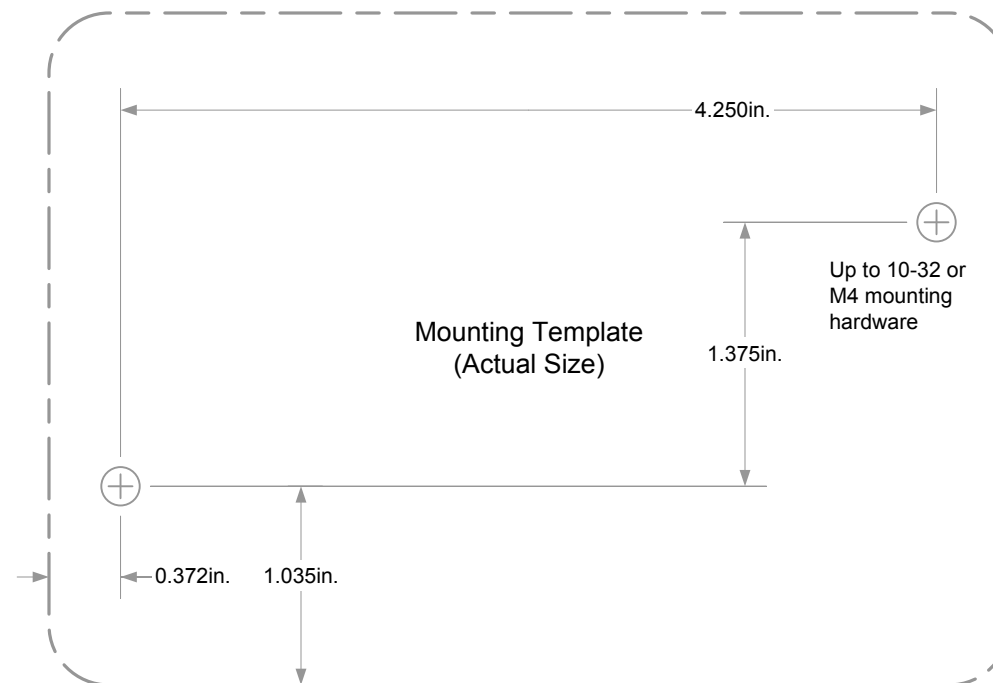
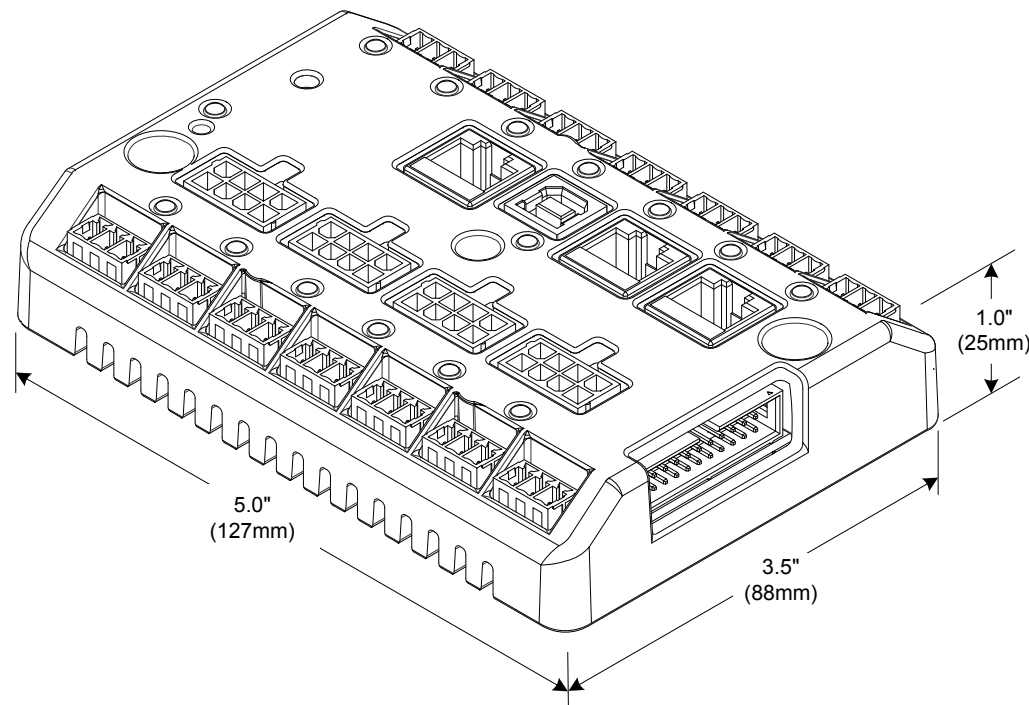
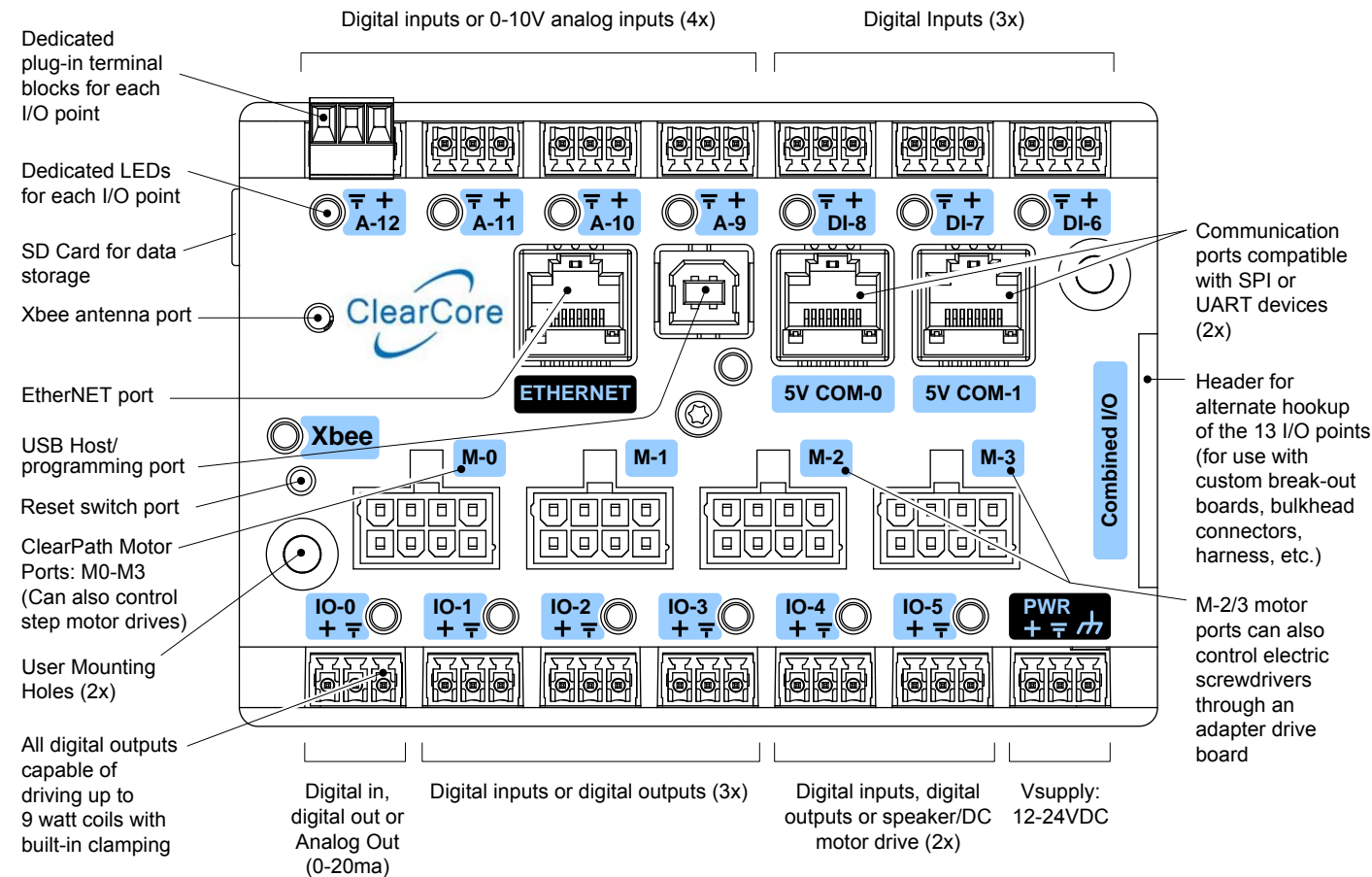




**Open-source!**  
Robust Embedded Controller



## Overview:

ClearCore is an industrial quality, open-source embedded controller with built-in motion control, hardened I/O and numerous wired/wireless connectivity options. When compared to PLCs, custom control boards and embedded PCs, ClearCore's hardware and software features reduce the engineering and manufacturing costs of machine controls.

## Features:

- Robust electrical hardware with numerous protection features minimize problems during commissioning and in the field.
- All I/O points are compatible with 24V industrial sensors and actuators as well as 3.3-5.0V logic.
- Individual plug terminal blocks for each I/O point include signal and power pins to minimize the need for external wiring devices and harnessing effort.
- All configuration of the I/O and communication port hardware is controlled by software, i.e., no jumpers, DIP switches, trim-pots, etc. need to be manually set.
- Open source hardware and software for flexible customization and worry free life-cycle management.
- C++ HAL and RTOS interface libraries speed embedded development.
- Rapid machine prototyping is supported by the optional Arduino compatible board support package and libraries.
- The 13 built-in I/O points are configurable as any combination of up to 13 digital inputs, 4 analog inputs, 6 digital outputs, 2 speaker outputs and 1 analog output (0-20mA or 4-20mA).
- Four (4) motor control ports directly control ClearPath® all-in-one servo motors for simplified motion control integration. These ports are also compatible with popular step motor drives.
- I/O can be expanded up to 77 points total using optional 8-point expansion modules.
- Outputs can directly drive resistive or inductive loads up to 9W.
- Two multi-functional serial ports, individually configurable for use with SPI or UART devices; (each port includes 5V power pins for the remote device, where necessary).
- Included 10Base-T/100Base-TX Ethernet port.
- Accepts Xbee modules for wireless connectivity (Mesh, Wi-fi, Bluetooth, etc.). Think IoT.
- Powered by a single 12-24VDC supply.
- SD card support for data logging, configuration files and disk emulation.
- 32-bit floating point ARM M4F processor @120MHz with 512KB FLASH and 192KB RAM

Input Equivalent Circuit

Typical Sensor Hookup Details

IO-0 through IO-5 configured as digital inputs

**IMPORTANT:**  
Inputs are "negative true":  
On<~1.0V, Off>~1.0V

**Digital "NPN" Sensor:**  
Proximity  
Optical  
Hall-Effect, etc.

**Switch or Relay Contact**

**5V/3.3V Logic System**

**Digital "PNP" Sensor:**  
Proximity  
Optical  
Hall-Effect, etc.

Sensor wire colors, where shown, are typical, check sensor data sheets to be certain.

**Recommended wire gauge range:**  
20AWG - 24AWG (0.8mm -0.5mm)

**Mating Plug Terminal Block:**  
Molex/0395105003 (3.81mm pitch)

**Recommended Ferrule:**  
American Electrical/1181050 (20-24AWG)

**Recommended Ferrule Crimp Tool:**  
American Electrical/TRAP 22-10

A-9 through A-12 configured as digital inputs;  
DI-6 through DI-8 digital inputs

**IMPORTANT:**  
Inputs are "negative true":  
On<~1.0V, Off>~1.0V

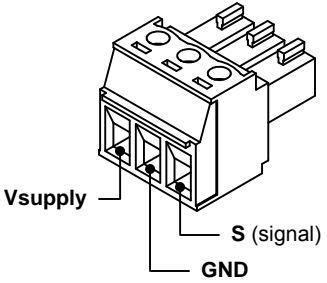
**Digital "NPN" Sensor:**  
Proximity  
Optical  
Hall-Effect, etc.

**Switch or Relay Contact**

**5V/3.3V Logic System**

**Digital "PNP" Sensor:**  
Proximity  
Optical  
Hall-Effect, etc.

Sensor wire colors, where shown, are typical, check sensor data sheets to be certain.



A-9 through A-12 configured as analog inputs  
(Cfg[NN]\_AIN\_DINn = Hi)

A/D  
0-10V

Out 0-10V  
Gnd Analog  
V+ Sensor

Out 4-20mA  
Gnd Analog  
V+ Sensor

Note:  
Place the 499 Ohm shunt resistor close to input terminal block.

Loop-powered  
4-20mA  
Sensor

Notes:

- Place the 499 Ohm shunt resistor close to input terminal block.
- Use twisted pair wire as shown to minimize noise pickup.

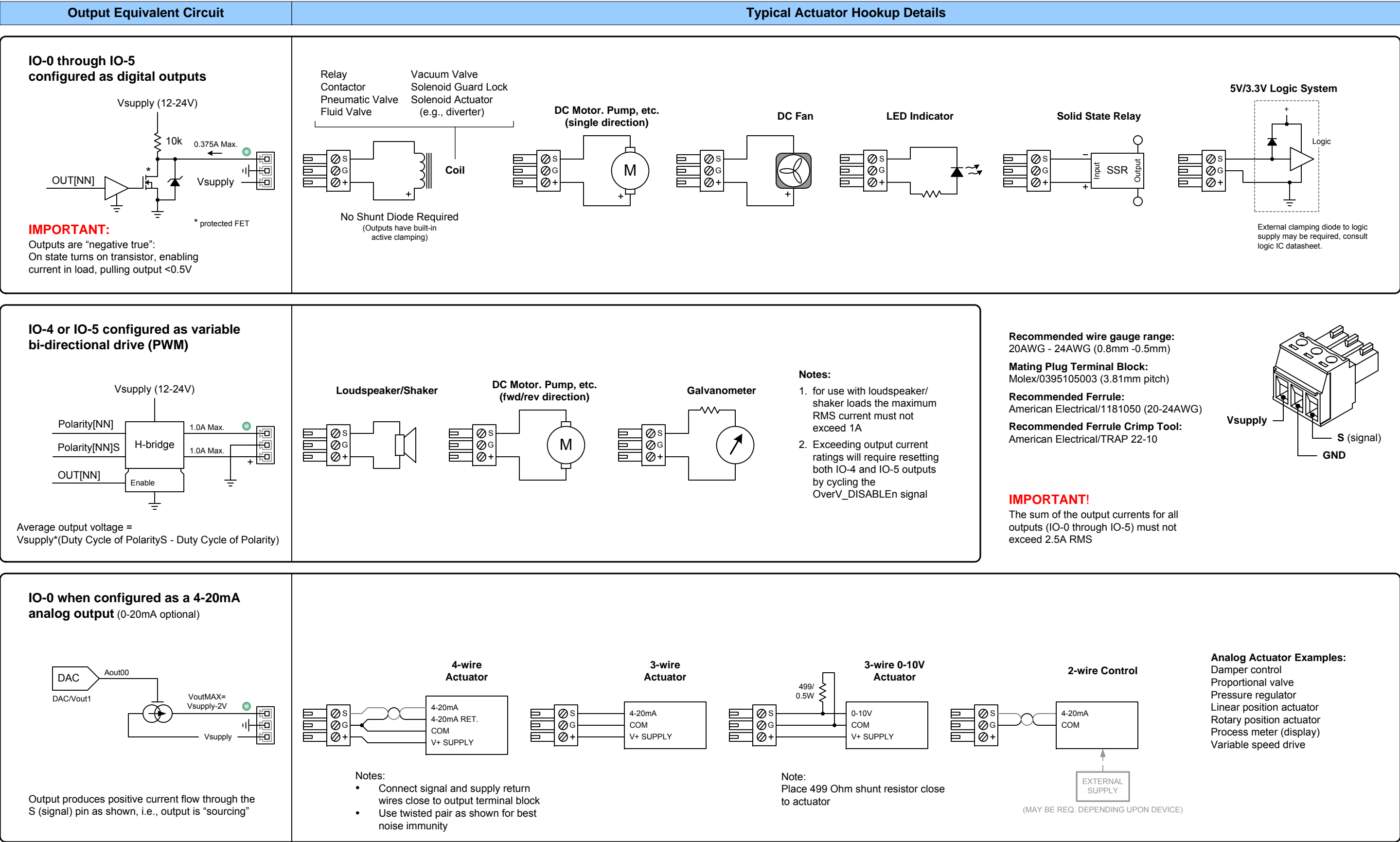
Potentiometer

Note:

The repeatability of this circuit will be affected by the drift and regulation of the power supply connected to Vsupply. (Values shown for a 24V supply.)

**Analog Sensor (Transducer)**  
**Examples:**  
Pressure Force  
Torque Temperature  
Angle Inclination  
Distance Level  
Velocity Acceleration  
Mass Flow Electric Current

**Sensor Notes:**  
1. 0-5V output sensors can be used with loss of 1 bit of resolution (provided they are compatible with Vsupply)  
2. 0-20mA sensors can be used with some loss of linearity near zero current (sensor dependent)



COM Port Equivalent Circuits

COM-[N] For use with 5V compatible RS-232 transceivers

(CfgCom[N]\_UART\_SpIn = Low, CfgCom[N]\_Polarity = Hi)

View looking into jack

COM-[N] For use with 5V logic UART devices

(non-inverting) (CfgCom[N]\_UART\_SpIn = Low, CfgCom[N]\_Polarity = Low)

View looking into jack

COM-[N] For use with SPI devices

(CfgCom[N]\_UART\_SpIn = Hi, CfgCom[N]\_Polarity = Low)

View looking into jack

Typical Hookup Details

DCE/Modem

(Male Connector Shown e.g., Amphenol/DE09P064TXLF)

Wire entry view (i.e., opposite of mating side) shown for all connectors; TIA T568A wire colors shown

DTE/Host

(Female Connector Shown e.g., Amphenol/DE09S064TLF)

Wire entry view (i.e., opposite of mating side) shown for all connectors; TIA T568A wire colors shown

IMPORTANT:

Mating serial port must be compatible with 0-5V signals (or a converter must be used)

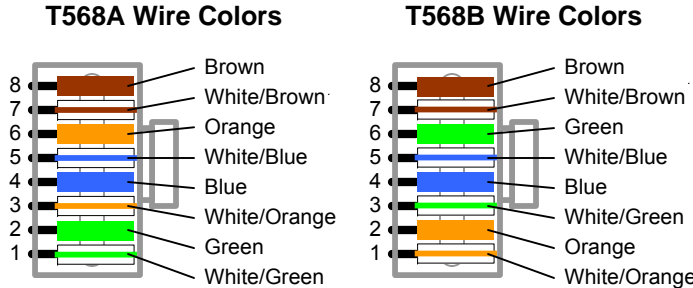
5VOB Supplies 5V power for any loads connected to the COM-0 and COM-1 connectors. 5VOB also supplies the Xbee module when installed. The total current available from 5VOB is 450mA. (See block diagram on page 7.)

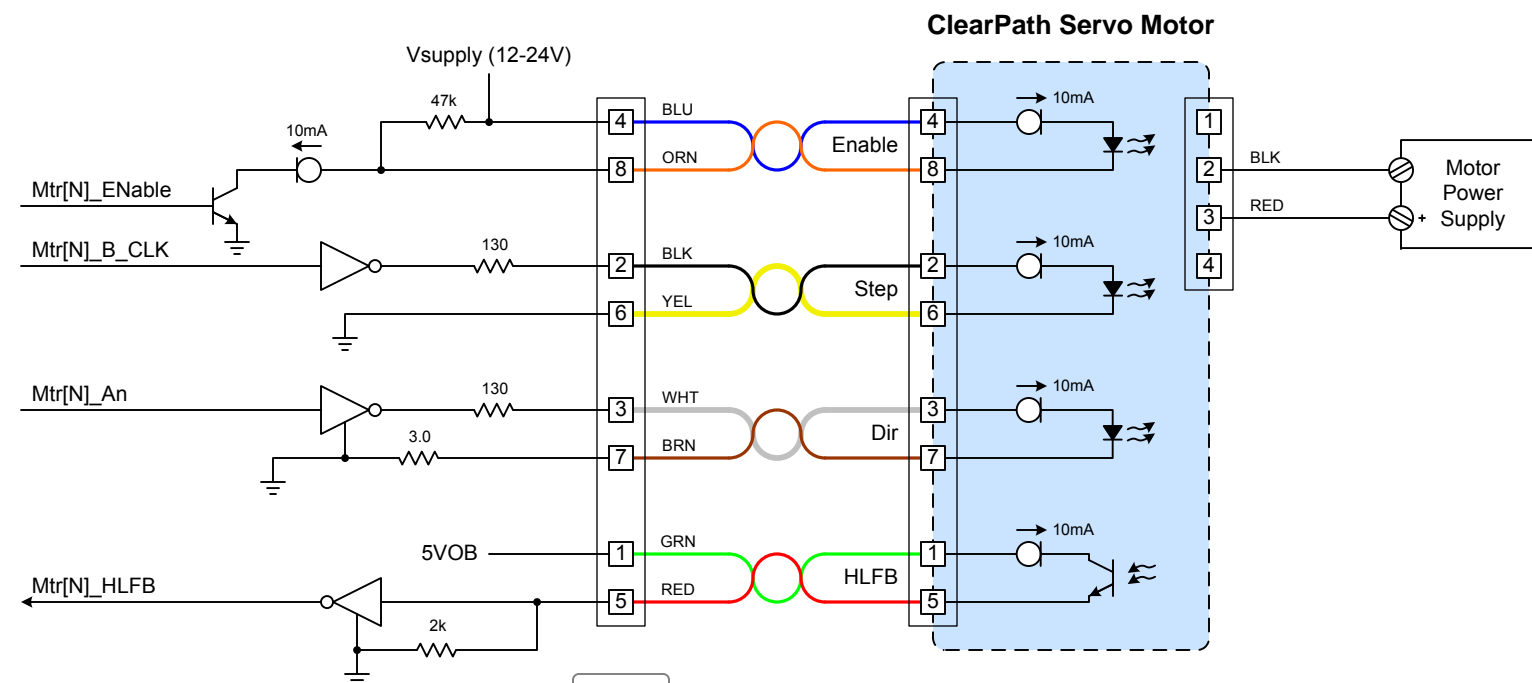
"TTL" UART port device

5VOB Supplies 5V power for any loads connected to the COM-0 and COM-1 connectors. 5VOB also supplies the Xbee module when installed. The total current available from 5VOB is 450mA. (See block diagram on page 7.)

SPI Slave Device

Common Cat-5 Patch Cable Wire Colors





Pre-fabricated motor control cables available from Teknic.com:

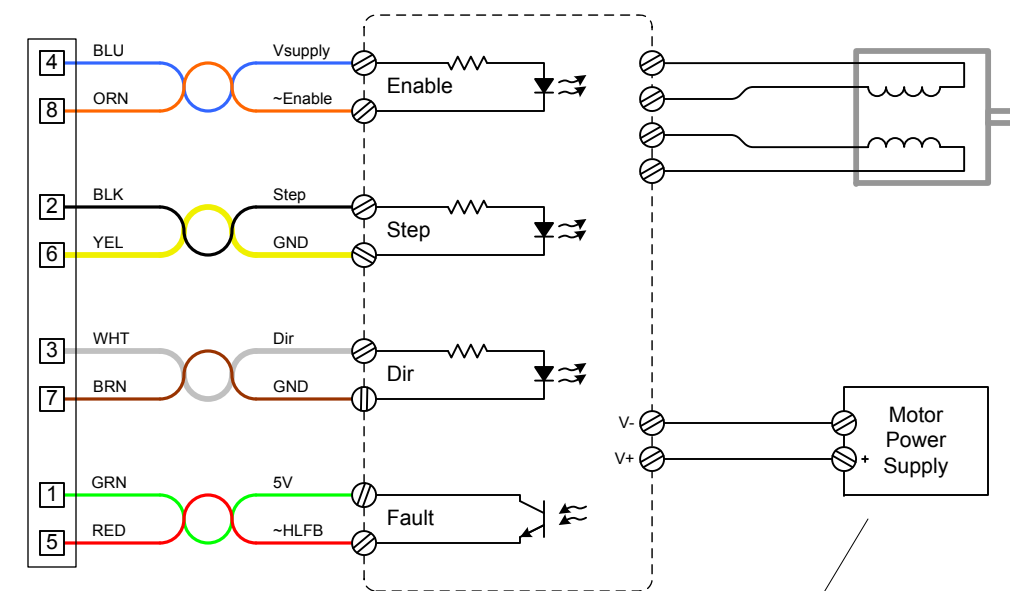
10-foot (3.1m): CPM-CABLE-CTRL-MU120  
55-foot (16.8m): CPM-CABLE-CTRL-MM660

Mating Connector Wire Entry View

#### Motor control cable components

Housing: Molex/39-03-9082 (black)  
Terminals: Molex/39-00-0047 (loose); Molex/ 39-00-0046 (reel)  
Crimp Tool: Molex/63819-0900  
Extractor Tool: Molex/11-03-0044

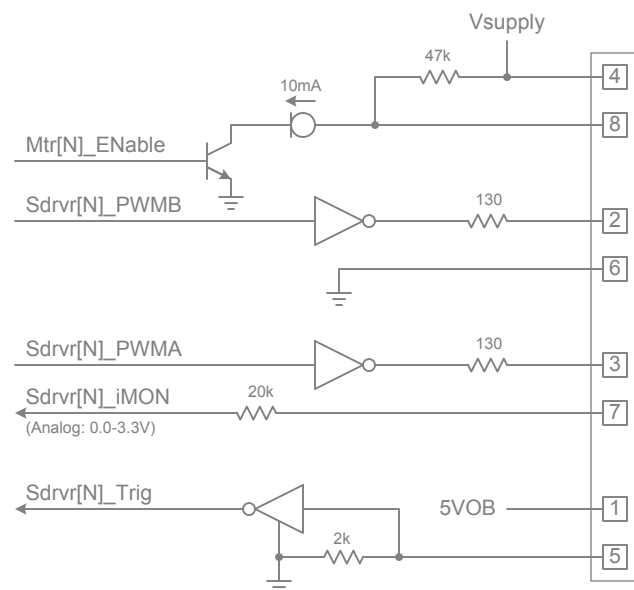
#### Typical Stepper Motor Drive



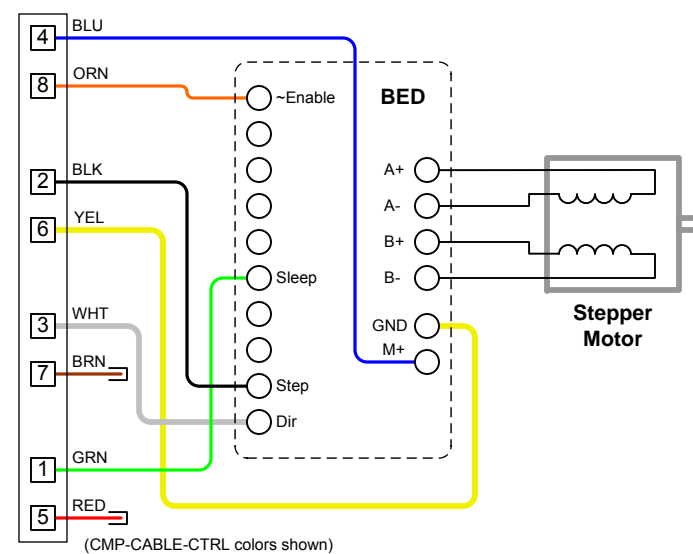
### IMPORTANT!

Do not power the ClearCore from the motor power supply. Regenerated power from the motor drives will raise the supply voltage causing ClearCore shutdown events.

#### Alternate Screwdriver Control Configuration (Available on motor ports M2 and M3 only.)

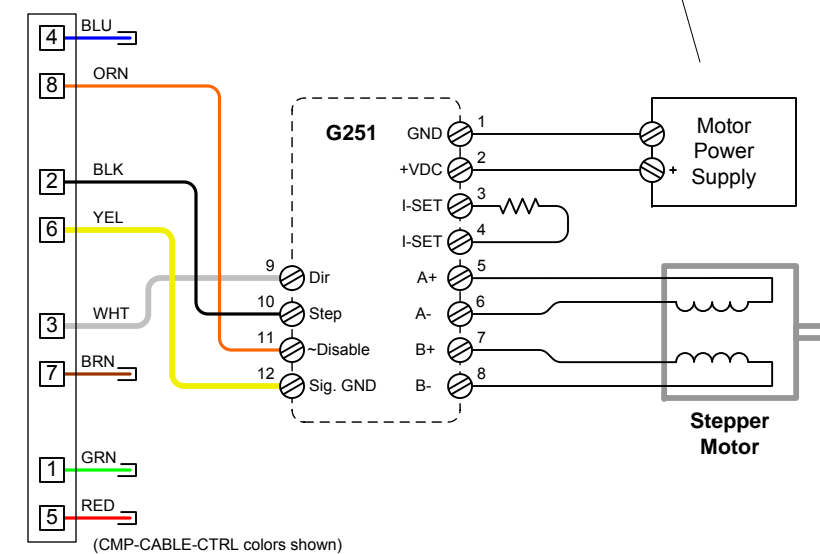


#### Big Easy Driver board Hook-up



For more information on the Big Easy Driver go to:  
[schmalzhaus.com/bigeasydriver](http://schmalzhaus.com/bigeasydriver)  
or [sparkfun.com](http://sparkfun.com)  
Note: this board has a blocking diode so regenerated power will not raise the ClearCore supply voltage.

#### GeckoDrive G251 Hook-up

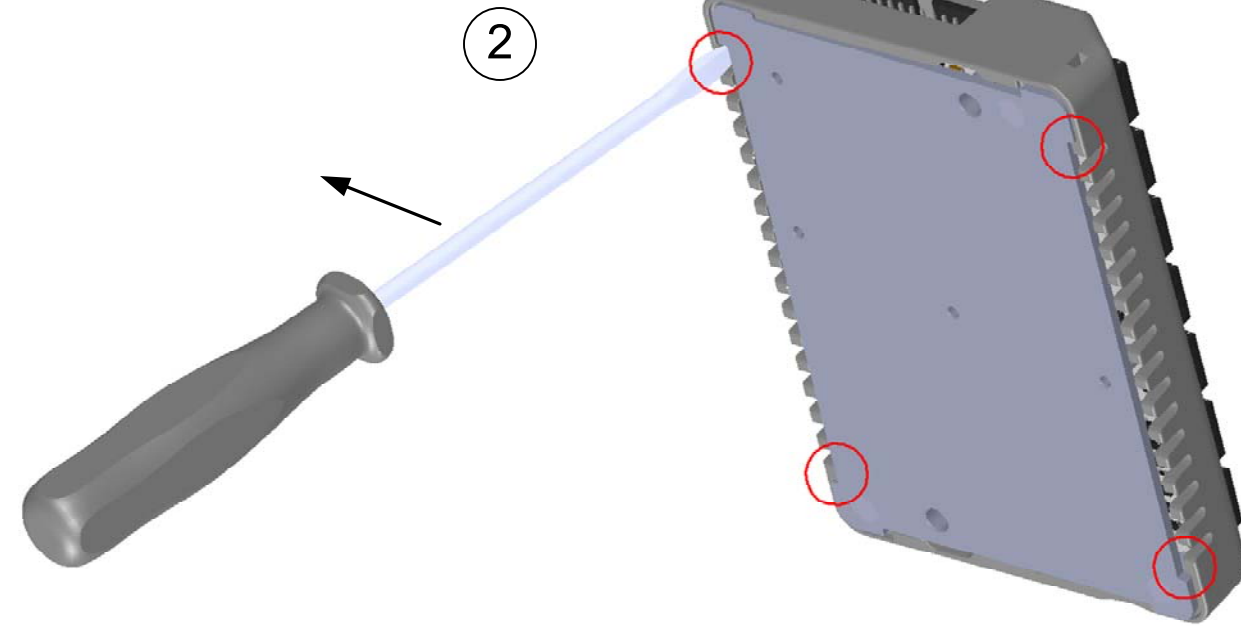
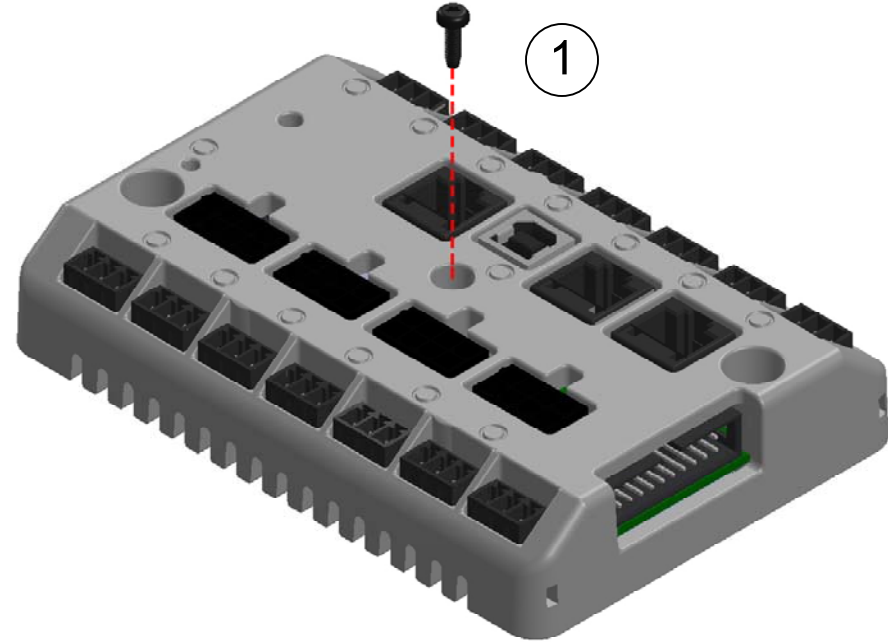


**Note:** The Enable signal needs to be inverted for proper operation, use the `polarityInvertSDEnable()` function.

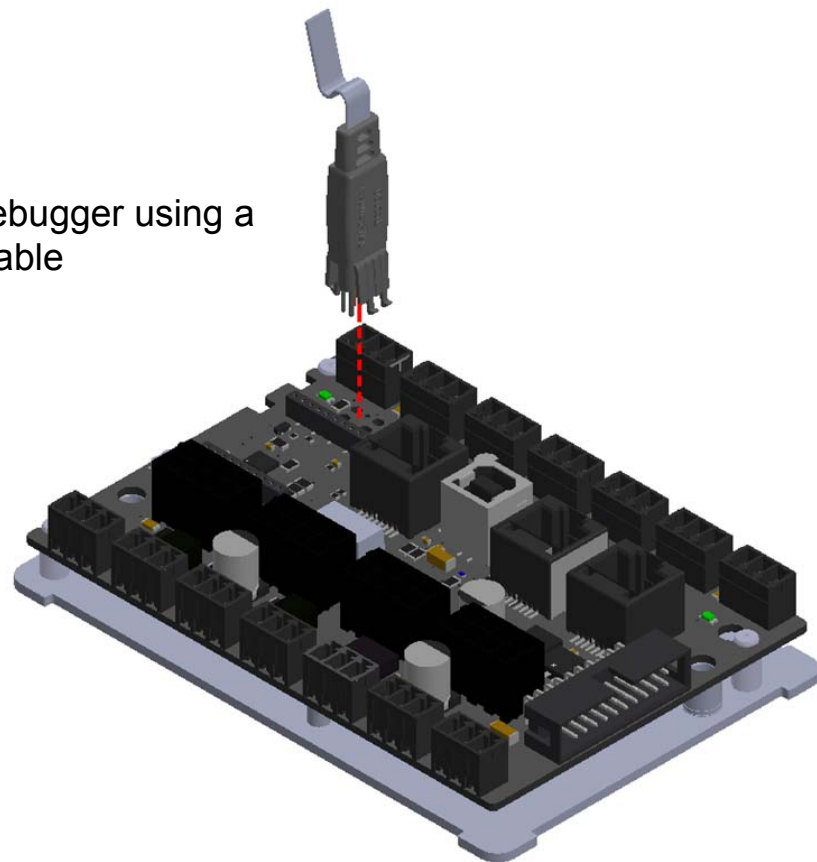
For more information on the G251 go to:  
[geckodrive.com](http://geckodrive.com)



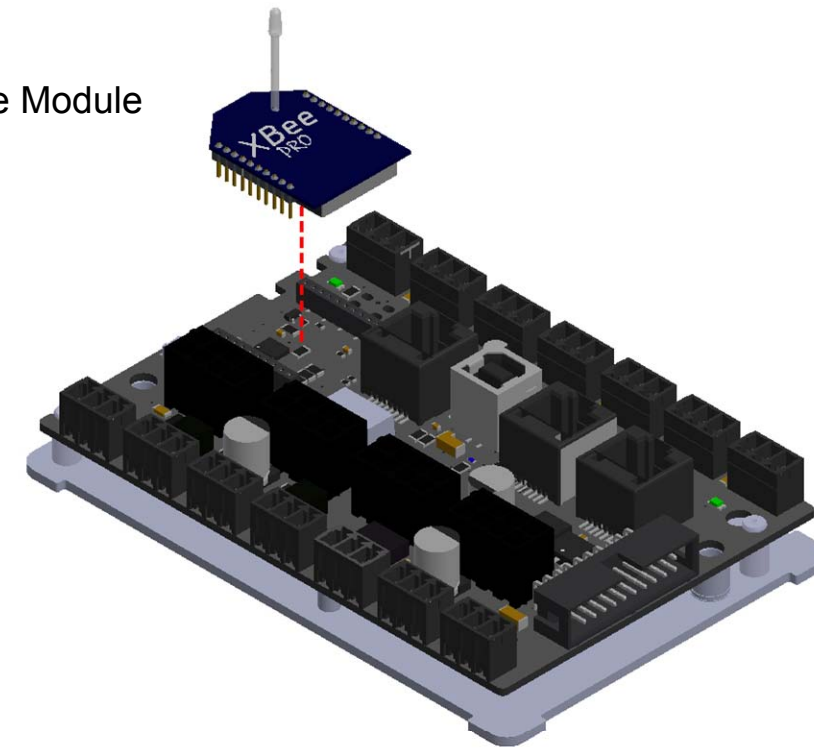
Removing the cover



Connecting a debugger using a TAG-Connect cable



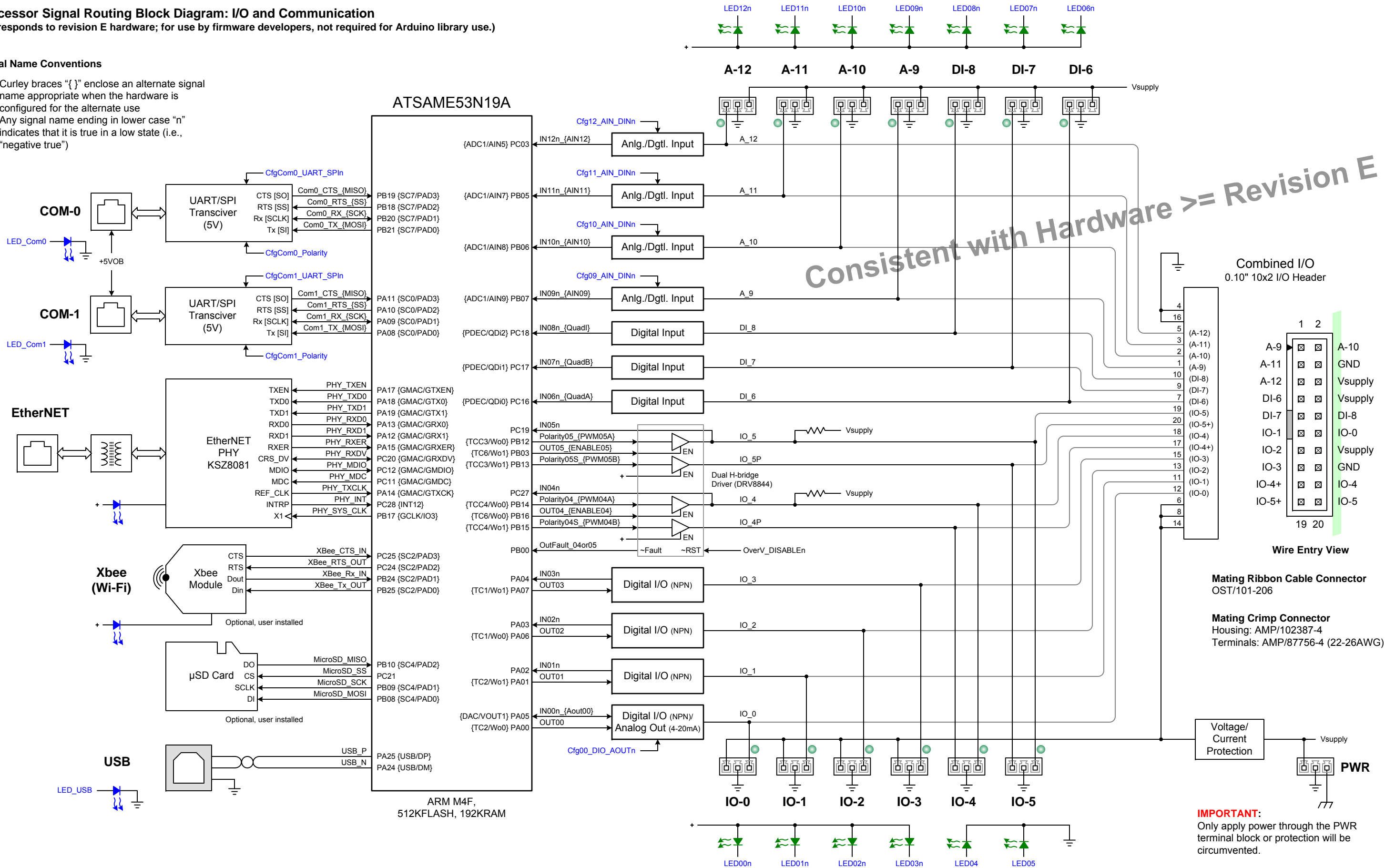
Installing an Xbee Module



Processor Signal Routing Block Diagram: I/O and Communication  
(Corresponds to revision E hardware; for use by firmware developers, not required for Arduino library use.)

Signal Name Conventions

- Curley braces “{ }” enclose an alternate signal name appropriate when the hardware is configured for the alternate use
- Any signal name ending in lower case “n” indicates that it is true in a low state (i.e., “negative true”)



**Processor Signal Routing Block Diagram: Motor I/O; Configuration Shift Register**  
(Corresponds to revision E hardware; for use by firmware developers, not required for Arduino library use.)

