# Main Controller Board

## Teensy 3.2

## Teensy Pinout

### Analog

Table 1 Analog Inputs to Teensy

|  |  |  |
| --- | --- | --- |
| Pin | Signal | Description |
| A0 | CAPVOLT | Voltage reading from the supercapacitors. Is scaled between 0 and 3.3V by voltage dividers on relay board. Is also low pass filtered to \_\_Hz. |
| A1 | FCCURR |  |
| A2 | FCVOLT |  |
| A3 | CAPCURR |  |
| A11 | FCPRESS | Reading from FC stack pressure sensor. On board voltage dividers divide signal by 2. |

### Digital

Table 2 Digital Signals to Teensy

|  |  |  |
| --- | --- | --- |
| Pin | Signal | Description |
| 0/RX1 | RX1 | Serial Data Port to CAN Bus Board |
| 1/TX1 | TX1 |
| 2 | MULTO2 | 2nd Output From Multiplexor |
| 3 | MULTA | Output Select Pins from Multiplexor |
| 4 | MULTB |
| 5 | MULTO1 | 1st Output From Multiplexor |
| 6 | SUPPLY\_V | Supply Valve Signal |
| 7/RX3 | RX3 | Serial Data Port to Sparkfun Open Log |
| 8/TX3 | TX3 |
| 9 | PURGE\_V | Purge Valve Signal |
| 10 | EXTRA\_V | Extra Output Signal |
| 11 | CAP\_R | CAP Relay Control Signal |
| 12 | CHARGE\_R | Charge Relay Control Signal |
| 13/LED |  | Status LED |
| 18/SDA0 | SDA | I2C Bus |
| 19/SCL0 | SCL |
| 20 | FCC\_R | Control Pin for FCC Relay. Turns Fuel Cell power to power board on and off. |
| 21 | START\_R | Start relay control pin |
| 22 | MOTOR\_R | Motor relay control pin |

#### Multiplexor

Due to the limited number of pins on the Teensy 3.2 some of the digital inputs are connected through a 74HC153D dual 4 to 1 multiplexor.

Table 3 Connections to Multiplexor

|  |  |  |
| --- | --- | --- |
| Pin | Signal | Description |
| A | MULTA | Multiplexor control signal A |
| B | MULTB | Multiplexor Control Signal B |
| 1C0 | CVMSIG1 | Signal 1 from CVM Board |
| 1C1 | CVMSIG2 | Signal 2 from CVM Board |
| 1C2 | CVMSIG3 | Signal 3 from CVM Board |
| 1C3 | CVMSIG4 | Signal 4 from CVM Board |
| 2C0 | H2\_OK | H2\_OK/ESTOP signal from hydrogen board |
| 2C1 | EXTRA\_SIG | An extra signal from hydrogen board |
| 2C2 | M\_SIG\_1 | Motor controller signal 1. Is an input to motor controller. Is also an input to fuel cell controller |
| 2C3 | M\_SIG\_2 | Motor controller signal 2. Is an input to both fuel cell controller and motor controller. |
| 1Y | MULTO1 | Multiplexor output 1 |
| 2Y | MULTO2 | Multiplexor output 2 |

|  |
| --- |
| Figure 1 Multiplexor truth table (taken from datasheet) |

## I2C Bus

### SHT Temperature/Humidity Sensor

Adafruit SHT31 Breakout Board:

* 3.3V
* +/-0.3C temperature accuracy
* +/-2 % humidity accuracy
* Default I2C address 0x44
* <https://learn.adafruit.com/adafruit-sht31-d-temperature-and-humidity-sensor-breakout/wiring-and-test>
* C++ Library <https://github.com/adafruit/Adafruit_SHT31>
* Will have to be modified to work with MBED RTOS

### RTC Breakout

Adafruit DS3231 RTC Breakout

* 3.3V
* Temperature Drift Corrected
* I2C Address 0x68
* C++ Library <https://github.com/adafruit/RTClib>
* Will have to be modified to work with MBED RTOS

### LCD Board

### Status LEDs

### Motor Controller

### CVM Board

### Fan Controller

# Relay Board

# List of Fuel Cell System Pinouts

## Fan Controller 1

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| 12V | 12V to fan 1 | 1 |
| PWM\_1 | PWM signal to fan 1 | 2 |
| TACH\_1\_IN | Tach signal from fan 1 | 3 |
| PWR\_1 | Ground switch for fan 1 | 4 |
| 12V | 12V to fan 2 | 5 |
| PWM\_2 | PWM signal to fan 2 | 6 |
| TACH\_2\_IN | Tach signal from fan 2 | 7 |
| PWR\_2 | Ground switch for fan 2 | 8 |

## Fan Controller 2

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| 12V | 12 to fan 3 | 1 |
| PWM\_3 | PWM signal to fan 3 | 2 |
| TACH\_3\_IN | Tach signal from fan 3 | 3 |
| PWR\_3 | Ground switch for fan 3 | 4 |
| GND | GND for thermistor 1 | 5 |
| THERM1 | Signal from thermistor 1 | 6 |
| GND | GND for thermistor 2 | 7 |
| THERM2 | Signal from thermistor 2 | 8 |

## Relay Board 1

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| START\_R |  | 1 |
| MOTOR\_R |  | 2 |
| CAP\_R |  | 3 |
| CHARGE\_R |  | 4 |
| AUX12 |  | 5 |
| FC12 |  | 6 |
| GND |  | 7 |
| GND |  | 8 |

## Relay Board 2

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| CAPCURR |  | 1 |
| FCCURR |  | 2 |
| CAPVOLT |  | 3 |
| FCVOLT |  | 4 |
| 5V |  | 5 |
| FCC\_R |  | 6 |
| GND |  | 7 |
| GND |  | 8 |

## Hydrogen Board

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| H2\_OK | E-Stop signal | 1 |
| EXTRA\_SIG | We might need this later? | 2 |
|  |  | 3 |
|  |  | 4 |
| GND |  | 5 |
| AUX 12V | Needed for remote sensor | 6 |
|  |  | 7 |
| AUX 5V |  | 8 |

## CAN BUS

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| CANH | High of differential Pair | 1 |
| CANL | Low of differential pair | 2 |
| GND |  | 3 |
|  |  | 4 |
|  |  | 5 |
| GND |  | 6 |
| GND |  | 7 |
| 5V | Aux 5V | 8 |

## FCC TO CVM BOARD

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| FC5 |  | 1 |
| TX12 |  | 2 |
| RX12 |  | 3 |
| GND |  | 4 |
| SIG1 |  | 5 |
| SIG2 |  | 6 |
| SIG3 |  | 7 |
| SIG4 |  | 8 |

## CVM BOARD TO FCC

|  |  |  |
| --- | --- | --- |
| Name | Description |  |
| FC5 |  |  |
| RX12 |  |  |
| TX12 |  |  |
| GND |  |  |
| SIG1 |  |  |
| SIG2 |  |  |
| SIG3 |  |  |
| SIG4 |  |  |

## AUX POWER BOARD

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| AUX 12 |  | 1 |
| AUX 12 |  | 2 |
| AUX 5 |  | 3 |
| AUX 5 |  | 4 |
| GND |  | 5 |
| GND |  | 6 |

## FC POWER BOARD

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| FC 12 |  | 1 |
| FC 12 |  | 2 |
| FC 5 |  | 3 |
| FC 5 |  | 4 |
| GND |  | 5 |
| GND |  | 6 |

## Pressure and??

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| FC12 |  | 1 |
| GND |  | 2 |
| FCPRES |  | 3 |
|  |  | 4 |
|  |  | 5 |
|  |  | 6 |
|  |  | 7 |
|  |  | 8 |

## FCC TO MOTOR

|  |  |  |
| --- | --- | --- |
| Name | Description | Number |
| TX12 |  | 1 |
| RX12 |  | 2 |
|  |  | 3 |
|  |  | 4 |
|  |  | 5 |
| M\_SIG\_1 |  | 6 |
| M\_SIG\_2 |  | 7 |
| GND |  | 8 |