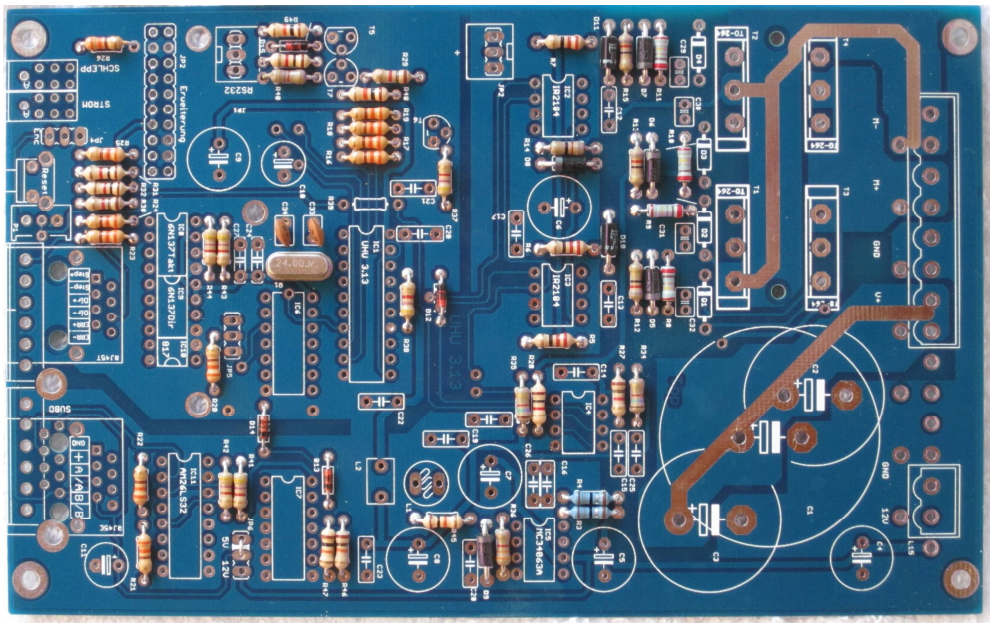
UHU PCB 3.13 ‚NiteOwl'

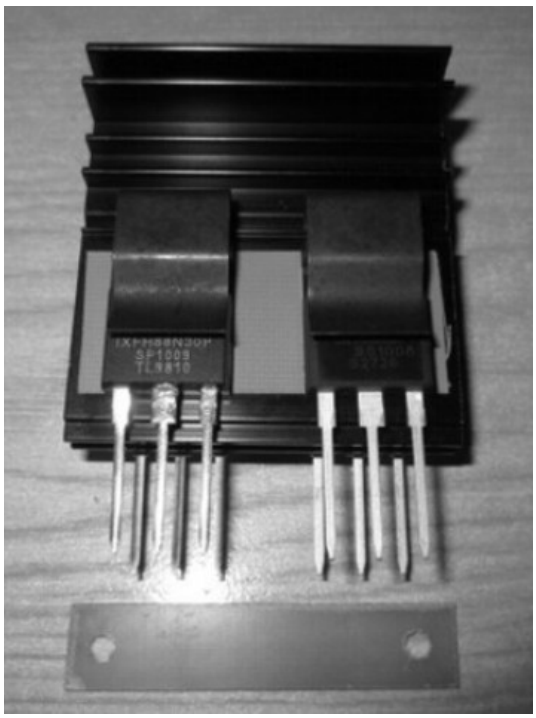
Components:

PCB, UHU controller, crystal and SMD measuring resistor are available from Uli Huber uli@uhu-servo.de
All other components can be easily obtained by a shopping basket at Reichelt, Germany:
„http://www.reichelt.de/?ACTION=20;AWKID=634644;PROVID=2084"
Shopping basket and parts list in this document include a superset of components used for the different possible versions (fixed/removable connectors, rack-mount, different current capabilities).You should remove unwanted items from the shopping basket before ordering.
I am not aware to what countries Reichelt is willing to deliver and at what cost. Please check before ordering. You also may use the list to get the parts locally.

Assembling



First of all, it has to be stated that there is no distinct order to be followed strictly. But as a matter of experience, it is easiest to start with the components that have the lowest profile (resistors, diodes).
Using sockets for integrated circuits is also just a good advice.
But other rules are not optional: All semi-conductors (diodes, transistors, ICs) must be placed in the correct orientation. Failing to do so will at least lead to a non-functional board. Even more probably, expensive damages would be the result. Same applies to bipolar capacitors.



After placing all other components, it's time for the MOS-Fet transistors.

If the suggested heat-sink with snap-in clamps is used, it first has to be cut to the correct length (50mm). Self adhesive insulation foil has to be attached on both sides of the heat sink to prevent the transistors to make direct contact with the metal. Please double check the position to ensure insulation quality. After that, place the MOS-Fets to the correct position and fix them with the clamps.

Of course, you may use your own special heat sink construction alternatively.

After having placed all 4 MOS-Fets, make fine adjustments to the completed unit and check if it can be placed into the PCB.
The holes for the heat sink screws must be widened to 3.5mm. Use an ordinary drill bit and drill carefully.
Before screwing the heat sink on the Board, a plastic strip apx. 50x10x1mm has to be placed between heat sink and board. **This is**

a safety issue because of the copper connections running under the heat sink.
In addition please also use insulation washers on the bottom side of the PCB. Alternatively you may use M3 plastic screws to attach the heat sink to the PCB.

Now it's time to solder the MOS-Fet pins to the board. This has to be done carefully, making sure not to have cold joints. If the solder did not come up to the top side of the board, re-solder from the top side.
Last action is soldering the chip resistor(s) 0.022 Ohm on the bottom side of the PCB. One is needed for every 12 A maximum current.
This finishes the assembly.

Placing into operation

Important: While this board has been tested with high voltages and currents, it is released for safe voltages under 50V only. Even with these relatively low voltages, capacitors can be dangerous for your health or even your life. Never touch the board while it is connected to the motor power supply. Wait at least 5 minutes after disconnecting the board from the power supply before touching it.

To avoid a total loss in case of assembly faults, it is strongly advised to place the board into operation in several steps.
First insert the MC34063A (IC5) into the socket and connect the board to the 12V power supply. Now you should have exactly 5V available for the logic components. Check this voltage over pin 1 and 2 of the encoder connector or pin 10 and 20 of the UHU controller socket. Availability of 5V is also indicated by the green power LED.

If it looks good so far, release power supply and insert the UHU controller. After switching on again, the yellow ‚Run LED' will light up after a short delay.
The board will draw about 20mA now.

Now you may insert the other ICs and opto isolators. Take care of the correct orientation and be aware that IC10 is rotated by 180°. This might be hardly visible because it's component print is covered by the IC Socked shared by all three opto isolators. With all active components but no encoder attached, drawn from the 12V supply will be around 80mA.

For the following tests you need to have the external connections in place. If possible, use a motor/encoder combination available in your lab instead of walking out to the workshop and trying to do the test at the machine. Please double check encoder voltage (JP 6) and polarity to avoid damages.

Do not apply motor voltage at this point. Just power up the board with 12V and revolve the motor shaft. After 2.000 encoder steps (UHU preset value) the ‚Error LED' will light up.

Now you may start with your first hot tests. After applying the motor supply voltage and pressing the reset button, the motor will be controlled and hold the shaft position with a torque correspondent to the motor current. If the motor runs away, please reverse it's polarity.
It is the right time now to test the current regulation. Trim the potentiometer about 10 turns to the maximum left position. Now holding torque will be minimal to none. By trimming the potentiometer to the right you can adjust the board to the maximum desired operation current. Unless you have one of these a really expensive TrueRMS amperemeters, use an old analogue amperemeter instead.

Last step is the connection to the PC. For a maximum tolerance against electromagnetic influences, use separate ground lines for the STEP and DIR signals. Use twisted pairs for each signal-ground –combination. A CAT4 network cable will suite you fine for this purpose.

Connectors and Jumpers

For the encoder connector on the face side of the PCB you may choose either screw type, pluggable type, RJ45 or SubD9. The pin-out is printed on the top side but may not be visible after the connector is inserted. You may find this information also on the last page of this documentation.
The power connectors (motor supply, 12V supply, motor) are located in the rear part of the board. They are either screwed or pluggable types. A 15 pin bus connector for 19” is also supported.

Connector pin-out

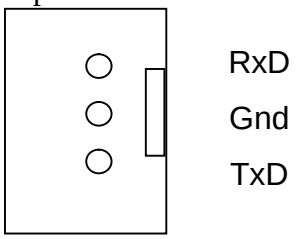
RJ45 Encoder		9polSub D Encoder
1	A +	+5V
2	A -	
3	B -	A -
4		B -
5	Parameter-set switch	Parameter-seset switch
6	B +	GND
7	+5V	A +
8	GND	B +

RJ45 Step/Dir/Error	
Step Opto K	
Dir Opto A	
Dir Opto K	
Step Opto A	
Error Opto C	
Error Opto E	

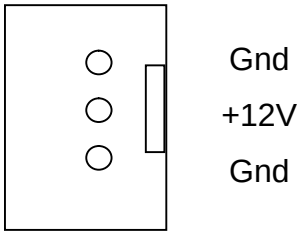
15 pin multipoint connector 19”	
4/6	Motor -
8/10	Motor +
12/14	GND
16/18	Motor Supply max 150V For IRFP 260N
26/28	GND
30/32	12 V +

Jumpers/logic connectors

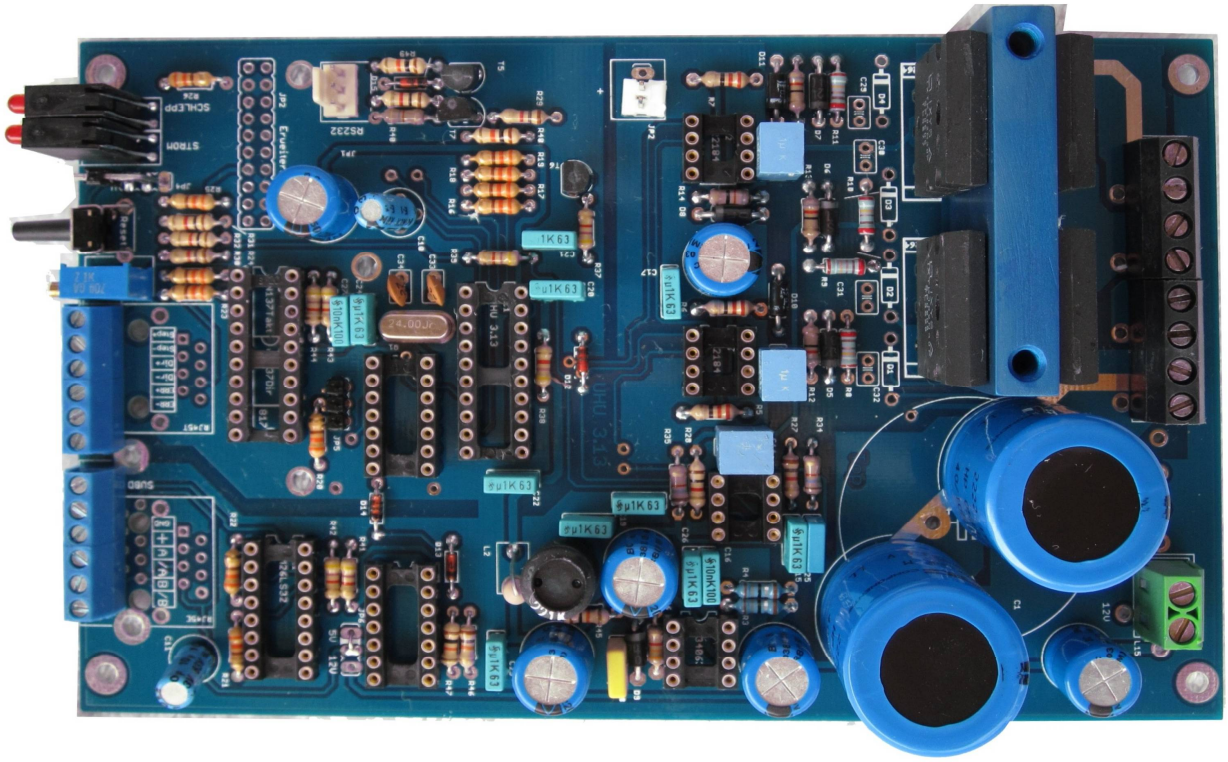
JP1: RS232 Analyzer
JP2: 12V optional cooling fan
JP3 Expansion, not yet used
JP4: Alternate configuration switch (future use)
JP5: Position error warning (Err) inverted/not-inverted
JP6: IMPORTANT! Encoder power supply can be chosen at 5V or 12V. Wrong voltage instantly kills your expensive encoder! You may decide not to use a jumper but to use a solder bridge here**JP1 – RS232**

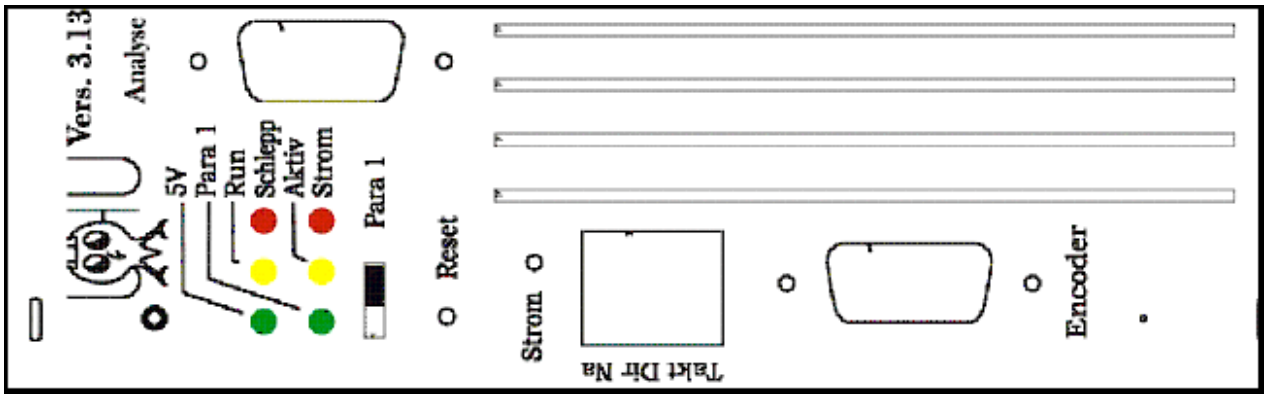


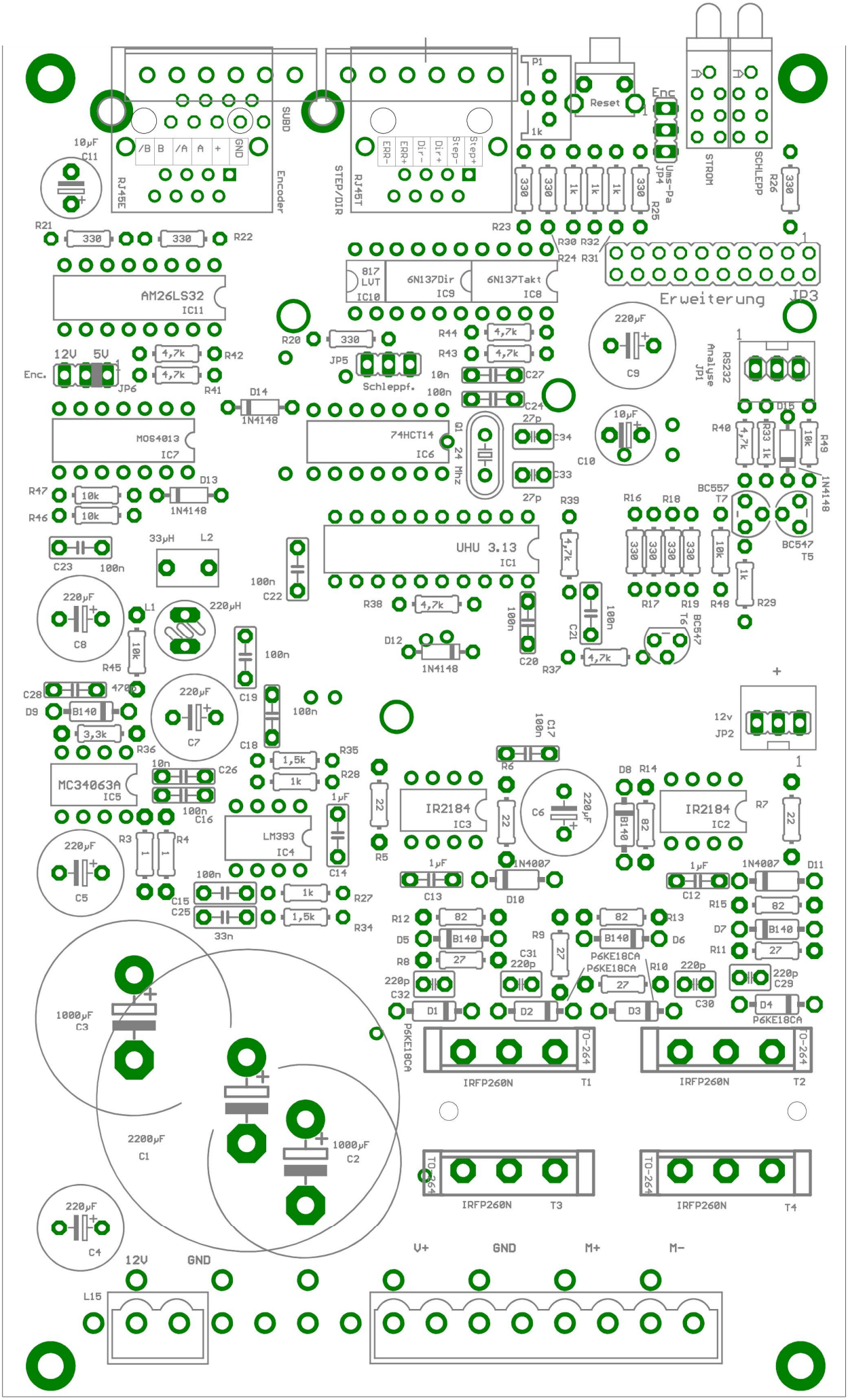
JP2 – 12V FAN

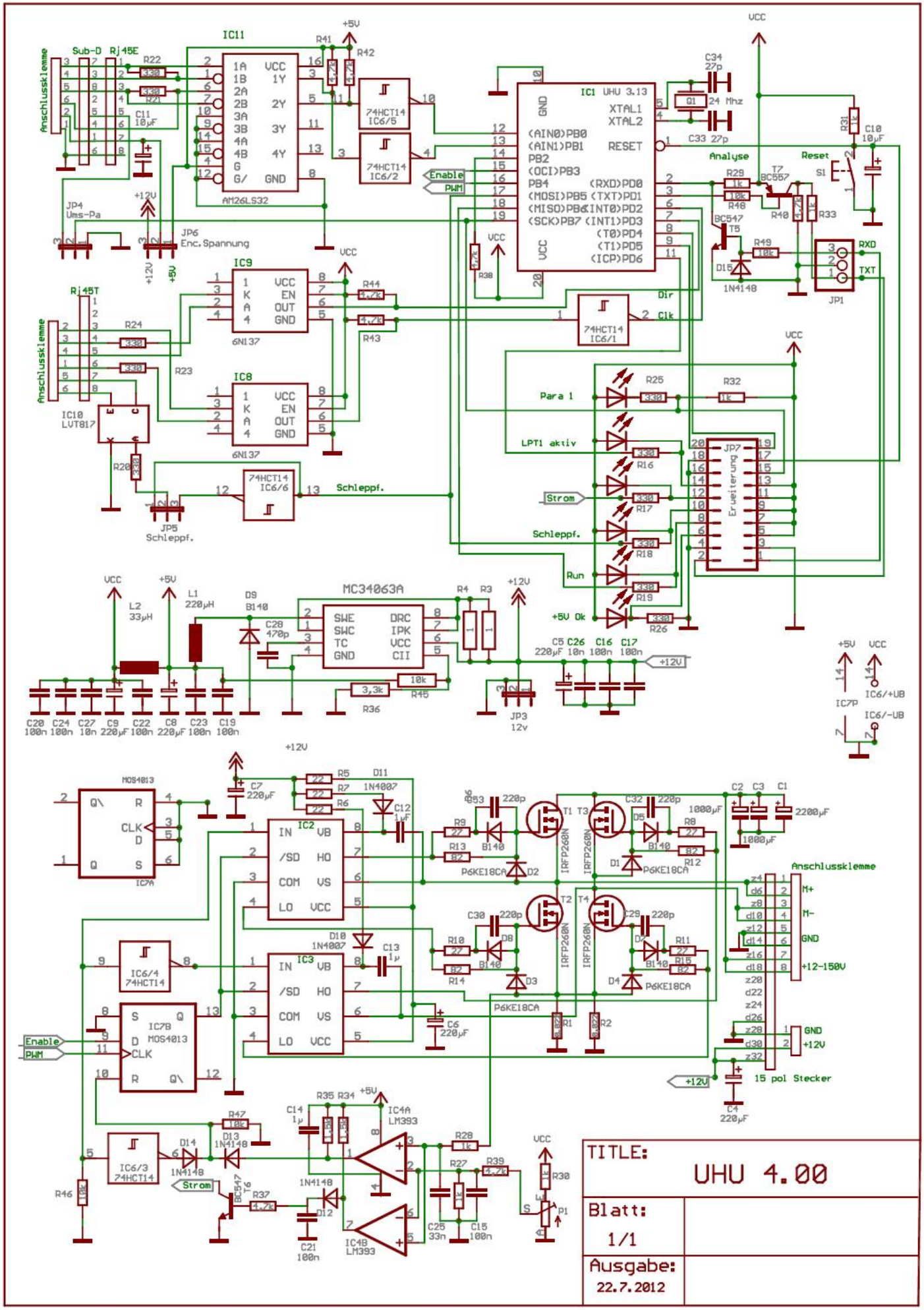


Almost fully assembled board:






SUBD
Encoder
RJ45E
/B
B
/A
A
+
GND
STEP/DIR
RJ45T
ERR-
ERR+
Dir-
Dir+
Step-
Step+
P1
1k
Reset
Enc
JP4
Ums-Pa
STROM
SCHLEPP
R26
330
R25
R23
R30
R32
R24
R31
817
LVT
IC10
6N137Dir
IC9
6N137Takt
IC8
Erweiterung
JP3
AM26LS32
IC11
R21
R22
R20
JP5
Schleppf.
R44
R43
C27
C24
C9
220µF
C10
10µF
Analyse
JP1
RS232
D15
R40
R33 1k
R49
1N4148
BC557
T7
BC547
T5
12V
5V
Enc.
JP6
R42
R41
D14
MOS4013
IC7
74HCT14
IC6
Q1
24 Mhz
27p
C34
C33
R47
R46
D13
R16
R18
R39
R17
R19
R48
R29
T6
C23
33µH
L2
UHU 3.13
IC1
C22
R38
C20
C21
R37
D12
C8
L1
220µH
R45
C19
C28
D9
B140
3,3k
R36
C7
C18
R35
R28
C26
MC34063A
IC5
C16
LM393
IC4
C14
R3
R4
C5
C15
C25
33n
R27
R34
R5
IR2184
IC3
C6
R6
C17
D8
R14
IR2184
IC2
R7
12v
JP2
C13
D10
1N4007
C12
D11
R15
D7
R11
R12
R13
D5
D6
R9
R8
C31
P6KE18CA
R10
C32
C29
D1
D2
D3
D4
C3
C1
C2
C4
IRFP260N
T1
T2
T3
T4
TO-264
12V
GND
V+
M+
M-
L15


IC11
AM26LS32
Sub-D
Rj45E
Anschlussklemme
JP4
Ums-Pa
JP6
Enc. Spannung
IC1 UHU 3.13
XTAL1
XTAL2
RESET
Q1
24 Mhz
C33 27p
C34 27p
C10 10µF
Analyse
Reset
S1
T7 BC557
T5 BC547
D15 1N4148
JP1
RXD
TXT
IC9
IC8
6N137
IC10 LVT817
Rj45T
JP5
Schleppf.
74HCT14 IC6/1
74HCT14 IC6/2
74HCT14 IC6/3
74HCT14 IC6/4
74HCT14 IC6/5
74HCT14 IC6/6
Dir
Clk
Enable
PWM
Para 1
LPT1 aktiv
Strom
Schleppf.
Run
+5V Ok
JP7
Erweiterung
MC34063A
L1 220µH
L2 33µH
D9 B140
JP3 12v
IC7A
IC7B
MOS4013
IC2
IC3
IRFP260N
P6KE18CA
B140
1N4007
1N4148
IC4A LM393
IC4B LM393
IC7P
IC6/+UB
IC6/-UB
Anschlussklemme
M+
M-
GND
+12-150V
15 pol Stecker
P1
TITLE:
UHU 4.00
Blatt:
1/1
Ausgabe:
22.7.2012

Bauteil	Wert	Stück	Package	Bezeichnung / Reichelt Bestell Nr.
R3-R4	1	2	R9	METALL 1,00 :: Metallschichtwiderstand 1,00 Ohm
R5-R7	22	3	R9	METALL 22,0 :: Metallschichtwiderstand 22,0 Ohm
R8-R11	27	4	R9	METALL 27,0 :: Metallschichtwiderstand 27,0 Ohm
R12-R15	82	4	R9	METALL 82,0 :: Metallschichtwiderstand 82,0 Ohm
R16-R26	330	11	R9	METALL 330 :: Metallschichtwiderstand 330 Ohm
R27-R33	1k	7	R9	METALL 1,00K :: Metallschichtwiderstand 1,00 K-Ohm
R34-R35	1,5k	2	R9	METALL 1,50K :: Metallschichtwiderstand 1,50 K-Ohm
R36	3,3k	1	R9	METALL 3,30K :: Metallschichtwiderstand 3,30 K-Ohm
R37-R44	4,7k	8	R9	METALL 4,70K :: Metallschichtwiderstand 4,70 K-Ohm
R45-R49	10k	6	R9	METALL 10,0K :: Metallschichtwiderstand 10,0 K-Ohm
C4-C9	220µF	6	EB8	RAD FC 220/25 :: Elektrolytkondensator, 8x11mm, RM 3,5mm
C10-11	10µF	2	E5	RAD 105 10/63 :: Elektrolytkondensator, 5x11mm, RM 2mm
C12-14	1µF	3	C5	MKS-2 1,0µ :: WIMA Folienkondensator, Rm 5mm, 1,0µF
C15-C24	100n	10	C5	MKS-2 100N :: WIMA Folienkondensator, Rm 5mm, 100nF
C25	33n	1	C5	MKS-2 33N :: WIMA Folienkondensator, Rm 5mm, 33nF
C26-C27	10n	2	C5	MKS-2 10N :: WIMA Folienkondensator, Rm 5mm, 10nF
C28	470p	1	C5	NPO-5 470P :: Vielschicht-Keramikkondensator 470P, 5%
C29-C32	220p	4	C2,5	NPO-2,5 220P :: Vielschicht-Keramikkondensator 220P, 5%
C33-C34	27p	2	C2,5	KERKO 27P :: Keramik-Kondensator 27P
D5-D9	B140	5	D9	SB 140 :: Schottky Diode, DO41, 40V, 1A
D10-D11	1N4007	2	D9	1N 4007 :: Gleichrichterdiode, DO41, 1000V, 1A
D12-D15	1N4148	4	D7,5	1N 4148 :: Planar Epitaxial Schaltdiode, DO35, 100V, 0,15A
IC Sockel	4 pol	4	DIIL8	GS 8P :: IC-Sockel, 8-polig, superflach, gedreht, vergold.
IC Sockel	14 pol	2	DIL14	GS 14P :: IC-Sockel, 14-polig, superflach, gedreht, vergold.
IC Sockel	16 pol	1	DIL16	GS 16P :: IC-Sockel, 16-polig, superflach, gedreht, vergold.
IC Sockel	20 pol	2	DIL20	GS 20P :: IC-Sockel, 20-polig, superflach, gedreht, vergold.
JP1-JP2	Analyse/12V	2	1X03	PS 25/3G WS :: Platinensteckverbinder gerade, weiss, 3-polig mit Kabe
JP3	Erweiterung		JP10Q	SL 2X10G 2,54 :: 2x10pol.-Stiftleiste, gerade, RM 2,54
JP4-JP6	Jumper	1	3pol	SL 1X36G 2,54 :: 36pol. Stiftleiste, gerade, RM 2,54
Jumper	Jumper	3		JUMPER 2,54 SW :: Kurzschlussbrücke, schwarz, RM 2,54
L1	220µH	1	Induktivität	L-11P 220µ :: Stehende-Induktivität, 11P, Ferrit, 220µ
L2	33µH	1	Neosid	SMCC 33µ :: Drosselspule, Festinduktivität, axial, 33µ
T5-T6	BC547	2	TO92	BC 547C :: Transistor NPN TO-92 45V 0,1A 0,5W
T7	BC557	1	TO92	BC 557C :: Transistor PNP TO-92 45V 0,1A 0,5W
IC2-IC3	IR2184	2	DIIL8	IR 2184 :: Halbbrücken-Treiber, DIP-8
IC4	LM393	1	DIL08	LM 393 DIP :: Comparator, DIP-8
IC5	MC34063A	1	DIIL8	MC 34063 A :: Schaltregler, DIP-8
IC6	74HCT14	1	DIL14	74HCT 14 :: IC-SCHALTUNG
IC7	MOS4013	1	DIL14	MOS 4013 :: 2 X D-FF
IC8-IC9	6N137	2	DIIL8	6N 137 :: OPTOKOPPLER
IC10	LVT 817	2	OPTO	LTV 817 :: OPTOKOPPLER
IC11	AM26LS32	2	DIL16	AM 26LS32 CN :: RS422-Empfänger, DIL-16
TASTER	Reset	1	TASTER	TASTER 3305 :: Kurzhubtaster 6,6x7,4mm,Höhe:11,8mm,12V,horiz
T1-T4	IRFP260N	4	FET	IRFP 260N :: Leistungs-MOSFET N-Ch TO-247AC 200V 50A je nach Spannungsfestigkeit
	IRFP 4332			IRFP 4332 :: Leistungs-MOSFET N-Ch TO-247AC 250V 57A je nach Spannungsfestigkeit
Clip	Befestigung	4	Feder	MC 797 :: Montage-Clip für Kühlkörper TO218, 14,5 mm
Kühlkörper	Kühlkörper	0,5	ALU	V PR118/94-M3 :: Spezialkühlkörper für Clipmontage, 3,2K/W 1/2 pro UHU
Isolierfolie	Kühlkörper	1	Silikon	SI 6018 :: Silikon-Isolierfolie, 94x20x0,18mm
Isolierscheibe	Kühlkörper	4	Kunstoff	IB 2 :: Isolierbuchse für TO220, TOP3

LED	5V Run	2	LED3D	MEN 1881.8720 :: Ampel-LED-Baustein, Ø 3mm, rot/gelb/grün
SUBD	Analyser	1	D-Sub	D-SUB BU 09 :: D-SUB-Buchse, 9-polig, Lötkelch

Aufbau liegend

C1	2200µF	1	EB35D	BSN 2.200/100 :: Snap-in Becher-Elko, 35x40mm, 2.200µF/100V je nach Spannungsfestigkeit
P1	1k	1		64Y-1,0K :: Präzisionspoti. 25 Gänge, stehend, 1,0 K-Ohm
SUBD	9 pol	1	SUBD	D-SUB ST 09P :: D-SUB-Stecker, 9-polig, Printausführung

Aufbau19 Zoll

C2-C2	1000µF	2	EB25D	BSN 1.000/100 :: Snap-in Becher-Elko, 22x30mm, 1.000µF/100V je nach Spannungsfestigkeit
P1	1k	1	Trimmer	64Z-1,0K :: Präzisionspoti. 25 Gänge, stehend, 1,0 K-Ohm
RJ45	Encoder/Takt Encoder D	2	RJ45UHU	MEBP 8-8G :: Modular-Einbaubuchse 8/8, geschirmt
SUBD	Sub	1	SUBD	D-SUB ST 09US :: D-SUB-Stecker, 9-polig, gewinkelt, RM 7,2
L15	Stecker		gewinkelt	ML-H 15 :: Messerleiste 15 Hochstromkontakte ????

Aufbau Klemmen,Stecker

K1-K2	Klemme 3,5	2	schraubar	AKL 059-06 :: Anschlussklemme 6-polig, RM 3,5
	Buchse		steckbar	AKL 169-06 :: Anschlussklemmensystem 6-pol, RM 3,5mm
	Stecker		gerade	AKL 183-06 :: Wannenstecker für AKL 169, 6-pol, RM3,5
	Stecker		gewinkelt	AKL 182-06 :: Wannenstecker für AKL 169, 6-pol, RM3,5
K 12V	Klemme 5,08	1	schraubar	AKL 101-02 :: Anschlussklemme 2-polig, RM 5,08
	Buchse		steckbar	AKL 249-02 :: Anschlussklemmensystem 2-pol, RM5,08
	Stecker		gerade	AKL 220-02 :: Wannenstecker für AKL 249, 2-pol, RM5,08
	Stecker		gewinkelt	AKL 230-02 :: Wannenstecker für AKL 249, 2-pol, RM5,08
KMot/Servo	Klemme 5,08	1	schraubar	AKL 101-08 :: Anschlussklemme 8-polig, RM 5,08
	Buchse		steckbar	AKL 249-08 :: Anschlussklemmensystem 8-pol, RM5,08
	Stecker		gerade	AKL 220-08 :: Wannenstecker für AKL 249, 8-pol, RM5,08
	Stecker		gewinkelt	AKL 230-08 :: Wannenstecker für AKL 249, 8-pol, RM5,08
L15	Stecker		gewinkelt	ML-H 15 :: Messerleiste 15 Hochstromkontakte ????

IC1	UHU 3.13	1	DIL20	
Q1	24 Mhz	1	QUARZ	
R1-2	0,022	2	R-CHIP	
D1-D4	P6KE18CA	4	D9	bei Bedarf