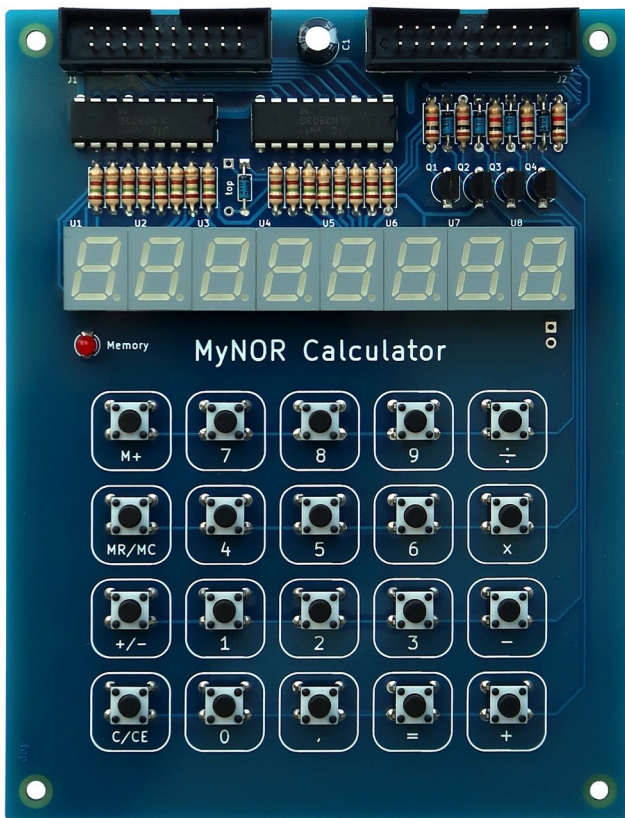
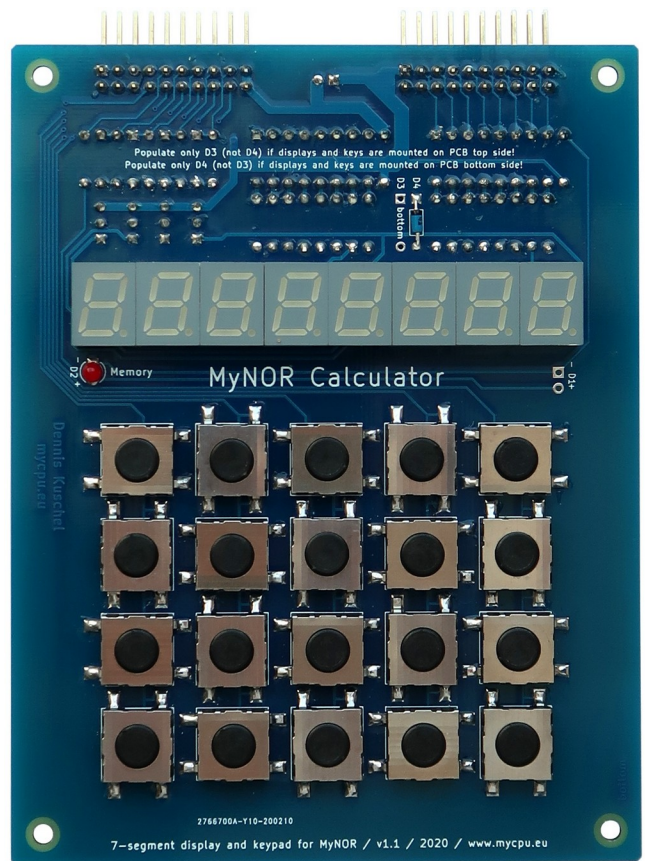


This document describes how the calculator extension board for MyNOR is assembled and mounted on the MyNOR computer board. There are two variants to assemble the board. The first is the usual variant, in which all components are mounted on the top side of the PCB. This variant should be chosen when the circuit board is to be used without a housing. The second variant is to solder the display and the buttons on the bottom side of the PCB. This type of assembling should be selected if the calculator is to be installed in a housing. All other components that would collide with the housing cover are now on the other side of the PCB.



Variant 1:
All components mounted on the top.



Variant 2:
Display and Buttons mounted on the bottom.



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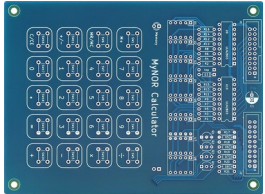
Required Components

The complete bill of material is listed in the table below. The Mouser part numbers can also be used to order the parts at Digikey or other distributors.

Parts in blue are only needed for variant 1: All assembled on top side

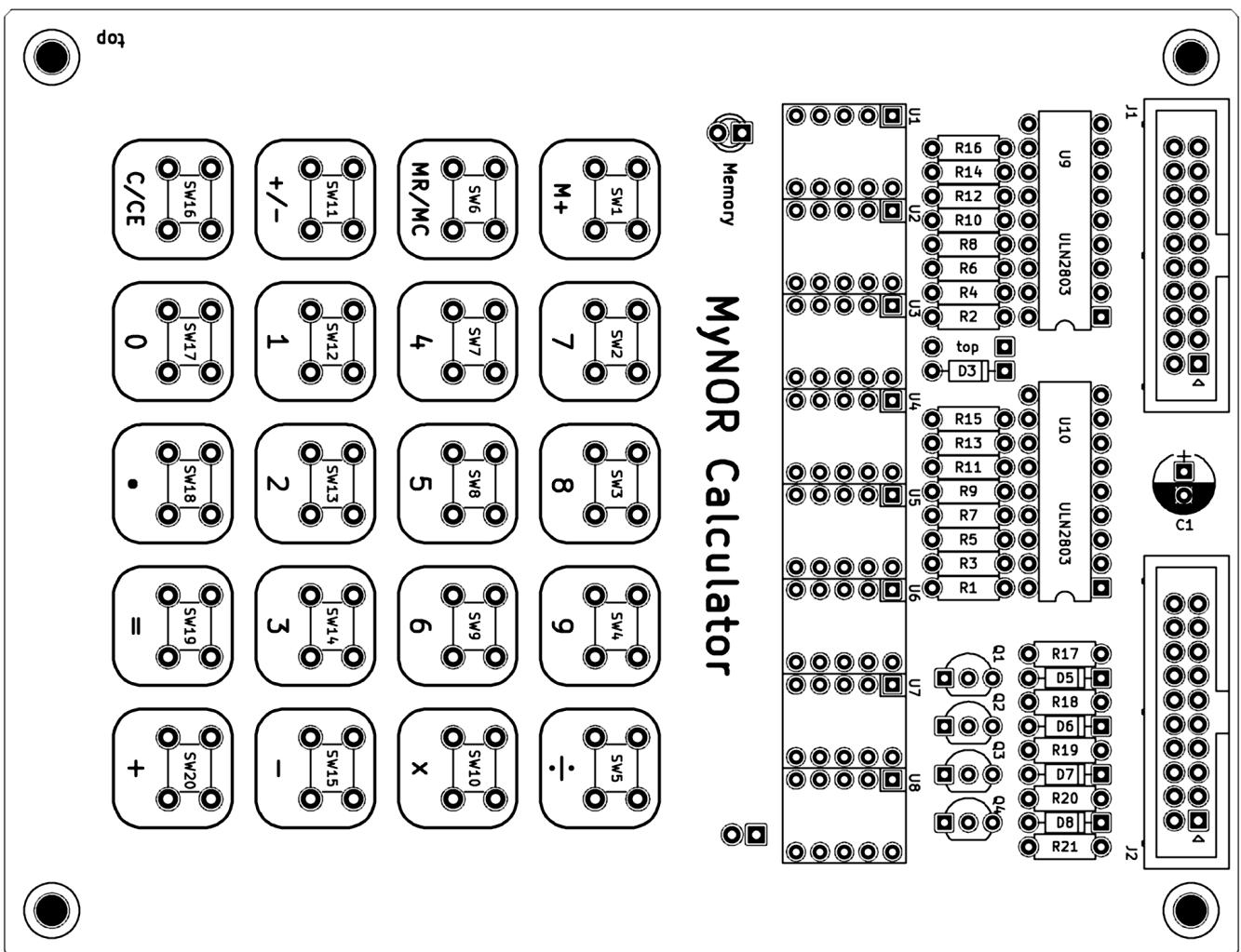
Parts in green are only needed for variant 2: Display and Buttons assembled on bottom side

Reference	Qty	Picture	Value	Mouser P/N www.mouser.com	Reichelt P/N www.reichelt.de
C1	1		100µF / 16V pitch 2.5 mm	16ML100MEFC6.3X7	SM 100/16RAD
D1	1		LED 3mm	LTL-4222N	KBT L-7104LSRD
D3	1		BAT41	BAT41-TAP	BAT 41
D2	1		LED 3mm	LTL-4222N	KBT L-7104LSRD
D4	1		BAT41	BAT41-TAP	BAT 41
D5 D6 D7 D8	4		BAT41	BAT41-TAP	BAT 41
J1 J2	2		20 pin header	710-61202021621	WSL 20G
Q1 Q2 Q3 Q4	4		BC327	BC32725TA	BC 327-40
R17 R18 R19 R20 R21	5		1k	CFR-25JR-521K	1/4W 1,0K
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16	16		150 Ohm	CFR-25JR-52150R	1/4W 150
SW1 SW2 SW3 SW4 SW5 SW6 SW7 SW8 SW9 SW10 SW11 SW12 SW13 SW14 SW15 SW16 SW17 SW18 SW19 SW20	20		SW_Push 6x4.3mm	TL1105BF160Q	TASTER 3301
SW21 SW22 SW23 SW24 SW25 SW26 SW27 SW28 SW29 SW30 SW31 SW32 SW33 SW34 SW35 SW36 SW37 SW38 SW39 SW40	20		SW_Push 11.4x11.4mm	1241.1600.11	TASTER 1600.11
U1 U2 U3 U4 U5 U6 U7 U8	1		7-Segment LED Display	SA39-11SRWA	SA39-11SRWA
U9 U10	2		ULN2803A	ULN2803A	ULN 2803A

	4		Spacer 10mm	970100354	DI 10MM
	4		Spacer 15mm	971150354	DA 15MM
	4		Screw M3 x 8	RM3X8MM-2701	SZK M3X8-200
PCB Raw Card	1		Use provided gerber files (in zip file) and order the PCB at jlcpcb.com		

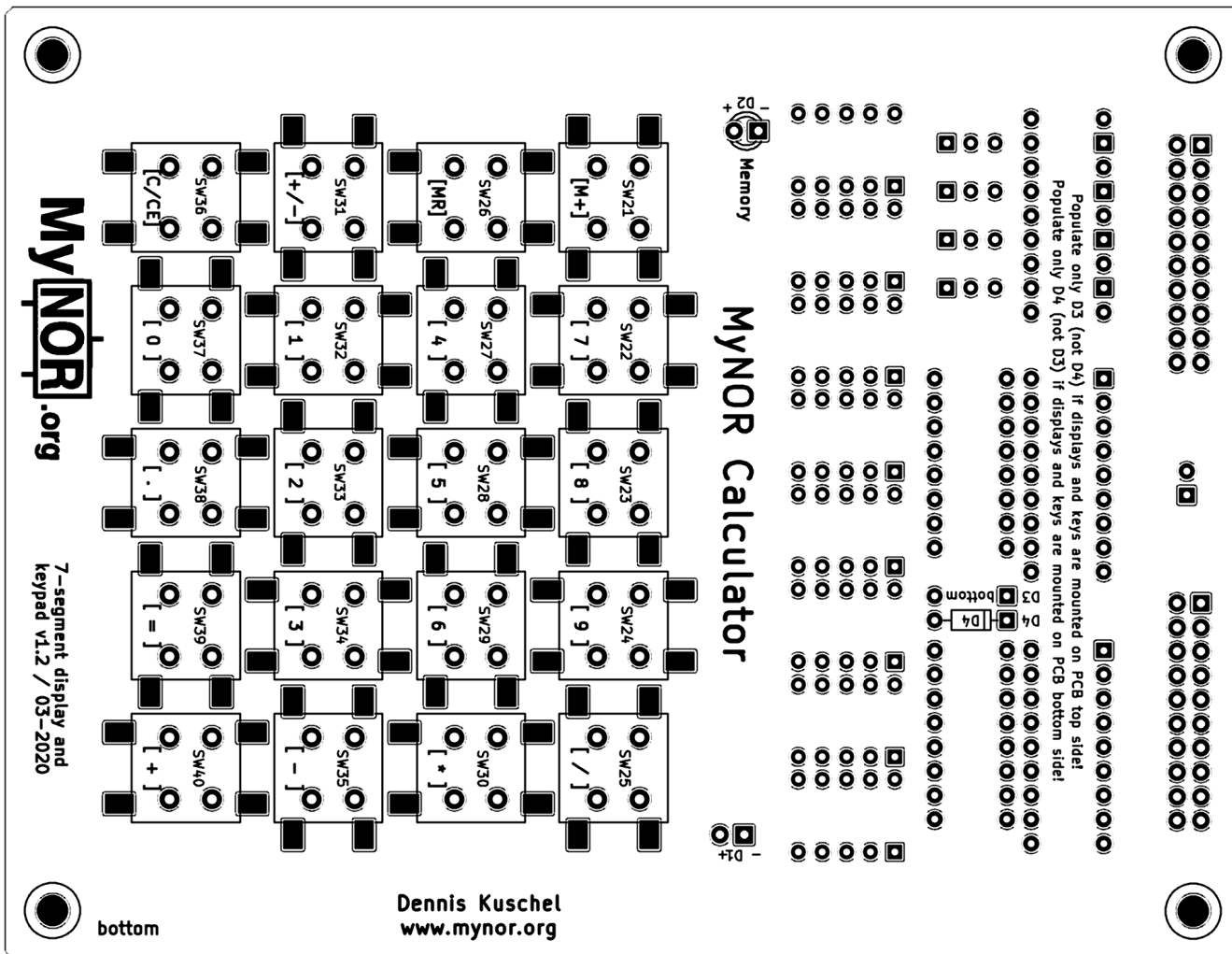
Board Assembly

The picture below shows the position of each part. Start with soldering the low components, in the following order: ICs, resistors, diodes, 7-segment displays, LED and the buttons. After that, continue with the transistors, the connectors and at last, the capacitor.

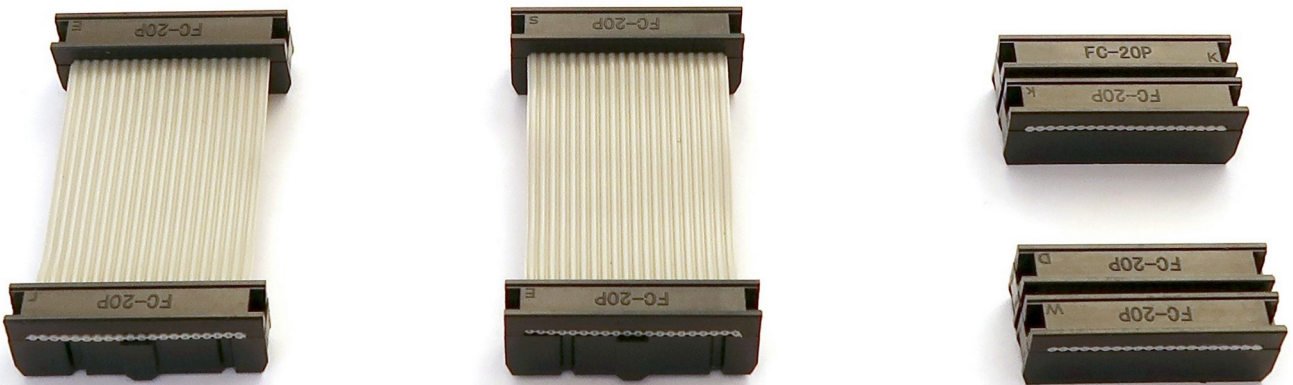


If you have soldered the buttons, the 7-segment displays and the memory LED on the PCB top side (the picture above), then populate also D3 on this side. D4 remains unpopulated.

But if you have soldered the buttons SW21-SW40, the 7-segment displays and the memory LED on the bottom side, then populate also D4. D3 (on the PCB top side) remains unpopulated:

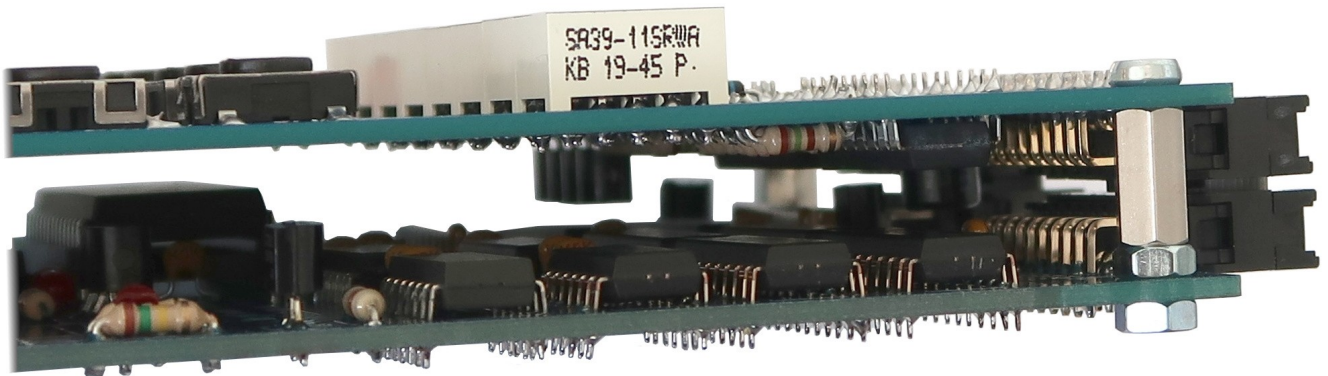


Connecting to MyNOR

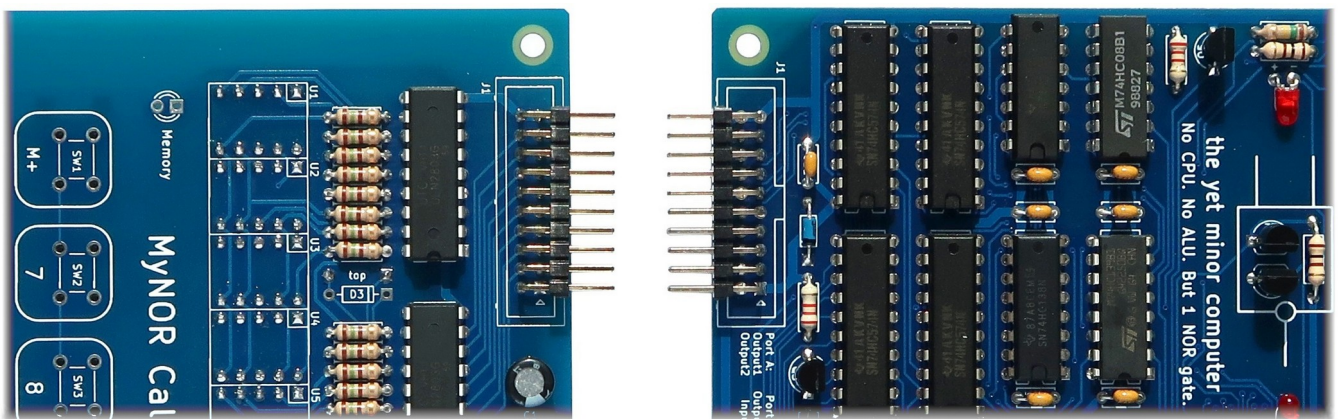


You need to build two jumper cables to connect the calculator extension board to the MyNOR computer board. The two long cables on the left side of the picture are used to connect the calculator extension board in its standard version (all components are on the top of the PCB). The very short cables on the right side of the picture are used to connect the other variant (displays and buttons on the opposite side) of the board to MyNOR.

The picture below shows how the two boards (variant 2) are connected with the short cables:



Here is a close-up of the connector used:



Operation

When you have connected the two boards together, you can now switch on the power supply. The calculator program is already included in the EPROM on the MyNOR board. A nice side effect is that the 8-pin EEPROM is not required and can be removed from the MyNOR board. The calculator mimics a standard calculator with basic math functions. But some buttons have a dual function:

Button	Function
C/CE	When pressed only once: Clears the number input buffer, so you can enter a new number. When pressed two times: Resets the calculator.
MR/MC	When pressed only once: Memory recall (get stored number back into the input buffer) When pressed two times: Clears the memory (the memory LED is switched off)
M+	Adds the number shown on the display to the number stored in the memory. If there is still no number stored in the memory, the displayed number is stored. If a math operation is still not finished (e.g. the buttons [5], [+], [3], [M+] are pressed in this order), the result of the math operation is added to the memory (which is 8 in this example).
=	When pressed only once: Calculates the result. When pressed two or more times: Repeats the last calculation with the last entered number. For example, if the buttons [5], [+], [3], [=], [=], [=] are pressed in this order, the output is: 8, 11, 14. Furthermore, the input of [2], [*], [=], [=], [=], [=] produces the output 4, 8, 16, 32 etc. (this is for example a very simple method for calculating the square of a number).
+/-	Negates the number on the display. Note that the initial 0 can not be negated.
.	Decimal point. Note that there is no need to enter a leading zero (this is already shown in the display as „0.“)
0 - 9	Numbers (no second function available)