SBL-Micro Building Instructions

The following pages presents the latest version of the self made controller for brushless motors SBL-Micro designed by Jo Aichinger. Here is a direct link to his SBL-Micro Support page. (Currently available in German only).

Starting end of September 2003 the board layout is modified. Especially the area of the over-current protection (which did not work very well in the previous version) has been modified. For the new boards you need processors programmed with SW version 1006. This version can also be used on old boards. But never try to use older SW versions on the new board layout. These pages are based on the new schematic

Please visit RCLINE Modellbauforum where you will find more information and experiences in different threads.

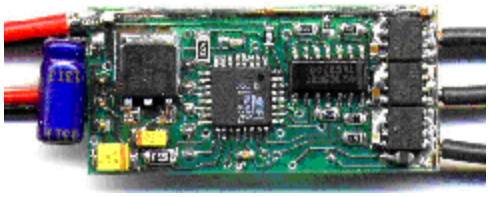
Helpful threads are:

SBL-Micro Sammelbestellung

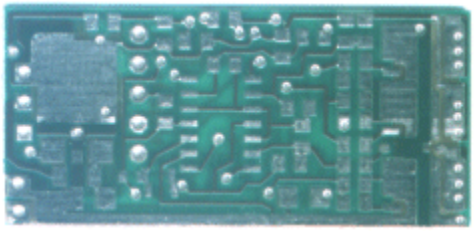
Auffälligkeiten/Ideen zur SBL-Micro Software.....

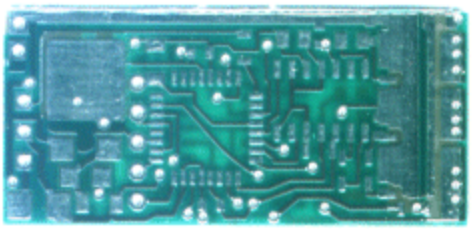
SBL-Micro Software-Update

This is how the controller should look like.



But it's still a long way to come there. We are still looking at the blank board.





For building the SBL-Micro you should have printed out the building instructions, the layout plan and the list of parts. Mark every part you have placed on the board on the parts list and may be on the layout plan. This is a way to keep the overview. If you do it this way it's easy to check if no part is missing on the board.

There often the question if an oscilloscope is really necessary to build the controller. The answer is easy. An oscilloscope is not necessary but very helpful if the controller does not work as expected.

Hint: The used SMD electrolytic capacitors are Tantalum capacitors. The line on the capacitors marks the (+) side.

Please clean the board carefully with alcohol before soldering.

Parts

S.No.	Cnt.	Type	Form	Part
1	1	33µ/6V	T491	C3
2	5	100n	0805	C6,C9,C14,C15,C16
3	5	100n	0603	C1,C7,C8,C13,C18
4	3	10n	0603	C10,C11,C12
5	2	4µ7/16V	3216	C2,C4
6	1	1µ/16V	3216	C5
7	1	100µ/16V	rad.	C17
	1	Socket	RM2,54	CON1
8	6	3k3	0805	R17,R18,R19,R20,R21,R22
9	1	4k7	1206	R1
10	9	10k	0805	R2,R9,R10,R23,R24,R25,R26,R27,R28
11	2	2k2	0805	R3,R4
12	2	470R	0805	R6,R31
13	1	1k	0603	R32
14	1	10R	0603	R29
15	1	4k7	0603	R30
16	6	47R	0805	R11,R12,R13,R14,R15,R16
17	1	0R	1206	R8
18	2	0R22	1206	R7,R8
19	1	NTC10k	0805	R5
20	1	LM324	SO14	IC3
21	1	AT-Mega8	TQFP32	IC1
22	1	TLC3704ID	SO14	IC2
23	2	L4941B	DPAK	U1,U2
24	3	SI4425DY	SO8	F1,F2,F3
25	3	IRF7455	SO8	F4,F5,F6
26	1	Board		

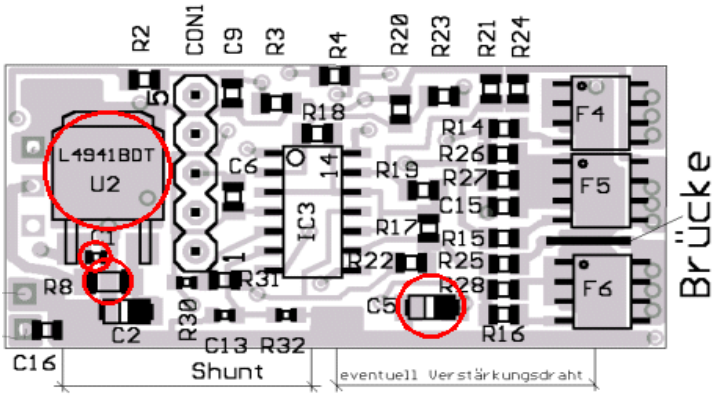
BEC

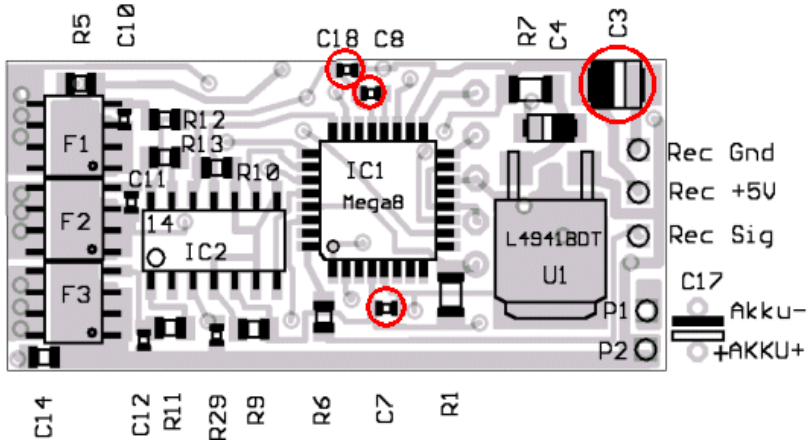
You can decide to build the SBL-Micro with a BEC for 2 or 4 servos. To build it for 2 servos you have to use the 0R resistor R8.

To solder the voltage regulator don't use the micro soldering iron. A soldering iron with about 30W and a good sharp soldering tip is the preferred tool.

The BEC for only two servos needs just one voltage regulator (U2). The parts U1, C2, C4 und R7 will not be used. The resistor R8 will be replaced by a 0R resistor format 1206.

S.No.	Part	Type	Form
3	C1, C7, C8, C18	100n	0603
1	C3	33µ	3528
23	U2	L4941B	DPAK
17	R8	0R	1206
2	C6	100n	0805
6	C5	1µ / 16V	3216





The BEC for 4 servos needs both voltage regulators (U1 and U2) and the parts C2, C4 and R7. Resistor R8 is now a 0R22 format 1206.

S.No.	Part	Type	Form
3	C1, C7, C8, C18	100n	0603
1	C3	33µ	3528
23	U1, U2	L4941B	DPAK
18	R7, R8	0R22	1206
2	C6	100n	0805
6	C5	1µ / 16V	3216
5	C2, C4	4µ7	3216

Testing the BEC

Connect two wires with P1 and P2. If available use a power supply unit with current limiting (50 or 100mA). If you don't have one and you are sure that you don't have not produced any short-circuits, you can also use rechargeable batteries

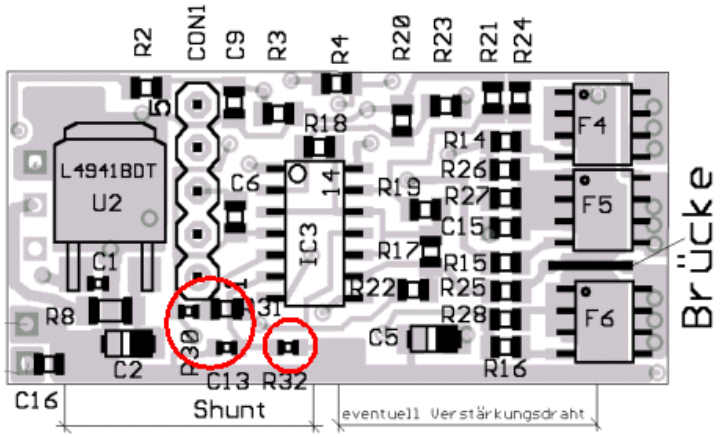
Between the two pads "REC Gnd" and "REC +5V" your voltmeter should now show 5V.

The Processor

In this chapter the brain of the controller, the MEGA8 processor, will be soldered on the board. Before soldering the socket for programming the controller you have to process some other parts because of space reasons.

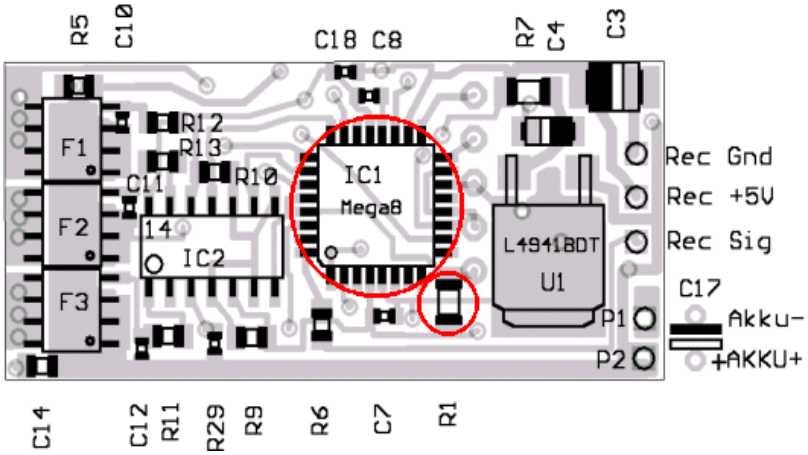
The parts you have to solder before soldering the socket.

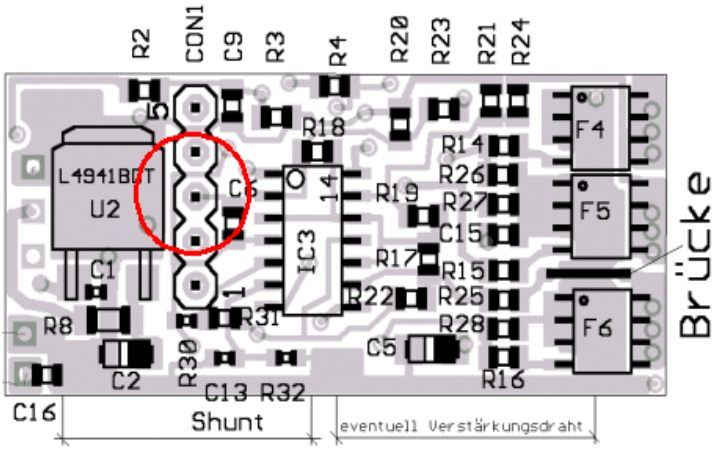
S.No.	Part	Type	Form
15	R30	4k7	
12	R31	470R	0805
3	C13	100n	0603
13	R32	1k	0603



Now the processor! While soldering the Mega8 be careful not to produce short-circuits.

S.No.	Part	Type	Form
21	IC1	Mega 8	TQFP32
9	R1	4k7	1206
7	CON1		





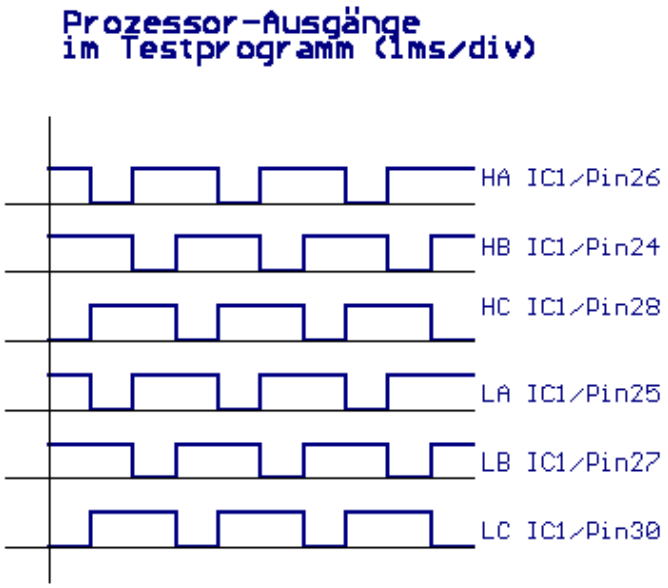
Testing the Processor

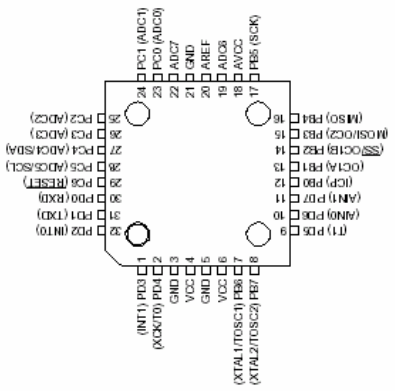
Connect two wires with P1 and P2. If available use a power supply unit with current limiting (50 or 100mA). If you don't have one and you are sure that you don't have not produced any short-circuits, you can also use rechargeable batteries

To attach the ground clamp of the probe without producing short-circuits I recommend to remove a little bit of isolation from the minus wire to the voltage supply. So you can use any alligator clip.

Connect Pin 2 and 3 of the socket with a 1k resistor. This activates the integrated test program. Set the oscilloscope to 1ms/div.

After you have connected the power supply unit, at pins 24-28 and 30 of the Mega8 you should see the 5V square wave signals shown in the picture below with the oscilloscope. There are small peeks in the middle of the 2ms signals. These are not shown here.





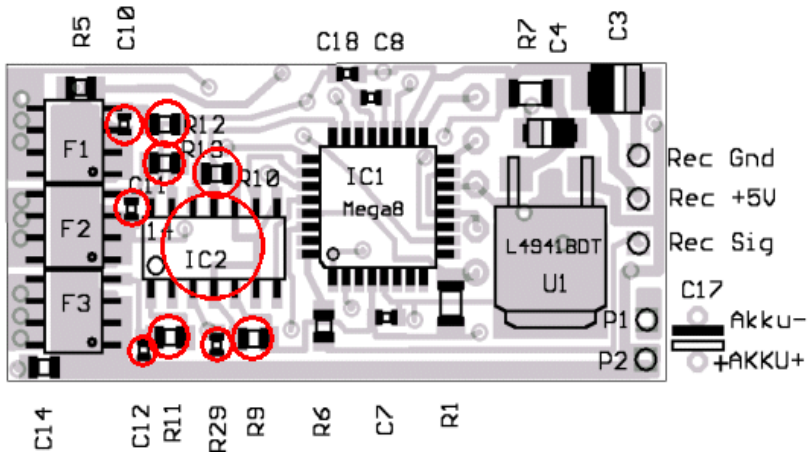
The Output Stage

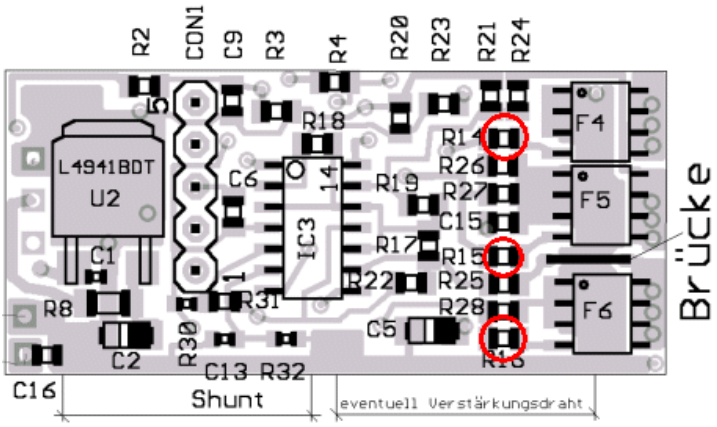
The MOSFET's will be soldered after testing the output stage.

Now the parts for the output stage control will be soldered and tested afterwards.

Hint: Don't confuse R15 with C15. They are very close together.

S.No.	Part	Type	Form
4	C10, C11, C12	10n	0603
16	R11, R12, R13, R14, R15, R16	47R	0805
10	R9, R10	10k	0805
14	R29	10R	0603
22	IC2	TLC3704ID	SO-14





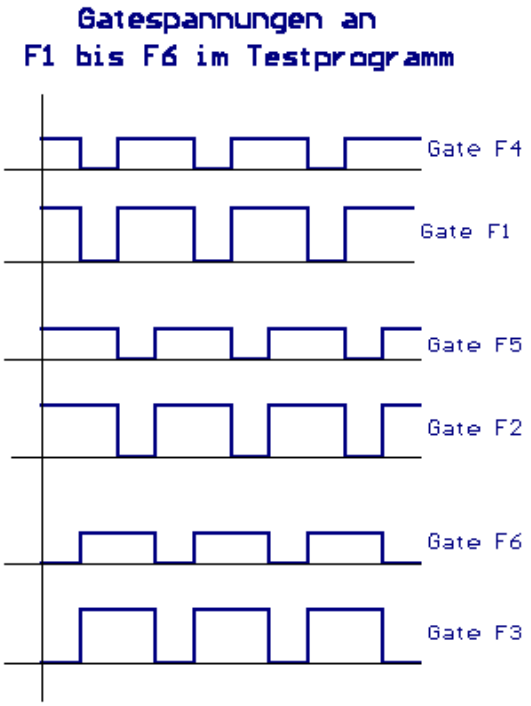
Testing Output Stage Control

Connect two wires with P1 and P2. If available use a power supply unit with current limiting (50 or 100mA). If you don't have one and you are sure that you don't have not produced any short-circuits, you can also use rechargeable batteries

To attach the ground clamp of the probe without producing short-circuits I recommend to remove a little bit of isolation from the minus wire to the voltage supply. So you can use any alligator clip.

Connect Pin 2 and 3 of the socket with a 1k resistor. This activates the integrated test program. Set the oscilloscope to 1ms/div.

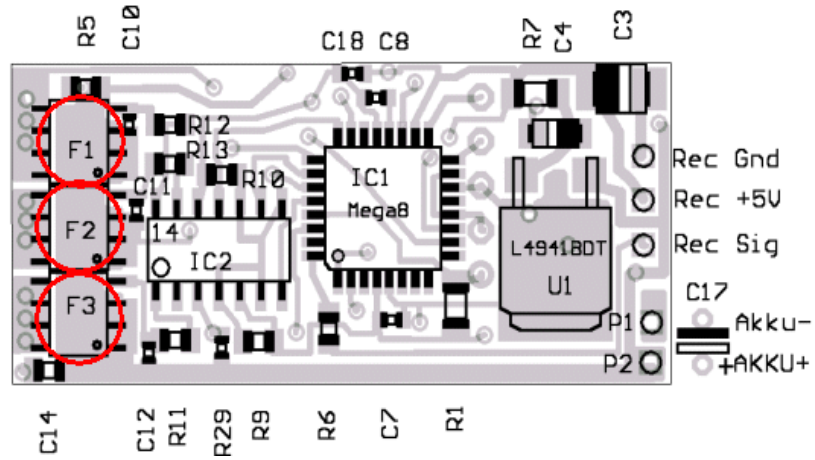
After you have connected the power supply unit at the gate pads of the MOSFET's you should see the square wave signals shown in the picture below.

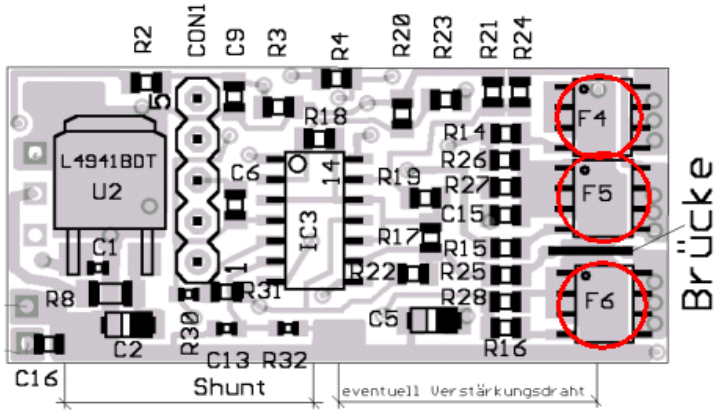


MOSFETS

The FET's should be soldered in the sequence described in the building instructions. You should test each pair as described on the next page.

S.No.	Part	Type	Form
24	F1, F2, F3	SI4425	SO8
25	F4, F5, F6	IRF7455	SO8



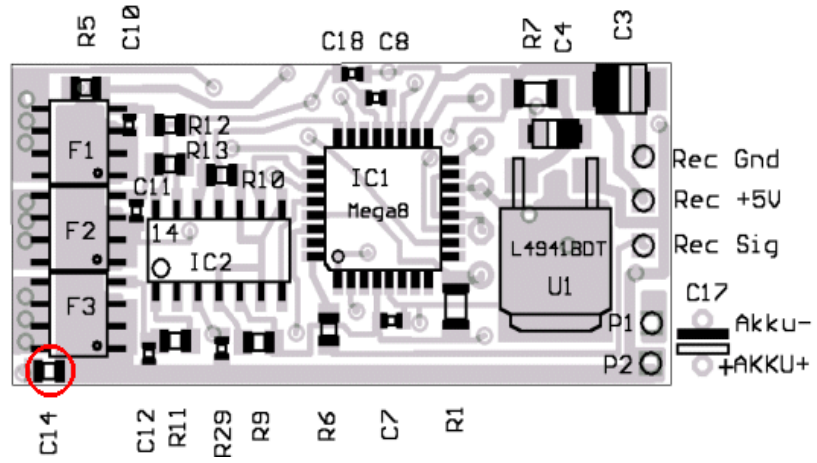


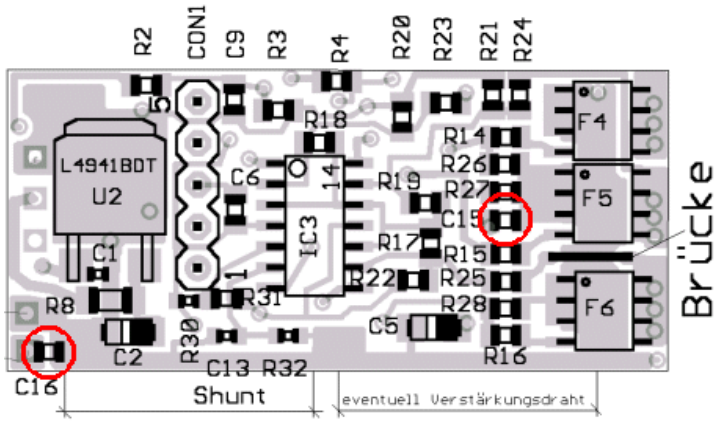
Filter Capacitors

The capacitor C14 will be soldered here. While soldering this capacitor it is very easy to produce a short-circuit to output C of the output stage (FET 3). Because of the already soldered FET a short-circuit will be almost invisible. Please check it with a multimeter.

Hint: Don't confound C15 with R15. They are very close together.

S.No.	Part	Type	Form
2	C14, C15, C16	100n	0805





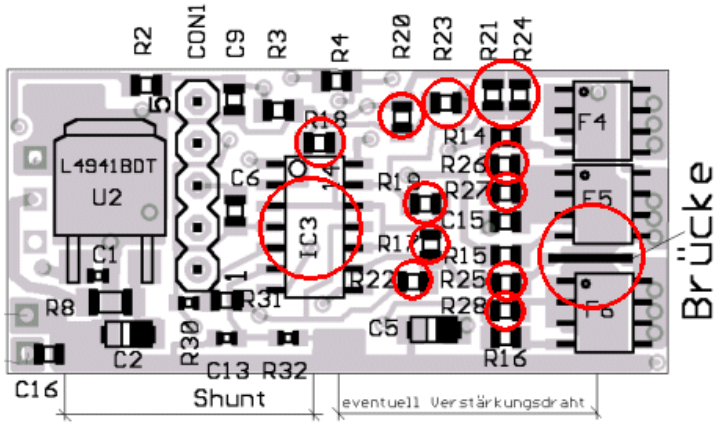
EMF Evaluation

Don't forget to solder the isolated wire between the two FET's F5 and F6.

Hint: While soldering the wire, be careful not to melt the isolation. This may short circuit F6 and cause F3 on the top side to be overloaded.

Hint: IC3 (LM324) may not have a marker for Pin 1. At one side of the IC you'll find a bevel instead. Place IC3 with the bevel on the side where you see the marker in the picture below.

S.No.	Part	Type	Form
8	R17, R18, R19, R20, R21, R22	3k3	0805
10	R23, R24, R25, R26, R27, R28	10k	0805
20	IC3	LM324	SO14
	Isolated wire		



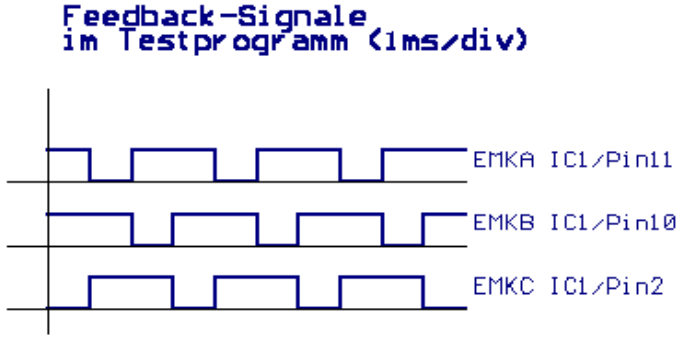
Testing the EMF

Connect two wires with P1 and P2. If available use a power supply unit with current limiting (50 or 100mA). If you don't have one and you are sure that you don't have not produced any short-circuits, you can also use rechargeable batteries.

To attach the ground clamp of the probe without producing short-circuits I recommend to remove a little bit of isolation from the minus wire to the voltage supply. So you can use any alligator clip.

Connect Pin 2 and 3 of the socket with a 1k resistor. This activates the integrated test program. Set the oscilloscope to 1ms/div.

After you have connected the power supply unit at the pins 2, 10 and 11 of the Mega8 you should see the square wave signals described in the building instructions with the oscilloscope.

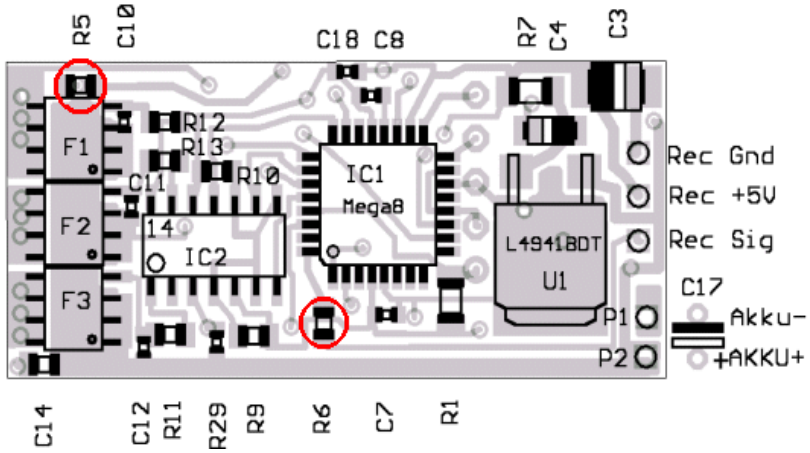


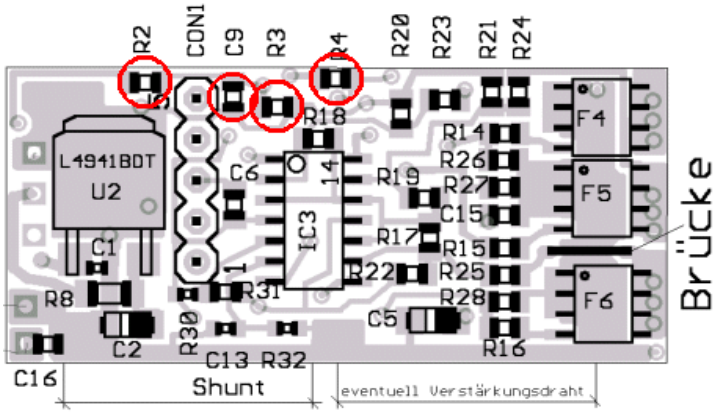
Remaining Parts

Important: Don't forget R3. Without this resistor you could destroy the Mega8 processor.

Connect the NTC R5 with FET F1 with some high-viscosity glue to get the NTC a chance to detect the FET temperature.

S.No.	Part	Type	Form
19	R5	10k NTC	0805
10	R2	10k	0805
11	R3, R4	2k2	0805
2	C9	100n	0805
12	R6	470R	0805





Completion

Now attach the input-capacitor C17, the cables (1mm flexible cables) to motor and power supply and the connection to the receiver. The controller should now look like the pictures below.