Tode-SIOST

Hardware Development

Tode Side-IO Screw Terminals [#SIOST]

by TGit-Tech [http://www.tgit-tech.com]

Build Version: 21C9 / Last Updated: 2021-12-09

Table of Contents

1. Introduction

- ✔ The Tode Project is a Universal Platform of...
  - Face - UI Options
  - Tode – Backplane with optional Radio & Arduino Micro-Controller
  - Extensions - IO Interfaces, Battery Trays

Face Options (User Interface)		
Model	**Components**	**Resources**
#TFT18KB6	1.8" TFT LCD Color Screen (6) Key keypad	Design Files https://github.com/TGit-Tech/Tode-RC
#COVER	A Cover Only	*Not available at this time*

Tode Models *(post-fix RC=Remote/Radio Control equipped)*		
Model	**Components**	**Resources**
Tode #AMP	Arduino Mega Pro (AtMega2560)	*Not available at this time*
Tode-RC #AMPE32T30	Arduino Mega Pro (AtMega2560) Ebyte E32-433T30D Radio (1W/30dbm)	Design Files https://github.com/TGit-Tech/Tode-RC Firmware https://github.com/TGit-Tech/Tode-RC-Firmware
Tode-RC #AMPE32T20	Arduino Mega Pro (AtMega2560) Ebyte E32-433T20D Radio (250mW/20dbm)	*Not available at this time*
Tode-RC #AMPXBEE	Arduino Mega Pro (AtMega2560) Digi Xbee Radio	*Not available at this time*

SIO Stations (*Input/Output by Todes Side-IO [SIO] plug*)		
Model	**Components**	**Resources**
#SIOST	Screw Terminals	Design Files https://github.com/TGit-Tech/Tode-SIOST
#SIOAP	Aviation Plugs	*Not available at this time*

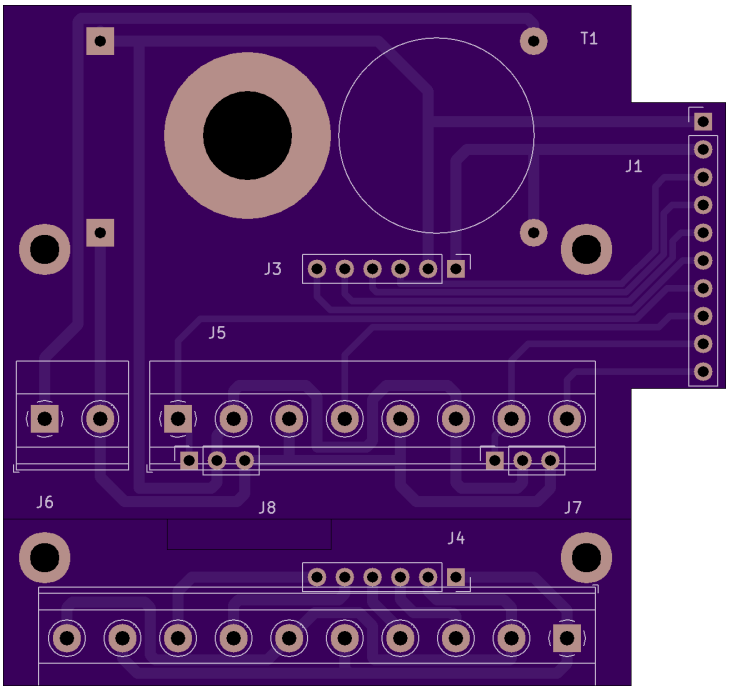
https://github.com/TGit-Tech/Tode-RC

✔ See the “Tode General Hardware Development” document for required tools

2. Bill of Materials (BOM) $14

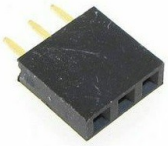
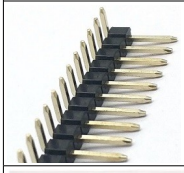
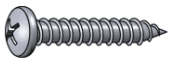
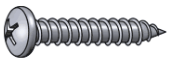
2.1 Parts $7

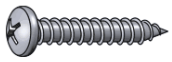
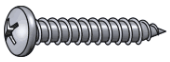
- ✔ LM2596 DC-DC Step Down Power Supply Module
  - Power In: 3Vdc to 35Vdc
  - Power Out: 1.5Vdc to 35Vdc (adjustable)
  - Load Amps: 2A to 3A (10W)
  - Dimensions: 44mm x 22mm x 12mm (high)
  - Temp Rng: -40C to 85C
  - Pricing: ~ $0.50/each
  - https://www.aliexpress.com/item/32668330319.html



- ✔ SideIO #SIOST PCB
  - Manufacturer: Oshpark.com
  - Pricing: $6.38/ea
  - Batch Price: $127.60 per 20

2.2 Supplies $3

	QTY: **(2) 1x3P Female Pin Headers** Dupont 2.54mm-Pitch *For Relay Plug-In* @$0.10/ea = $0.20		QTY: **(10) 1x2P Screw Terminal** 5.08mm Pitch @$0.10/ea = $1.00
	QTY: **(1) 1x10P 90º Male Pin Header** Dupont 2.54mm-pitch *For Side-IO Plug* @$0.10/ea = $0.10		QTY: **(1/2-Sheet) Adhesive Shipping Label** @$0.04/sheet = $0.02
	QTY: **(256 sq-in) Clear Craft Plastic** Grafix Clear Craft Plastic 0.02 thick *For SIOST-Cover.stl Windows* 8" x 8" (Pack of 4) = $9.17 ($0.036/sq-in) Use ~9sq-in x $0.036 = $0.33		**GE-2708910 Clear Adhesive Silicone** 2.8oz Tube = $6.61 ($2.36/oz) Use ~0.1oz x $2.36/oz = $0.24
	QTY **(2) #2 x 1/4" Sheet Metal Screws.** *For SIOST-KBHood.stl* $0.05/ea = $0.10		QTY **(3) #2 x 5/8" Sheet Metal Screws.** *For SIOST-KBCover.stl & SIOST-Cover.stl* $0.05/ea = $0.15

	QTY **(2) #4 x 1/2" Sheet Metal Screws.** *For SIOST-CableEntry.stl* $0.05/ea = $0.10		QTY **(2) #4 x 5/8" Sheet Metal Screws.** *For SIOST-CableEntry.stl* $0.05/ea = $0.10
	QTY: **(2) #2-56 x 1" Machine Screws.** *For PSCover, Screw-Terminal Stack* @$0.05/ea = $0.10		

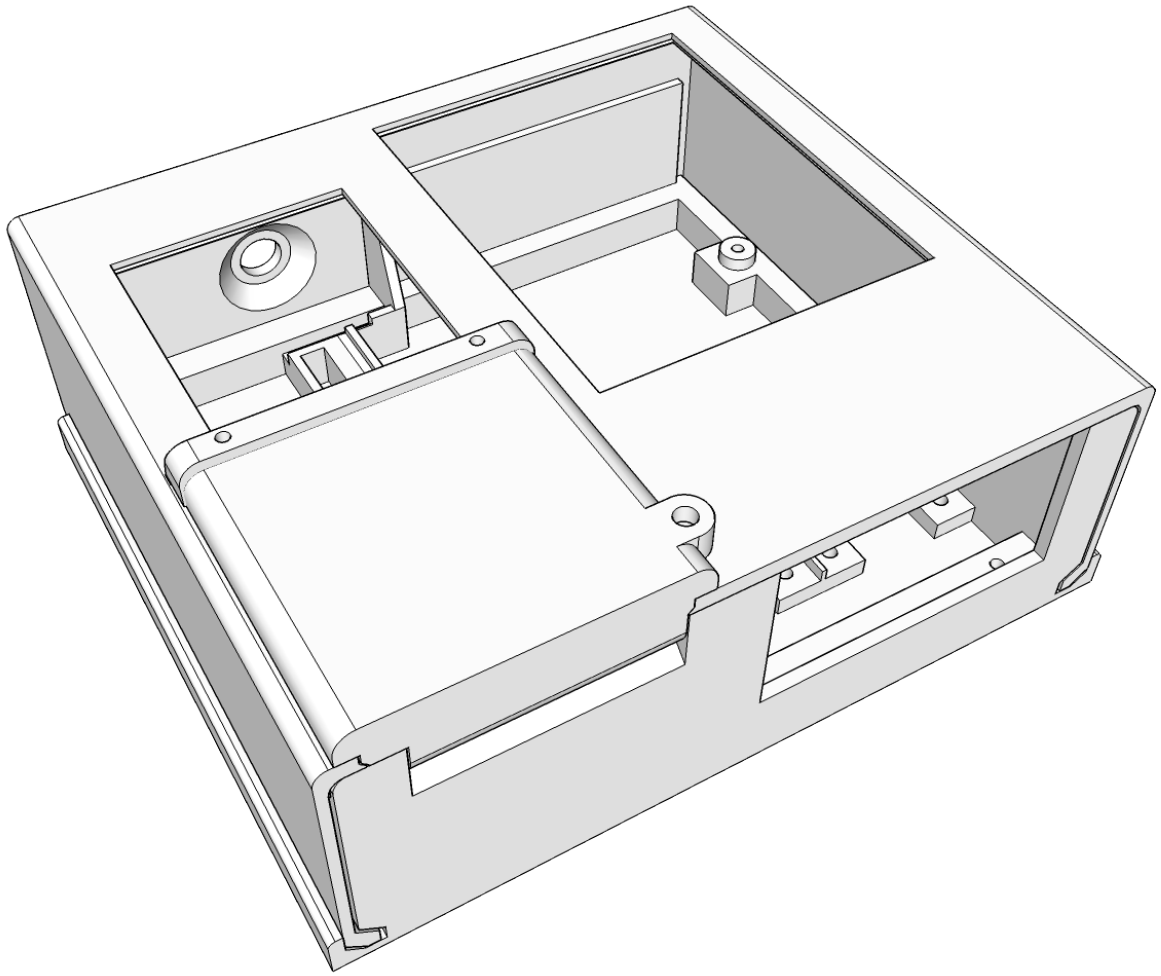
3. 3D-Prints $3

✔ 3D Print the Following Files in Folder: /3DPrints/stl

QTY	File Name	Grams	Cost $0.02/g	Time	Power & Use $0.01/hr	Total Cost
1	SIOST-Base.stl	60-grams	$1.14	10h 59m	$0.04	$1.25
1	SIOST-Standoff.stl	5-grams	$0.10	54m	$0.01	$0.12
1	SIOST-PSCover.stl	4-grams	$0.08	40m	$0.01	$0.10
1	SIOST-KBCover.stl	8-grams	$0.12	1h 21m	$0.01	$0.14
1	SIOST-KBHood.stl	2-grams	$0.04	0h 20m	$0.01	$0.05
1	SIOST-Cover.stl	40-grams	$0.82	5h 35m	$0.03	$0.90
1	SIOST-CableEntry.stl	12-grams	$0.24	1h 30m	$0.01	$0.26
4	SIOST-CablePlug.stl	1-gram	$0.08	6m	$0.01	$0.09

- Pricing at $20/per 1KG Roll

Assembly Diagram



4. PCB Assembly

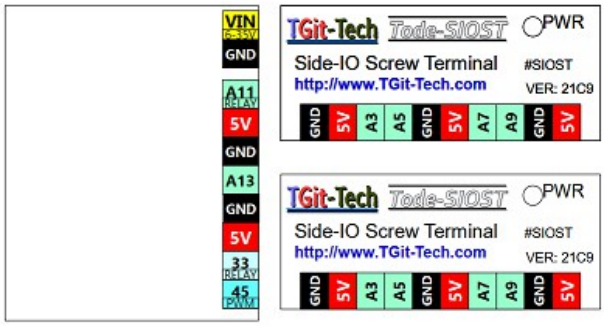
Printed Circuit Boards can be either ordered from a Custom PCB Manufacturer or created with a CNC Router.

- ✔ Custom Manufactured PCB
  - ○ Benefits - Custom PCB manufacturing is by far the better approach.
    - ▪ Copper through holes provide better connection
    - ▪ A Silk Sscreen for better corrosion resistance
    - ▪ Far easier to solder
  - ○ Common Custom Manufacturing Businesses
    - ▪ https://oshpark.com/
    - ▪ https://jlcpcb.com/
    - ▪ https://www.pcbway.com/orderonline.aspx
    - ▪ https://www.customcircuitboards.com/
    - ▪ https://custompcb.com/
- ✔ CNC Routed PCB
  - ○ Benefits
    - ▪ Generally cheaper by a couple dollars
    - ▪ Instant product (No shipping/manufacturing wait time)
    - ▪ Good for designing phases; not good for finished design production.

4.1 Preparation

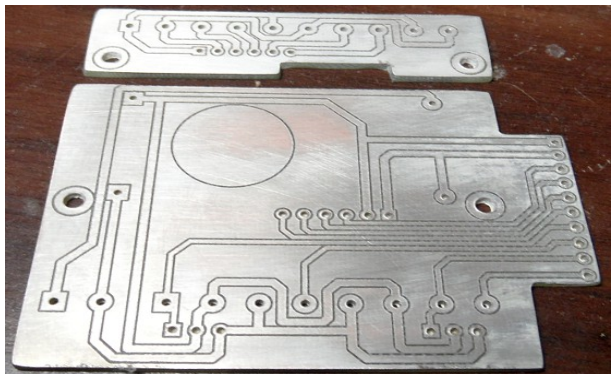
4.1.1 Print Stickers

- ✔ Printer – Color Laser
- ✔ Media - 1/2-Sheet Self-Adhesive Shipping Label Paper
- ✔ File
  - ○ FOLDER = /docs/
  - ○ FILE = Tode-SIOST Stickers.pdf



4.1.2 Obtain SIOST PCB(s)

- ✔ Purchase or Make the Design File at (2-pcs in one file)
  - ○ FOLDER = /kicad/SIOST/SIOST/output/
  - ○ GERBER FILE = SIOST-F_Cu.gbr
- ✔ CNC Routing
  - ○ CNC File = SIOST-F_Cu.gbr.nc
  - ○ CNC Settings: Z-Down: -0.045, Speed: 45mm/s
  - ○ CNC Isolation Bit = Pyramid 0.2mm Tip 45-deg
  - ○ Hole Sizes = 0.9mm, 1.0mm, 2.7mm (1.0 is plenty tight for ST)



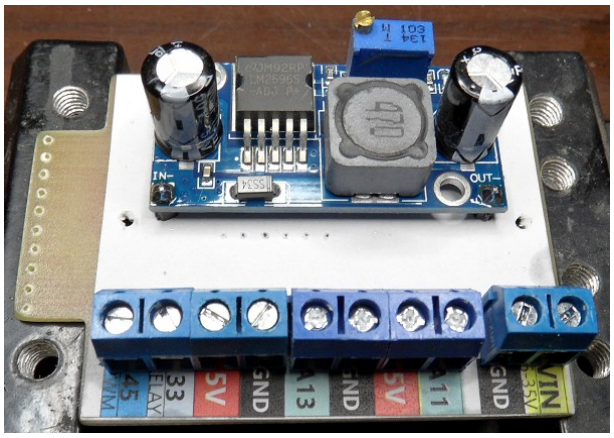
4.2 Assembly

4.2.1 Bottom-PCB Labels, Terminals & LM2596 Power Supply

1. Cut & Stick Terminal Label from the printed stickers sheet

2. Install and Solder the Left-8 and Right-2 Screw Terminals
   a) NOTE: The right 2 screw terminals are separated

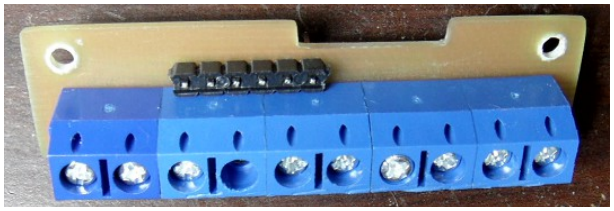
3. Install and Solder the LM2596 Power Supply Module
   a) Using (4) 1Pin Male Headers soldered on both ends.



4.2.2 Top-PCB Terminals & Pin-Header

4. Install & Solder 10 Merged Screw Terminals to the Top-PCB

5. Solder on a 6P Male Header from the back-side of the Top-PCB pushing the pins flush on the top (as shown).



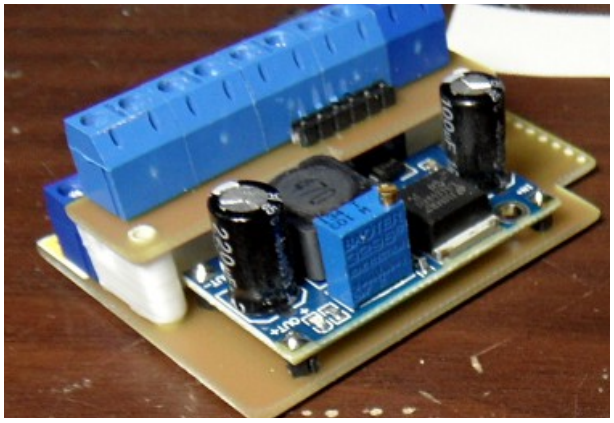
4.2.3 Header 6PF for Top-PCB

6. Plug a 6P Female Plug [6PF] onto the Top-PCB Male Header

7. Place the Top-PCB Standoff in front of the LM2596 Power Module.
   a) LOCATION = /3DPrints/stl
   b) FILE = SIOST-Standoff.stl

8. Place Top-PCB onto the Bottom-PCB with plug pins through holes

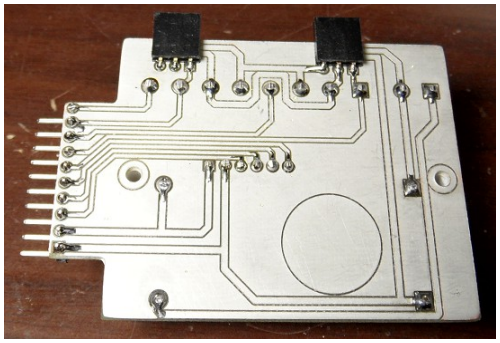
9. Solder the back-side of the Bottom-PCB at plug pins.



4.2.4 Headers (2)3PF for Relays & 10PM Angled Side-IO Header

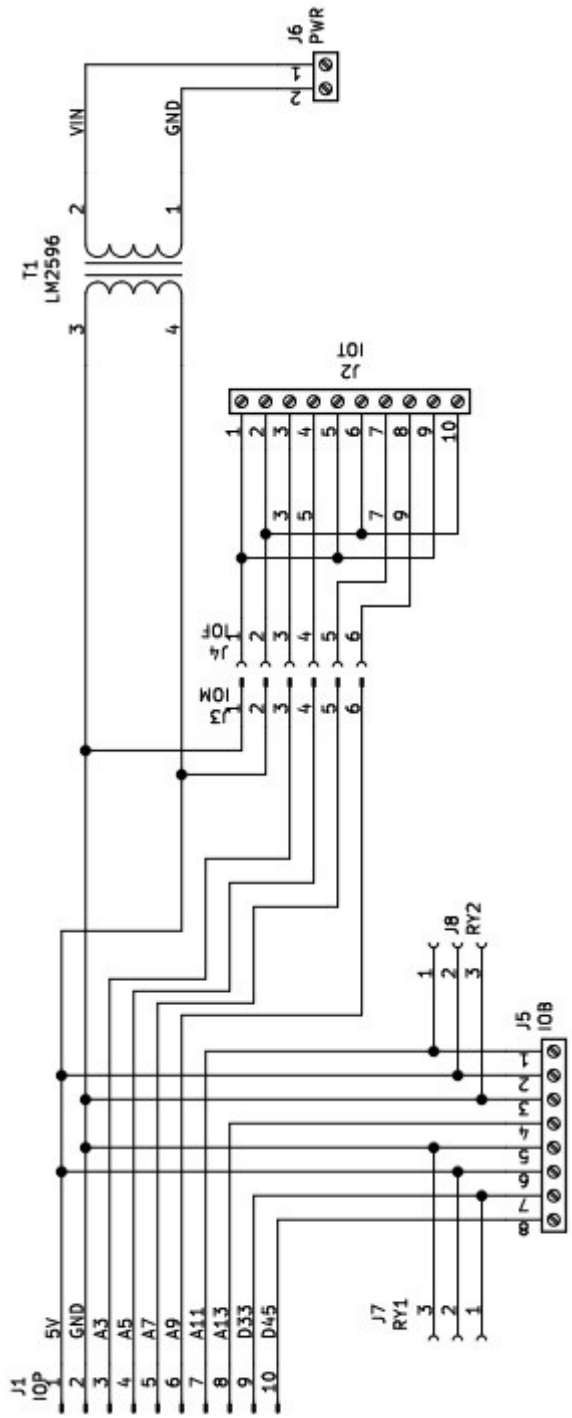
10. Install & Solder the Side-IO Plug using 90-Degree 10P Male Header as shown on the left.

11. With (2) 3P Female Headers bend pins to a 90-degree angle and solder to the backside of PCB as shown.

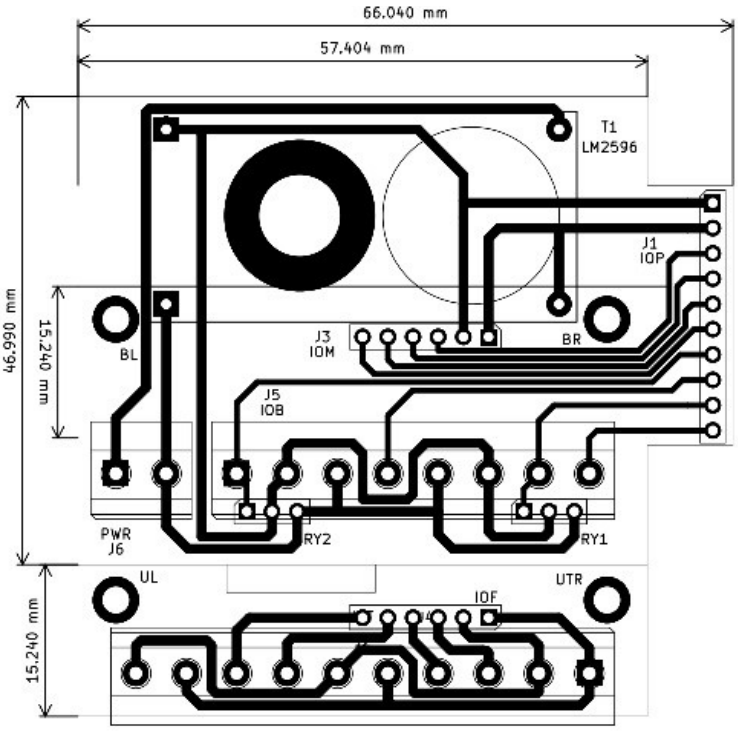


4.3 Schematic & Layout

SCHEMATIC



LAYOUT



T1	LM2596 DC-DC Power	
J1	IO-Plug	1x10P Male 90
J3	Top-PCB Plug-in	1x6P Female
J4	Top-PCB Plug-in	1x6P Male
J5	Screw Terminals	1x10 Screw Terminals
J6	1x2P Screw Terminals	
J7	Relay #1 Plug-In	1x3P Female PH
J8	Relay #2 Plug-In	1x3P Female PH

5. Final Assembly

5.1 Final Assembly Steps

5.1.1 Power Supply Module Cover

12. Cut & Stick PS Cover Label from the printed stickers sheet
    a) Stick to the SIOST-PSCover.stl Power Supply Cover

13. Cut out Top-Right Hole by "PWR" text and screw holes.

5.1.2 Power & Adjust the Power Supply Module

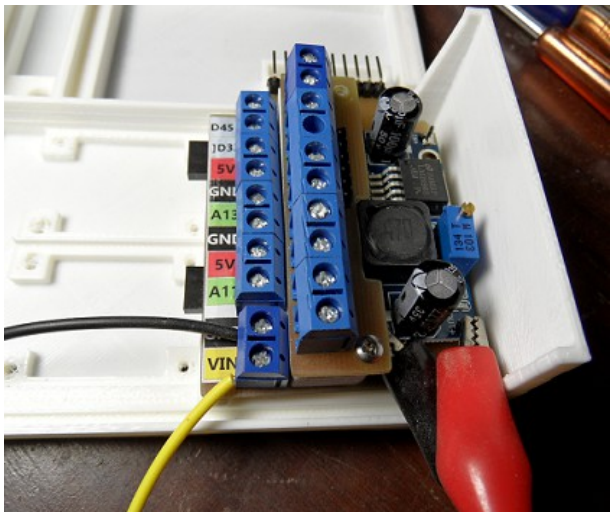
WARNING: Never Attach Tode until Power Supply is Set to 5Vdc

14. Wire-Up an adjustable DC Power Supply to VIN & GND

15. Attach a DMM Volt Meter to the Top two pins of the Side-IO Plug.

16. Turn on adjustable DC Power Supply (Be sure not set over 35Vdc)
    a) Adjust the Blue-Pot till **Voltage Out is ~4.98Vdc**
    b) Check ~5Vdc is maintained while Voltage in ranges 6V-35V

17. Apply Hot-Glue to Blue Pot to keep static.



5.1.3 Screw PCB-Assemblies into SIOST-Base

18. Stack from Bottom-to-Top the following pieces (as shown)
    a) Bottom-PCB
    b) Top-PCB Standoff
    c) Top-PCB
    d) Power Supply Cover

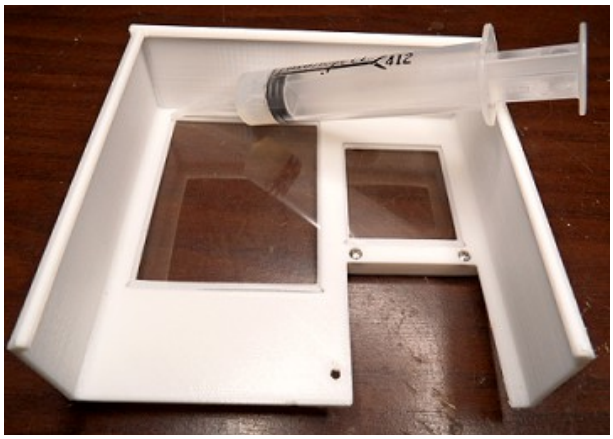
19. Fasten stack to SIOST-Base using **(2) #2-56 x 1"** Machine Screws.

5.1.4 Install Cover Window Plastic

- ✔ Cut (2) Clear Plastic squares
  - **38mm x 42mm** for Tode-Display Window
  - **56.5mm x 70mm** for IO-Screw Terminals Window
- ✔ Trim to Fit
  - Slide each into the SIOST-Cover.stl Case in appropriate spots
  - Trim with scissors for precise fit.
- ✔ Seal Seams with Clear Adhesive Silicone
  - Using a MonoJet 412 syringe suck up adhesive
  - Them apply to inner seam conservatively (No finger spread)

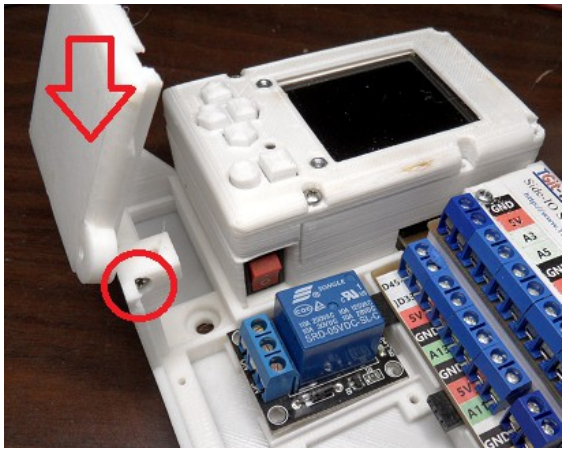
5.1.5 Install KBHood

- ✔ Fasten KBHood using **(2) #2 – 1/4"** Sheet Metal Screws
  - Attach SIOST-KBHood.stl to face with grooves meshed
  - Tigthen the screws; make sure screw tops are flush with inner face.



5.1.6 Install KBCover, Tode & Relays (Optional)

- ✔ Fasten KBCover using **(2) #2 – 5/8"** Sheet Metal Screws
  - Place KB Cover as shown and Left and Right screws holes (in red)
  - Tighten screws just enough to allow a tight flipping of KBCover.
- ✔ Plug a Tode into the SIOST as shown.
- ✔ Attach Relays (optional) as shown.



5.1.7 Install SIOST-Cover

- ✔ Slide the SIOST-Cover with Windows from top down as shown.
  - The SIOST-Cover Back edges should slide down in slots of Base
- ✔ Fasten with **(1) #2-5/8"** Sheet Metal Screw (shown half in @middle)
  - NOTE: This screw can be used to keep the KBCover closed by screwing it through the KBCover after closed.
- ✔ Screw in the Antenna to the Tode-RC.
- ✔ Include Cable Entry Brackets and Plugs with Assembly