Science Board Description and Pinout

(Datasheets at the bottom)

Current Board Dimensions: 147.828mm x 53.594mm, 20mm height

Update(06/05/2021): The board has connectors for a LED strip and a solenoid.

LED Strip: BXEB-L0340U-40E0750-C-C3 (the model is different from the link, check the datasheet)
https://www.digikey.com/en/products/detail/bridgelux/BXEB-L0590U-50E1500-C-C3/10279841

D32 - LED_CONTROL : Active low LED control

Solenoid: https://bc-robotics.com/shop/large-push-pull-solenoid/

D22 - SOLENOID_ON: Active high solenoid control

Fault Detection/Shutdown Lines:

Update(18/03/2021): The board now has an onboard relay driven by a beefy BJT.

D51 - POWER_ON: Set high to close relay, enabling power to reach the rest of the board. (The relay is normally open.)

1- Regulator

5V is regulated down from 12V onboard. The regulator (LT3501) is a dual-channel, dual-output buck regulator that can supply 3A from each input. One of those channels is used for the stepper motors, and the other is used for the rest of our 5V needs (lasers, the CCD sensor assembly, onboard logic)

D52 - STEPPER_LINE_OK: High when the regulator channel feeding the stepper motors is within an acceptable range.

D53 - OTHER_LINE_OK: High when the regulator channel feeding everything else is within an acceptable range.

D7 - REG_SHUTDOWN: Regulator shutdown functionality

2- Steppers

The steppers are driven with DRV8834 controllers, with each having one fault indication line. The numbering is arbitrary for now, and the steppers should be named later on depending on where exactly they will be.

D38 - notFAULT1: High when stepper #1 is not in a fault condition.

D36 - notFAULT2: High when stepper #2 is not in a fault condition.

D44 - STEPPER1_notENABLE: Stepper #1 is enabled when this pin is low.

D50 - STEPPER2_notENABLE: Stepper #2 is enabled when this pin is low.

There isn't enough current to run both steppers at once, so **either D50 or D44 has to be high at any given time.** As of now, this is fine because Science doesn't need both steppers to be active at the same time. If it does change, we will need to pick a beefier regulator in a later version of the board.

Stepper Control:

The DRV8834 stepper drivers are being used in "Indexer Mode" and wired for 16 microsteps/step resolution. When in this mode, the chip sorts out the PWM internally and only needs a step signal and direction data. Again, the numbering is arbitrary for now and the steppers should be named later depending on what exactly they will do.

Stepper #1:

D42 - STEPPER1_STEP: Stepper will advance one step on the rising edge of this pin.

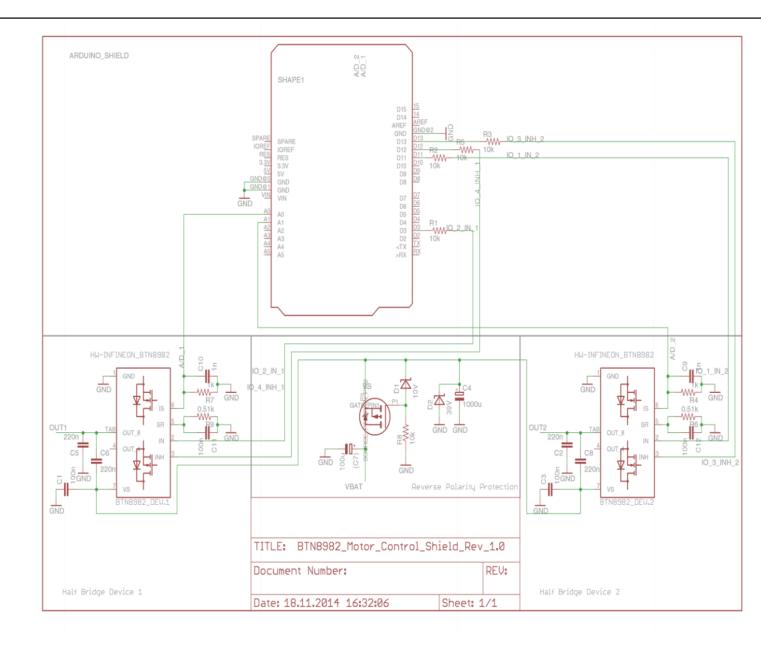D40 - STEPPER1_DIRECTION: Reverses stepper direction on rising edge.

Stepper #2:

D48 - STEPPER1_STEP: Stepper will advance one step on the rising edge of this pin.

D46 - STEPPER1_DIRECTION: Reverses stepper direction on rising edge.

Brushed DC Motor Control:

To future proof the board against different motor choices, two high current bridges (BTN8982TA) are used. The manufacturer (Infineon) actually has an Arduino shield, so the pinout is exactly the same as what they used in their product. See the schematic: https://www.infineon.com/dgdl/Infineon-Motor_Control_Shield_with_BTN8982TA_for_Arduino-UserManual-v02_00-EN.pdf?fileId=5546d4624ca27d02014cb20b89867eed

The pinout is the same as that schematic:

ARDUINO_SHIELD

SHAPE1

A/D_2
A/D_1

D15   15
D14   14
AREF   AREF
GND   GND@2
D13   D13   R3   IO_3_INH_2
SPARE SPARE   D12   D12   R5   10k
IOREF IOREF   D11   D11   R2 10k   IO_1_IN_2
RES   RES   D10   D10   10k
3.3V   3.3V   D9   D9
5V   5V   D8   D8
GND@0 GND
GND@1 GND   D7   D7
VIN   VIN   D6   D6
GND   D5   D5
A0   A0   D4   D4   R1   IO_2_IN_1
A1   A1   D3   D3   10k
A2   A2   D2   D2
A3   A3   <TX   TX
A4   A4   >RX   RX
A5   A5

HW-INFINEON_BTN8982

GND
GND

OUT1
220n
C5   C6
C1   220n
GND

Half Bridge Device 1

IO_2_IN_1
IO_4_INH_1

VS
GATE(PIN)   D1 10V P1   C4
                                   1000u
                 D2 39V
                 GND GND
                 R8 10k
GND (C7)
VBAT   Reverse Polarity Protection

C10 1n
R7 0.51k
D9
100n C11

HW-INFINEON_BTN8982

GND
GND

OUT2
220n
C2   C8
C3   220n
GND

Half Bridge Device 2

A/D_2
C9
IO_1_IN_2
1k
R4 0.51k
D6
100n C12
IO_3_INH_2

BTN8982_DEV.1

BTN8982_DEV.2

TITLE: BTN8982_Motor_Control_Shield_Rev_1.0

Document Number: REV:

Date: 18.11.2014 16:32:06   Sheet: 1/1

Laser:

Since the laser has a 250mA current requirement and no control logic, it is switched with a BJT transistor in a common emitter configuration. This means that the pin is **active low.**

D8 - LASER1_CONTROL: Laser is on when this pin is low.

The CCD sensor picked by Science is TCD1304DG with a cryptic datasheet. There is much work to be done to figure out what we need to do in order to get data from it, but for now they are wired like so:

D15 - OutputSignal_out: "out" as in "out to Arduino". As a side note, this pin is also a serial receive pin so that might be a possibility.

D16 - phiM(CCD_Clock): Clock output to CCD sensor.

D17 - SH: "Shift Gate" (???)

D19 - ICG: "Integration Clear Gate" (???)

Datasheets:

(Stepper Driver) DRV8834: *https://www.ti.com/lit/ds/symlink/drv8834.pdf?ts=1613165364751&ref_url=https%253A%252F%252Fwww.google.at%252F*

(Motor Control) BTN8982TA: *https://www.infineon.com/dgdl/Infineon-BTS8982TA-DS-v01_00-en.pdf?fileId=db3a30433fa9412f013fbe32289b7c17&sd=t*

(Regulator) LT3501: *https://www.analog.com/media/en/technical-documentation/data-sheets/3501fd.pdf*

(Lasers) CPS532: *https://www.thorlabs.com/thorproduct.cfm?partnumber=CPS532*

(CCD Sensor) TCD1304DG: *https://toshiba.semicon-storage.com/ap-en/semiconductor/product/linear-image-sensors/detail.TCD1304DG.html*

(Relay) J115F11AH12VDCS61.5U: https://www.citrelay.com/Catalog%20Pages/RelayCatalog/J115F%2050amp.pdf