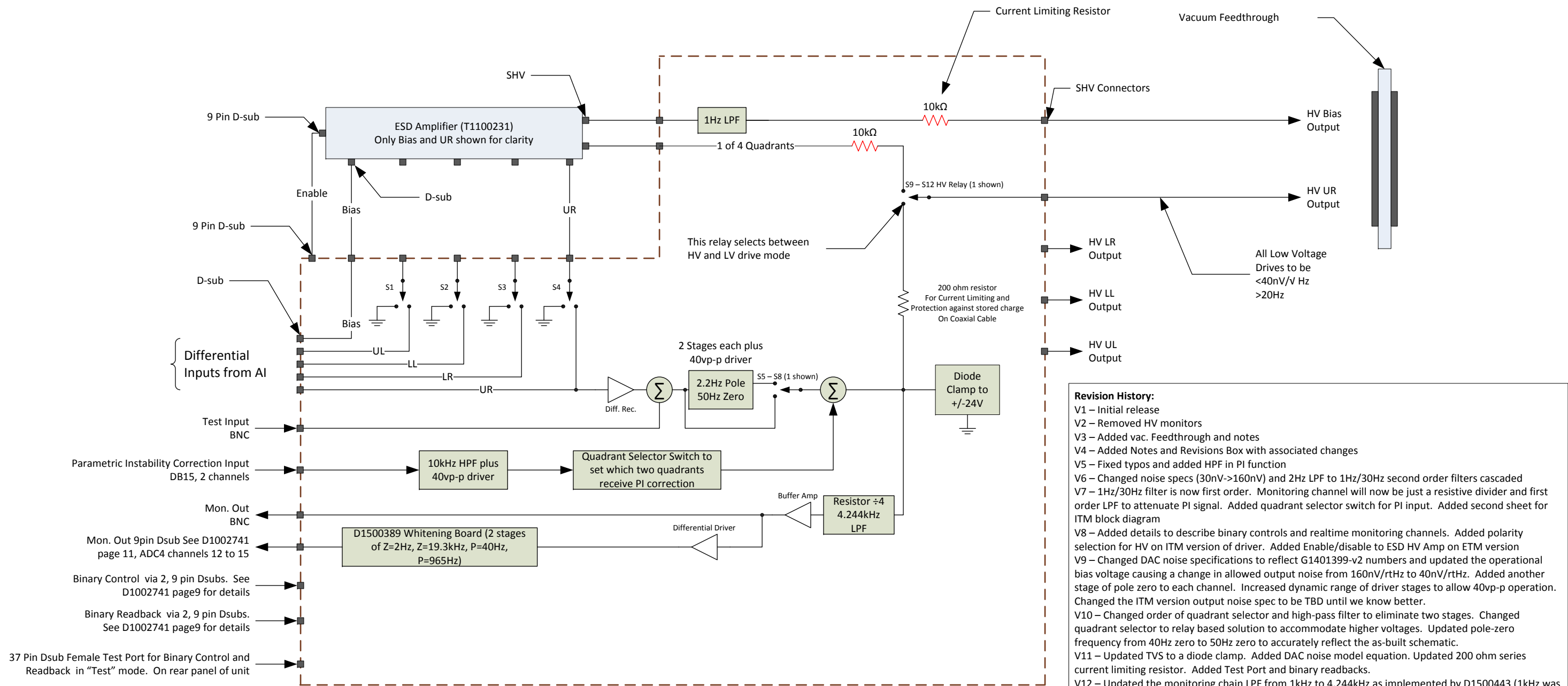


ETM ESD Low Voltage Driver and Monitor



Revision History:
 V1 – Initial release
 V2 – Removed HV monitors
 V3 – Added vac. Feedthrough and notes
 V4 – Added Notes and Revisions Box with associated changes
 V5 – Fixed typos and added HPF in PI function
 V6 – Changed noise specs (30nV->160nV) and 2Hz LPF to 1Hz/30Hz second order filters cascaded
 V7 – 1Hz/30Hz filter is now first order. Monitoring channel will now be just a resistive divider and first order LPF to attenuate PI signal. Added quadrant selector switch for PI input. Added second sheet for ITM block diagram
 V8 – Added details to describe binary controls and realtime monitoring channels. Added polarity selection for HV on ITM version of driver. Added Enable/disable to ESD HV Amp on ETM version
 V9 – Changed DAC noise specifications to reflect G1401399-v2 numbers and updated the operational bias voltage causing a change in allowed output noise from 160nV/rtHz to 40nV/rtHz. Added another stage of pole zero to each channel. Increased dynamic range of driver stages to allow 40vp-p operation. Changed the ITM version output noise spec to be TBD until we know better.
 V10 – Changed order of quadrant selector and high-pass filter to eliminate two stages. Changed quadrant selector to relay based solution to accommodate higher voltages. Updated pole-zero frequency from 40Hz zero to 50Hz zero to accurately reflect the as-built schematic.
 V11 – Updated TVS to a diode clamp. Added DAC noise model equation. Updated 200 ohm series current limiting resistor. Added Test Port and binary readbacks.
 V12 – Updated the monitoring chain LPF from 1kHz to 4.244kHz as implemented by D1500443 (1kHz was a calculation error). Added new whitening amplifier board block element (D1500389) that was inserted in the monitoring chain.
 V13 – Added ITM Drive block diagram

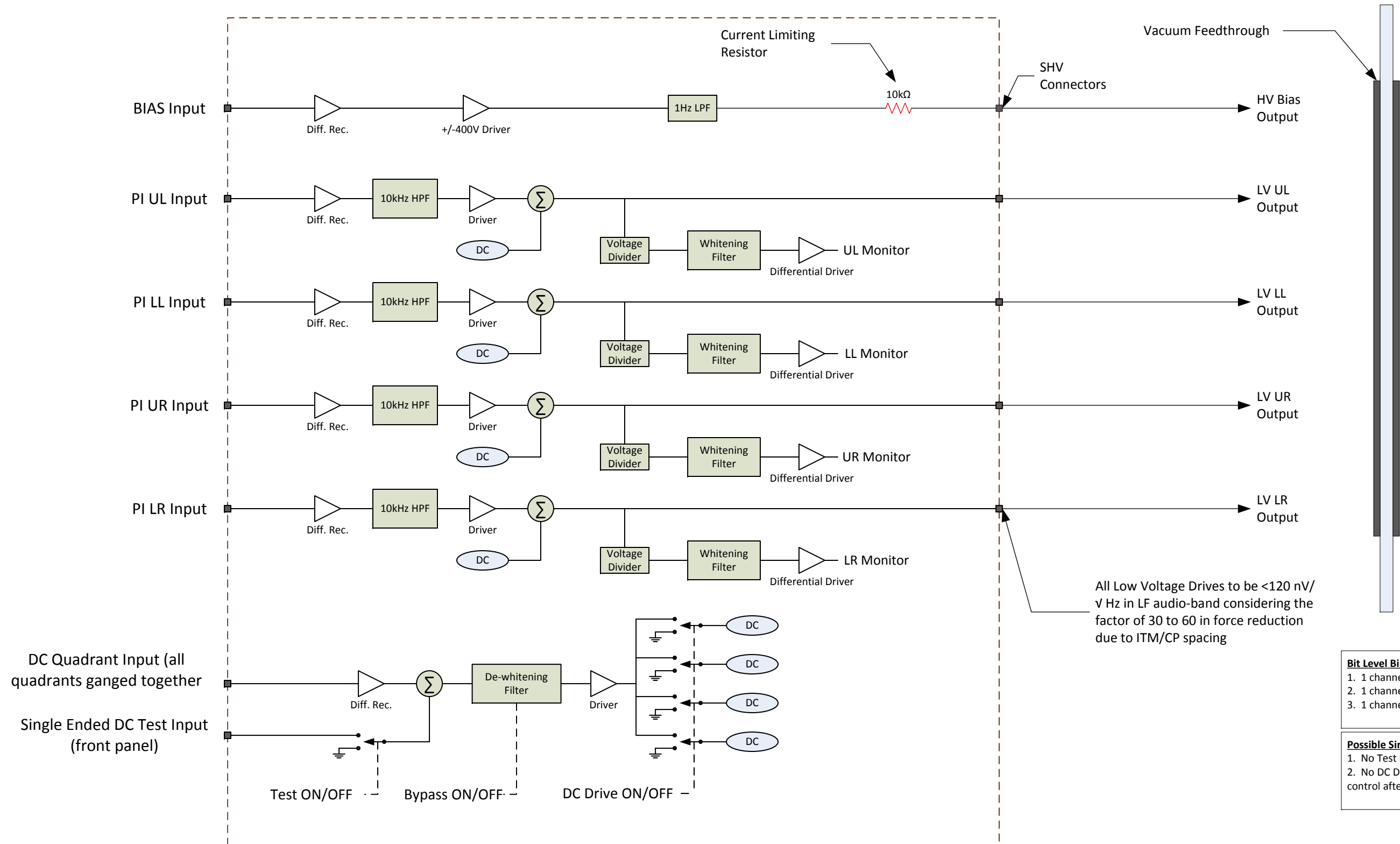
Bit Level Binary Control List
 1. 4 channels input switching for signals going to ESD HV amp
 2. 2 channels PI Quadrant select
 3. 4 channels of de-whitening bypass
 4. 1 channel for ESD HV amp remote ON/OFF (the ESD HV amp needs +5V applied for less than 1 second will toggle the state)
 5. 4 channels HV Relay control to switch from HV to LV mode

Total Count 15 channels. There are 8 channels per SUS binary output 9 pin D-sub. Per D1002741 page9, there are plenty of extra binary IO channels

$$v_n = \sqrt{300^2 (50 \text{ Hz}/f)^2 + 300^2} \frac{nV}{\sqrt{\text{Hz}}}$$

DAC Noise Model from G1401399-v2

ITM ESD Low Voltage Driver



All Low Voltage Drives to be <math><120\text{ nV}/\text{V Hz}</math> in LF audio-band considering the factor of 30 to 60 in force reduction due to ITM/CP spacing

- Bit Level Binary Control List**
- 1 channel Test Input ON/OFF
 - 1 channel DC Quadrant Drive ON/OFF
 - 1 channel of de-whitening bypass

- Possible Simplifications**
- No Test Input
 - No DC Dewhitening Filter (turn off DC control after lock acquisition)