LISY80

LInux for SYstem80

Hardware Version 5.1

Board Assembly

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table of contents

Important remark 3
1. Bill of Material 4
1.1. Base function 4
1.2. WLAN Option 5
1.3. Sound Option 2 5
2. Step by Step 6
2.1. Step1: X1, diodes, IC-Sockets and Kerkos 6
2.2. Step 2. LEDs and resistors arrays 7
2.3. Step 3, Elko C1 & Switches S1, S2 und S3 8
2.4. Step 4, Header K1 & K2 and Socket for Raspberry PI 8
2.5. Step 6, Placement of all IC and the Raspberry PI 10

Important remark

By using LISY80 it is possible to damage your pinball machine. As this is a private project with NO commercial interest the author accepts no liability for any damage that may arise by using LISY80!

1. Bill of Material

You will find shopping cards for 'Reichelt' and 'Digikey' on www.lisy.dev.

1.1. Base function

The following components are needed for a working LISY1 board

#	Quant.	Label	Function	ID Reichelt	ID Digikey
1	1	X1	I2C Bus Repeater	PCA 9517 D	568-1828-1-ND
2	3	IC1,IC2,IC3	switches, displays, lamps	PIC 18F45K22-IP	PIC18F45K22-I/P-ND
3	1	IC4	Adaption 3,3V PI	74HC 4050	296-9213-5-ND
4	2	IC 5, IC6	Decoder Displays 80 & 80A	74HCT238	CD74HC237E-ND
5	1	C1	5V Capacitor 100µF	AX 100/16	1572-1048-ND
6	10	C2; C11-C19	Capacitor 100nF	Z5U-5 100N	399-5453-1-ND
7	8	C3-C10	Capacitor 470pF	KERKO 470P	BC5190-ND
8	1	C20	Capacitor 220nF	Z5U-5 220N	399-13966-ND
9	1	R1	Resistor Array 47K	SIL 9-8 47K	4609X-101-473LF-ND
10	1	R2	Resistor Array 3,3K	SIL 9-8 3,3K	4609X-101-332LF-ND
11	2	R3, R4	Resistor Array 3,3K	SIL 5-4 3,3K	4605X-101-332LF-ND
12	2	R6, R7	Resistor 1K	1/4W 1,0K	CF14JT1K00CT-ND
13	1	R5	Potentiometer 10K	PT 10-L 10K	987-1696-ND
14	3	R8, R9, R10	Resistor 10K	1/4W 10K	CF14JT10K0CT-ND
15	2	R11, R12	Resistor 470 Ohm	1/4W 470	CF14JT470RCT-ND
16	3	R13, R14, R15	Resistor 220 Ohm	1/4W 220	CF14JT220RCT-ND
17	1	R16	Resistor Array 220	SIL 5-4 220	4605X-101-221LF-ND
18	2	D1, D4	LED 3mm green	LED 3MM GN	732-5008-ND
19	1	D3	LED 3mm yellow	LED 3MM GE	732-5010-ND
20	4	D2, D5, D6, D13	LED 3mm red	LED 3MM RT	732-5006-ND
22	9	D7 - D12,D14-D16	Diode	1N 4148	1N4148
23	1	S1	Dip Switch 8 pos ‚options'	NT 08	CT2068-ND
24	1	S2	Dip Switch 6 pos ‚Game'	NT 06	CT2066ST-ND
25	1	S3	Push Button	TASTER 3301	SW400-ND
26	5		Jumper Debug Option	JUMPER 2,54 SW	S9001-ND
27	1	K2	Serial connection (3V!)	PSS 254/5G	WM4203-ND
28	1	K3,K4,PI	Male header	SL 2X40G 2,54	S2011EC-40-ND
29	1		Conn Header female for Raspberry PI	MPE 094-2-040 or 1 x Extra Tall Header	S6106-ND
30	3		IC- Socket IC2,5,6	GS 16P	ED3046-5-ND

31	3		IC- Socket IC1,3,4	GS 40P	ED3048-5-ND
32	1	SD Karte	8 GB Micro SD	INTENSO MSDHC8G	
33	1	PiZero	‚the master' ;-)	RASP PI ZERO WH	
		Amp Zero	Soundcard (see user manual for options)	JustBoom Amp Zero pHAT	
			Pin Headers 1*3	MPE 087-1-003	

1.2. WLAN Option

If you want to use ‚LISYcontrol' (recommended) a (Wireless) LAN connection is needed. This is included in the PI-Zero-W, with the 'old' PI-Zero without Wireless LAN you will need a Wireless LAN 'USB Stick' and an Adpater.

1.3. Sound Option 2

With the components of Sound option2, you are able to control the sound volume with the pot in the coin door at the front. New wiring needed!

Quantity	Label	Function	Label Reichelt
1		Potentiometer 6mm 10K	PO6M-LIN 10K
1		Connection terminal AKL	AKL 169-02
1	K5	Box connector 2pol	AKL 182-02
1	K5	Loud Speaker wire 0,75	LAT 275-10
4	K5	Flat connector sleeve	FSH-R-4,75

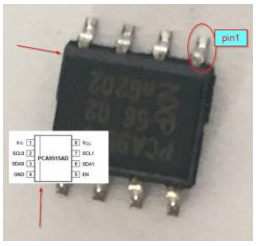
2. Step by Step

This Guide starts with the components with the least height and went from there step by step.

Please watch carefully the orientation of the components marked at the PCB. As I did some ‘optimization’ with the wiring (yes I did this by hand) you cannot expect that all parts have the same orientation. Especially with the resistor Arrays take a second look to be on the save side and watch the right position of ‘PIN1 ‘.

2.1. Step1: X1, diodes, IC-Sockets and Kerkos

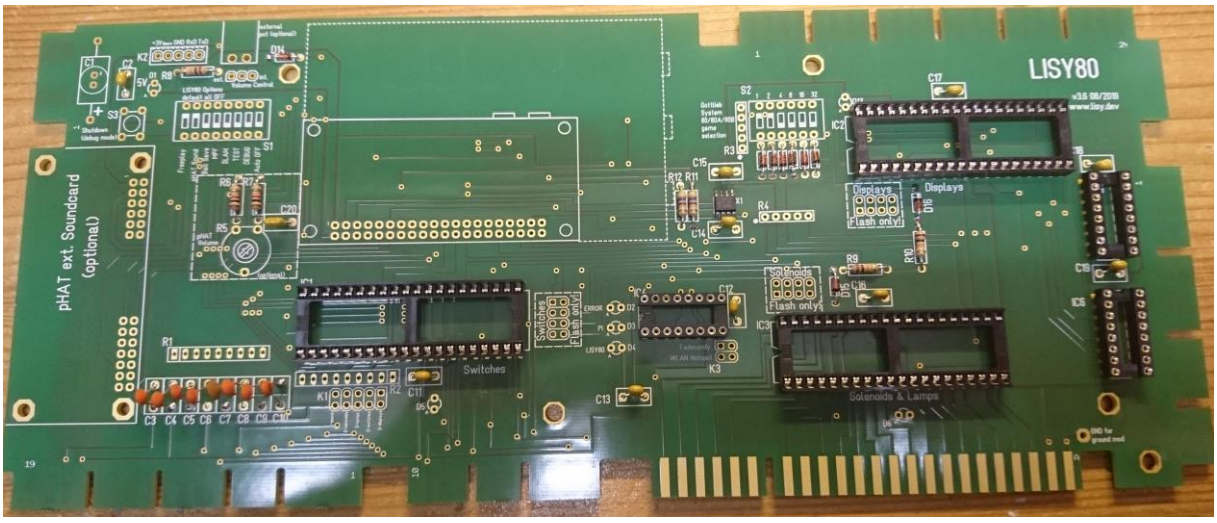
We start with the one and only SMD part the ‚I2C Bus Repeater X1.‘



It could be difficult to identify ‘pin1’ of this SMD Chip. Depending on which variant you have it could be marked with a dot, or the side with pins 1..4 are a bit sloped. See picture on the left for details.

If you are unsure that the soldering has contact, check the following connections from X1

Pin 1 (VCC 3V) -> Pin1 PI	Pin 2 (SCL0) -> Pin5 PI
Pin 3 (SDA0) -> Pin 3 PI	Pin 4 (GND) -> Pin 6 PI
Pin 5 -> not used	Pin 6 (SDA1) -> Pin 2 R4
Pin 7 (SCL1) -> Pin 3 R4	Pin 8 (VCC 5V) -> Pin2 PI

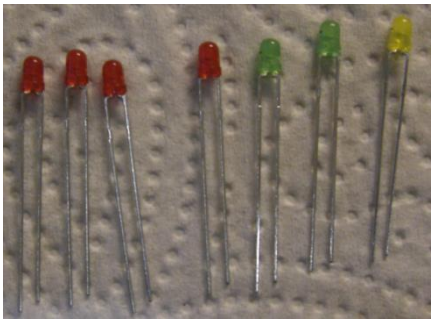


Picture 1: LISY80 after step1

2.2. Step 2. LEDs and resistors arrays

The position of the anode of LEDs D1-D6 & D13 are marked with an ‚A' on the PCB.

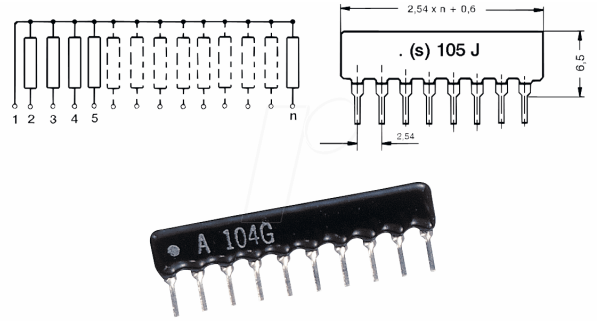
Hint: With new LED you can identify the anode by looking for the longer PIN. Some LEDs also have marked the Cathode with a small dot.



Picture 2: LEDs with the longer PIN (anode) on the left

Important: Only use 5V LEDs with integrated resistor!

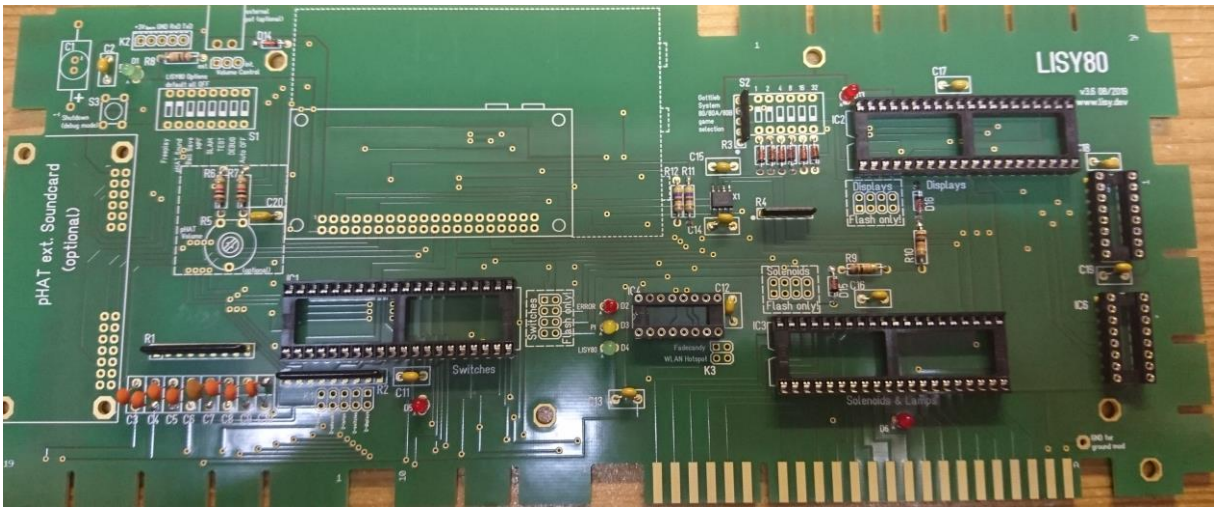
The resistor arrays (R1 – R4 & R8) are marked with a dot at Pin1



You will find that Pin 1 marked with a small quadrat on the PCB.

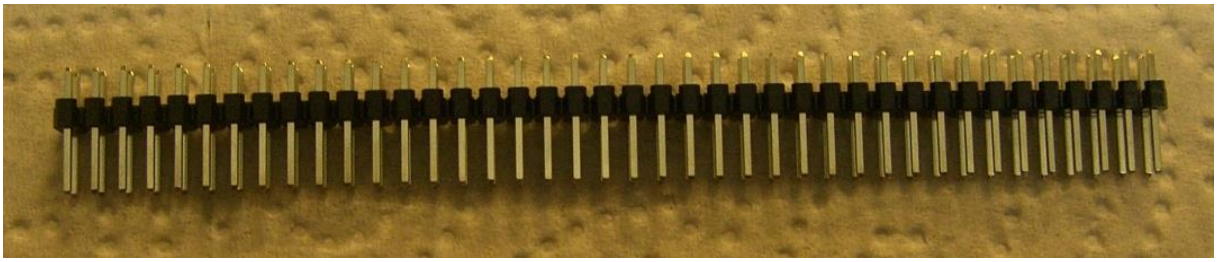
2.3. Step 3, Elko C1 & Switches S1, S2 und S3

For C1 the negative pole is at the top of the PCB. Nothing special fort he switches, just solder them in the way that you can read the description on it.



Picture 3: LISY80 with components after Step 3

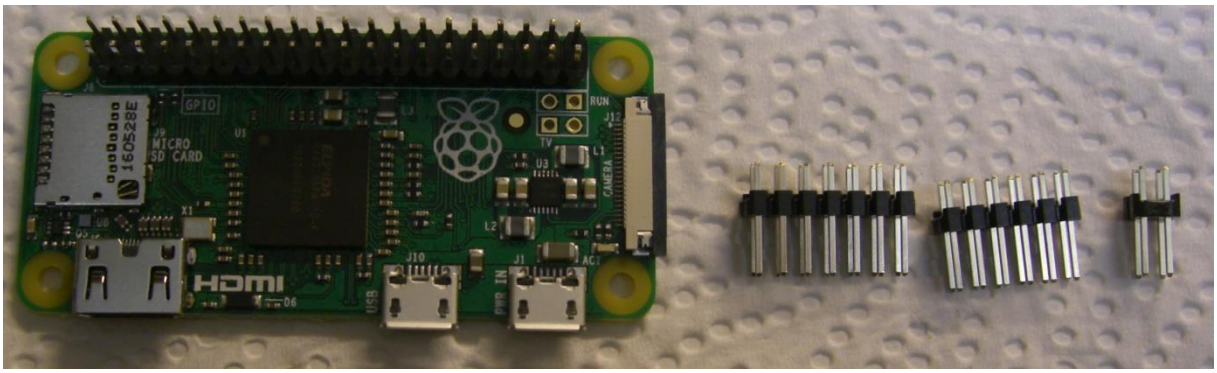
2.4. Step 4, Header K1 & K2 and Socket for Raspberry PI



Picture 4: Male Header 40 Pins

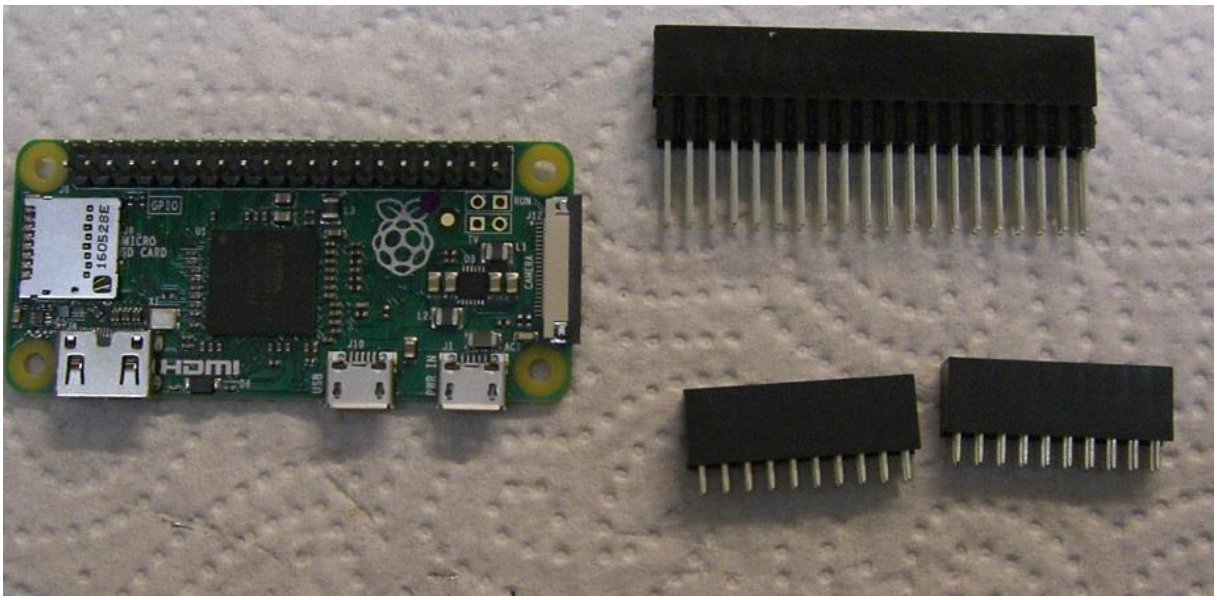
Cut the Male Header with a sharp knife to the parts you are need.

These are: 1*20 (Raspberry PI); 1*5(K1); 1*2 (Option); 1*6 & 1*7 (Soundoption)

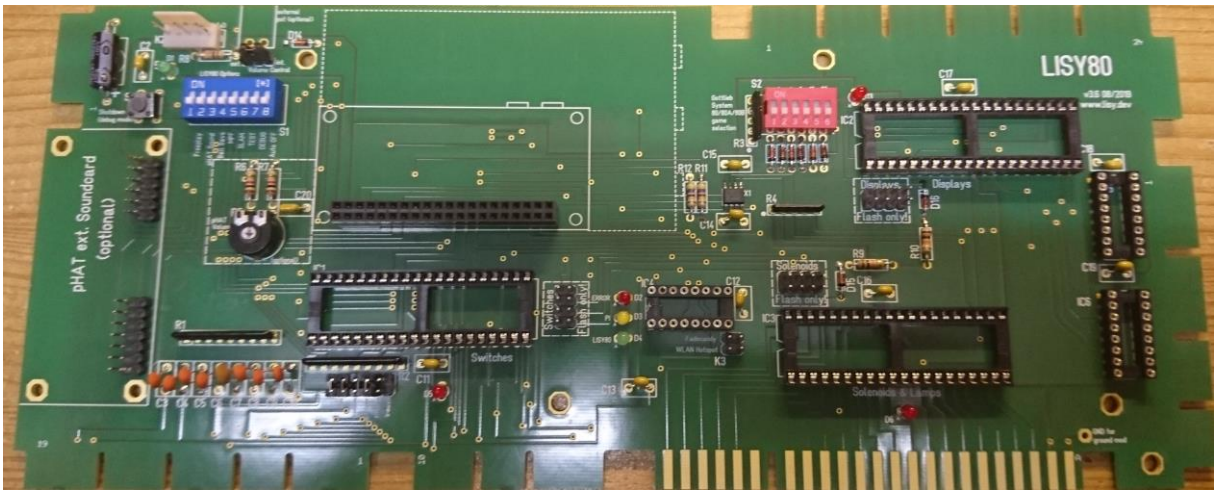


Picture 6: Needed parts of the 40 pin Male Header after cutting

Hint: LISY can be used with ALL type of the Raspberry PI (B, A+, PI3, ..). However for the ‘bigger’ ones you need a to replace the socket MPE 094-2-040’ with the “2x20 Extra Tall Header“ which is available at ‚The Pi Hut‘. See below a picture with both types of sockets.



Picture 5: Raspberry Pi Zero with alternate sockets

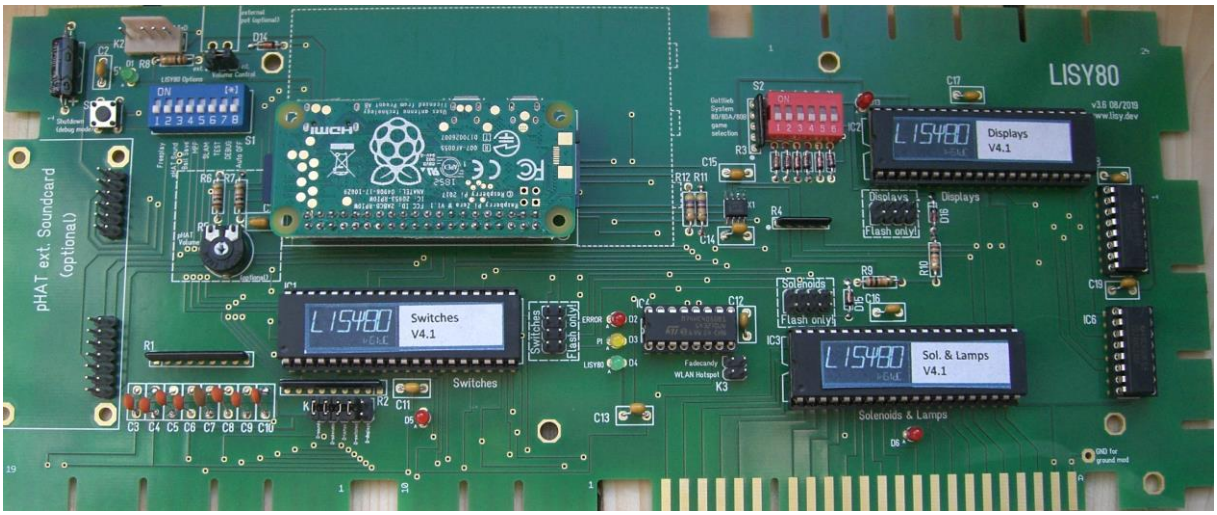


Picture 6: LISY80 after Step 5

2.5. Step 6, Placement of all IC and the Raspberry PI

After a final check of your soldering work, you can now place all the IC in the sockets. Again look carefully on the orientation of the ICs.

For further instructions on how to place the ‘LISY’ image onto the SD card have a look at user manual.



Picture 7: LISY80 after Step 6. ‘Ready to go’