

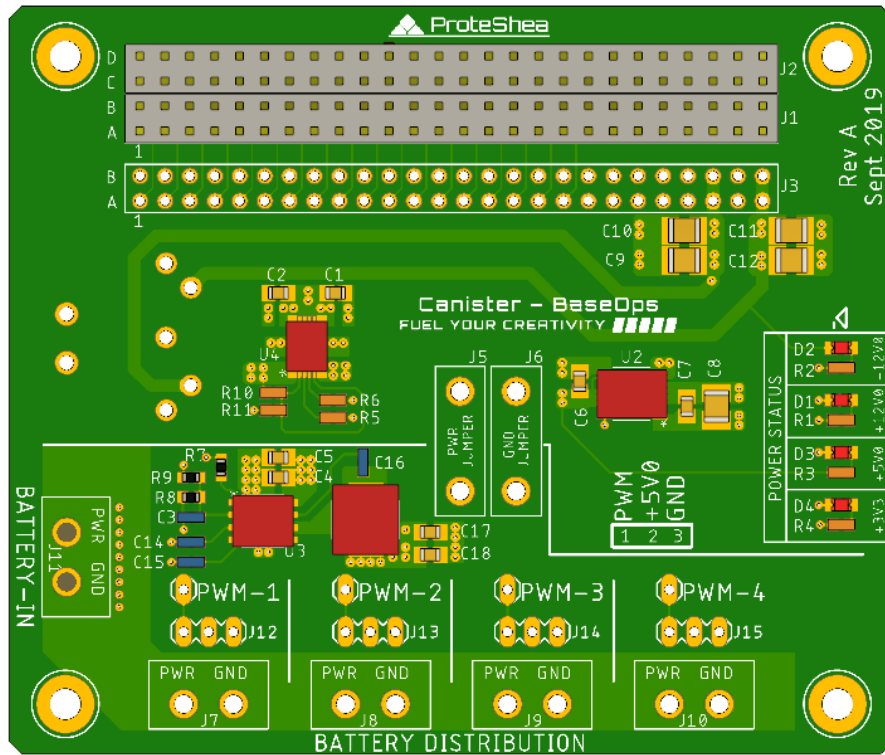


ProteShea®
Learn. Apply. Create.™

Canister – BaseOps™

ECCN (US): EAR99

USER MANUAL



FUEL YOUR CREATIVITY ™

Use of this product or documentation signifies acceptance of the legal terms and conditions set forth below. Disagreement with any part of the legal terms and conditions set forth below permits the return of this product within 30-days of the date of purchase, per the terms described below.

Website: <https://proteshea.com>
Phone: 772-336-9761

REVISION HISTORY




Date	Version	Revision
11/21/2019	1.0	Initial release
1/9/2019	1.1	Modified “Intended Uses” section

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A. SYMBOL DESCRIPTION

Table 1. Symbol Description

Symbol	Warning Description
 ELECTRIC SHOCK WARNING	Symbol draws your attention to potential serious injury or death due to electric shock
 WARNING	Symbol draws your attention to potential serious or minor injury
 ESD CAUTION	Symbol draws your attention to notification that the device is sensitive to electro-static discharge (ESD). Handle electronics on an ESD workbench and wear proper protection and clothing to prevent accidental damage or loss of functionality.



WARNING: To prevent injury, death, and/or damage to property while using this product, read this entire instruction manual.

B. IMPORTANT INSTRUCTIONS & SAFETY

WHEN USING THIS PRODUCT, BASIC PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, DAMAGE TO PROPERTY, AND/OR INJURY TO PERSONS, INCLUDING THE FOLLOWING:

1. Read all instructions before using the Canister.
2. Use the Canister only as described in this manual. Any other use not recommended by ProteShea may cause, without limitation, fire, electric shock, damage to property, and/or injury to persons.
3. Do not modify the Canister in any way that is not described in this user manual.
4. Do not use the Canister in a wet or extreme environment.
5. Do not operate the Canister after it malfunctions. Disconnect power at the main 5-pin DIN connector and unplug the AC/DC adapter from the AC source if using the AC/DC adapter. Disconnect power from the battery pack, if applicable.
6. Do not exceed maximum power ratings of the AC/DC adapter or battery as specified by the manufacturer.
7. The Canister kits may contain small parts which pose a choking hazard, keep out of the reach of children less than 6 years of age.
8. When installing the Canister, see the **INSTALLATION** section for additional warnings and precautions.
9. For safe operation throughout the lifetime of this product, see the **MAINTENANCE** section.

C. INTENDED USES

The BaseOps™ Canister is designed for use other Canister models (Adapticon™ and/or Modulus™) that can be stacked on top of BaseOps™ to provide the user's desired functionality.

Its intended users, 12+ years of age, include the following:

- Electronics hobbyists
- High school students interested in a STEM degree
- College students pursuing a STEM degree
- University researchers

Its intended use cases include the following:

- Raspberry Pi and Arduino evaluation and development
- Electronics prototyping and evaluation
- Teaching beginner soldering skills
- Teaching board interfacing
- Teaching communication interfaces to sensors
- Teaching power supply design

NOTE: BaseOps is not compatible with Fuelcan.

D. FEATURES

BaseOps™ Canister contains the following features:

- Stackable with other Canister models (i.e. Adapticon)
- Compatible with FuelCan's AC/DC Adapter
- Automatic switchover circuit for 5V supply
- Single-point grounding between battery and canister stack for minimal ground noise
- 4 terminal block headers for power distribution to external peripherals (i.e. motors)
- 4 power status LEDs to quickly determine if power rails are nominal
- Small board footprint

E. TECHNICAL SPECIFICATIONS

Table 2. Overview of Technical Specification.

Model	Canister – BaseOps™
Mass	36 grams
Dimensions	3.05" x 3.55"
Max current rating of DIN connector	7.5A
Max current rating of terminal block connector J11	16A
Max current rating of terminal block connectors J7, J8, J9, J10	16A
Max current rating of connectors J1 and J2	5.7A per contact
Operating Temperature	0°C to 85°C



WARNING: To prevent risk of fire or damage, do not exceed maximum current or power ratings of the provided AC-DC adapter as shown in Table 3.



WARNING: Combined current rating for the +5.0V and +3.3V supplies is 2.5A. Potential risk of fire, damage, or injury if this rating is exceeded. Ensure that these limits are not exceeded across the entire application including development board and full Canister board stack.

Table 3. AC/DC Adapter Current Ratings.

-12V0 Rail Current Rating	300mA
+12V0 Rail Current Rating	1A
+5V0 and +3V3 Rail Combined Current Rating	2.5A

F. DESCRIPTION OF PRODUCT

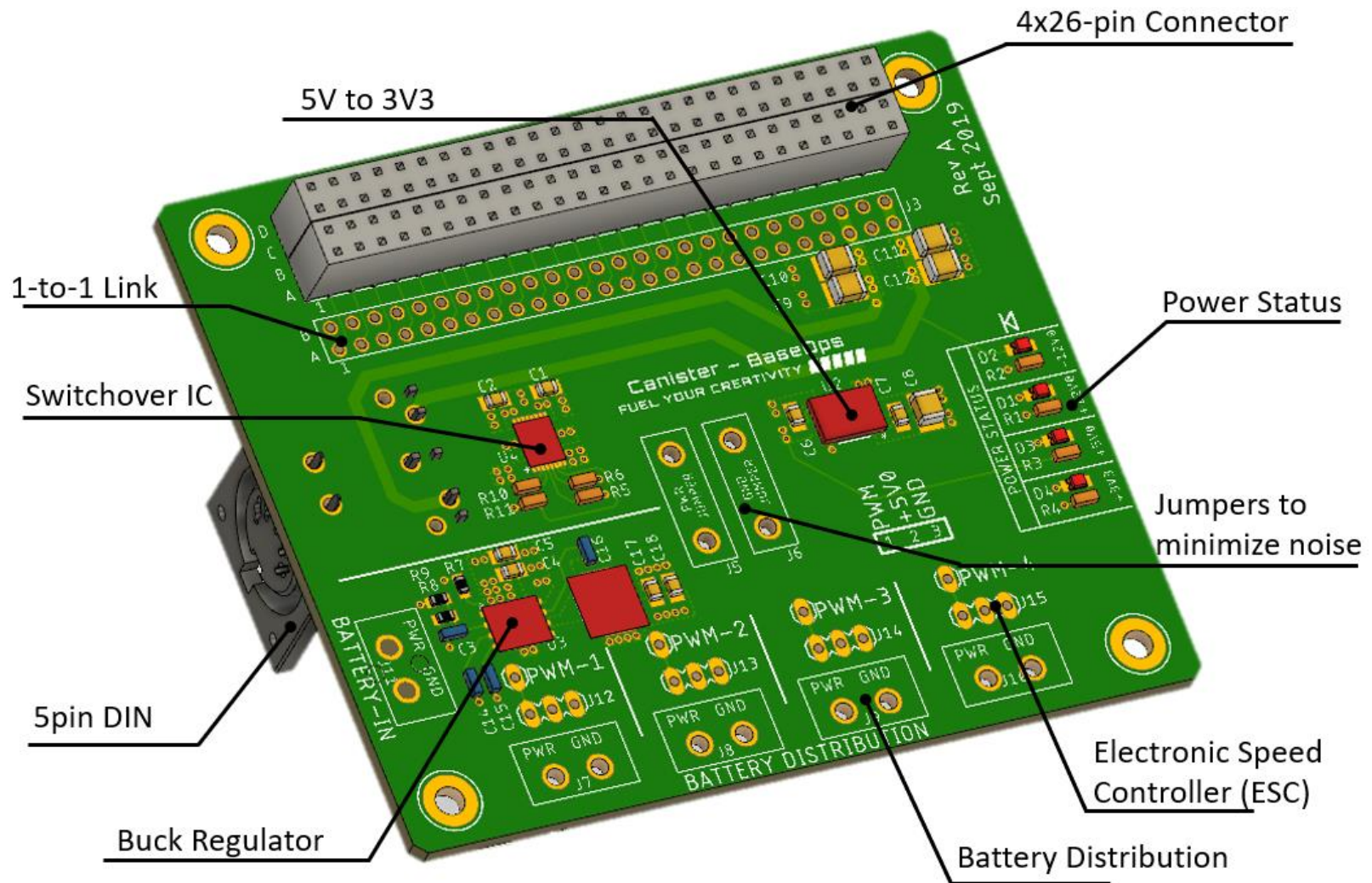


Figure 1. BaseOps™ Description (Top View).

G. HOW TO USE PRODUCT

Table 4. Pinout for 4x26-pin Connector.

	1	2	3	4	5	6	7	8	9	10	11	12	13
D	GPIO-D01	GPIO-D02	GPIO-D03	GPIO-D04	GPIO-D05	GPIO-D06	GPIO-D07	GPIO-D08	GPIO-D09	GPIO-D10	GPIO-D11	GPIO-D12	GPIO-D13
C	GPIO-C01	GND	GPIO-C03	GND	GPIO-C05	GND	GPIO-C07	GND	GPIO-C09	GND	GPIO-C11	GND	GPIO-C13
B	GND	GPIO-B02	GND	GPIO-B04	GND	GPIO-B06	GND	GPIO-B08	GND	GPIO-B10	GND	GPIO-B12	GND
A	GPIO-A01	GPIO-A02	GPIO-A03	GPIO-A04	GPIO-A05	GPIO-A06	GPIO-A07	GPIO-A08	GPIO-A09	GPIO-A10	GPIO-A11	GPIO-A12	GPIO-A13

	14	15	16	17	18	19	20	21	22	23	24	25	26
	GPIO-D14	GPIO-D15	GPIO-D16	GPIO-D17	GPIO-D18	GND	+5V0	GND	+3V3	GND	+12V0	GND	-12V0
	GND	GPIO-C15	GND	GPIO-C17	GPIO-C18	GND	+5V0	GND	+3V3	GND	+12V0	GND	-12V0
	GPIO-B14	GND	GPIO-B16	GND	GPIO-B18	GND	+5V0	GND	+3V3	GND	+12V0	GND	-12V0
	GPIO-A14	GPIO-A15	GPIO-A16	GPIO-A17	GPIO-A18	GND	+5V0	GND	+3V3	GND	+12V0	GND	-12V0

Table 4 shows the pinouts for the 4x26-pin connector as shown in Fig. 1. The 1-to-1 link provides connections to the 4x26-pin connector so that wire wrap can be used to connect from this header to the PWM signals, labeled as PWM-1, PWM-2, PWM-3, and PWM-4. See figures 2 and 3 below for more details.

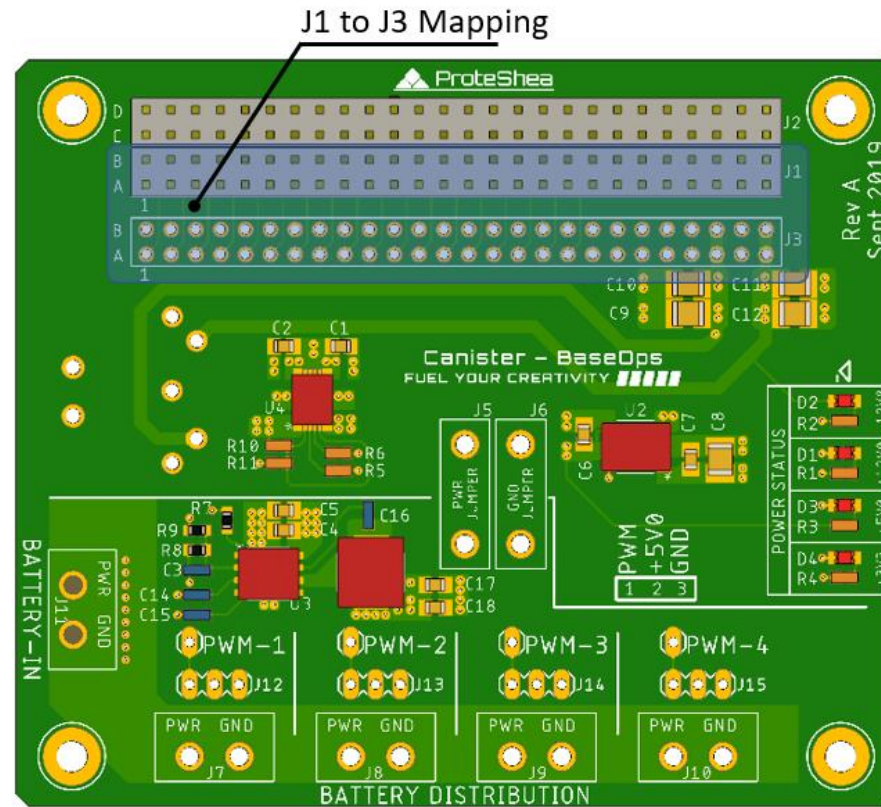


Figure 2. J3 Header to J1 Connector Pin Mapping.

The J3 header is a 1-to-1 link to the J1 Connector (i.e. J3 pin A1 maps to J1 pin A1, J3 pin B1 maps to J1 pin B1, etc.). The design of this header configuration gives the user flexibility when connecting the PWM signals (PWM-1, PWM-2, PWM-3, and PWM-4 shown in Fig. 3) to the 4x26 pin connector since the PWM signals are not fixed.

Wire wrap the PWM signals to any of the GPIO pins that aren't being used by other canisters in your stack. An example wire wrap configuration is shown in Fig. 3 where the PWM signals are wired to GPIO-A12, GPIO-A13, GPIO-A14, and GPIO-A15.

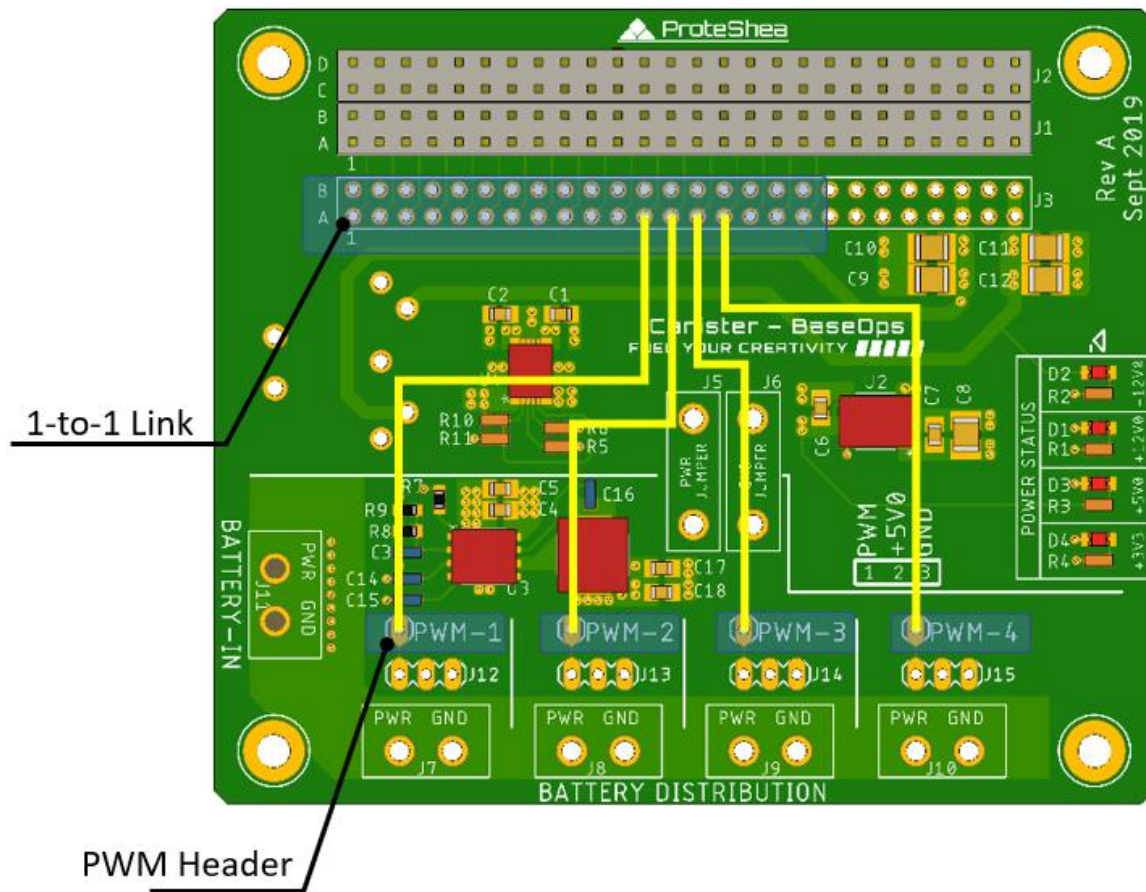


Figure 3. PWM Signal Wire Wrap Example.

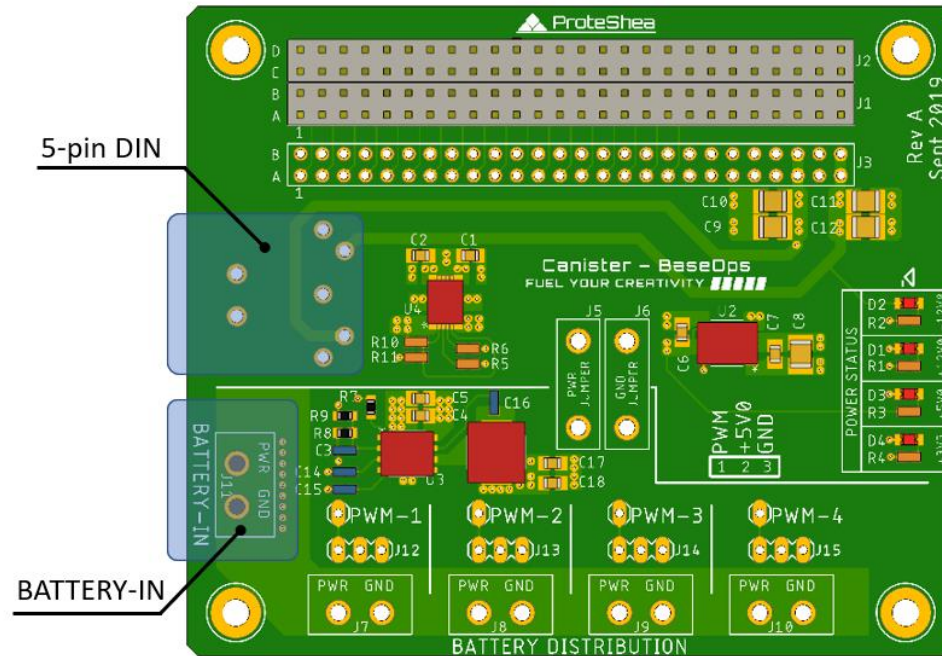


Figure 4. Power Connections.

An automatic switchover IC gives priority to the “BATTERY-IN” input for the 5V rail if the 5-pin DIN connector is plugged in simultaneously. See Tables 5, 6, and 7 for a description of how the “BATTERY-IN” and “5-pin DIN” supplies can supply power to J1, J2, and J3 connectors/header.



WARNING: Do not exceed the maximum power ratings for the battery as specified by the manufacturer. Exceeding the maximum power ratings could cause an explosion resulting in damage, injury, or death.

Table 5. Board Power – 5-pin DIN and BATTERY-IN.

	Power Rail				
Power Source	-12V0	+12V0	+5V0	+3V3	BATTERY DISTRIBUTION
5-pin DIN	✓	✓			
BATTERY-IN			✓	✓	✓

Table 6. Board Power – 5-pin DIN Only.

	Power Rail				
Power Source	-12V0	+12V0	+5V0	+3V3	BATTERY DISTRIBUTION
5-pin DIN	✓	✓	✓	✓	
BATTERY-IN					

Table 7. Board Power – BATTERY-IN Only.

	Power Rail				
Power Source	-12V0	+12V0	+5V0	+3V3	BATTERY DISTRIBUTION
5-pin DIN					
BATTERY-IN			✓	✓	✓

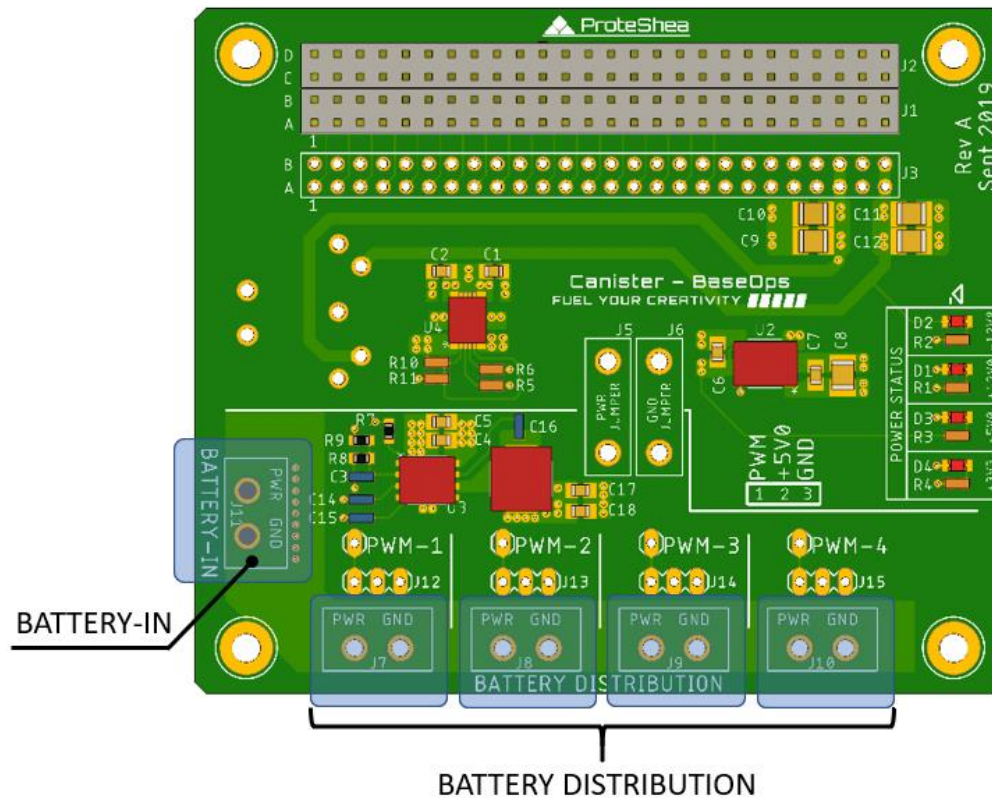


Figure 5. Battery Connection and Battery Distribution.

⚠ WARNING: Use the silkscreen labels “PWR” and “GND” on designators J7, J8, J9, and J10 to correctly connect peripherals to power (“PWR”) or ground (“GND”). Potential risk of fire, damage, explosion of battery, injury, or death if peripherals are soldered or connected incorrectly.

The “BATTERY-IN” voltage is supplied to the “BATTERY DISTRIBUTION” connectors labeled J7, J8, J9 and J10 in Fig. 5.

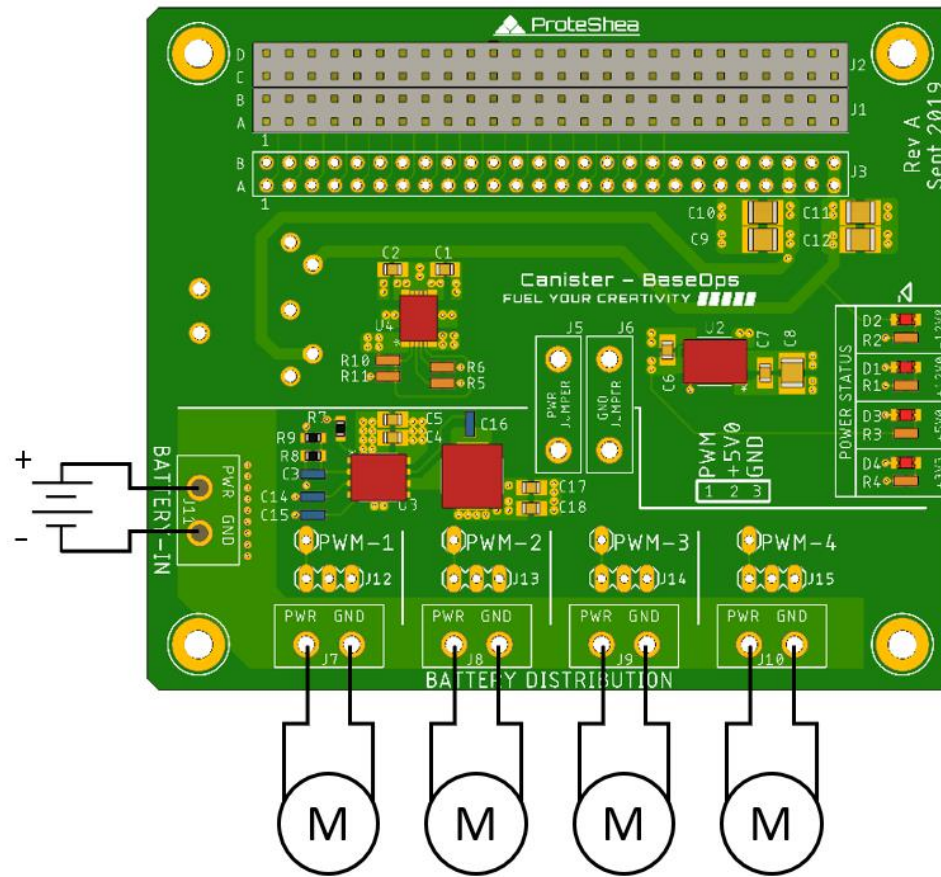


Figure 6. Battery Distribution Example.

Figure 6 shows an example application in which a battery connected to J11 provides power to motors on J7, J8, J9, and J10.

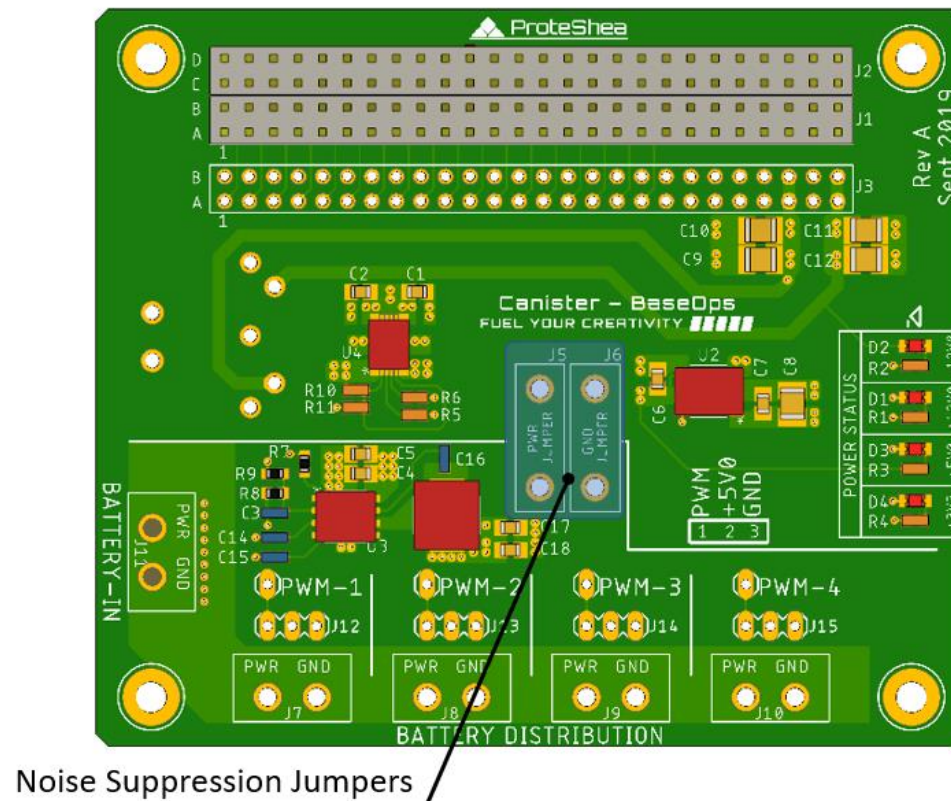


Figure 7. Jumpers to Minimize Noise.

Designators J5 and J6 are used for single-point power and ground connections, illustrated in Fig. 7, to minimize noise that can be coupled into the rest of your board stack due to the high-current loads from multiple motors. These jumpers can be removed if you need to have the battery power and battery load isolated from the system. The jumper labeled “PWR JUMPER” will connect +5V0 (regulated down from “BATTERY-IN” to connectors J1, J2, and header J3).

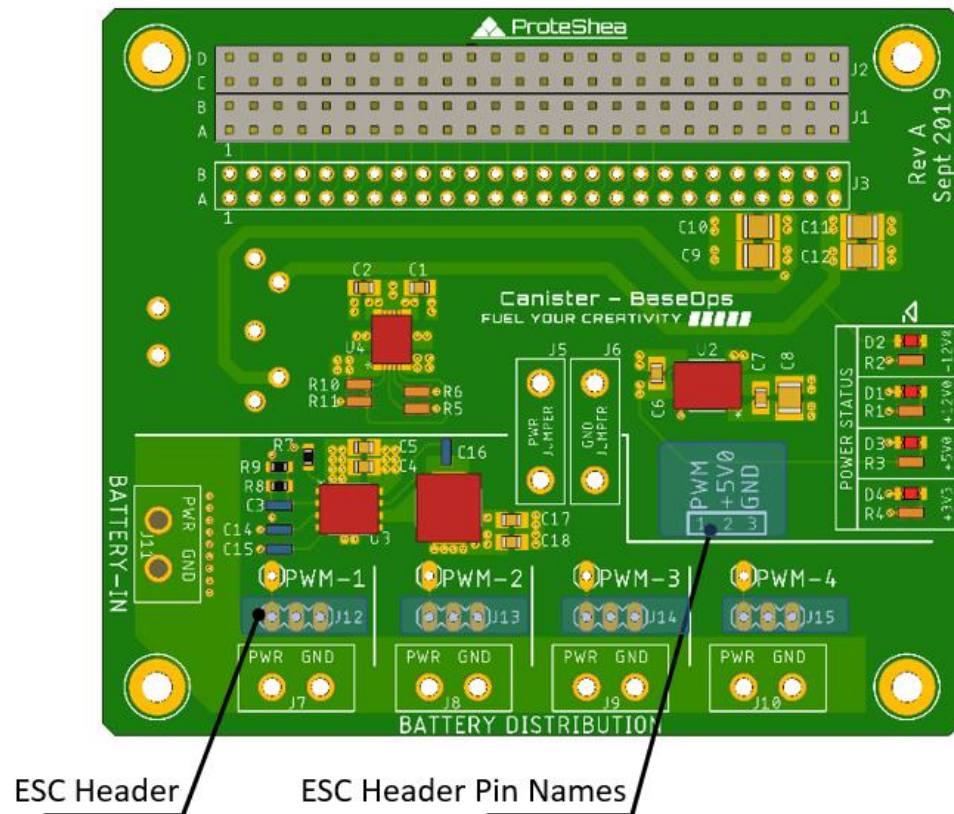


Figure 8. PWM Description.

Figure 8 shows the location of the electronic speed controller (ESC) pins which are labeled according to the uppermost blue box. +5V0 is output from headers J12, J13, J14, and J15. The “PWM” net of J12, J13, J14, and J15 are routed to “PWM-1”, “PWM-2”, “PWM-3”, and “PWM-4”, respectively. This allows the PWM signals to be wire wrapped to the J3 header as shown in Fig. 3.



ELECTRIC SHOCK WARNING: Plugging in additional Canisters to the BaseOps board improperly could pose a potential risk of fire, damage, electric shock, or injury. Ensure that the canisters are stacked according to Fig. 9 in which pin A1 of all canisters line up.

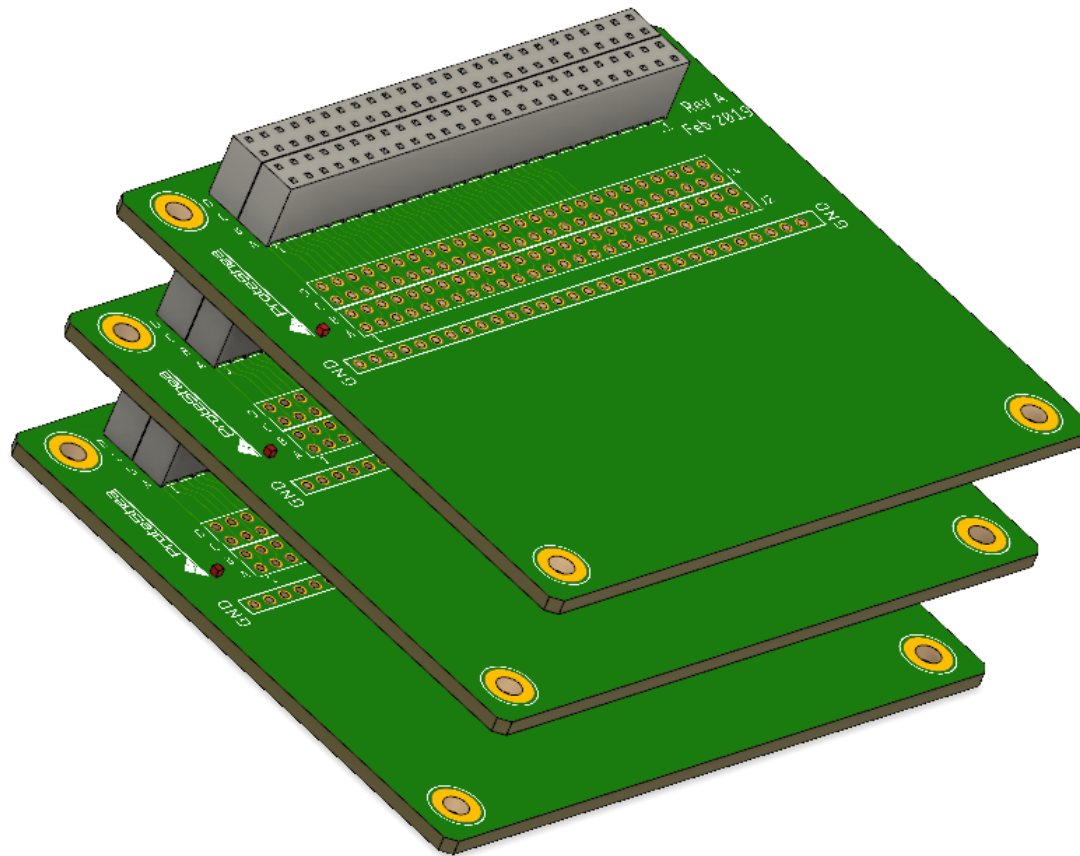


Figure 9. Example Canister Stack.

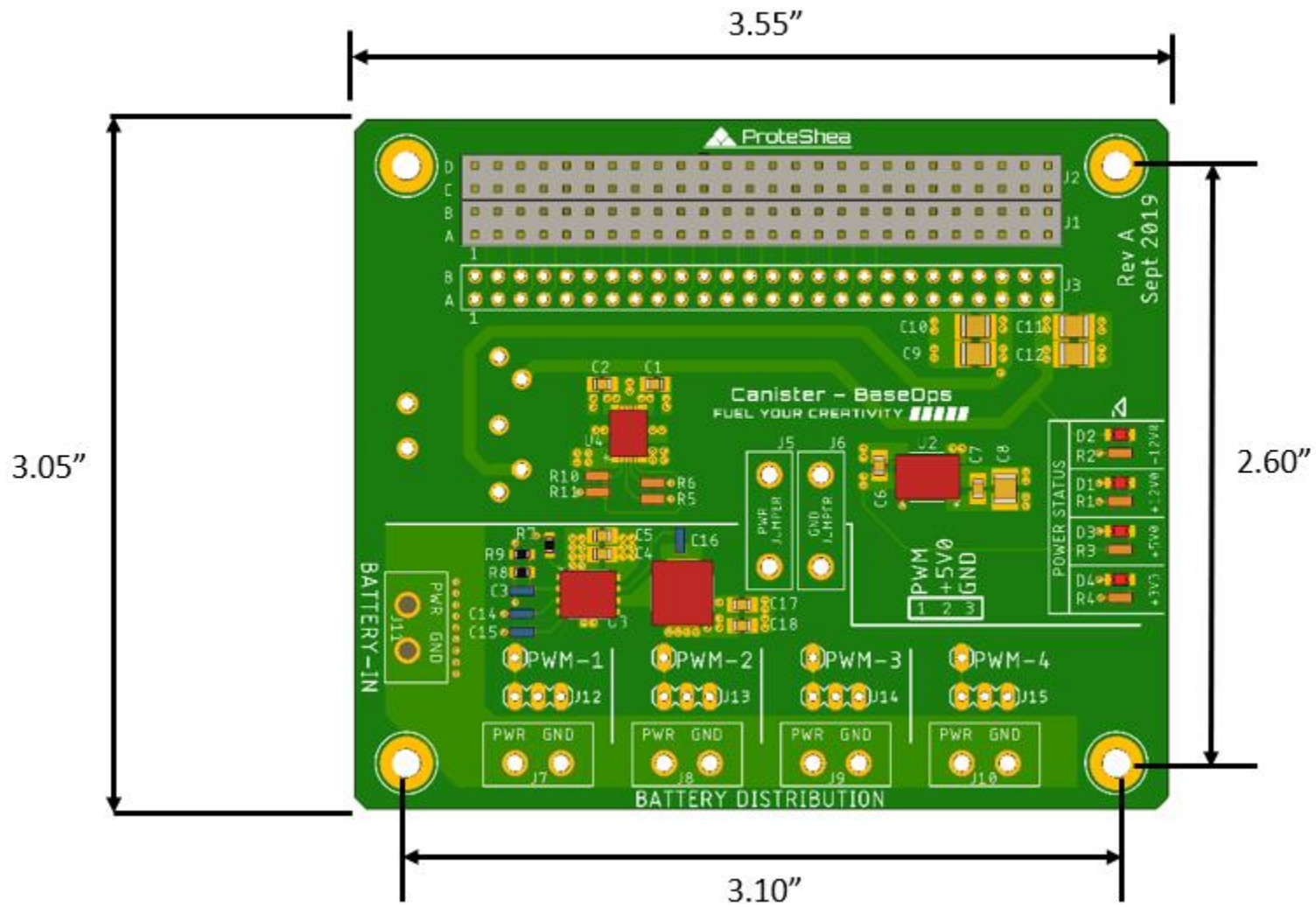


Figure 10. BaseOps™ Dimensions.

H. INSTALLATION

Visit us at <https://proteshea.com/canisters> to find up-to-date information and how-to videos for this Canister.

Follow the steps below for first-time operation of the Canister:



ELECTRIC SHOCK WARNING: Never use BaseOps with a damaged AC-DC Adapter, power cable, or battery. There is a potential danger of fatal electric shock.

Never plug in a Canister while BaseOps is powered. There is a potential danger of fatal electric shock.



WARNING: Do not apply excessive force when plugging in a Canister to BaseOps since this could damage the connector pins.



ESD CAUTION

1. Inspect AC-DC Adapter, power cables, and battery to ensure there are no cuts, defects, or other damages. Do not proceed if any damage is found.
2. Inspect canister stack to ensure there are no visible short circuits or damage. Do not proceed if any short circuits or damage is found.
3. Use Table 4 to properly use the GPIO (general purpose input output) and power pins on the 4x26-pin connector.
4. Use figures 2 and 3 to wire wrap the pins of PWM-1, PWM-2, PWM-3, and PWM-4 to header J3. Refer to Fig. 2 for a description of the 1-to-1 link to determine which pins on the J3 header to wire wrap to. Fig. 3 is used for reference but can be wire wrapped differently depending on user configuration and canister stack.
5. Properly install peripherals to the “BATTERY DISTRIBUTION” (labeled J7, J8, J9, and J10) and ESC connectors (labeled J12, J13, J14, and J15).
6. Use Fig. 9 above to correctly connect additional Canisters with BaseOps by aligning pin A1 on both boards.
7. Plug in AC/DC adapter or battery, if applicable. See Tables 5-7 to determine which power supply you will need.

I. REMOVAL

Follow the steps below for removal of Canisters from BaseOps:



ELECTRIC SHOCK WARNING: Never use BaseOps with a damaged AC-DC Adapter, power cable, or battery. There is a potential danger of fatal electric shock.

Never plug in a Canister while BaseOps is powered. There is a potential danger of fatal electric shock.



WARNING: Do not apply excessive force when removing a Canister from BaseOps since this could damage the connector pins.



ESD CAUTION

1. Unplug BaseOps' AC-DC Adapter and battery pack to power down the voltage supplies to the Canister stack.
2. Use two hands and apply even pressure on both sides of the Canister (areas marked in red in Fig. 11) to pull the board vertically out of the BaseOps board.

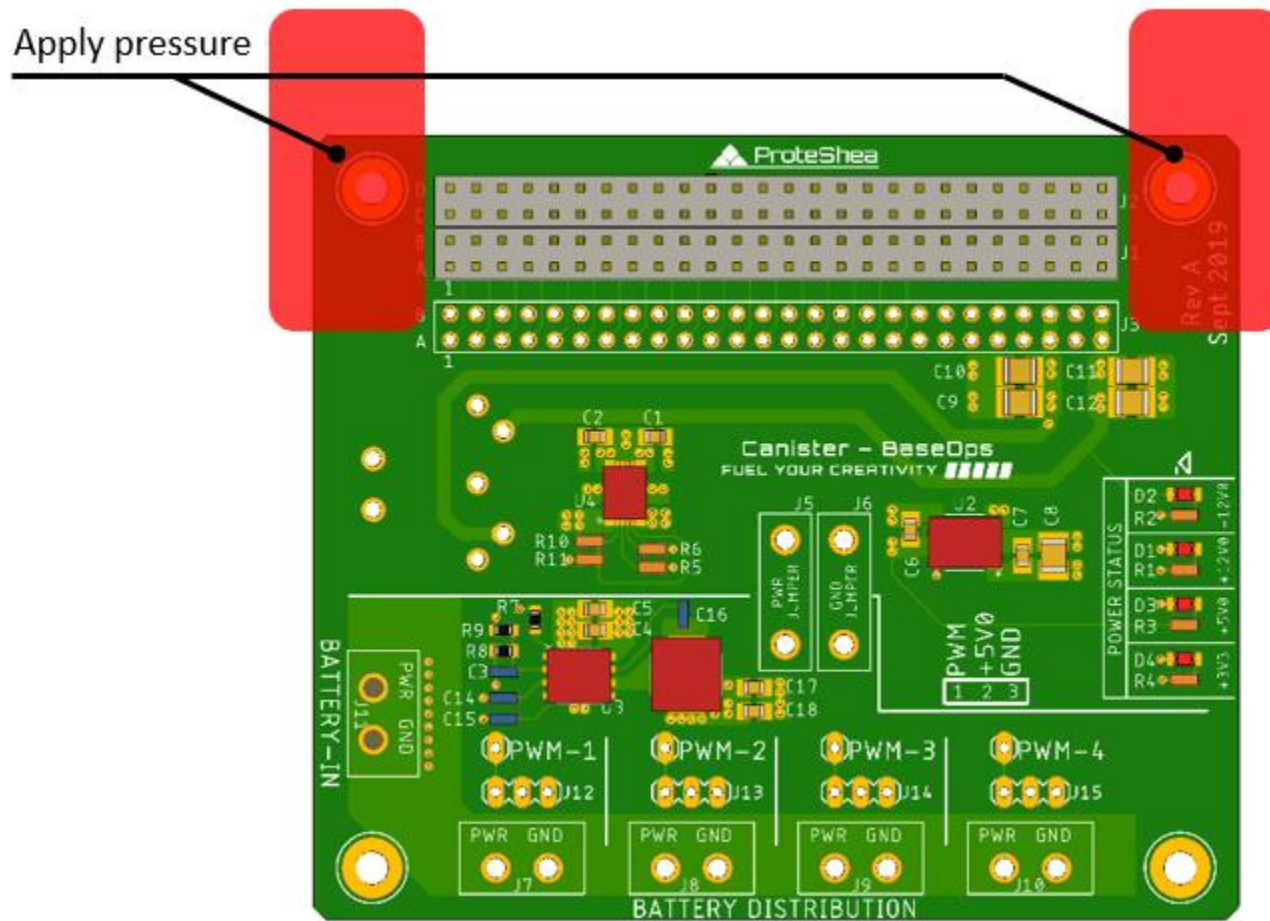


Figure 11. Areas to Apply Pressure for Installation or Removal.

J. OPERATION

Follow the steps below for operation of the Canister:



ELECTRIC SHOCK WARNING: Never use BaseOps with a damaged AC-DC Adapter, power cable, or battery. There is a potential danger of fatal electric shock.

Never plug in a Canister while BaseOps is powered. There is a potential danger of fatal electric shock.



ESD CAUTION

1. Inspect AC-DC Adapter, power cables, and battery to ensure there are no cuts, defects, or other damages. Do not proceed if any damage is found.
2. Inspect canister stack to ensure there are no visible short circuits or damage. Do not proceed if any short circuits or damage is found.
3. Use the power status LEDs to monitor the operation of BaseOps.

K. MAINTENANCE

To ensure the longevity of your Canister, take proper precautions as listed below:

- Use two hands and apply even pressure to carefully plug-in or remove the Canister
- Inspect soldered wires for damage which could lead to potential short-circuits
- Store the Canister in a cool, dry place.
- Use only for intended purposes – see **INTENDED USES** section.

L. TROUBLESHOOTING

Problem	Cause	Solution
No power to Canister	AC-DC adapter shutdown voltage rails due to circuit protection	Unplug power and check for shorts between 4x26-pin connector of Canister and development board
Power regulator is overheating	Not enough copper or vias to dissipate heat	Add small DC fan or heat sync to top of component
	Current draw to load is too high	Decrease amount of load on regulator

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N. CONTACT INFORMATION

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Please send us your feedback and/or concerns by visiting <https://proteshea.com/contact/> or via email at support@proteshea.com

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