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Date: 6.10.04

Rev Date:

Project: Layer 0 Low Voltage Power Supply System

Doc. No: B040610-Bagby-LV_Voltage_System

Subject: This document describes the Low Voltage Power Supply system required by the RunIIb Layer 0 Silicon Upgrade.

Introduction

Three voltages are required by the new Layer 0 Silicon detector, VCC5, VCC3.3, and VDD. VCC5 and VCC3.3 are required by the newly designed four channel Adapter Card (AC). A channel is defined as the output of one hybrid, each containing two SVX4 readout chips. VCC5 and VCC3.3 will be provided by the currently installed VICOR Power Supply system via the Interface Board (IB) and 80 conductor cable. VDD, an isolated supply, provides power to the isolation signal drivers on the AC as well as SVX4 power. Figure 1 illustrates the overall Low Voltage system design.

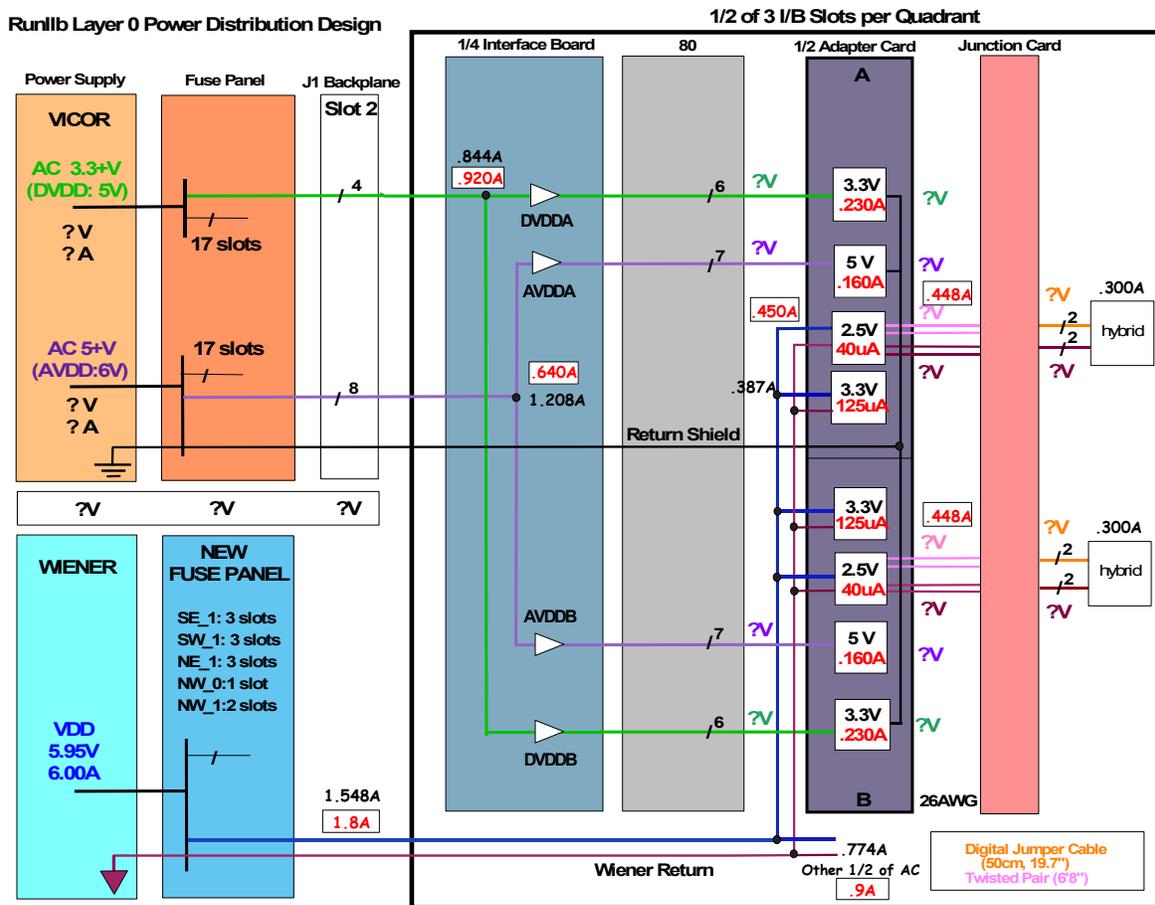


Figure 1: RunIIb Layer 0 Low Voltage System

KSU provided current load requirements for the design. Table 1 shows the measurements they submitted.

Description	Peak Voltage Measured	Peak Current	Nominal Voltage Measured	Nominal Current
Hybrid Current Pre Download	0.145	0.29	0.105	0.21
Hybrid Current Post Download	0.14	0.28	0.105	0.21
Hybrid Current Readout	0.224	0.448	0.16	0.32
Signal Power Current Pre Download	0.17	0.34	0.14	0.28
Signal Power Current Post Download	0.16	0.32	0.13	0.26
Signal Power Current Readout	0.204	0.408	0.18	0.36
AVDD (unregulated 5v) Pre Download	0.06	0.12	0.04	0.08
AVDD (unregulated 5v) Post Download	0.03	0.06	0.005	0.01
AVDD (unregulate 5v) Readout	0.08	0.16	0.04	0.08
DVDD (unregulated 3.3v) Pre Download	0.09	0.18	0.07	0.14
DVDD (unregulated 3.3v) Post Download	0.095	0.19	0.06	0.12
DVDD (unregulated 3.3v) Readout	0.115	0.23	0.07	0.14

Table 1: Current measurements of new 4-channel Adapter Card

The peak current, during readout mode, was used to determine design parameters. They are indicated in red on Figure 1. Currents indicated in black were supplied by A. Nomeroski. Discrepancies between the two have not been resolved. Therefore, the highest values are used in this design. The Hybrid Current is measured at the output of the AC. This is the current draw from two SVX4 chips. Signal Power was measured from the power supply feeding the AC. This current draw is required by the SVX4 power regulator and the isolation drivers on the AC.

The current requirements for the design are as follows:

VCC5 (AVDD): 5V, 640mA to IB (.160A*4).

VCC3 (DVDD): 4.5V, 920mA to IB (.230A*4).

VDD: 4.5V, 2A at Adapter Card (480mA+165µA)*4=1.92A...rounded up to 2A.

Voltage Drops

Figure 2 shows the voltage drops throughout the system. The 'Bulk' supply and return are 4 AWG cable. 465mV is the total voltage drop on the source and return lines. From the fuse panel to the 'AWG Change' panel, 10 AWG wire will be used. 150mV are dropped on each set 10 AWG cables. The 'AWG Change' panel is a terminal block that provides a connection point from the 10 AWG wire to 22 AWG wire required by the AC. 80mV is dropped on the 22 AWG from the 'AWG Change' panel to the AC. The total voltage drop for each AC is .33V. Based on studies conducted by J. Foglesong, a .1 V drop is included for each of the fuses on the fuse panel. Therefore, .99V is the total voltage drop from the AC to the Fuse

Panel. To compensate for the voltage drops (1.455 V total) on the cables, the Wiener supply will need to provide 5.95V at 6A. This will ensure 4.5V is delivered to the AC as requested. The Wiener supplies (PL500), in house, can accommodate this requirement, (2-7V, 30A).

ISOLATED POWER REQUIRED PER QUADRANT

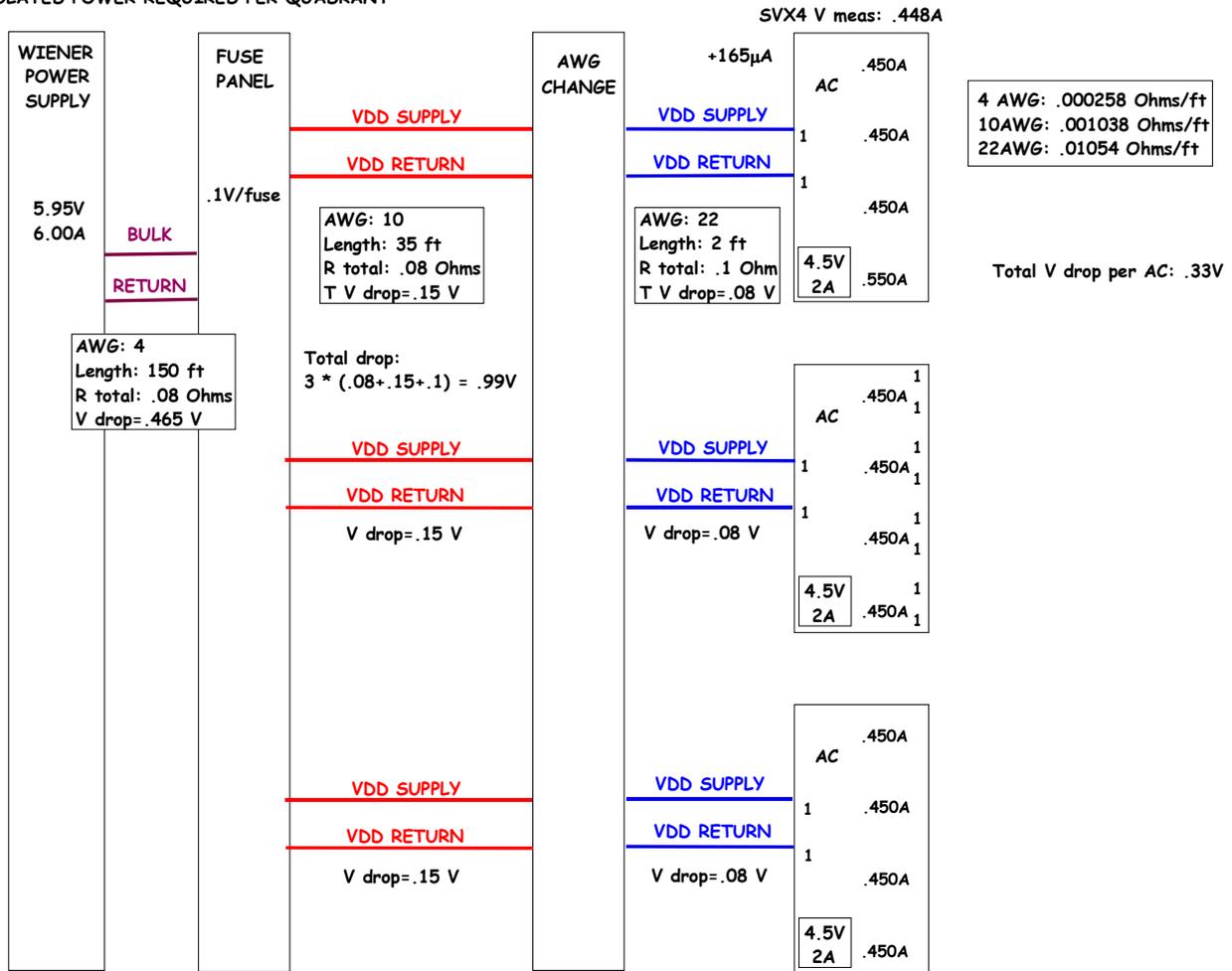


Figure 2 : Voltage drops for the isolated system.

External Interlocks

The Wiener power supplies were designed to accept an external interlock. D0 uses the Silicon Glycol Cooling status and the VESDA system status, in the Cathedral, as interlock mechanisms. These two interlocks are inputs into an Interlock Box where the signals can be directed to trip the Wiener supply. The Interlock Box is basically composed of a few relays that convert the normally closed dry relay contacts, provided by the cooling and VESDA systems, into a 5V line the supply interlock circuit requires. LED indications of trip status are on the front panel. The interlock input to the Wiener housing controls all 4 isolated low voltage power supply modules. The same interlock signals are used to control the VICOR supplies that will also be used in this system.