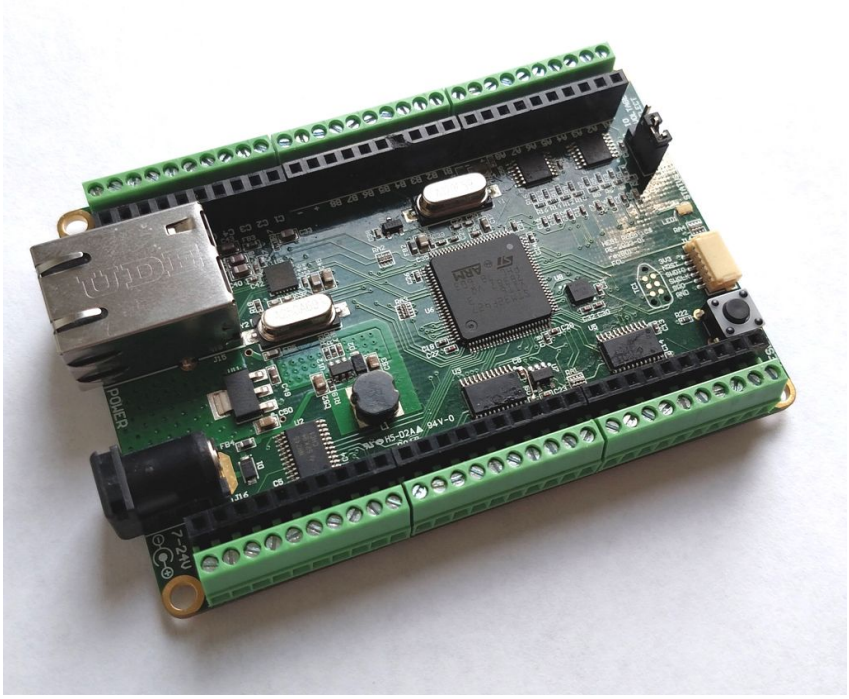
HEBI IO Board

Preliminary Specifications and User Information



Revision 0.1, June 2016

Pittsburgh, PA

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Important Notice

HEBI Robotics Inc. designs and manufactures measurement and automation peripherals that enable the connection and communication of physical devices to a central control computer. It is possible, in the case of improper and/or unreasonable use, to damage the IO Board and even the control computer or networking equipment to which it is connected. HEBI Robotics Inc. will not be liable for any such damage.

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The HEBI IO Board is currently considered a component or sub-assembly, not a complete product. If it is being used as part of a product to be "placed on the market," the complete product must comply with any applicable standards.

ESD (Electrostatic Discharge) Precaution

Although there are no overly sensitive components on the IO Board, there is also no ESD protection. Care must be taken to not damage the device through ESD by taking the appropriate precautions.

General Precautions

The HEBI IO Board consists of a bare PCB without an enclosure. Care must be taken to protect the connections on the bottom of the PCB. Do not operate the board while it is resting on a conductive surface. Always double check wiring before powering on the board. Never make connections while power is on.

Power Connections

Power input to the board can accept between 7V and 24V DC. There is a reverse protection diode inline with the input. Care must be taken to avoid high voltage transients on the input bus as it may damage the switching power supply. Power pins have a total rating of 500mA. Exceeding this amount may damage the on-board regulators.

All Inputs/Outputs

All of the digital input signals will read either 3.3V levels or 5V levels. The digital outputs can be configured to use either 3.3V levels or 5V levels by switching the “IO VOLTAGE SELECT” configuration jumper. Do not move the jumper while the device is powered on.

Please note that all of the digital inputs are connected directly to the processor (STM32F427 from STMicroelectronics). The processor runs at 3.3V, but it has 5V tolerant inputs. The inputs are not 5V tolerant when the power is disconnected however, so it is important that external 5V sensors be either powered by this board or incorporate a switching (or level shifting) circuit.

The digital outputs are buffered using a bus transceiver IC made by Texas Instruments. The part number is SN74LVC8T245. This IC has a maximum per-pin recommended output sink and source current rating of 24mA when running on 3.3V and 32mA while running on 5V. However, the absolute maximum rating for each IC is only 100mA. The IO board uses three of these ICs. The 8 digital outputs (E1-E8) share one IC, the 8 PWM outputs (F1-F8) share one IC, and the the serial/SPI outputs share a third IC.

A1-A8: Analog Inputs

There are 8 analog inputs which have a range of 0-5V, and have a fixed, first order low pass filter with a cutoff frequency of approximately 4.8kHz. All data is sampled at approximately 8kHz and averaged over 8 cycles. The data registers are only updated at a 1kHz interval, so polling the board faster will not produce any benefit. The analog resolution is 12 bits. All of the analog inputs are buffered with op amps, which have the part number TSV321 and are made by STMicroelectronics.

It is recommended that for high-accuracy applications, an external calibration procedure is used as the analog scaling may be slightly off. Additionally, the voltage supply provided by the board has a fair amount of switching noise, so an external filter on sensitive analog components is recommended. The ADC readings may also be affected by noisy loads that are connected to the board. If significant power is drawn from the power bus, there may be a slight offset to the readings. It is recommended in these situations to perform an additional calibration step for your test setup.

B1-B8: Digital Inputs

There are 8 digital inputs, which can handle either 3.3V or 5V levels. Note that the inputs are high impedance and will have an undefined value if left unconnected. Proper use of pull-up or pull-down resistors is highly recommended. All of the inputs are directly connected to the processor, and must observe its ratings. All digital inputs are sampled at a 1kHz rate.

E1-E8: Digital Outputs

There are 8 digital outputs, which can output either 3.3V or 5V levels depending on the voltage selection jumper. All digital outputs are set at a 1kHz rate.

F1-F8: PWM Outputs

By default, F1-F8 are configured to switch at approximately 20kHz, which is good for DC motor control applications. All PWM outputs are updated at a fixed 1kHz interval. The PWM resolution is 10 bits.

C1-C6: Quadrature Encoder Inputs

There are two quadrature encoder inputs. The A and B inputs for each encoder are used for the quadrature readings. Counting is handled by dedicated hardware within the microcontroller, however the data is registered at a rate of 1kHz along with all of the other I/O. The value starts at 0 upon boot. The index line is not currently supported, but will be in future firmware revisions.

C7-C8, D1-D2: Serial Ports

Not currently supported.

D3-D4: I2C Port

Not currently supported.

D5-D8: SPI Port

Not currently supported.

Document Revision History

0.1 - Initial release