

POWER ELECTRONICS

****DC-DC Switching Power Regulation****
5V and 3.3V outputs are isolated from High Voltage, but not each other

Isolated Power Supply

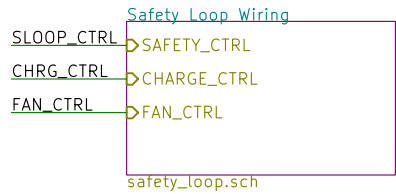


FTDI USB UART

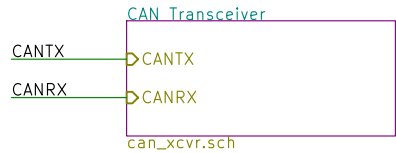
FTDI USB UART



SAFETY LOOP WIRING



CAN TRANCEIVER

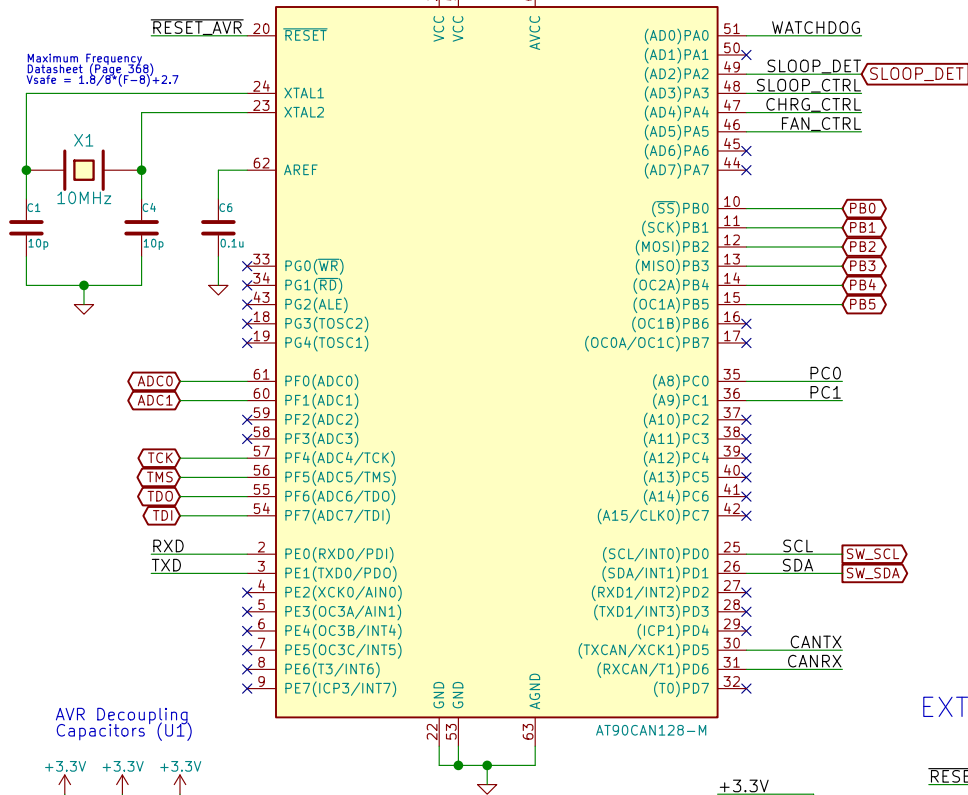


CONNECTORS

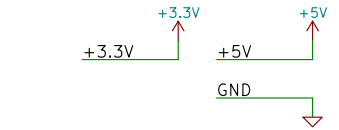
External Connectors



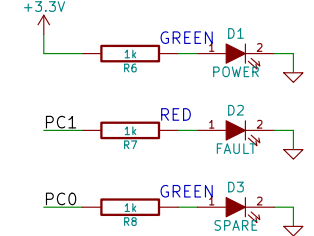
AVR MICROCONTROLLER



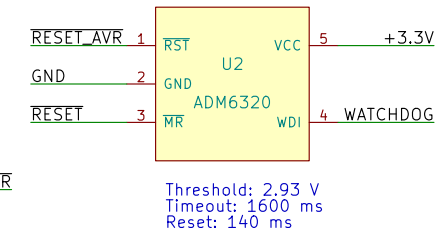
GROUNDING LOW VOLTAGE



SYSTEM STATUS LEDS



EXTERNAL WATCHDOG



DEVELOPMENT ONLY

Engineer: Geoff Nudge
Supervisor: Christopher Nadovich
Fall Semester 2015

Lafayette College

Sheet: /

File: pacman-main.sch

Title: Battery Pack Management Computer

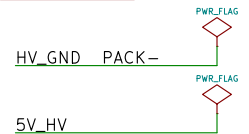
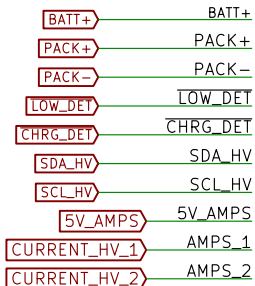
Size: USLetter Date: 2016-04-01

KiCad E.D.A. kicad 4.0.2-4+622538ubuntu14.04.1-stable

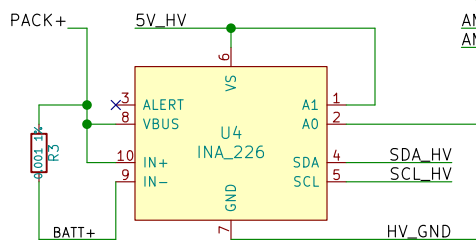
Rev: 0.5

Id: 1/6

HIGH VOLTAGE INTERFACES



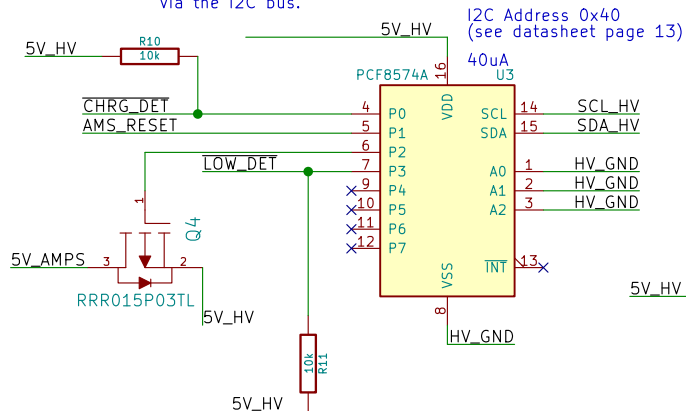
PACK VOLTAGE SENSOR AND CHARGE SENSOR



I2C Address 0x44
(see datasheet page 18)
Additional documentation
of the use of this component
is req'd.

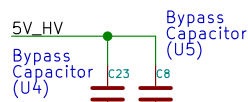
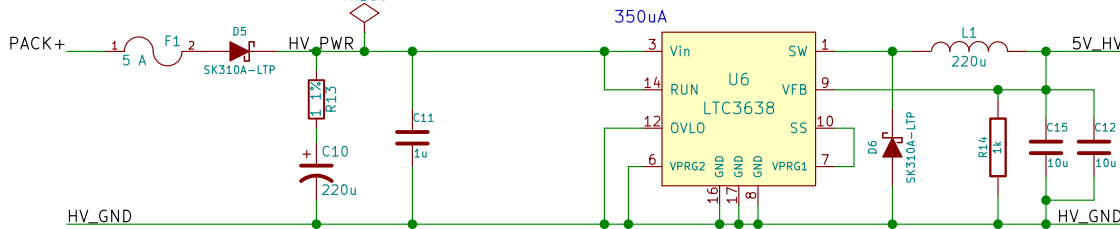
HIGH VOLTAGE DIGITAL I/O

This I/O expander is responsible for relaying
digital signals across the HV-LV isolation barrier
via the I2C bus.

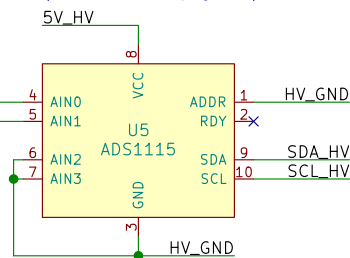


HIGH VOLTAGE POWER

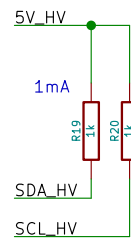
This power supply is responsible for delivering non-isolated 5V
power to the high voltage electronics. All AMS bus connected
devices are powered from this regulator. Maximum current draw
250mA. This Switcher was selected for its high efficiency even at light load.



I2C Address 0x48
(see datasheet page 14)

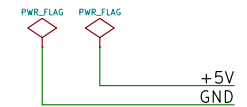


I2C PULLUP

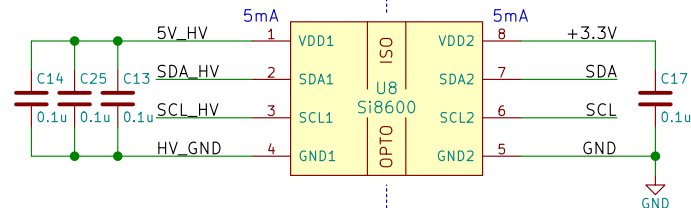


HIGH VOLTAGE

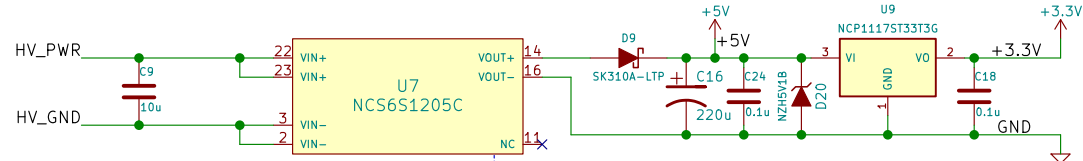
LOW VOLTAGE



I2C ISOLATOR



HIGH VOLTAGE LOW VOLTAGE



The flyback regulator responsible for delivering
5V isolated power to low voltage systems has been
replaced with an isolated DC/DC converter. This
is due to the insufficient output current (300mA)
available when assembled. Cost is comparable.

Maximum Current Draw on 5V output: 1.2A

DEVELOPMENT ONLY

Engineer: Geoff Nudge
Supervisor: Christopher Nadovich
Fall Semester 2015

Lafayette College

Sheet: /Isolated Power Supply/
File: power.sch

Title: Battery Pack Management Computer

Size: USLetter Date: 2016-04-01

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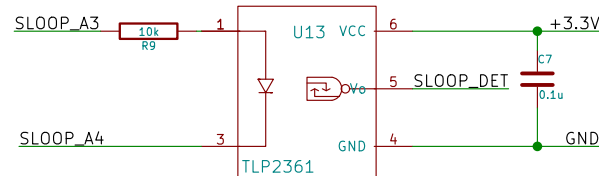
Rev: 0.5

Id: 2/6



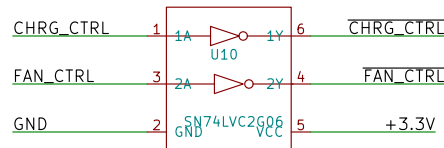
OPTO-ISOLATOR ON SL CLOSED SIGNAL

This device provides a galvanically isolated signal to the microcontroller to let it know the safety loop is closed in all components. The HV current sensor is enabled as a result. This means the AIRs should be closed if functional.



HIGH SIDE P-FET DRIVER

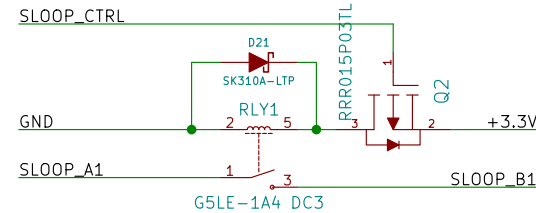
This device is responsible for driving the high side p-fet switches.



SAFETY LOOP RELAY

This relay is responsible for switching the PACMAN safety loop connection ON/OFF. The lights show the user at a glance if the safety loop is open or closed.

This relay is capable of switching 8A. The SLOOP_CTRL signal is active low.

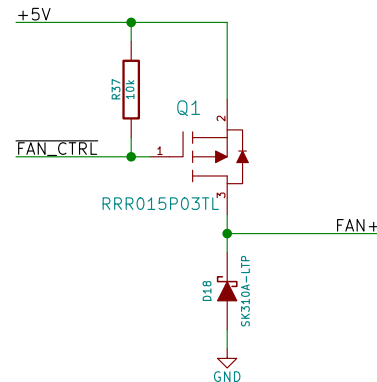


FAN CONTROL P-FET

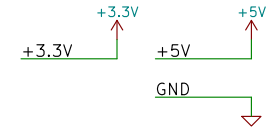
This MOSFET is responsible for switching the charge fan ON/OFF.

The fan will not come on automatically when charging begins, it is controlled by the software.

Fan Output Voltage: 5V

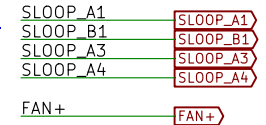


GROUNDING LOW VOLTAGE



A1 and B1 pins are shorted together only when the safety loop is not opened by this board.

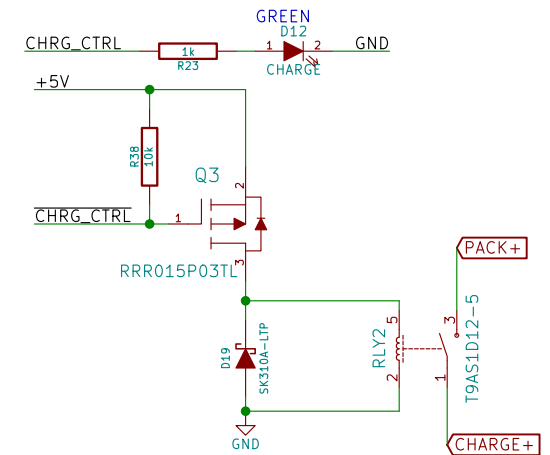
Voltage between A3 and A4 greater than 0 means the safety loop is not opened by any other component in the system.



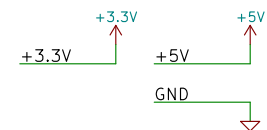
CHARGE CONTROL P-FET

This MOSFET is responsible for connecting the CHARGE relays when the pack charger has been connected. Power is supplied from either the pack terminals, or USB connector.

Coil Output Voltage: 5V



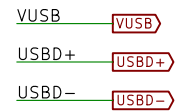
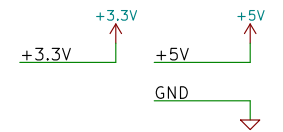
DEVELOPMENT ONLY	
Engineer: Geoff Nudge	
Supervisor: Christopher Nadovich	
Fall Semester 2015	
Lafayette College	
Sheet: /Safety Loop Wiring/	
File: safety_loop.sch	
Title: Battery Pack Management Computer	
Size: USLetter	Date: 2016-04-01
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	Id: 3/6



R26 provides the ability to use this board as a terminating CAN node in development only.

Id: 4/6

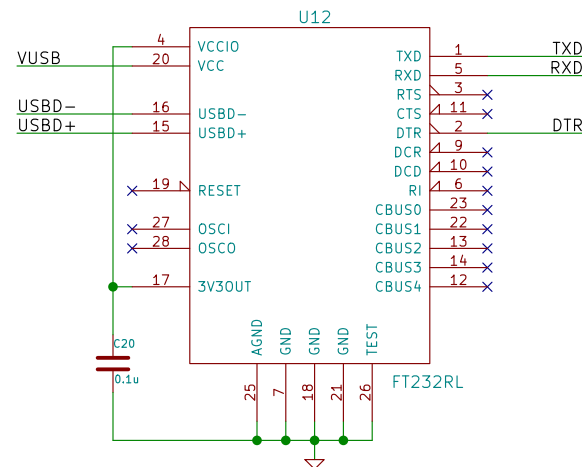
GROUNDING LOW VOLTAGE



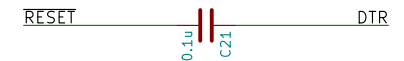
USB UART

This is an FTDI USB Serial Converter IC, it can be used to upload code, configure the device, or transfer debugging information if the software is configured properly.

Drivers available for Windows, Mac OS & Linux



FTDI Reset Connection



USB BOOTSTRAP POWER

This diode is used to power the PACMAN computer board when the battery pack has been fully discharged. If voltage is not present between PACK+ and PACK-, then this diode will allow the USB port to supply up to 500mA of sustained current. For periods less than 0.1 seconds, 1A can be drawn.



DEVELOPMENT ONLY

Engineer: Geoff Nudge
Supervisor: Christopher Nadovich
Fall Semester 2015

Lafayette College

Sheet: /FTDI USB UART/
File: ftdi_uart.sch

Title: Battery Pack Management Computer

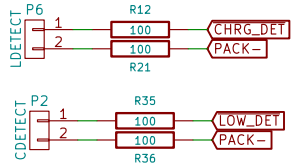
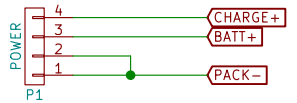
Size: USLetter Date: 2016-04-01

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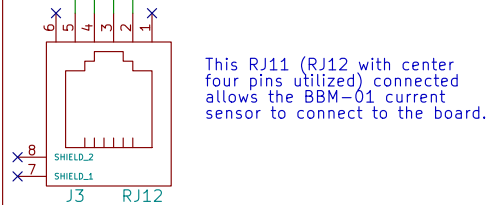
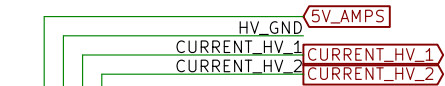
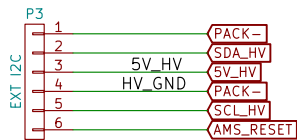
Rev: 0.5

Id: 5/6

HIGH VOLTAGE

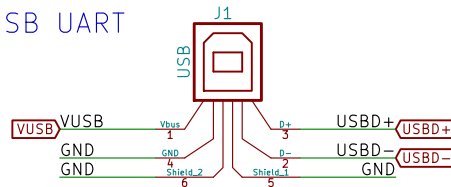


A jumper in the Anderson charge connector pulls an input low on the HV I2C expander, corresponding to either charge or low current output.



This RJ11 (RJ12 with center four pins utilized) connected allows the BBM-01 current sensor to connect to the board.

USB UART

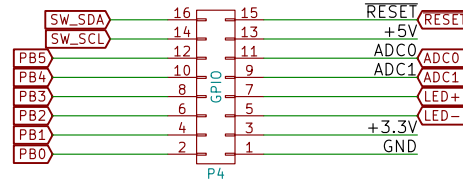


PACK WIRING HARNESS APPLICATION NOTE

Port J2 is a DB-37 backplane connector, which will be connected to the pack wiring harness via solder pot connections. The wiring of this connector, and its inputs/outputs are described in more detail in the pack wiring diagram.

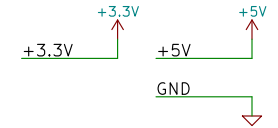
GPIO HEADER

0.1" IDC Connector
External User Interface Board

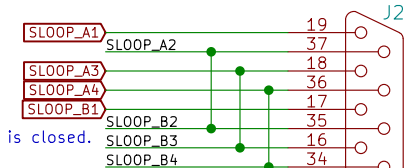


This connector contains pins for I2C communication with the LCD screen, input from control panel push buttons, and to illuminate the pack alile LED. If, at a later time, more complicated LCDs, or more I/O is required these pins can be utilized.

GROUNDING LOW VOLTAGE



SAFETY LOOP A/B



SLOOP_A1 and SLOOP_B1 pins are shorted together only when the safety loop is closed.

Pins in these sections are connected to obsolete signals in the test stand. They may be used, but the test stand must be updated as well.

FAN

FAN+
FAN-

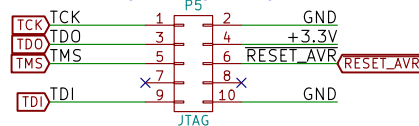
GLV HARNESS

CANH
CANL
GND

BACKPLANE CONNECTOR

AVR DEBUGGING

JTAG Programming/Debug Header



DEVELOPMENT ONLY

Engineer: Geoff Nudge
Supervisor: Christopher Nadovich
Spring Semester 2016

Lafayette College

Sheet: /External Connectors/
File: connectors.sch

Title: Battery Pack Management Computer

Size: USLetter Date: 2016-04-01

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