C1C0 Power and Communication Block Diagram

Version: 8
Last Updated: 05/04/2024

Function
Device
-Sub-Function Code

Motor/Servo
Jetson Controller
Microcontroller
Aux Device
Sensors

Power Line Key

24v Power
12v Power
5v Power
To Be Confirmed

Interface ID
XX

Left Suspension Encoder
Encoder - TBD

Right Suspension Encoder
Encoder - TBD

Encoder Data
Encoder Data

Left Magnetic Rotary Encoder
CTRE SRX Magnetic Encoder No Magnet

Left Drive Motor
Motor - Maxon motor 441045

Hall Sens.

Left Drive Motor Driver
Motoring Driver – ESCON 70/10 Servo Driver

PWM
Analog

Right Drive Motor Driver
Motoring Driver – ESCON 70/10 Servo Driver

PWM
Analog
Hall Sens.

Right Drive Motor
Motor - Maxon motor 441045

Right Magnetic Rotary Encoder
CTRE SRX Magnetic Encoder No Magnet

Encoder Data (QEI/PWM)
Encoder Data (QEI/PWM)

Locomotion
Arduino Mega
- Motor Controller code

PWM

Head Rotation Servo
Servo - HITEC HS-785HB

Power Board
C1C0 Power Board

24v DC Battery

Lidar
Sensor - Slamtec RPLIDAR A1

Serial (TXRX)

USB/UART

I2C

Sensor
Teensy 4.0
- Terabee code
- LIDAR code
- Gyro/Magnetometer code

Time of Flight (1)
Terabee 1 (array of 8)

Serial (TXRX)

I2C

Internal Measurement Unit (IMU) w/ accelerometers and gyro
Adafruit BNO055

Central Control
Jetson Nano
-Object Detection Code
-Path Planning Code
-Tablet Code
-System Code
-Locomotion Code
-ChatBot Code
-Facial Recognition Code

USB/UART
USB/UART
USB/UART

Strong Arm
Arduino Mega
- Motor Control

Precise Arm
Arduino Mega
- Motor Control

Freq
Freq
PWM
PWM

Shoulder Motor Driver
Motor Driver - TBD

Elbow Motor Driver
Motor Driver - TBD

Shoulder Motor
Stepper Motor – Nema 34

Elbow Motor
Stepper Motor – Nema 23

Wrist: Lift End Eff. Servo
Servo – Tower Pro Mg946g

Hand: Grab End Eff. Servo
Servo – Tower Pro Mg946g

Freq
Freq
Freq
Freq
Freq
Freq

Shoulder: Rotat Motor Driver
Motor Driver - DM542T

Shoulder: Lifting Motor Driver
Motor Driver - DM542T

Elbow Motor Driver
Motor Driver - DM542T

Forearm: Rotat Motor Driver
Motor Driver - DM320T

Wrist: Lifting Motor Driver
Motor Driver - DM542T

Wrist: Rotat Motor Driver
Motor Driver - DM320T

Shoulder: Rotational Motor
Stepper Motor – Nema 17

Shoulder: Lifting Motor
Stepper Motor – Nema 23

Elbow Motor
Stepper Motor – Nema 17

Forearm: Rotational Motor
Stepper Motor – Nema 11

Wrist: Lifting Motor
Stepper Motor – Nema 17

Wrist: Rotational Motor
Stepper Motor – Nema 14

Shoulder: Rotational Motor Encoder
Encoder - AMT222A-V

Shoulder: Lifting Motor Encoder
Encoder - AMT222A-V

Elbow Motor Encoder
Encoder - AMT222A-V

Forearm: Rotational Motor Encoder
Encoder - AMT222A-V

Wrist: Lifting Motor Encoder
Encoder - AMT222A-V

Wrist: Rotational Motor Encoder
Encoder - AMT222A-V

PWM

End Effector Servo
Servo – TBD

Pressure Sensor
Sensor - Force Sensitive Resistor

Encoder Data (SPI Bus)
Encoder Data (SPI Bus)
Encoder Data (SPI Bus)
Encoder Data (SPI Bus)
Encoder Data (SPI Bus)
Encoder Data (SPI Bus)

USB (Serial)

USB Hub
Blackweb USB 3.0 Hub

TBD Jetson or PB

USB (Serial)
USB (Serial)
USB (Serial)
USB (Serial)
USB (Serial)
USB/UART
15-pin ribbon cable? (incl. 3.3v pwr)
PWM

Remote Control
Xbox Controller

Wi-fi Adapter
Adapter – Panda PAU05

Object Detection Camera
Intel RealSense Depth Camera D435

Speaker
USB Speaker

Tablet
ELECROW 7 Inch Capacitive Touchscreen

ChatBot Mic
FIFINE K668 USB Microphone

Facial Recognition Camera
Camera – Pi Cam?

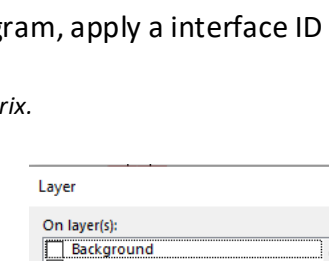
Facial Recognition Camera Lens Aperture Servo
Servo - XXX

The original file format for this document is a Microsoft Visio document (.vsdx). Microsoft Visio should be available to Cornell students.

Updating C1C0 Block Diagram Document
When this document needs to be updated to reflect design changes, the following steps should be considered.

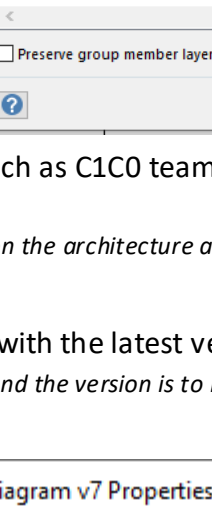
1. Ensure the version and last revision date are updated on the diagram.

Why? These are critical so users know how old the document is or what version they may be looking at.



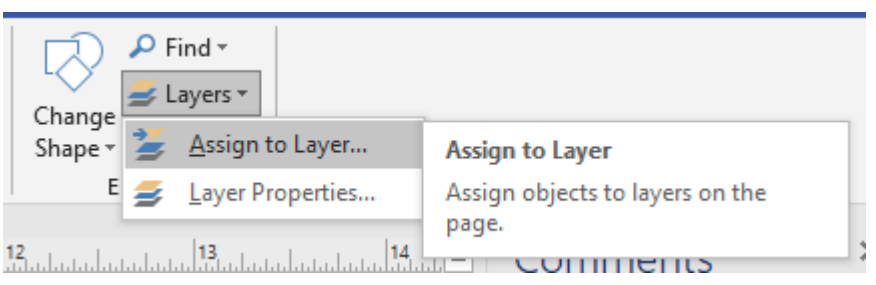
2. Any elements that were added to the diagram, ensure the coloring and format matches the diagram key. Add diagram key elements as needed.

Why? This greatly increases the readability of the diagram.



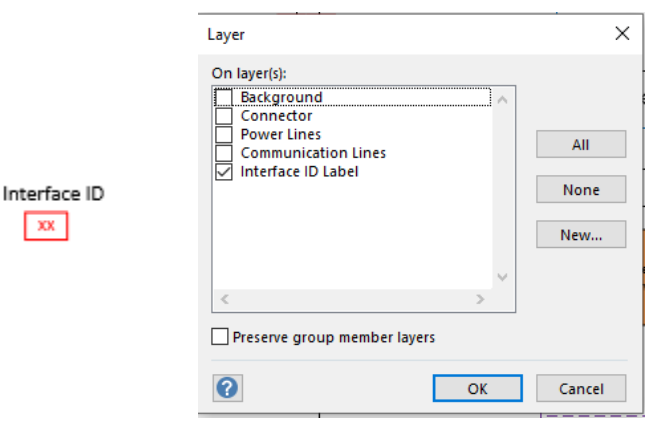
3. For the added elements, ensure they are added to the proper layer (see the Using Layers tab for tips on using layers in Visio).

Why? To maintain the ability to visually turn off details if desired by users. For example, maybe you don't want to see all of the power lines, so they can be visually turned off.



4. If new interface lines are added to the diagram, apply a interface ID number and apply the interface ID label to the interface ID label layer.

Why? To create traceability to the wiring matrix.

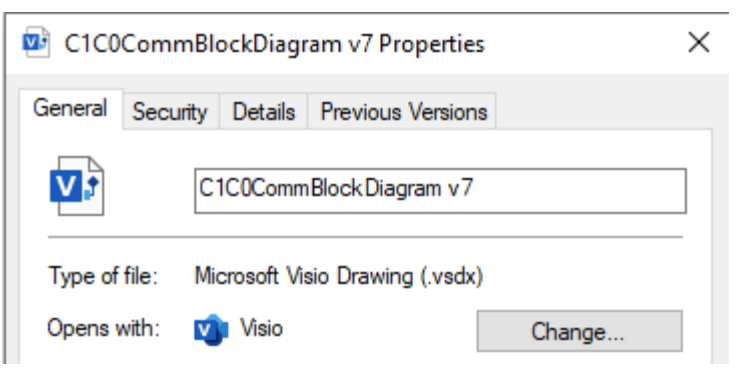


5. Review your changes with key stakeholders such as C1C0 team leads to ensure they are accurate and everyone agrees.

Why? It is critical all sub-teams are in alignment on the architecture and made aware of changes incase it impacts them.

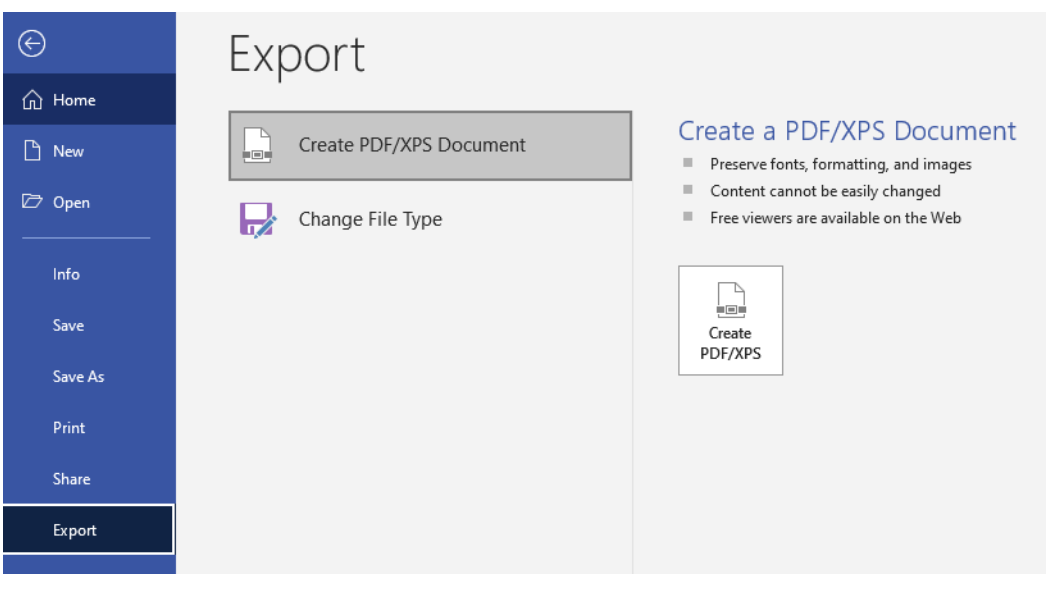
6. Save a version of the document as a .vsdx file with the latest version number in the title (vX)

Why? The file type is to allow for future updates and the version is to help understand what version the file is. The date can be added to the title too if desired.



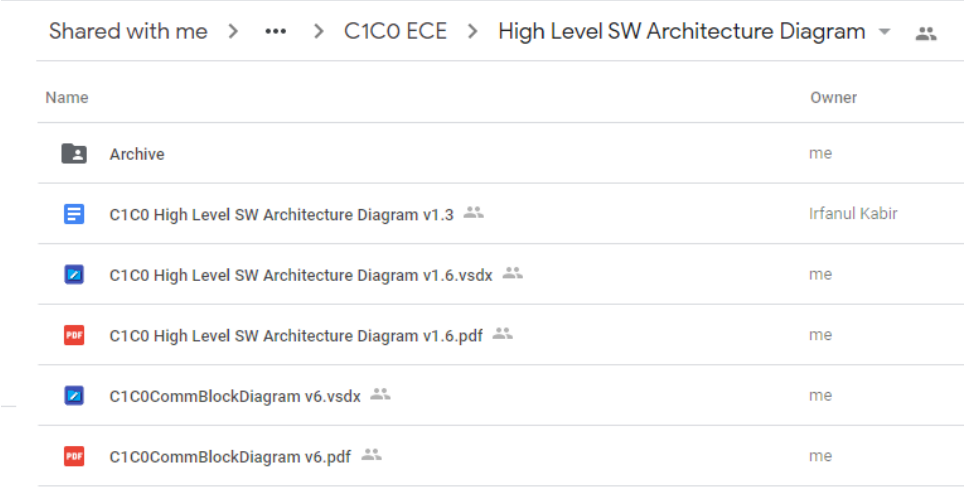
7. Export a version of the document as a .pdf by going to File > Export > Create PDF/XPS and save with the same name as the Visio file type

Why? Incase you need to share the document with someone that does not have Visio available on their machine, your you want to share a read-only copy.



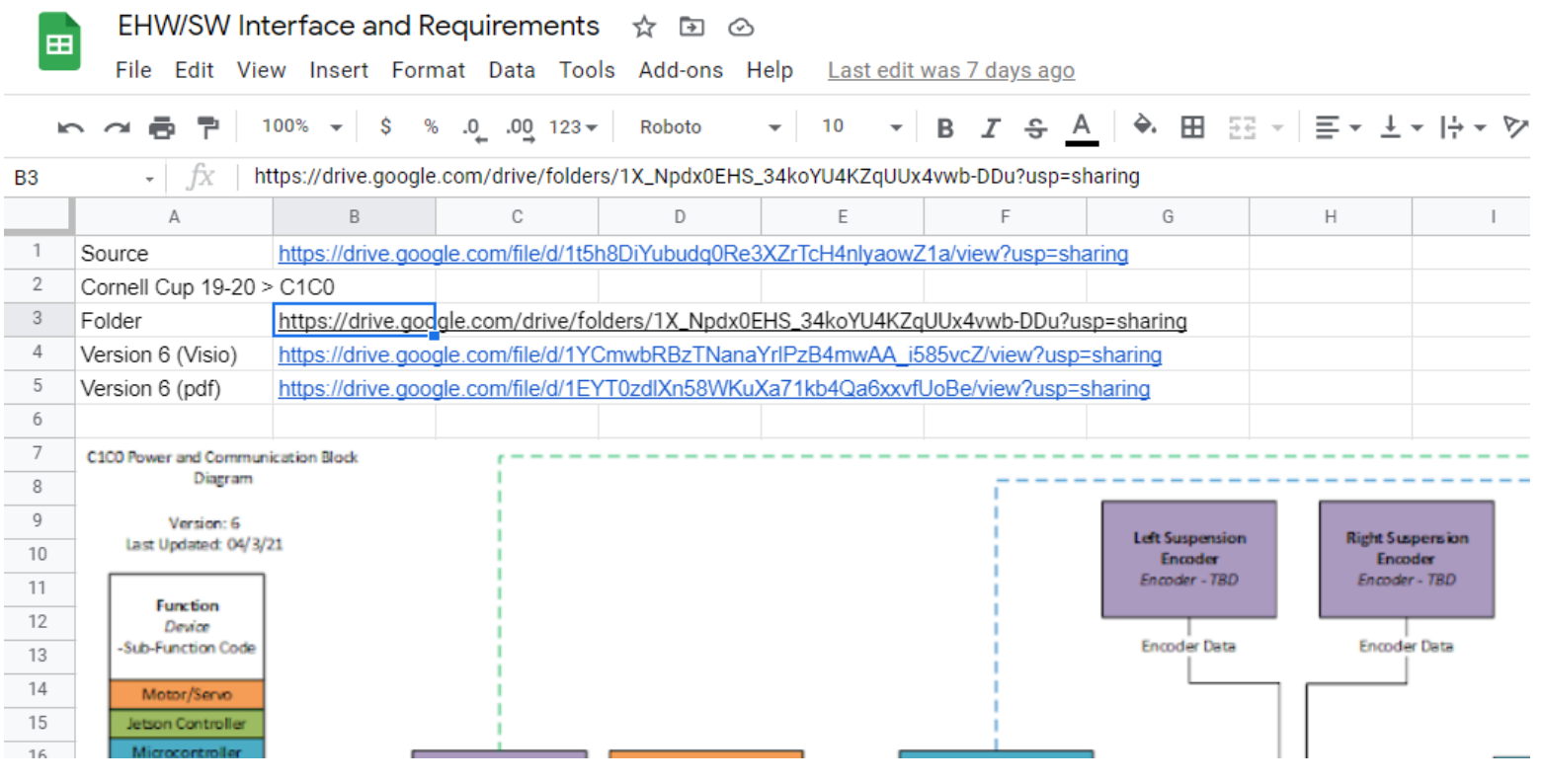
8. Save both files in the teams current storage location. As of SP2021, the storage folders are re-created each year. It is recommended to create an archive folder to store past versions incase they are needed again.

Why? Want to make sure they are available to any user who needs to reference them.



9. Place an image of the diagram in the complimenting/traced EHW Interface and or wiring diagram documents. As this diagram has gotten larger, a 'Save As…' to an image format such as a png has worked best. It has been helpful to include a link to where the original files are kept with the image version.

Why? To have a local reference for traceability.

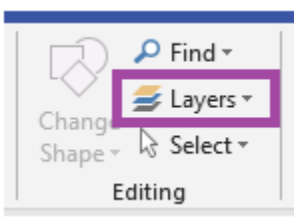


10. Update the EHW Interface and or wiring diagram documents with the respective changes. The Interface ID should help identify the appropriate parts of the other documents if maintained.

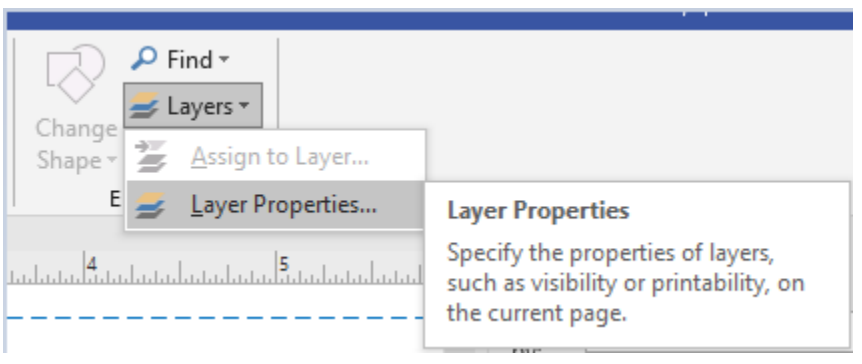
Why? To ensure both documents are accurate.

Layers are used to split communication lines, power lines, and interface labels on the diagram to aid in readability

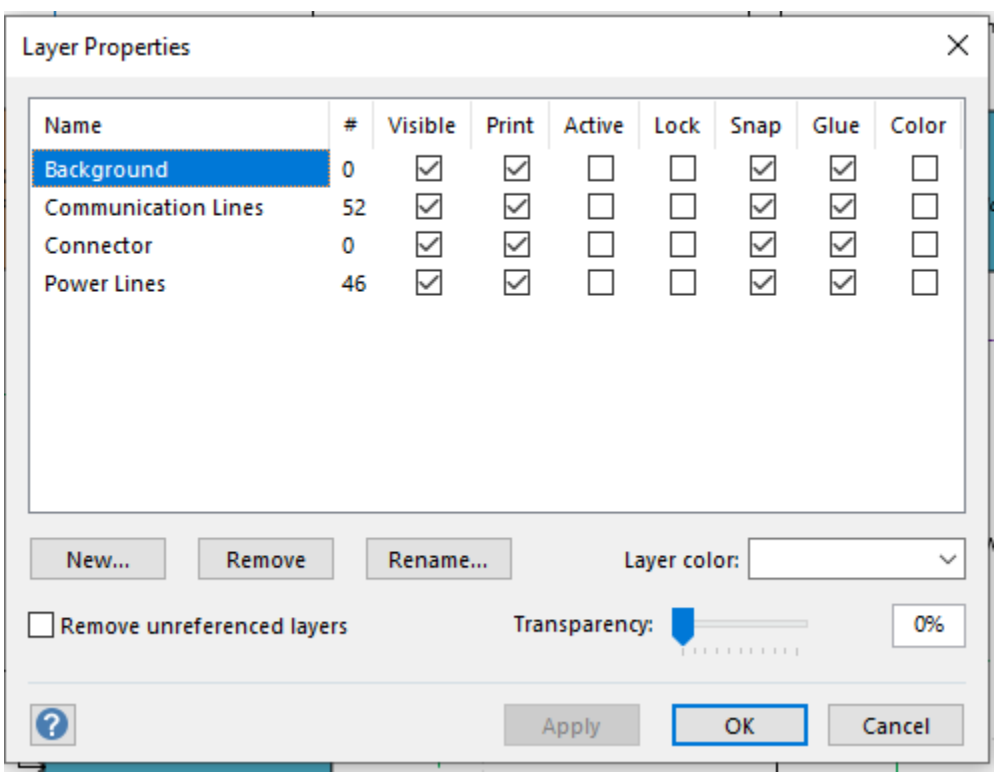
Layers can be found:
Under the *Home* Tab, under *Editing* Group is *Layers*



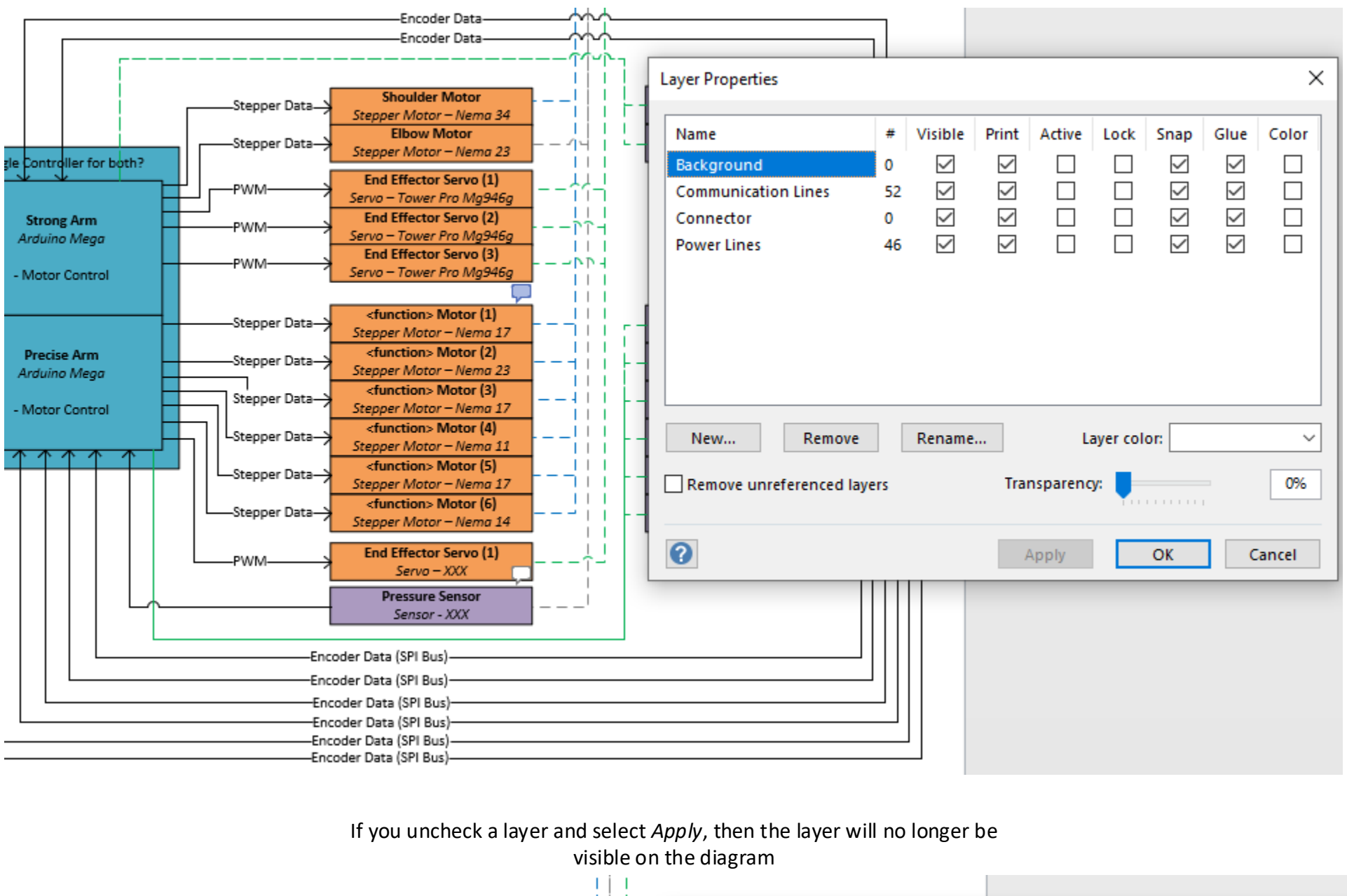
If you select Layer Properties



You can see the layers that are in the diagram. Some names are generated by default as elements are added to a the diagram such as C*onnector*

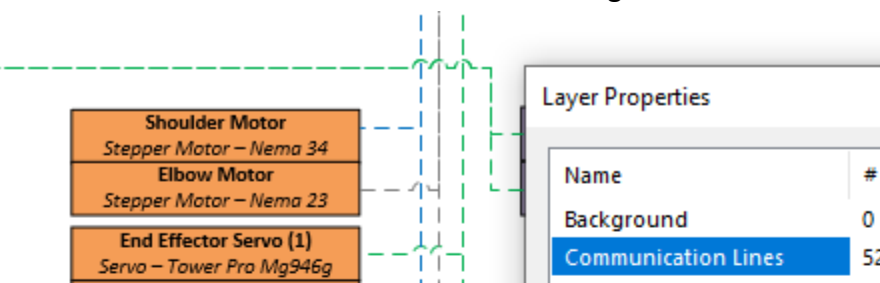


If all layers are selected as *Visible*, then all elements should appear on the diagram



If you uncheck a layer and select *Apply*, then the layer will no longer be visible on the diagram

To add an element to a layer, select the element, then in the *Layers* menu, select *Assign to Layer...*



Then just select what layer you want the element to be a part of and select *OK*