2017
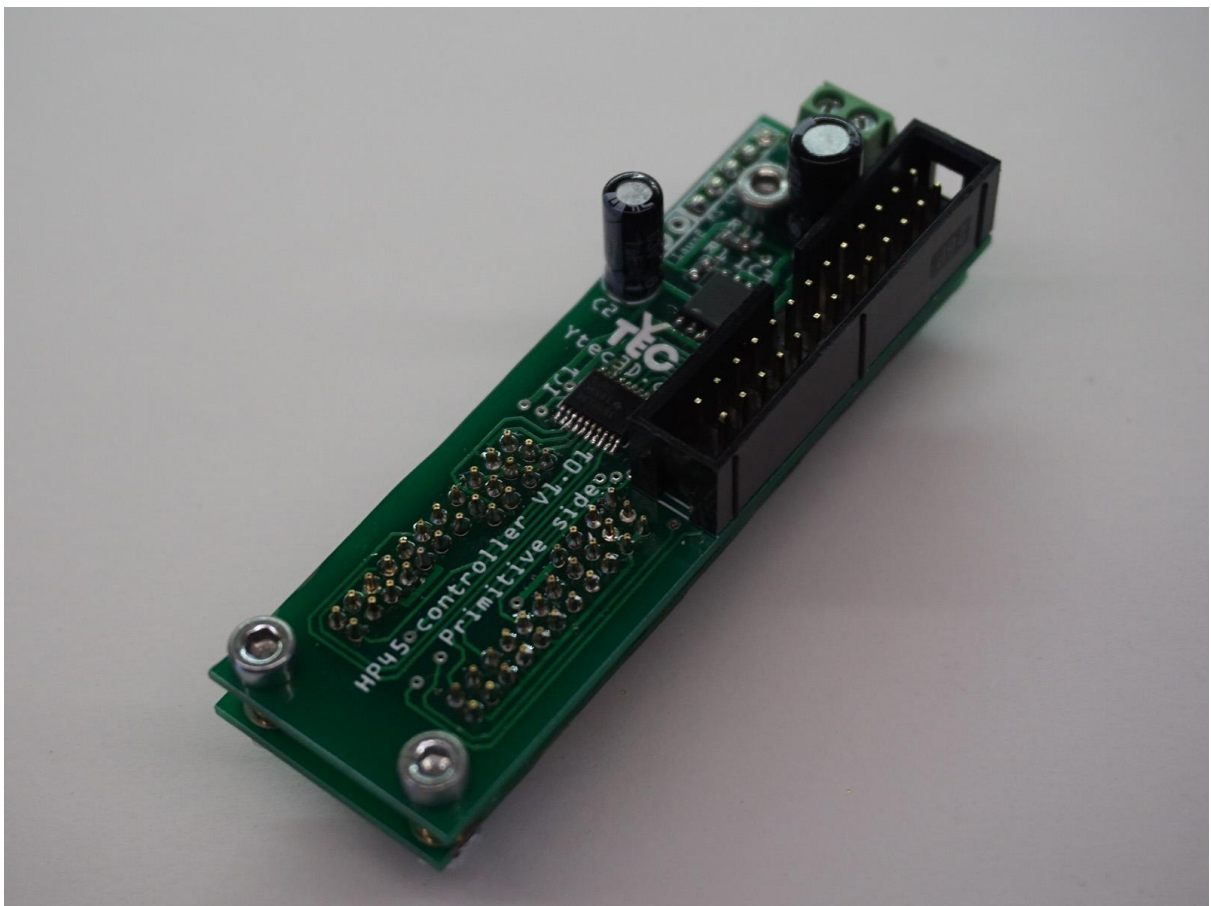
Ytec3D.com

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[HP45 CONTROLLER V1.01 ASSEMBLY]

How to assemble the HP45 controller V1.01 and printhead carrier

Table of Contents

Introduction

In this assembly guide I try to show how to assemble the HP45 controller V1.01 and its carrier. While this is not the simplest kit to assemble with a few hours and some experience in SMD soldering it should be possible to assemble. How to operate the HP45 controller after assembly is described in a different manual.

If there are questions left at the end of this document, you can visit the contact form on Ytec3D.com or mail directly to info@ytec3d.com.
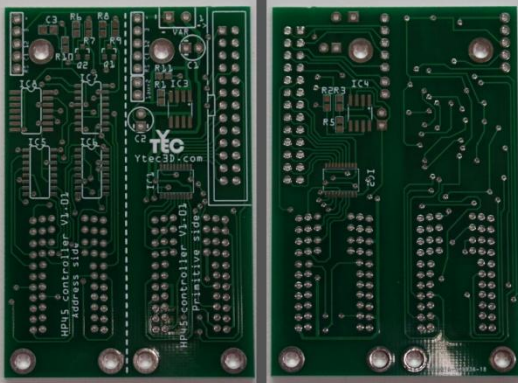
PCB assembly

Before you start

This controller has parts that are quite difficult to solder by hand and is not intended for beginners. It is not really for anyone that has little to no experience with soldering SMD components. If you are not completely sure about your soldering skills, this controller might be too difficult.
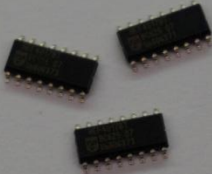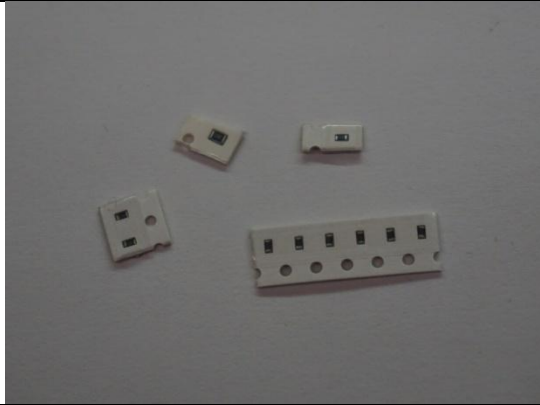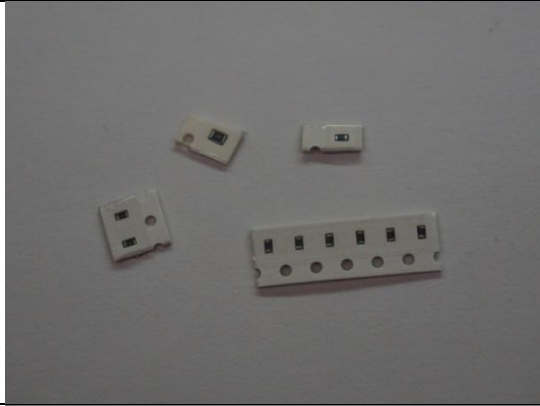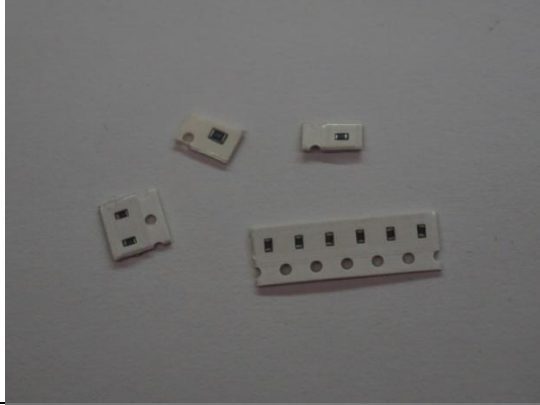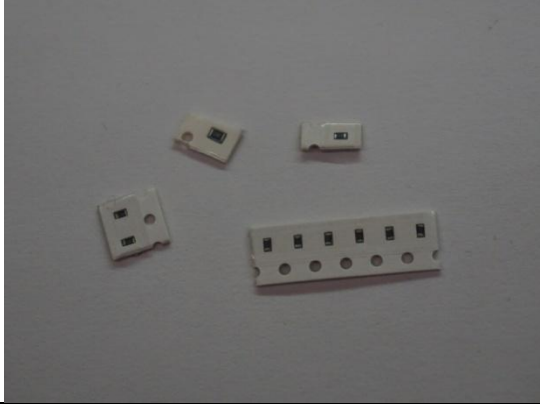
Tools required

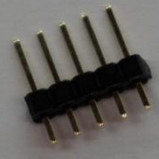To assemble the HP45 controller you will need the following tools:

- Soldering iron with a fine SMD tip;
- Fine (<0.5mm) resin core solder;
- flush cutters;
- Metal saw;
- Files;
- (optional, Dremel with a narrow cutting wheel);
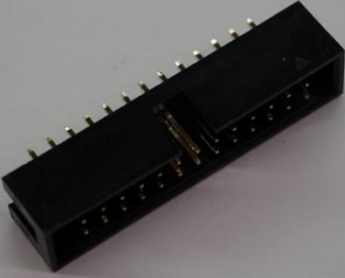- (optional, 3D printer with 0.25mm nozzle for the pogo pin template);

Bill of materials

Name:	HP45 controller V1.01 PCB
Quantity:	1
Part number:	-
Package:	-
Supplier:	Ytec3D.com
Link:	-
Note:	

Name:	Pogo pin 0.68mm 16mm long
Quantity	52
Part number:	-
Package:	-
Supplier:	Ebay
Link:	http://www.ebay.com/itm/100pcs-P50-J1-Dia-0-68mm-Length-16mm-75g-Spring-Test-Probe-Pogo-Pin-Receptacle-/151785406493?hash=item23571d801d:g:iAkAAOSwIgNXl3Mt
Note:	Round head, buy more in case there are damaged pins.

Name:	TLC59213
Quantity:	2
Part number:	595-TLC59213AIPWR
Package:	TSSOP-20
Supplier:	Mouser
Link:	http://mouser.com/Search/ProductDetail.aspx?R=TLC59213AIPWRvirtualkey59500000virtualkey595-TLC59213AIPWR
Note:	

Name:	LM311
Quantity:	1
Part number:	863-LM311DR2G
Package:	SOIC-8
Supplier:	Mouser
Link:	http://mouser.com/Search/ProductDetail.aspx?R=LM311DR2Gvirtualkey58410000virtualkey863-LM311DR2G
Note:	

	Name:	SIRA12DP-T1-GE3
	Quantity:	1
	Part number:	78-SIRA12DP-T1-GE3
	Package:	SOIC-8
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Vishay-Semiconductors/SIRA12DP-T1-GE3/?qs=sGAEpiMZZMshyDBzk1%2fWi34%252bjiTX84hXNsjfRHjG4Os%3d
	Note:	
	Name:	HEF4017
	Quantity:	3
	Part number:	771-HEF4017BTD
	Package:	SO-16
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/NXP-Semiconductors/HEF4017BT652/?qs=sGAEpiMZZMutXGli8Ay4kDE4J8KCiPsFLWWSlq0qOaw%3d
	Note:	
	Name:	HCF4081
	Quantity:	1
	Part number:	511-4081BM-TR
	Package:	SOP-14
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/STMicroelectronics/HCF4081M013TR/?qs=%2fha2pyFaduiKwCFISZSFJLLSk1wqERWB2u%2fKE7DcyVY%3d
	Note:	
	Name:	DMG2302UK-7
	Quantity:	2
	Part number:	621-DMG2302UK-7
	Package:	SOT-23-3
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Diodes-Incorporated/DMG2302UK-7/?qs=sGAEpiMZZMshyDBzk1%2fWi8ItRWc04xxfkC1RM9bfNAr2kg0rvMh6TA%3d%3d
	Note:	Alternate part. Original part is IRLML2502PbF

	Name: 220Ω resistor 0.1W
	Quantity: 1
	Part number: 667-ERJ-3EKF2200V
	Package: 0603
	Supplier: Mouser
	Link: http://mouser.com/ProductDetail/Panasonic/ERJ-3EKF2200V/?qs=sGAEpiMZZMu61qfTUdNhG6gKAQVNBKOojXbh5RPUu0w%3d
	Note:
	Name: 1.2kΩ resistor 0.1W
	Quantity: 1
	Part number: 667-ERJ-3EKF1201V
	Package: 0603
	Supplier: Mouser
	Link: http://mouser.com/ProductDetail/Panasonic/ERJ-3EKF1201V/?qs=sGAEpiMZZMu61qfTUdNhG6gKAQVNBKOoTC0hNDHH3WI%3d
	Note:
	Name: 2.2kΩ resistor 0.1W
	Quantity: 6
	Part number: 667-ERJ-PA3F2201V
	Package: 0603
	Supplier: Mouser
	Link: http://mouser.com/ProductDetail/Panasonic/ERJ-PA3F2201V/?qs=sGAEpiMZZMu61qfTUdNhGwyN077O4KhFX9zrWTTJPlPrTO3Y9GhC2Q%3d%3d
	Note:
	Name: 10kΩ resistor 0.1W
	Quantity: 2
	Part number: 667-ERJ-3EKF1002V
	Package: 0603
	Supplier: Mouser
	Link: http://mouser.com/ProductDetail/Panasonic/ERJ-3EKF1002V/?qs=sGAEpiMZZMtlubZbdhIBIHcx2Q2RnT7KusLiC2u%2fTVc%3d
	Note:

	Name:	100nF ceramic capacitor
	Quantity:	1
	Part number:	81-GRM40X104K50L
	Package:	0805
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Murata-Electronics/GRM21BR71H104KA01L/?qs=sGAEpiMZZMs0AnBnWHyRQKf3b7LydMIhPJtWqHYP2rg%3d
	Note:	
	Name:	1µF 100V electrolytic capacitor
	Quantity:	1
	Part number:	598-105CKE100M
	Package:	5x11mm
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Illinois-Capacitor-CDE/105CKE100M/?qs=sGAEpiMZZMtZ1n0r9vR22fPWwtj8kO8aGTdhkAsuCM5vYvIsVJPtRg%3d%3d
	Note:	Voltages as low as 16V permitted.
	Name:	100µF 16V electrolytic capacitor
	Quantity:	1
	Part number:	667-ECA-1CM101I
	Package:	5x11mm
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Panasonic/ECA-1CM101I/?qs=sGAEpiMZZMsh%252b1woXyUXj7WOPB%2fJZkV%252b0wpmeZSiF8c%3d
	Note:	Higher capacitance allowed as long as it is 5mm diameter.
	Name:	2.54mm pin header, 5 pins
	Quantity:	1
	Part number:	653-XG8V-0831
	Package:	-
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Omron-Electronics/XG8V-0831/?qs=sGAEpiMZZMs%252bGHln7q6pm%252bv5BXf4QdrTUprKlfXrIZ0%3d
	Note:	Can be split.

	Name:	26 pin boxed header
	Quantity:	1
	Part number:	517-30326-6002
	Package:	-
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/3M-Electronic-Solutions-Division/30326-6002HB/?qs=sGAEpiMZZMs%252bGHln7q6pm67xkeHW1IZNYlL8VAGOtj8%3d
	Note:	
	Name:	Screw terminal, 2 position, 3.5mm
	Quantity:	1
	Part number:	651-1984617
	Package:	-
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Phoenix-Contact/1984617/?qs=sGAEpiMZZMvZTcaMAxB2AESRb0B7PLuENBlLLdAoFxM%3d
	Note:	
	Name:	standoff, 5mm for M3
	Quantity:	3
	Part number:	855-R30-6200514
	Package:	-
	Supplier:	Mouser
	Link:	http://mouser.com/ProductDetail/Harwin/R30-6200514/?qs=sGAEpiMZZMtrde5aJd3qw4L16p8RLiBxP8oCQaKYWd4%3d
	Note:	Can also be made by hand using brass or aluminium tube. Max OD 5mm.
	Name:	DIN912 cilinder screw M3x12mm
	Quantity:	3
	Part number:	
	Package:	
	Supplier:	
	Link:	
	Note:	Temporarily used to hold the controller together

	Name:	DIN934 M3 nut
	Quantity:	3
	Part number:	
	Package:	
	Supplier:	
	Link:	
	Note:	Temporarily used to hold the controller together
	Name:	Pin template
	Quantity:	1
	Part number:	-
	Package:	-
	Supplier:	Ytec3d
	Link:	-
	Note:	Optional, 3d printed. Used for mounting the pogo pins more accurately

Assembly

With the warnings out of the way, all parts gathered and the soldering iron heated, it is time to start assembling the controller.

1: The first step is to separate the 2 halves of the PCB. There is no scoring in the PCB, but there is a line where the PCB roughly needs to be cut. On this line the PCB can be cut with a knife, thin metal saw or Dremel with narrow cutting disc. As long as no traces are damaged with the cutting, it does not matter where you cut the board. When you have cut the boards, there are 2 sides. The primitive side and the address side. When this guide mentions up or front, it means with the primtive and address side text facing up. Down or back is the opposing side.

(Note: in future versions, the boards will come in 2 pre-cut sections. The first batch does not have this)
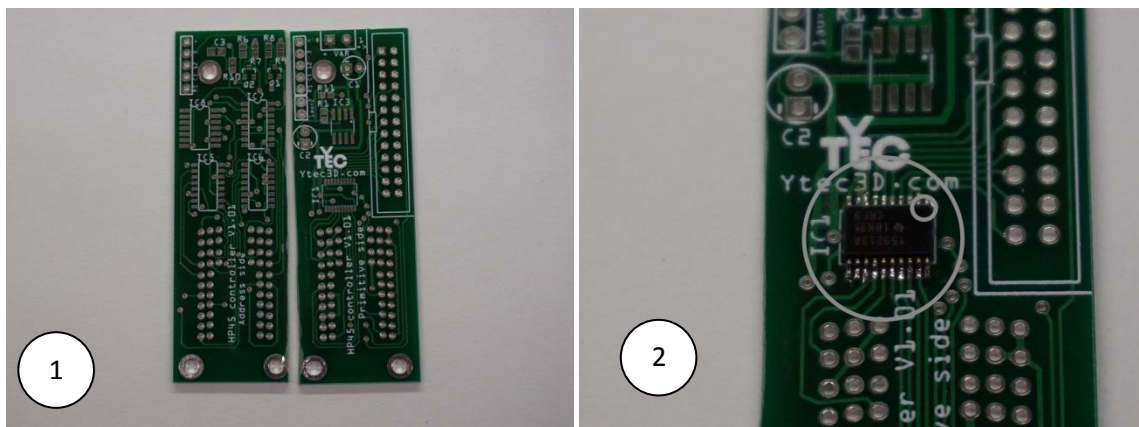

2: Solder the TLC59213 *(IC1)* on the front of the primitive side, with the marking facing towards the 26 pin boxed header connector. Be aware that the TLC has fine spacing and is difficult to solder by hand.

3: Solder the TLC59213 *(IC2)* on the back of the primitive side, with the marking facing the IC2 text. Be aware that the TLC has fine spacing and is difficult to solder by hand.
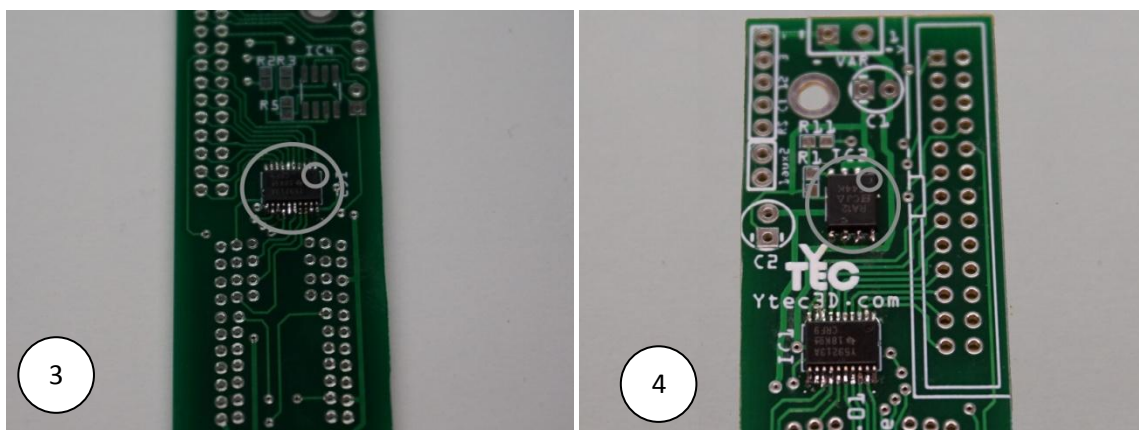


4: Solder the SIRA12DP-T1-GE3 *(IC3)* mosfet on the front of the primitive side with the marking facing the 26 pin boxed header. The pins on the SIRA are hard to reach with the solder, and require a bit of heat before the solder sticks to it.

**5:** Solder the LM311 *(IC4)* on the back of the primitive side with the marking away from the boxed header.
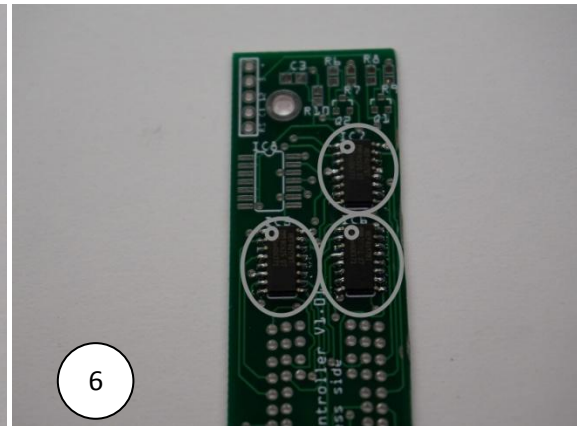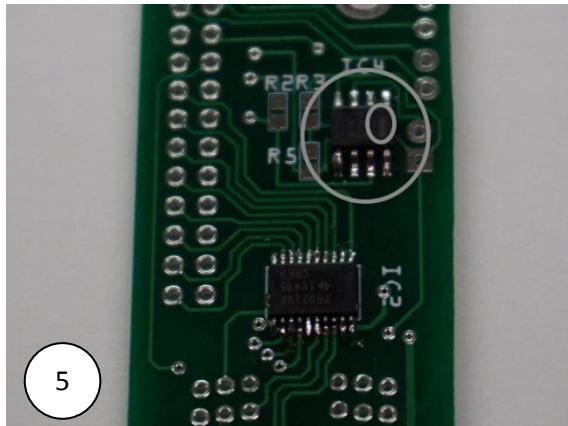
6: Solder 3x 4017 *(IC5, IC6, IC7)* on the front of the address side with the markings as shown in the image.

7: Solder the 4081 *(IC8)* on the front of the address side with the marking as shown in the image.
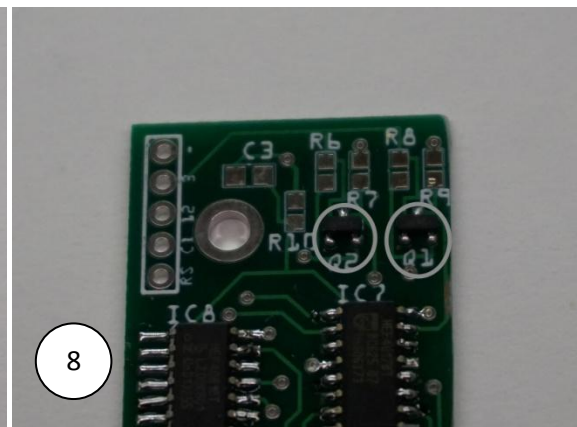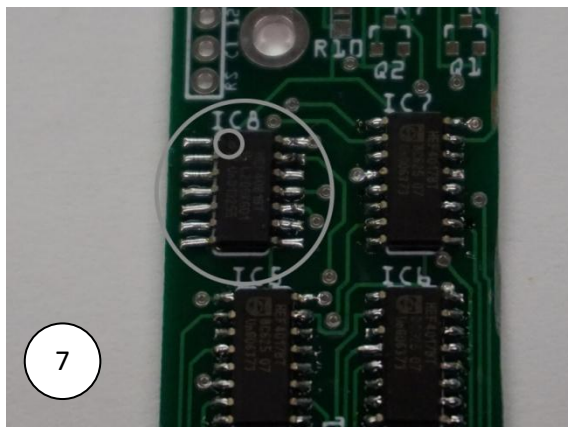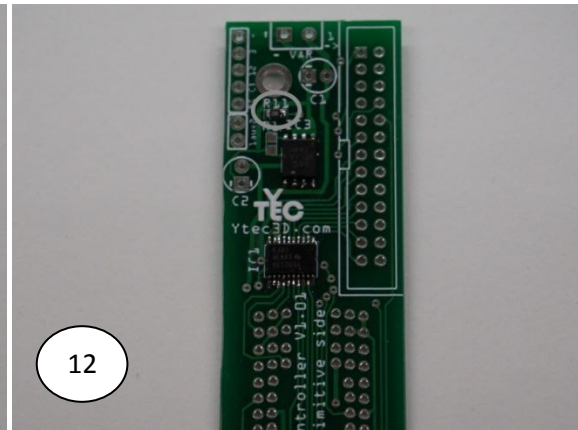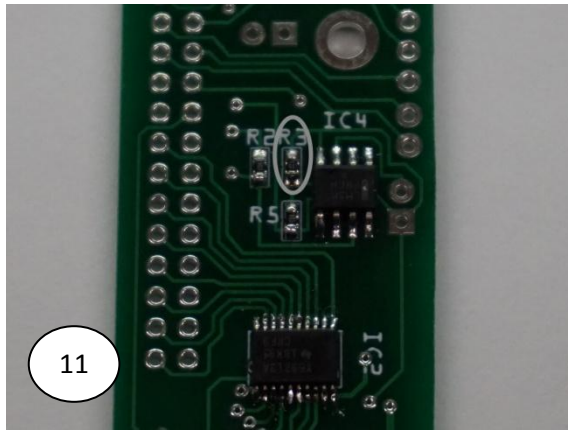

8: Solder the DMG2302UK-7 *(Q1, Q2)* or a similar mosfets on the front of the address side.

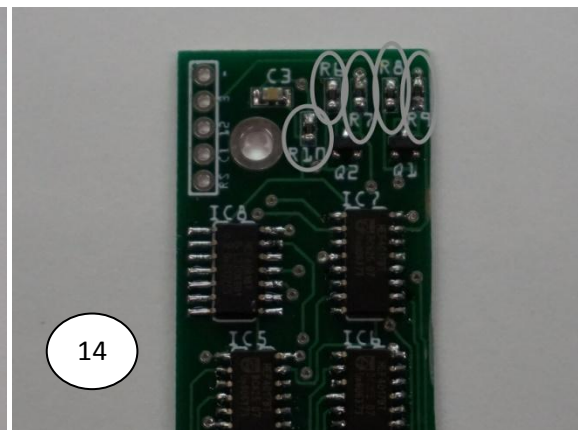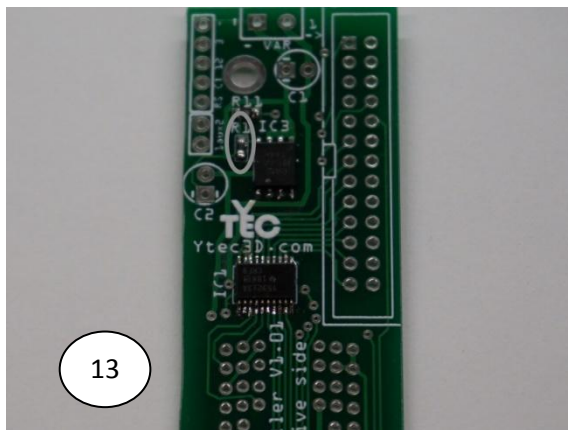**9:** Solder the 100nF capacitor *(C3)* on the front of the address side.
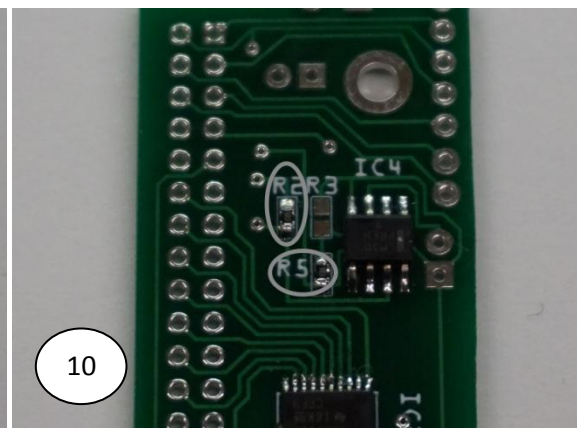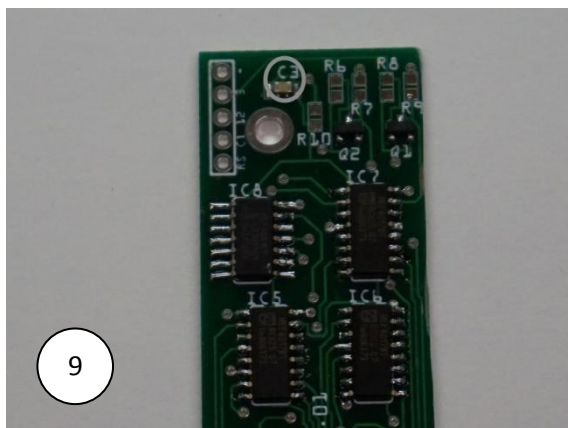
10: Solder 2x 10k resistor *(R2, R5)* on the back side of the primitive side.

11: Solder the 1.2k resistor *(R3)* on the back side of the primitive side.
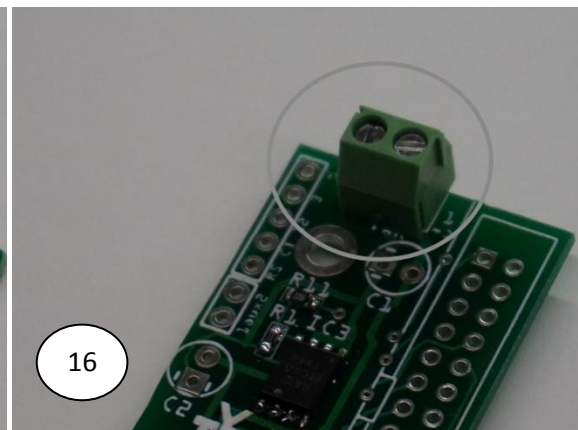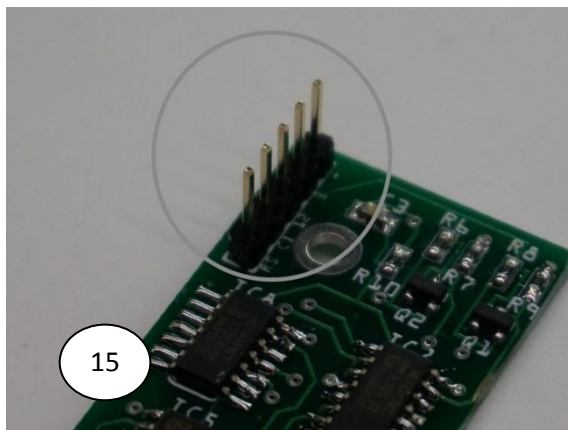

12: Solder the 220 resistor *(R11)* on the front of the primitive side.

**13:** Solder the 2.2k resistor *(R1)* on the front of the primitive side).

14: Solder 5x 2.2k resistor *(R6, R7, R8, R9, R10)* on the front of the address side.

15: Solder the 5 pin header in the front of the address side. Cut wires on the bottom side of the address side as close as possible to the board.


16: Solder the screw terminal on the front of the primitive side.

17: Solder the 26 pin boxed header in the front of the primitive side.
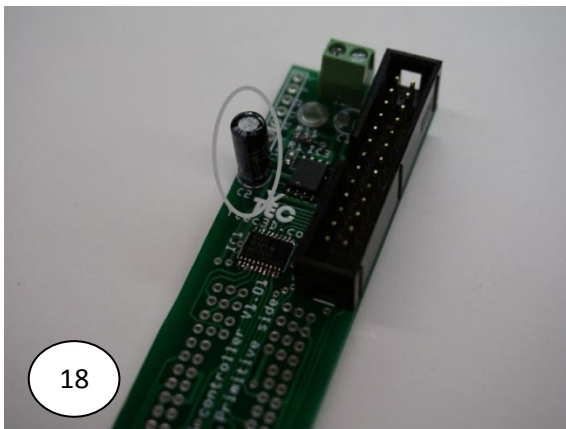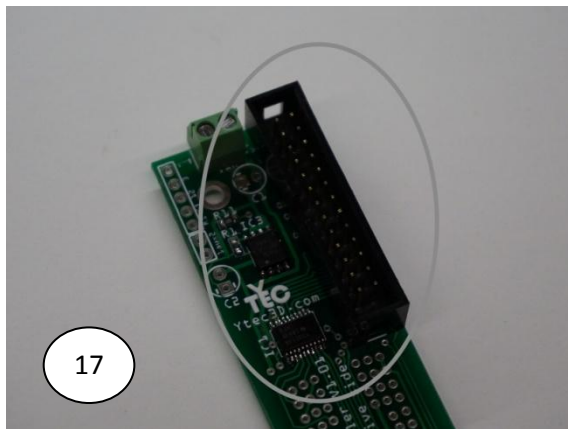
18: Solder the 1μF *(C2)* capacitor with the cathode facing away from the terminal in the front of the primitive side. Cut the wires as short as possible after soldering.

19: Solder the 100μF *(C1)* capacitor with the cathode facing away from the terminal in the front of the primitive side. Cut the wires as short as possible after soldering. (220μF shown in image)
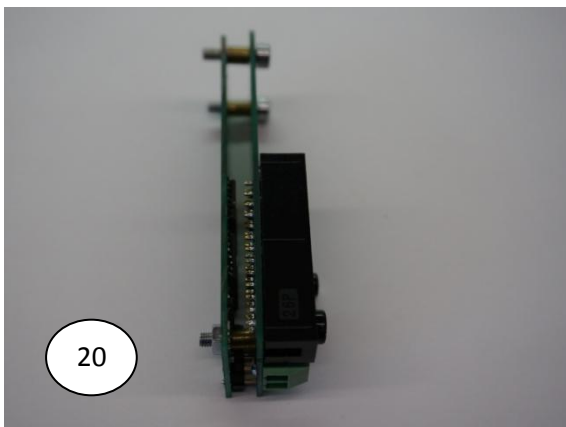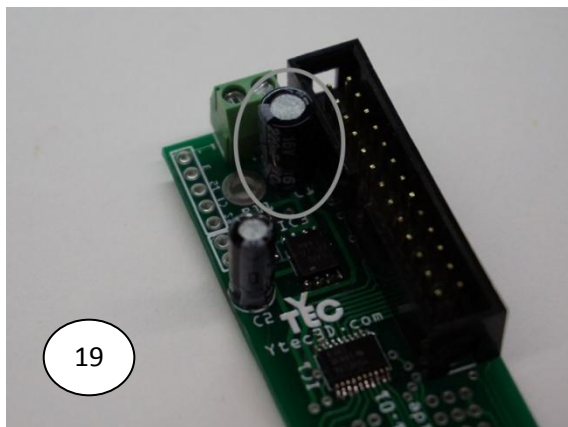

At this point it is important to check all connections on the address front side and the primitive back side . Make sure there are no shorts or unconnected pins. Once the 2 boards are fully soldered together, they are not going to come apart again without some serious work. With this check, the TLC59213 on the bottom of the primitive side is the highest risk of having a mistake.

Once you are happy with all the connections, you can move to the next steps.

20: Use the spacers, 12mm screws and one nut to mount the assembly to the primitive side. The 5 pin header should go from the address side and through the bottom of the primitive side. hand tight is tight enough for the nuts in this stage of the build.

The set of 2 screw on the pogo pin side of the board should have no nuts. The M3 nuts will obstruct the template later.

**21:** Place the template with the marking facing down.
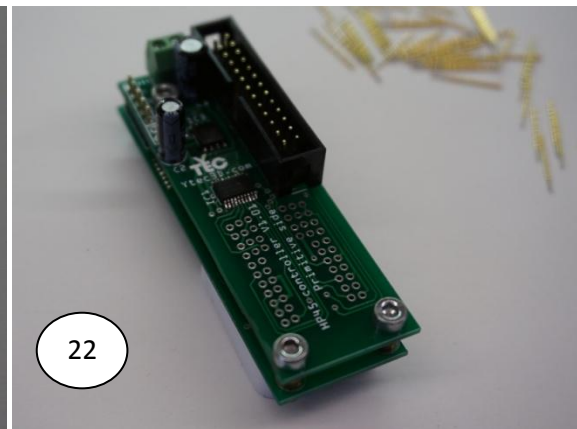
22: Place the combined controller on top of the template with the primitive front side up and roughly align the holes.

23: Place the pogo pins with the sprung part down through the 52 holes. It is advised to check if every pin springs before mounting it. After all pins are placed all pins should roughly stick the same length out of the primitive front side board (about 2-3mm).
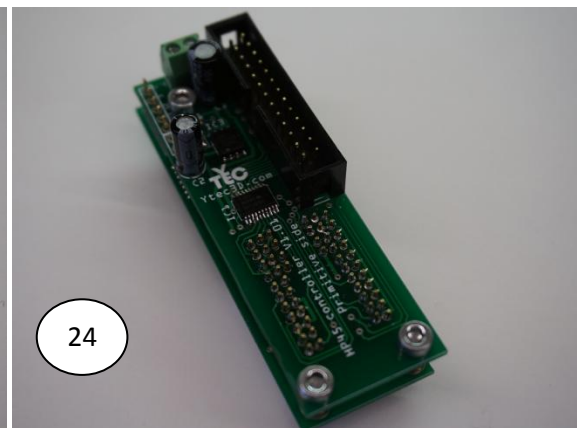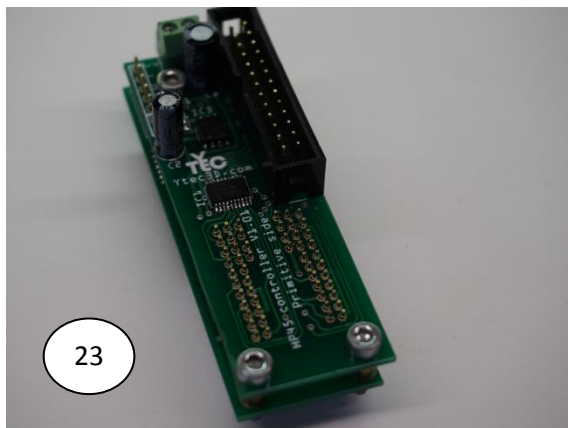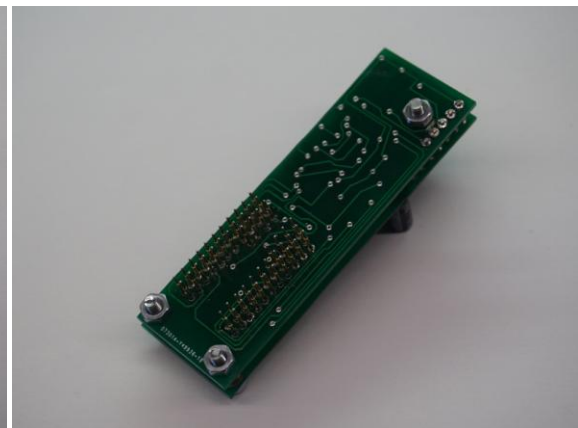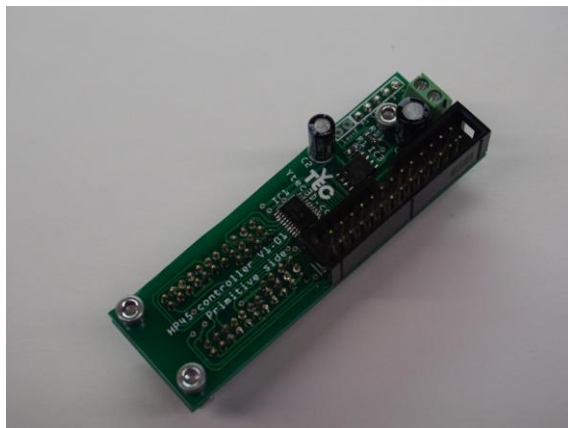

24 : Solder the primitive front side of all the pogo pins. It is important that no solder leaks into the small hole in the back of the pogo pin. If this happens, the solder will seize the spring and the pogo pin will be unusable.

25: Remove the template and repeat step 24 with the bottom of the address side, making sure no solder leaks into the joint between the static part and the sprung part of the pogo pin.
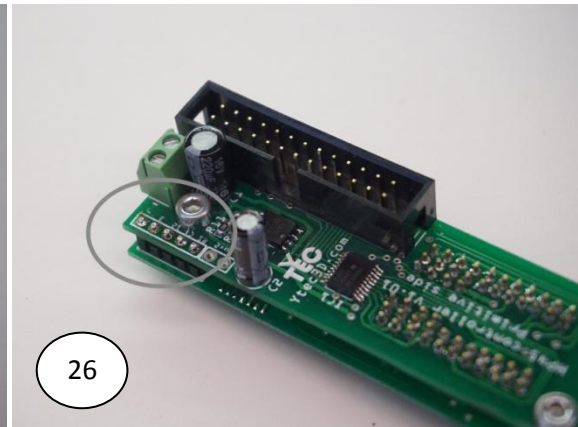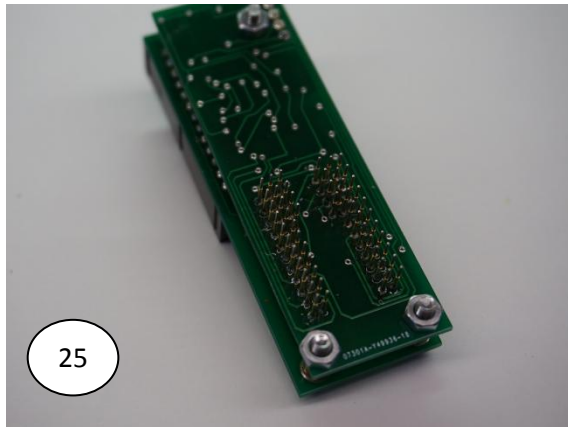
26: Solder the primitive front side of the 5 pin header and cut the wire flush with the board.

This finishes the PCB assembly.

Appendix 1: Schematics

fritzing