

Documentation / Part Lists	20.11	/0.20	Next Section
--	-----------------------	-----------------------	------------------------------

- Contents
1. [Part Lists for the NG Hardware 0.20](#)

1. [Build Options](#)

1. [Sum-Signal Option](#)

2. [Buzzer](#)

3. [Voltage Regulator Option](#)

4. [Jumpers](#)

1. [SJ1](#)

2. [SJ2](#)

3. [SJ100](#)

4. [JP-U1 and JP-U2](#)

5. [JP-ISP](#)
2. [NG Flight Control 0.20](#)

3. [NG Sensor Board 0.20](#)

4. [NG Accessories](#)

5. [MLX Breakout Boards](#)

6. [Tips & Tricks](#)

7. [Footnotes](#)

Part Lists for the NG Hardware 0.20

The following tables list the electronic parts needed to build the flight control, sensor board and the MLX breakout boards and some additional accessories. There are columns for part numbers from [Reichelt](#), [CSD-Electronic](#), [Farnell](#), [DigikKey](#), [Distrelec](#) and a few other distributors.

You will probably get the best price by ordering your parts from [CSD-Electronic](#). They are a bit slow sometimes, though. If you need something quickly you had better choose a different distributor.

What's not available at [2CSD-Electronic](#), order from [DigikKey](#) or [Farnell](#). That way you will get all the parts at around EUR400 at the time of writing.

Build Options

There are several options you can choose from.

■ Sum-Signal Option

Sum-Signal at the LPC:

- Populate R5, don't populate R4 and R13

Sum-Signal at the RC controller (not yet functional):

- Populate R4, don't populate R5 and R13

■ Buzzer

Unfortunately there's a bug in the buzzer circuit which makes it unusable without a little trick. If you look closely at the pads for the buzzer you will notice that one of them is connected to the ground plane whereas the other one is connected to a conductive track going away from the pad. In order to get the buzzer working you need to solder one leg (marked as -) to the pad with the conductive track and the other leg (marked as +) to R15. R15 should be 0-10 Ohm.

Populate R12, R15 and T101. Bridge R102 and C106. Do not populate R13, R103, C105 and T100.

■ Voltage Regulator Option

Linear Voltage Regulator:

- populate IC2

Switched Voltage Regulator:

- populate IC5

Excel-File with little price comparison [UAVP-Bauteile.xls](#).

■ Jumpers

JS1

Connects pin 3 of the SB connector on the FC board with ground level. **Set** this jumper.

JS2

Connects the output of the 2LiPo voltage measurement with pin AD0.4 of the L-PC. The output is by default and unalterably also connected to pin ADC0 of the RC controller. The RC controller doesn't measure the 2LiPo voltage at the moment which requires S22 to be **set**.

JS100

This is a double jumper which allows you to choose the voltage level of the SSP interface and its slave select pins. Make sure you set it to any of both values. Additional hardware might someday require you to adjust this setting, but for now both values are just fine.

JP-U1 and JP-U2

Those jumpers let you choose the supply voltage of the UART connectors which might possibly power your USB/UART or RS232/UART converter. This will **not** change the actual voltage level of the UART.

JP-ISP

This is a double jumper which connects SDA1 or SDA0 with the nearby button. Setting a jumper and pressing the button at startup will either activate the UART or USB bootloader. (Can someone clarify which jumper needs to be set for USB or UART respectively?)

NG Flight Control 0.20

This are the needed parts for the hardware 0.20 flight control board:

Name	Value / Manufacturer	Part Type / Description	Package	Quantity	Comments	Reichelt	CSD-Electronic	Farnell	Digikey	Distrelec [CH]	Other
IC1	ATMEGA644P-20AU / Atmel	8-Bit microcontroller	TQFP44	1			301746	1455121	ATMEGA644P-20AU-ND		
IC3, IC4	P82B96 / Texas Instruments or NXP	I2C Buffer / Levelshifter	SO8	2		P 82B96 TD		8906068	568-1009-1-ND		
D1, D2, D4, D5		Duo LED	SOT23	4	SOT23 Duo LEDs are hard to find. Instead						Conrad

					you can also use two 0805 LEDs.						
D3	SM6T15A / ST Microelectronics	transient voltage suppression diode	SMB	1	Breakdown voltage might need to be adjusted for 4S Lipo configurations. (SM6T18A)		SM6T15A: 9885900 SM6T18A: 9802630	SM6T15A: 497-7430-1-ND SM6T18A: 497-7431-1-ND	SM6T15A: 60 09 84 SM6T18A: 60 09 85		
D6, D7, D8, D10	SML VT3V3 / ST Microelectronics	transient voltage suppression diode	SMBG	4			9802886	497-2496-1-ND			
D9, D11	SM6T6V8A	transient voltage suppression diode	SMB	2			9802720	497-6501-1-ND	60 09 80		
S1, S2, S3	SKHMPSE010 or FSM1LPA	SMD tactile switch		3		TASTER 9312	351015	1570387	450-1139-ND	20 08 56	
C1, C2, C3, C4, C6, C7, C8, C10, ... 1	100nF	ceramic SMD capacitor	C0805	8 (20)		X7R-G0805 100N	115-08N100	8820120		83 14 69	
R15, ...	0 Ohm	SMD resistor	R0805	1 (2)	Bridge these pads using a 0 Ohm resistor.	SMD-0805 10,0	Part of 10-08FAMP AK	1500660		71 32 46	
R4, R5 R16, R17, R19, R20, R21, R22	100 Ohm	SMD resistor	R0805	6		SMD-0805 100	Part of 10-08FAMP AK	1500662		71 32 70	
R8, R11, ...	330 Ohm	SMD resistor	R0805	2 (3)		SMD-0805 330	Part of 10-08FAMP AK	1500705		71 32 82	
R2, R3, ...	470 Ohm	SMD resistor	R0805	2 (4)		SMD-0805 470	Part of 10-08FAMP AK	1500718		71 32 86	
R9, R10, ...	1.8 kOhm	SMD resistor	R0805	2 (4)		SMD-0805 1.80k	Part of 10-08FAMP AK	1500686		71 33 00	
R7	2.2 kOhm	SMD resistor	R0805	1		SMD-0805 2.20k	Part of 10-08FAMP AK	1500692		71 33 02	
R1, R14, R18, ...	10 kOhm	SMD resistor	R0805	3 (5)		SMD-0805 10,0k	Part of 10-08FAMP AK	1500664		71 33 18	
R6	47 kOhm	SMD resistor	R0805	1		SMD-0805 47,0k	Part of 10-08FAMP AK	1500720		71 33 34	
L1	22 uH	SMD inductor	L2220K	1		L-PIIS2408 22µ			DN7962CT-ND	35 14 81	Conrad
X-DSL1, X-DSL2	1.25mm Pitch Picoblade Header, SMD, right angle / MOLEX	SMD connector	53261-04	2				1125374	WM7622CT-ND	11 68 63	

U100	MAX3002	Level-shifter, used as a SPI buffer here	TSSOP20	1			1379762	MAX3002EUP+-ND		
T103	IRF 7205	P-channel mosfet	SO8	1		IRF 7205	9103368	IRF7205PBECT-ND	60 12 80	
T101, T104, T106, T107	BC817-16	NPN transistor	SOT23	3		BC 817-16 SMD	8734739	BC817-16-FDICT-ND	61 03 72	
C110, C114	22pF	ceramic SMD capacitor	R0805	2		NPO-G0805 22p	1362555		83 14 16	
C100, C101, C102, C103, C104, C107, C108, C109, C111, C112, C113, C115	100nF	ceramic SMD capacitor	C0805	12 (20)		X7R-G0805 100N	8820120		83 14 69	
C106	0 Ohm		C0805		Bridge these pads using a 0 Ohm resistor.					
R102	0 Ohm	SMD resistor	R0805	1 (2)	Bridge these pads using a 0 Ohm resistor.					
R104	330 Ohm	SMD resistor	R0805	1 (3)		SMD-0805 330	1500705		71 32 82	
R111, R112	470 Ohm	SMD resistor	R0805	2 (4)		SMD-0805 470	1500718		71 32 86	
R12,R110	680R	SMD resistor	R0805	1		SMD-0805 680	1500731		71 32 90	
R100, R101	1.8 kOhm	SMD resistor	R0805	2		SMD-0805 1,80k	1500686		71 33 00	
R106	3k3	SMD resistor	R0805	1		SMD-0805 3,30k	1500706		71 33 06	
R107	4k7	SMD resistor	R0805	1		SMD-0805 4,70k	1500719		71 33 10	
R108, R113	10 kOhm	SMD resistor	R0805	2 (5)		SMD-0805 10,0k	1500664		71 33 18	
R105, R109	56k	SMD resistor	R0805	2		SMD-0805 56,0k	1500726		71 33 36	
Q100	20 MHz	SMD crystal oscillator	HC49/UJ	1		20,0000-HC49-SMD	9713352		33 50 38	
IC5	PTH08080WAH	5V switching voltage regulator		1	This device provides a powerful power supply		1295824	296-20432-ND		

					for currents up to 2.25A without dissipating heat. It may interfere with RC receivers. It is therefore recommended to place them as far away from the switching regulator as possible. Especial care must be taken in positioning the antenna.					
IC2	7805 or L4941	5V linear voltage regulator	TO220	1	This is only a replacement for IC5 and must not be used in combination with IC5.	µA 78S05 or L4941	22-0520		64 52 30	
C5, C9	220µF	electrolytic capacitor	Grid: 3.5mm, Ø 8mm	2		RAD 220/25	R0220V025	9451196	80 06 30	
F1	MF-RX135-2	multifuse		1		PFR A135		9350136	MF-RX135/72-0-ND	27 25 37
SP1		5V buzzer	AL 60P	1		SUMMER TDB 05	064-BUZZ5V	1022392	56 00 70	
LPC-H2148		(shrouded) pin header, 2 x 13 pins		2		WSL 26G	015-WG26	8395950	12 14 10 / 12 25 18	
LPC-H2148		Olimex LPC2148 header board		1						Embedded Projects
I2C1, X-PS		shrouded pin header, 2x3 pins, right angle	ML 6L	2		WSL 6W (?N/A?)	015-WWW06		12 16 20	
X-SP12		shrouded pin header, 2x5 pins, right angle	ML 10L	1		WSL 10W	015-WWW10	8395993	12 16 21	
X-SB		shrouded pin header, 2x7 pins, right angle	ML 14L	1		WSL 14W	015-WWW14	618160	12 16 22	
SV1 - SV12		pin headers, single-rowed		2		SL 1X36G 2.54	015435	9729038	12 20 98	
AVR-ISP		pin header, double-rowed		1		SL 2X17W 2.54	015485	9729070	12 25 10	

X-BATT	LPV pin header, 3 pins	connector		1		PS 25/3G WS	016-S030	1462950		
X-UART1, X-UART1	Molex22-23-2041	Molex connector		2		PSS 254/4G	016-S040	1462920		
KK1		heatsink		1	A heatsink must only be used if IC2 is mounted instead of IC5.	V PR5/25-M3			65.00.36	

As shopping cart of all parts available at [Reichelt](#) for the FC-0.20 can be accessed [here](#). [TODO optimize part amounts!]

NG Sensor Board 0.20

This is the part list for the hardware 0.20 sensor board:

Name	Value / Manufacturer	Part Type / Description	Package	Quantity	Comment	Reichelt	CSD-Electronics	Farnell	Digikey	Distrelec	Other
U14	ADS1255 / Texas Instruments	24 Bit ADC	SSOP20	1	The footprint on the board is too small which means pins need to be shortened in order to be able to solder the device. Pin 2 and 3 might seem to be connected by mistake after soldering. This is no reason to worry since they are actually connected. Pin 8,9,10 need to be connected manually.			1470339	296-15743-1-ND		
U15	MAX3002 / Maxim IC	Level-shifter, used as a SPI buffer here	TSSOP20	1				1379762	MAX3002EUP+-ND		
U6	MAX1167 / Maxim IC	16 Bit ADC	QSOP16	1	Pin 11 and 12 might seem to be connected by mistake after soldering. Again, this is no problem, since they are						

				actually connected electrically.						
U12	ATMEGA168-20AU / Atmel	8-Bit Microcontroller	TQFP32	1		30195	9171193	ATMEGA168-20AU-ND	645165	
U5, U11	LT1763 / Linear Technology	Low-noise voltage regulator	SO8	2			1273618	LT1763CS8-5#PBF-ND	64 13 40	
U4	OPA4350 / Texas Instruments	Quad Op-amp	SO14	1			1097445	OPA4350UA-ND		
U10	OPA2350 / Texas Instruments	Dual Op-amp	SO8	1			1101542	OPA2350UA-ND	64 84 66	
U9	LM1117 or LT1117	3.3V voltage regulator	SOT223	1		LT 1117 CST-3.3	223-1705	1663356	LM1117IMPX-3.3-ND	64 04 10
U8	MAX5490GA01000 / Maxim IC	precision voltage divider	SOT23	1	If this part is not available at Digilkey, it can be replaced by two 50kOhm resistors.				MAX5490GA01000+T-ND	
LED1, LED2, LED3		SMD LED	0805	3	Colors can be chosen freely.	green: SMD-LED 0805 GN red: SMD-LED 0805 RT blue: SMD-LED 0805 BL	orange: 26-0806060 red: 26-0801032 blue: 26-0804070	green: 1685052 red: 1685054 orange: 1685051	orange: 25 02 33 red: 25 45 60 blue: 25 02 30	
D1	SM6T15A / ST Microelectronics	transient voltage suppression diode	SMB	1	Breakdown voltage might need to be adjusted for 4S Lipo configurations. (SM6T18A)		SM6T15A: 9885900 SM6T18A: 9802630	SM6T15A: 497-7430-1-ND SM6T18A: 497-7431-1-ND	SM6T15A: 60 09 84 SM6T18A: 60 09 85	
D2	ES2D	rectifying diode, super fast recovery	SMB	1		SMD 1N 4006	11026	1467491		60 17 15
C6, C8, C12, C13, C14, C15	100 Hz, 10 nF 146Hz, 6,8 nF 255 Hz, 3,9 nF 452 Hz, 2,2 nF 553 Hz, 1,8 nF 1000 Hz, 1 nF	ceramic SMD capacitor	C0805	6	These capacitors specify the cut-off frequency of the second order gyroscope low-pass filter. You must choose the same value for all capacitors.					

C36, C42	55 Hz: 18 nF 100 Hz: 10 nF 235 Hz: 3.9 nF 452 Hz: 2.2 nF 553 Hz: 1.8 nF 1000 Hz: 1 nF	ceramic SMD capacitor	C0805	2	These capacitors specify the cut-off frequency of the second order pressure sensor low-pass filter. You must choose the same value for both capacitors.					
C5, C7, C16, C19, C21, C25, C29, C31, C33, C35, C37, C38, C43, C44, C45, C48, C49	100 nF	ceramic SMD capacitor	C0805	17		X7R-G0805 100N	115-08N100	8820120	83 14 69	
C10, C22, C39	10 nF	ceramic SMD capacitor	C0805	3		X7R-G0805 10N	115-08N010	1658874	83 14 62	
C20, C40	100 pF	ceramic SMD capacitor	C0805	2		NPO-G0805 100P	115-08C100		83 14 24	
C50, C51, C53, C54	22 pF	ceramic SMD capacitor	C0805	4		NPO-G0805 22P	115-08C022		83 14 16	
C9	0.1 Hz: 10 uF 1 Hz: 1 uF	ceramic SMD capacitor	C0805	1	This capacitor specifies the cut-off frequency of the second order temperature sensor low-pass filter.					
C1, C3, C4, C11, C28, C30	1 uF / 16 V	tantal SMD capacitor	SMA	6		SMD TAN.1,0/16		9753869	81 20 91	

C17, C18, C23, C27, C32, C41, C46, C47, C52	10 uF / 10 V	tantal SMD capacitor	SMA	9		SMD TAN. 10/16		1135105		81 10 00	
C34	47 uF / 10 V	tantal SMD capacitor	SMB	1		SMD TAN. 47/10		1658971	478-3282-1-ND	81 21 28	
R1, R4, R8	100 Ohm	SMD resistor	R0805	3	Increase resistor values if your LEDs shine too bright.						
R2, R13, R15, R19	0 Ohm	SMD resistor	R0805	4							
R24	1 kOhm	SMD resistor	R0805	1							
R17, R18	10 kOhm	SMD resistor	R0805	1							
R23	15 kOhm	SMD resistor	R0805	1							
R5, R6, R7, R9, R10, R11, R12, R21, R22	160 kOhm	SMD resistor	R0805	9		Part of 10-08FAMP-PAK					
R3, R14, R16, R20	Do not populate!										
L1, L2	47 uH	SMD inductor	L2220K	2		L-PIIS2408 47µ		1174028	DN7964CT-ND	35 14 83	Conrad
F1	MF-SM075	SMD multifuse	MF-SM0XX	1				9350217RL	MF-SM075CT-ND	28 30 01	
C24	10 uF / 25 V	electrolytic SMD capacitor	L x B max.: 4.5mm x 4.5mm, Ø 4mm	1	Please ensure you buy washable capacitors which can withstand washing the PCB after soldering.	SMD ELKO 10/35	121-016V010	8823081		80 11 50	
C2, C26	100 uF / 25 V	electrolytic SMD capacitor	L x B max.: 6.8mm x 6.8mm, Ø 6.3mm	2	Please ensure you buy washable capacitors which can	SMD ELKO 100/16	121-016V100			80 11 46	

					withstand washing the PCB after soldering.					
X-GPS	1.25mm Pitch Picoblade Header, SMD, right angle / MOLEX	SMD connector	53261-04	1		1125374	WM7622CT-ND	11 68 63		
Q1	20 MHz	crystal oscillator	HC49US	1		20,0000- HC49U-S	14-US20,000MHZ	64 45 99		
Q2	7.68 MHz	crystal oscillator	HC49US	1		9509828	X163-ND	64 45 78		
X-SB		shrouded pin header, 2x7 pins, right angle	ML14L	1		WSL 14W	015-WW14	12 14 26		
X-PS, X-ISP		shrouded pin header, 2x3 pins, right angle	ML6L	2			015-WW06	12 16 20		
U7	LIS3LV02DQ breakout board / Sparkfun	3-axis acceleration sensor on breakout board		1	It is recommended to use a female header on the sensor board in order to be able to remove the ACC breakout board if necessary.				sparkfun	
U13	Micromag3 / PNI	3-axis magnetic field sensor		1	It is recommended to use female headers on the sensor board in order to be able to remove the device if necessary.					
U1, U2	MLX90609 / Melexis	MEMS gyroscope mounted in upright direction		2	It is recommended to use female headers on the sensor board in order to be able to remove the device if necessary. If already at hand you can also use ADXR3300 breakout boards from				sander- electronic	

U3	MLX90609 / Melexis	MEMS gyroscope mounted horizontally	1	It is recommended to use female headers on the sensor board in order to be able to remove the device if necessary. If already at hand you can also use ADXRS300 breakout boards from sparkfun.					
U16	MPXH6115A/ Freescale	barometric pressure sensor	SSOP 08 1	Please do not solder this device onto the board before washing.		1457170	MPXH6115AC6T1TR-ND		

As shopping cart of all parts available at [Reichelt](#) for the SB-0.20 can be accessed [here](#). [TODO optimize part amounts.]

NG Accessories

This is the part list for the accessories of the boards:

Name	Quantity	Reichelt	CSD-Electronic	Farnell	Other
Pfostenverbinder (14 pol)	2		015-PF14	1107819	
Pfostenverbinder (10 pol)	10		015-PF10	1098498	
Pfostenverbinder (6 pol)	10		015-PF06		
LPV Buchse (4 pol inkl. Kabel)	2	PSK 254/4W + PSK-KONTAKTE	016-KB04		
LPV Buchse (3 pol inkl. Kabel)	1	inkl. in PS 25/3G WS	016-KB03		
Flachbandkabel (14 pol)	3m		456-14-003		
FC Jumper (Jumper schwarz Lasche)	10	JUMPER 2.54GL SW	015499		
Molex Verbindungskabel vorgefertigt	1			1125272	
Molex Crimp-Gehäuse	5			9733116	
BTS555	1	BTS 555		4109260	Conrad

MLX Breakout Boards

This is the part list for the MLX break boards:

Part	Value	Package	Quantity	Reichelt	CSD-Electronic	Farnell
C1-C3	100nF	0603	3			1414610
C4	3,3nF	0603	1			1414635

Note
:: If you will use ADXR300 gyros you will not need the MLX breakout boards.
The ADXR300 come with their own breakout boards!

Tips & Tricks

* It seems to be a good idea to get a E12 Familypack of 0805 resistors and capacitors, it's much cheaper then getting all the resistors in single strips. For example, you can get them from [CSD Electronics](#) order number for resistor family pack is 10-08FAMP/PAK.

Footnotes

.. means : More pieces of the same part on the bottom side of the PCB. (1)
Please read the notes on sum signal options. (2)

Documentation/PartLists/0.20 (last edited 2009-02-25 22:32:13 by 2PatrickSchmid)