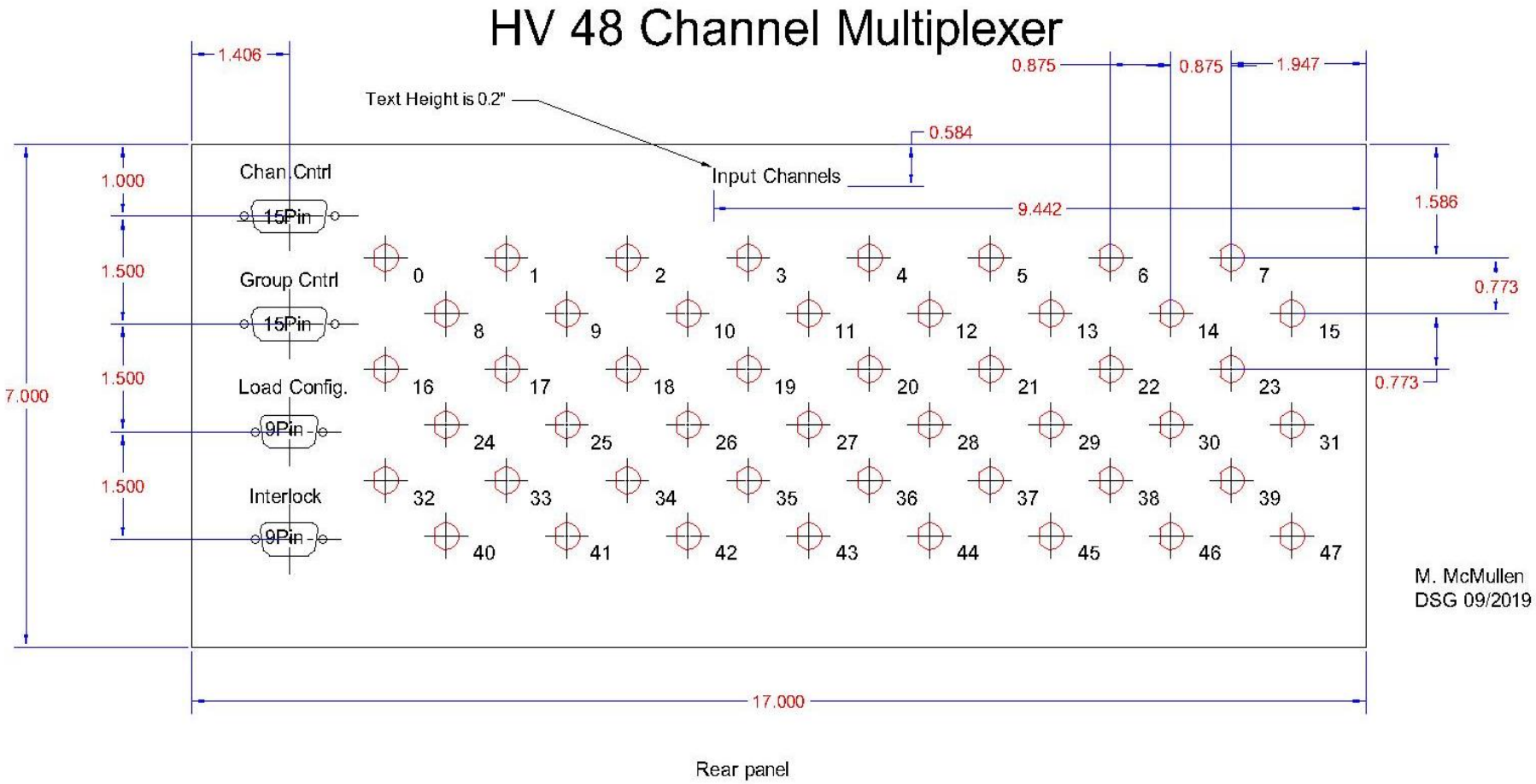
- New HV multiplexer will increase rate of channel testing by expanding automated channel sequencing from 6 channels in a row to maximum of 48 channels in a row
- Operator will be able to test complete module (x36 channels)
- New multiplexer will be designed to test all new and current Hall C CAEN modules (A1535, A7030TN, and A7435N/P)

48 Channel Multiplexer Front Panel



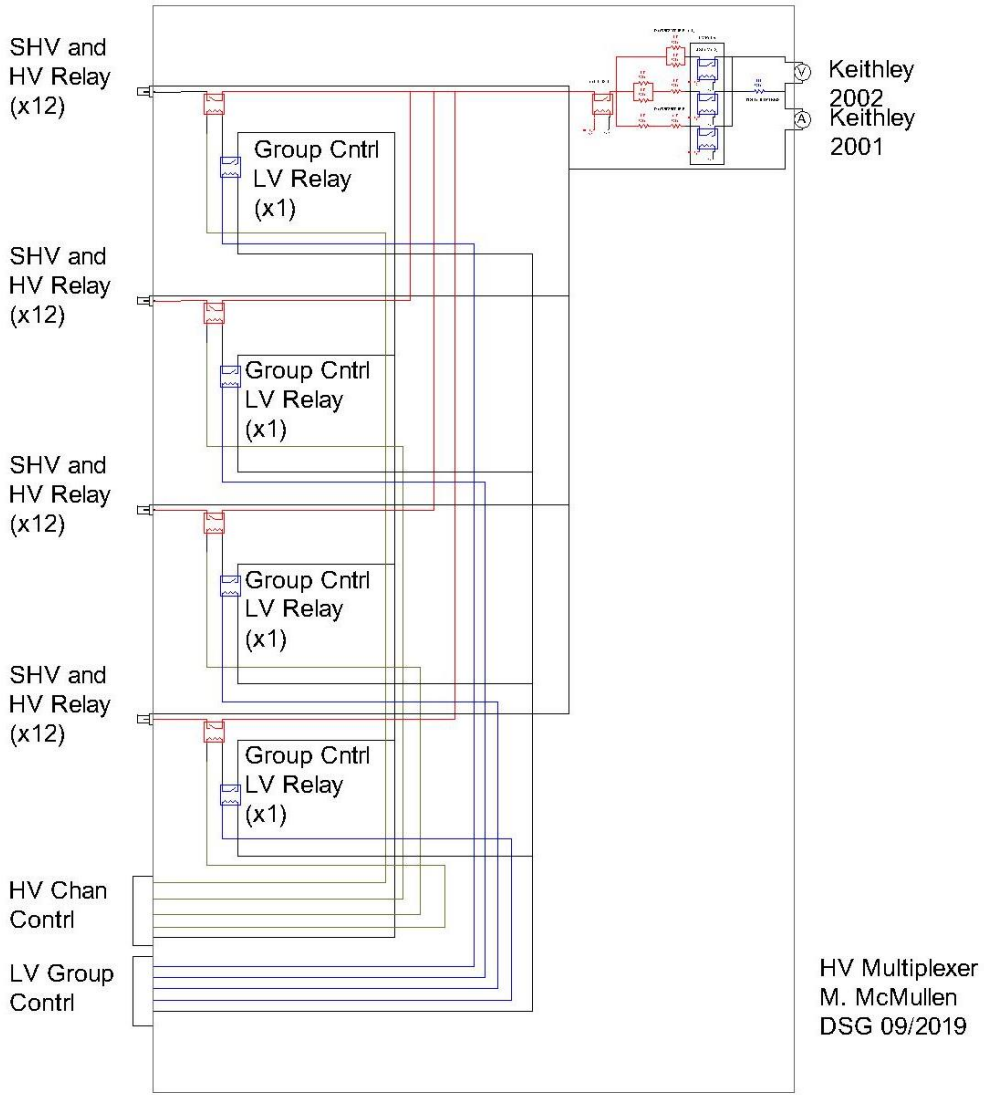
- Outputs voltage and current simultaneously to DMM via multi-channel BNC connectors
- Output voltage measurement is low (< 1 V), to protect measurement device

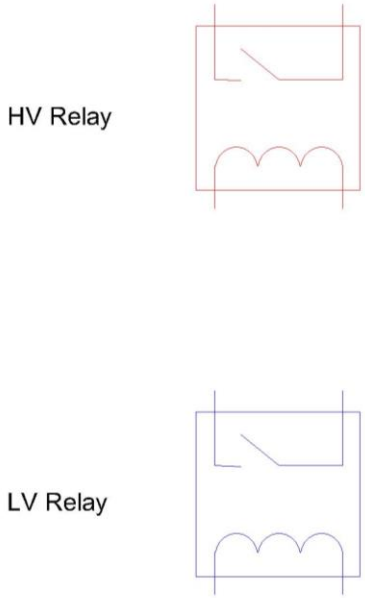
48 Channel Multiplexer Rear Panel



- Accepts up to 48 channels of HV using individual SHV connectors
- Channel control and load configuration is done via cRIO relay modules using D-sub connectors

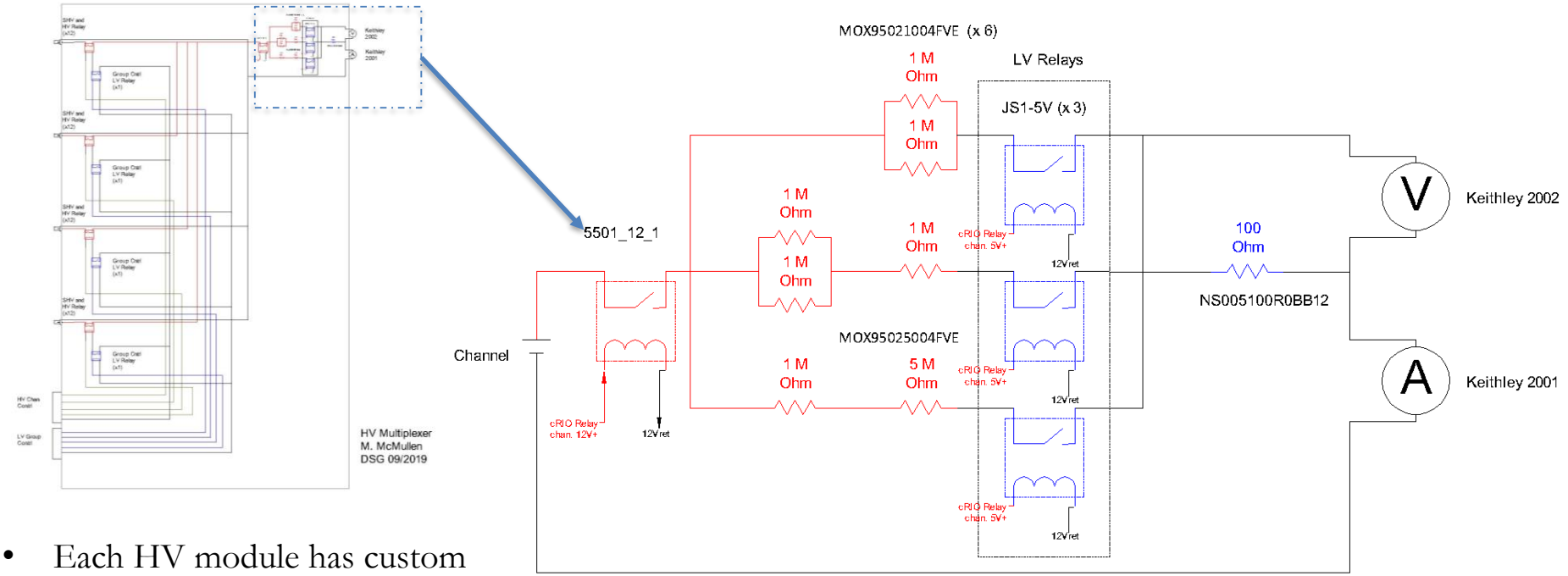
New Instrumentation: HV Multiplexer Schematic





- 4 groups of 12 HV relays are cycled through each test sequentially (1, 2, 3,…12)
- Each of 4 groups is cycled sequentially, using LV relay, so that only one group is powered at a time (1, 2,…4)

New Instrumentation: HV Multiplexer Schematic



- Each HV module has custom designed load to achieve max current
- All modules will use 6 MΩ to reach max voltage
- Load configuration is controlled and sequenced through cRIO relay module

Module	Max Voltage (V)	Max Current (I)	Max Power (W)	Max I Voltage (V)	Max I Total Res. (Ω)	Max V Total Res. (Ω)
A7030TN	3000	0.001	1.5	~1500	1.5 M	6 M
A7435	3500	0.0035	9	~1750	0.5 M	6 M
A1535	3500	0.0035	8	~1750	0.5 M	6 M

Load Configuration Divider Circuit

HV Multiplexer Components

NS005100R0BB12
- Resistance 100 Ω
- Power rating 5 W
- Tolerance 0.1%

5501_12 HV Relay
- Switching voltage 7.5 KV
- Coil voltage 12 V
- Coil current 125 mA
- Operating/release time 3 ms

MOX95021004FVE-ND

MOX95025004FVE-ND

- 1 MΩ and 5 MΩ
- Max voltage 40 KV
- Max power 12.5 W
- Tolerance 1%

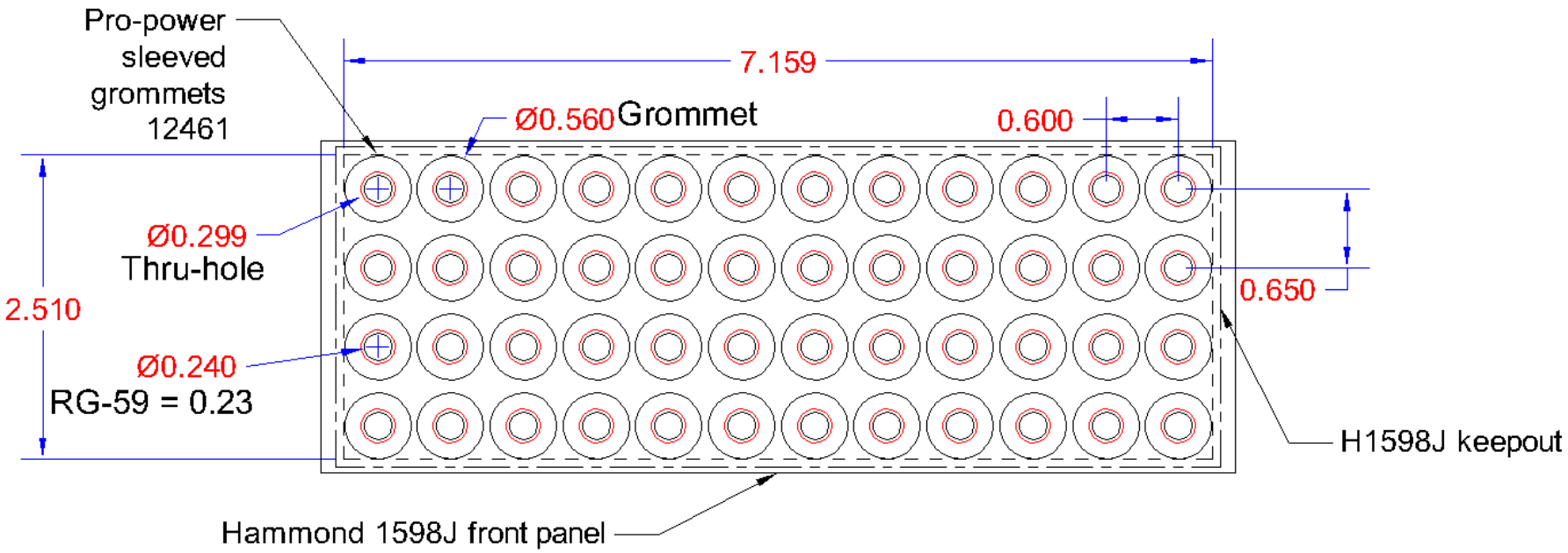
JS1-5V Relay
- Switching voltage 100 V
- Coil voltage 5 V
- Coil current 72 mA
- Operating/release time 10 ms

Conclusion

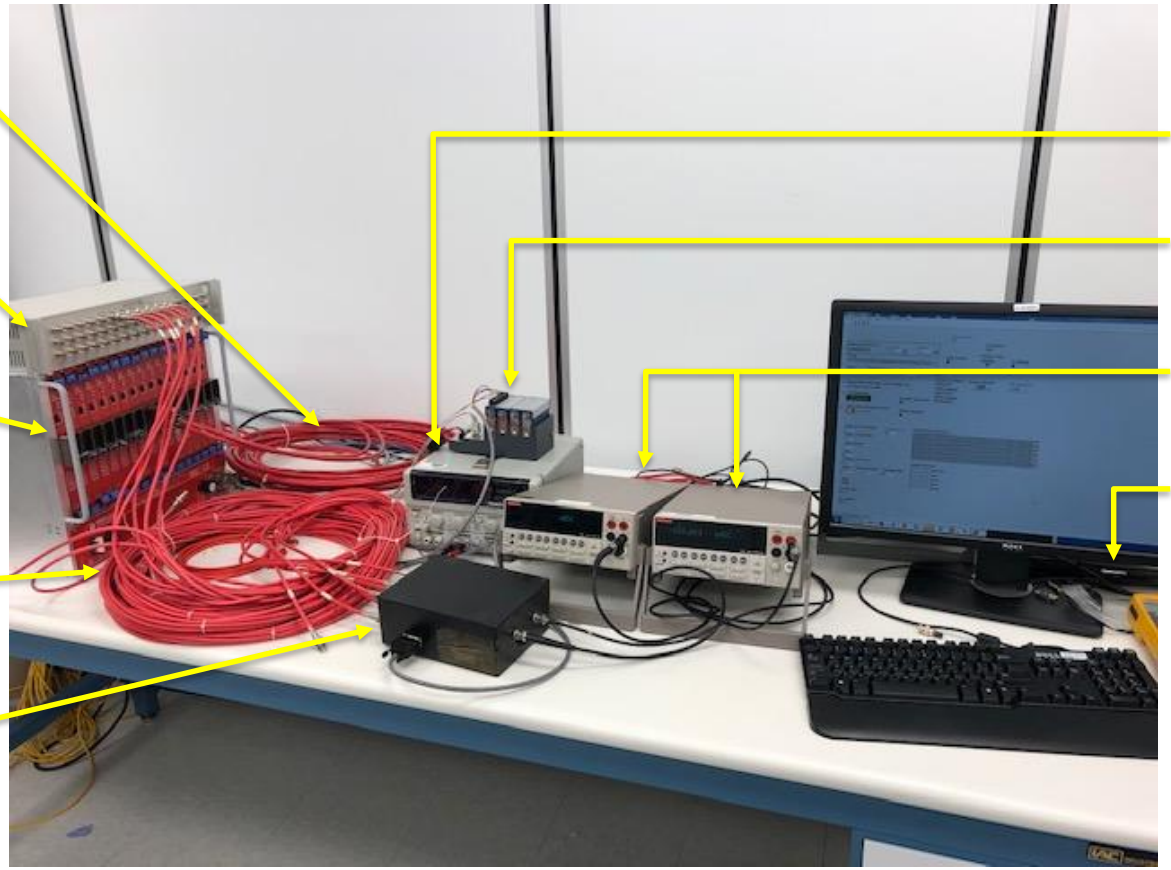
- DSG is testing all new and some old Hall C CAEN HV modules
  - Controls and hardware testing software has been developed and used to validate operational findings and issues with CAEN internal software
- DSG has developed cost effective method to adapt Radiall 52-pin connector to standard SHV
  - Provides safe method of connectivity for testing HV
- DSG is developing new instrumentation
  - To expedite testing of modules
  - To provide current testing capability for EPICS software setup

End

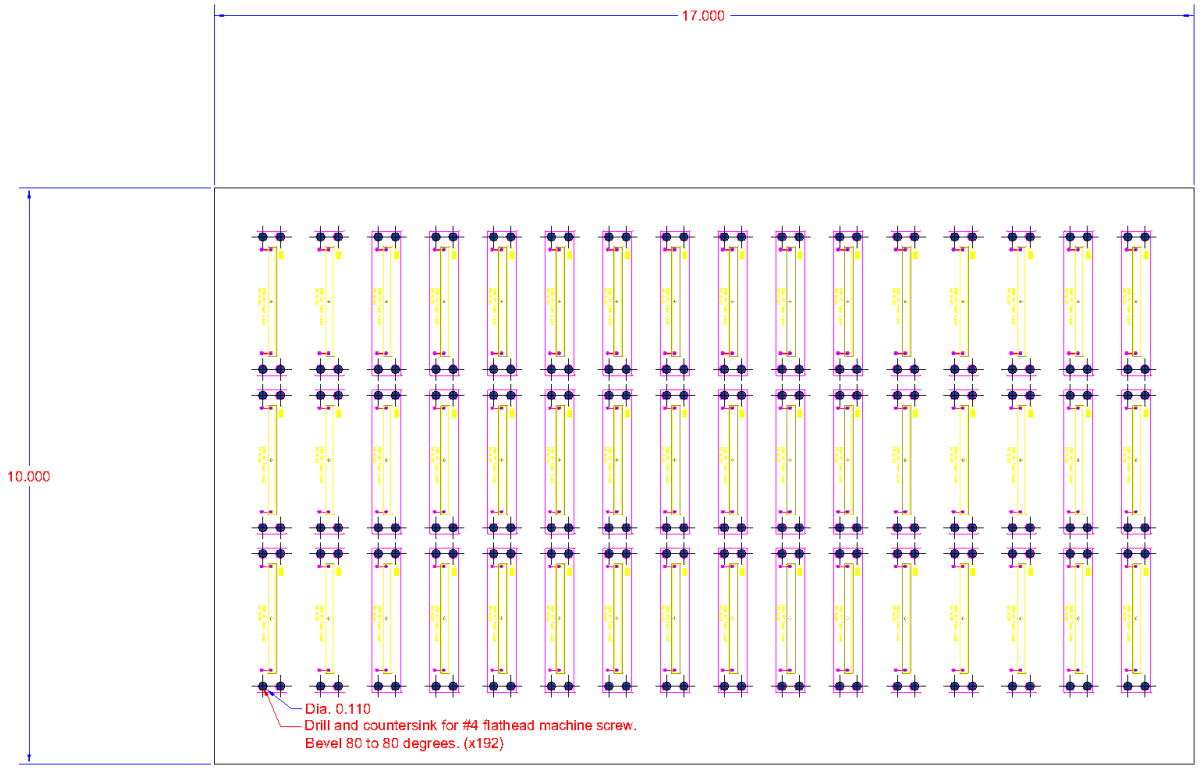
New Instrumentation: R52 to SHV Adapter Front Panel



HV Module Test Stand



New Instrumentation: 2 M Ohm HV Load Chassis

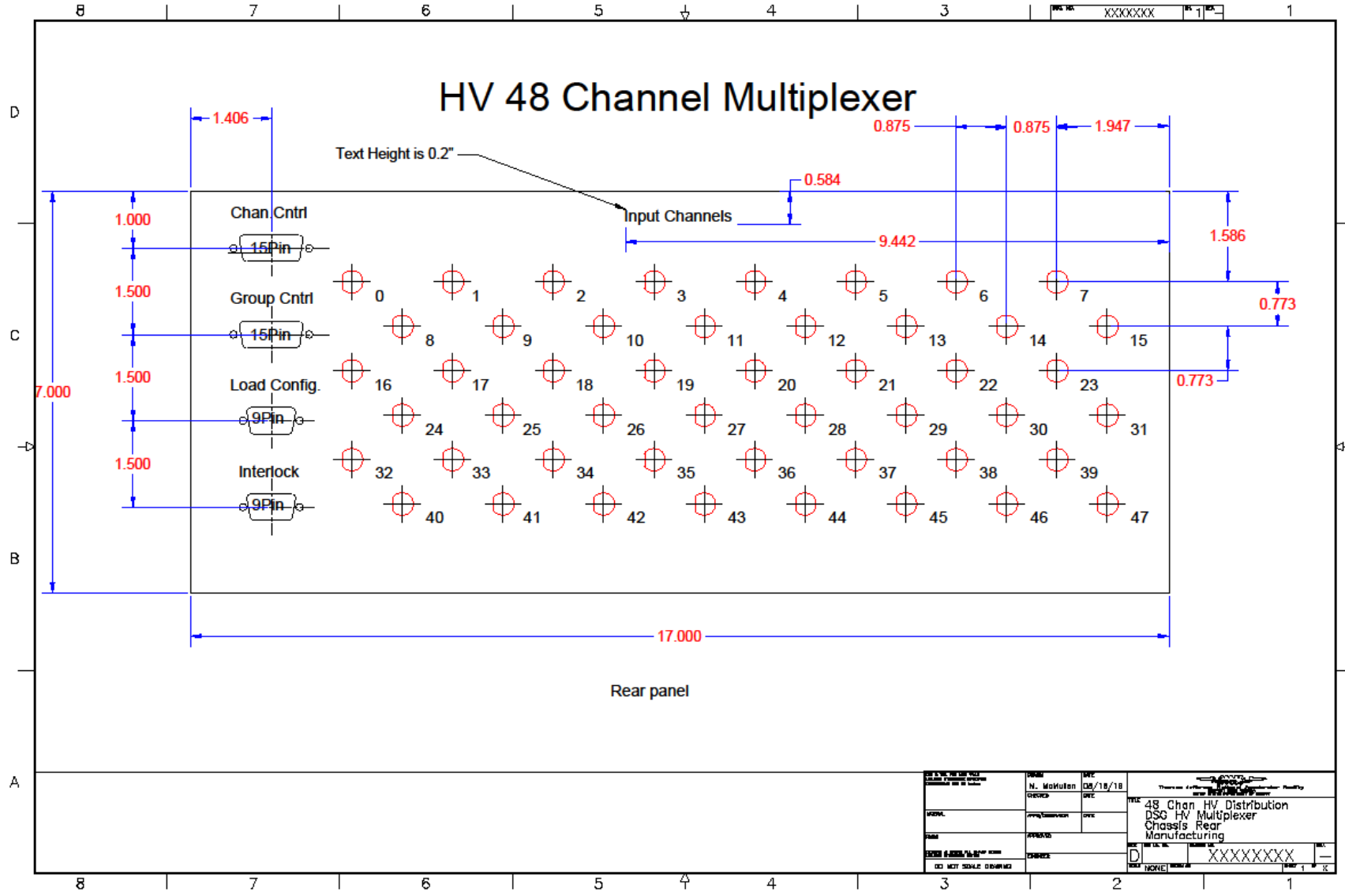


Bottom panel

- 48 individually mounted 2 MΩ HV Resistors (2.5W)
- Will sink 1mA of current per channel and 2.5W at 2500 V

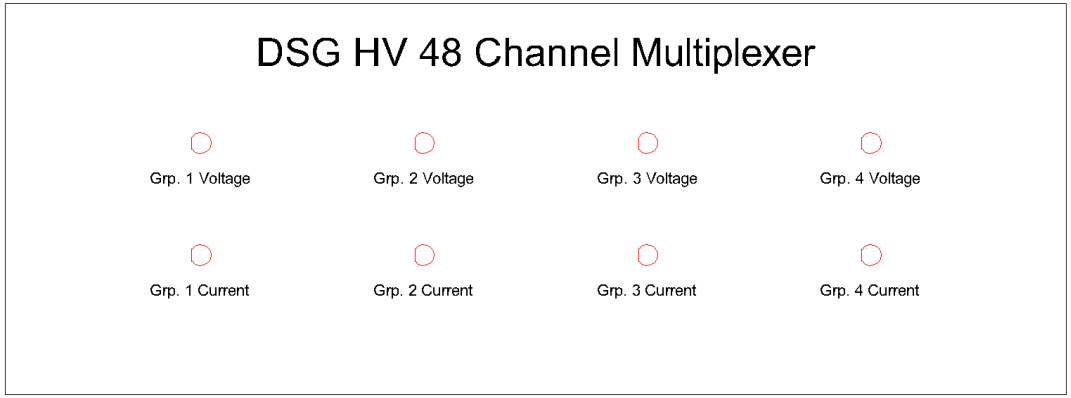
Ohmite Slim-Mox 2 MΩ 1% resistor

48 Channel Multiplexer Rear Panel



New Instrumentation: HV Multiplexer

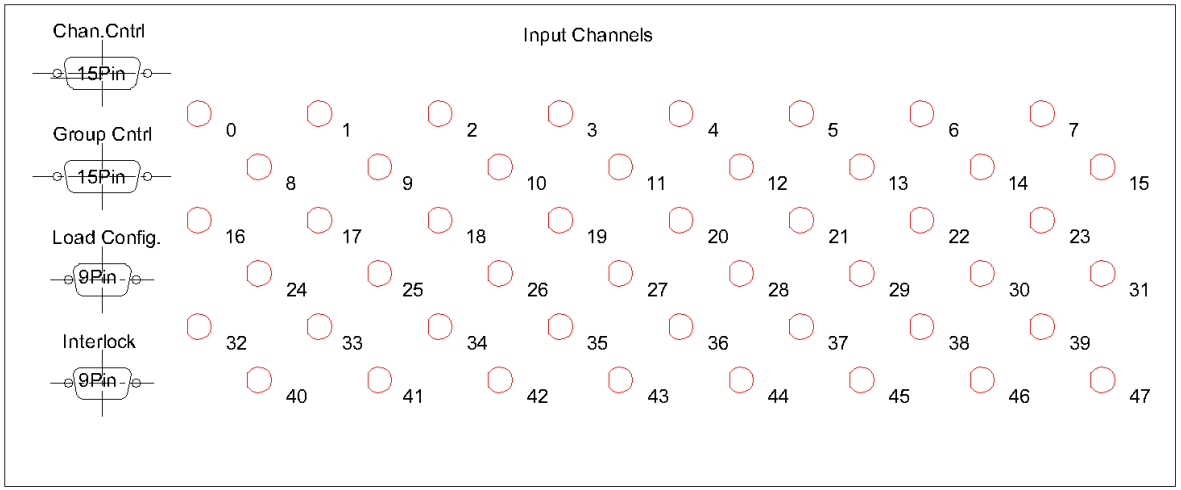
Front Panel



- Output channels on front panel to external measurement instruments (Kiethley DMMs)
- Contains multi-configuration voltage divider, to allow max current and max voltage measurement for multiple HV modules.
- Outputs LV (< 1V) for safe measurements of HV circuit.

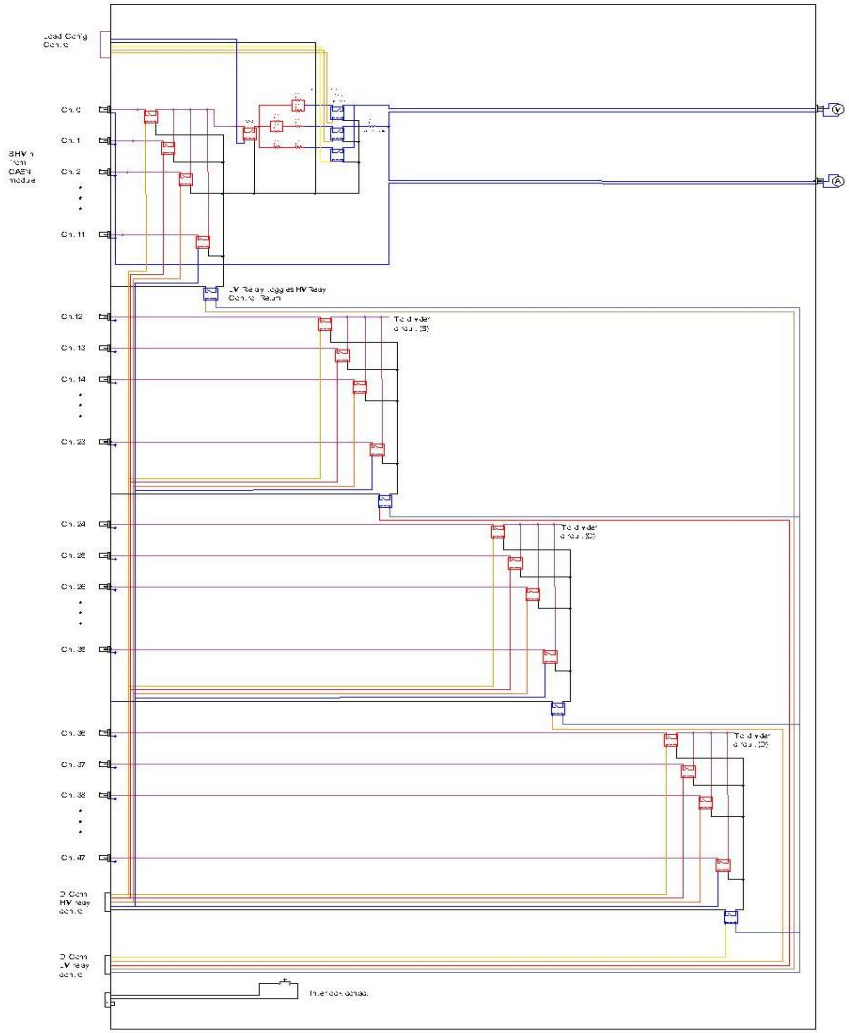
- 48 HV input channels
- D-sub connectors for mux control

Make 2 different slides



Rear Panel

New Instrumentation: HV Multiplexer



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Rearrage drawing so that 0 – 35 circuits is visible. Rotate to landscape.