						Lowest					
WoodenHaptics.org Bill of Materials and Recommended Equipment		Estima	ted part co	ost w/o motor & enc.	€962.23						
		Estima	ited motor	& encoder cost:	€1,420.78	€1,420.78					
We will try to reduce the number of distributors to reduce complexity		Estimated PC connection cost:		€811.29	€51.61						
Maxon, Farnell and Misumi is easy to access globally		Estima	ted require	ed tools cost:	€196.95	€0.00					
Other distributors might be tricky in some parts of the world		Estima	ted total*	part cost for kit:	€3,391.25	€2,434.62					
Let us know your experience in the forum of woodenhaptics.org											
*) No labour cost included, i.e. for laser-cutting or soldering.		1 EUR			kr9.45						
Largest costs are in the motors, drivers and PCIe card that could		1 EUR	in USD		\$1.19						
be re-used in several projects if you so wish. Required tools		1 EUR	in CHF		CHF1.03						
(except laser-cutter and soldering tools) are included.											
				Suggested d				Estimated			
Our Name	quantity	Maxon	Farnell	Misumi	Elektrokit	Tecni-cable	Other Distributor	Unit Cost €	Full name	Notes	Sum Cost €0.0
MECHANICS											€0.0
											€0.0
Raw Material											€0.0
6 mm birch plywood A2 sheet (594 x 420 mm) (alternatives possible)	5	5					Local / cutlasercut.com	€5.29			€26.4
											€0.0
Construction Hardware: Base											€0.0
M3x10 (for motor)	6			CB3-10				€0.09			€0.5
M3x35	6			CB3-35				€0.12			€0.7
M3x50	4			CB3-50				€0.24			€0.9
M5x90	6			CB5-90				€0.30			€1.8
M3x22 6x10x1 washer	10			CB3-22 WSSB10-6-1				€0.10 €1.05			€1.0 €6.3
6x10x1 washer 10x55x4x5 capstan (10x55 shaft (RDOF10-55) ok if 10mm coupler)	1			WSSB10-6-1 SFRMHP10-55-F5-F				€1.05			€6.3
	2			SB6900ZZ	'4			€7.36			
10x22x6 bearing Flexible Coupler that fits motor shaft diameter and 4 (10) mm capstan	1			CPL25-6-10				€28.80			€11.2 €28.8
ALT For smaller motor, use CPL12-3-4 or CPL12-4-5	0			CPL25-6-10				€28.80			€28.8
3x20 dowel pin	4			MS3-20				€0.08			€0.3
3x40 dowel pin	7			MS3-40				€0.00			€1.4
3x60 dowel pin (Substitute with MS3-40)	5			MS3-40				€0.20			€1.0
Sxou dower piri (Substitute with MSS-40)	0			M33-40				€0.20			€0.00
Construction Hardware: Body A											€0.0
M3x10 (for motor)	12	2		CB3-10				€0.09			€1.0
8x22x7 bearing	2			B608ZZ				€1.80			€3.6
10x22x6 bearing	4			SB6900ZZ				€5.60			€22.4
M3x22	7			CB3-22				€0.10			€0.7
M3x18	16	3		CB3-18				€0.09			€1.4-
M3x45	6			CB3-45				€0.17			€1.0
M6/1.0 nut	1	1		LBNR6				€0.32			€0.3
M4x45 full thread (thread M4/0.75)	1	1		ACB4-45				€0.35			€0.3
M4/0.75 nut	1	1		LBNR4				€0.28			€0.2
8x60 Shoulder bolt	1	1		MSB8-60				€0.80			€0.8
8x110 Shoulder bolt (thread M6/1.0)	1	1		MSB8-110				€1.00			€1.0
8x05 Belleville (spring) washer	1	1		SSRBW8				€1.05			€1.0
8x14x05 shim	6	3		CIMR8-14-0.5				€0.50			€3.0
Flexible Coupler (25x10x6 or 16x6x5)	2	2		CPL25-6-10				€28.80			€57.6
10x55x4x5 capstan (10x55 shaft (RDOF10-55) ok if 10mm coupler)	2	2		SFRMHP10-55-F5-F	4			€7.36			€14.7
Construction Hardware: Body B											€0.0
8x14x05 shim	1	1		CIMR8-14-0.5				€0.42			€0.4
8x05 Belleville (spring) washer	1	1		SSRBW8				€1.05			€1.0
3x25 pin	9			MS3-25				€0.20			€1.8
M3x22	11			CB3-22				€0.10			€1.1
8x22x7 bearing	4			B608ZZ				€1.80			
M4x45 full thread (thread M4/0.75)	1	1		ACB4-45				€0.35			€0.3
M4/0.75 nut	1	1		LBNR4				€0.28			€0.2
											€0.0
Construction Hardware: Body C											€0.0
M3x30	4			CB3-30				€0.12			€0.4
M3x18	2			CB3-18				€0.09			€0.1
3x20 dowel pin	2			MS3-20				€0.08			€0.1
3x35 dowel pin (3x30 preferred)	4			MS3-35				€0.20			€0.8
8x60 shoulder bolt	1	1		MSB8-60				€0.80			€0.8

8x14x05 shim	9	CIMR8-14-0.5			€0.42			€3.78
8x05 belleville (spring) washer	1	SSRBW8			€1.05			€1.0
M6 nut (1mm thread)	1	LBNR6			€0.32			€0.3
								€0.0
Construction Hardware: Body C'								€0.0
M4x45 full thread (thread M4/0.75)	1	ACB4-45			€0.35			€0.3
M4/0.75 nut	1	LBNR4			€0.28			€0.2
M3x22	7	CB3-22			€0.10			€0.70
8x22x7 bearing	2	B608ZZ			€1.80			€3.60
3x35 dowel pin	4	MS3-35			€0.20			€0.80
M3x35	3	CB3-35			€0.12			€0.36
8x14x05 shim	6	CIMR8-14-0.5			€0.42			€2.52
								€0.00
Construction Hardware: Cabling								€0.00
Wire rope (more threads preferable)	10		603.000.540		€0.89	0.54mm 7x7 A4-AISI 316 Stainless Steel Cable MBL 16kgs - 603.000.540		€8.92
Double ferrule (for crimping onto wire rope)	20		115.000.700		€0.24	Code 0.7 Double Copper Ferrule		€4.78
Turnbuckle (spannschloss)	1			Hobbykellershop.eu: 018-3051	€6.19	Spannschloss M2.5 - High Precision		€6.19
								€0.00
Required Tools for Mechanics Workbench								€0.00
Arbor Press	1			Schuchardt Maskin smaskin.se	€92.06	Verkstadspress (1 tonne recommended)	Chose a larger next time	€92.06
Wire rope cutter	1		100.004.062			Budget Wire Rope Cutter up to 3mm Diameter - 100.004.062	Chose a better and more expensive	€9.95
Wire rope ferrule crimper (you really need this)	1		115.007.023	3		TECNI®Cable Crimp Tool for Double Copper Ferrules - 115.007.023		€51.43
Torch	1			Teknikmagasinet.se 340927	€24.34			€24.34
Torch gas	1			Teknikmagasinet.se 340927	€3.17			€3.17
Hex keys	1			Local	€8.00			€8.00
Adjustable wrench	1			Local	€8.00			€8.00
								€0.00
Other								€0.00
Rubber feet (from a computer case; SilverStone Milo ML05B Black)	4				€1.00			€4.00
								€0.00
ELECTRONICS								€0.00
								€0.00
Electronics Box								€0.00
WoodenHaptics Motherboard (see below)	1							€0.00
WoodenHaptics DAQ Extension board (see below) /or/	1							€0.00
ALT mbed.org LPC1768 (OM11043) M3 extension board (for USB experime	0 1761	179			€51.61	NXP OM11043 LPC1768, MBED PROTOTYPING BOARD, KIT	The chip alone is only 90kr	€0.00
Maxon 50/5 driver module (could eventually be custom made)	3 438725				€148.64	ESCON Module 50/5, 4-Q Servocontroller for DC/EC motors, 5/15 A, 10 - 50 VDC		€445.92
								€0.00
Power Supply								€0.00
48V power supply, at least 5A (should probably be 9A)	1			Elfa.se 69-655-94	€148.57	Nätaggregat med fast utspänning 4358 VDC CH -, DE -, EA-PS548-05R	Should be replaced	€148.57
								€0.00
Motors & Encoders								€0.00
Maxon 40mm (148877) & 500 CPR Encoder (110514) combination	3 200116				€473.59			€1,420.78
ALT Maxon 30mm	0 310009							€0.00
ALT Maxon 25mm	0 118755							
Electric Cables								€0.00
12mm sleeves (5m)	1 1297	228				PRO POWER, SLEEVING, BRAID, 12MM, BLACK, 5M, PRO POWER-PETBK12BG5-SLEEVING, BRAID, 12MM, BLACK, 5I	М	€3.03
Male 10 pin cable head (for extending enc.cables)	3		41011859			IDC hane kabel 10-pol 2.54mm		€4.98
Female 10 pin cable head (for extending enc. cables)	3		41000574			IDC hona kabel 10-pol guld 2.54mm		€1.10
10 pin flat cable, per meter (for extending enc. cables)	5		31670207		€0.63	Flatkabel grå 10 ledare 1.27mm /m		€3.14
								€0.00
PC Connection								€0.00
Sensoray S826	1			www.enciris.com		http://www.sensoray.com/products/826.htm	Order directly or through distributor	€793.73
DAQ Cable 26-pin	1 2217					AMPHENOL FC26600-0 LEAD, 2.54MM, F/F, 600MM, 26WAY		€4.14
DAQ Cable 50-pin	1 2217	690			€7.02	AMPHENOL FC50600-0 LEAD, 2.54MM, F/F, 600MM, 50WAY		€7.02
								€0.00
								€0.00
ELECTRONICS CIRCUIT BOARDS								€0.00
								€0.00
WoodenHaptics Motherboard								€0.00
PCB manufacturing (price based on order of 2 units)	1			pcb-pool.com	€69.00			€69.00
motor & high pwr connectors	4 1761					IMO PRECISION CONTROLS 20.155MH/2 HEADER, 3.5MM, HORIZ, 2WAY		€1.23
ALT vertical connectors (4)	0 1761					IMO PRECISION CONTROLS 20.155MV/2 HEADER, 3.5MM, 2WAY		€0.00
cable block high pwr	4 1761					IMO PRECISION CONTROLS 20.1550M/2 TERMINAL BLOCK, 3.5MM, 2WAY		€3.34
10 pin encoder connector	3 2215					MULTICOMP MC9A22-1034 HEADER, THT, RIGHT ANGLE, 2.54MM, 10WAY		€2.69
ALT 10 pin STRAIGHT encoder header (3x)	0 2215	304			€0.49	61201021621 HEADER, THT, VERTICAL, 2.54MM, 10WAY		€0.00
micro usb connector, smd (non-reversed)	1 1645	225			€1.48	HIROSE(HRS) ZX62-B-5PA(11) MICRO USB, B TYPE, RECEPTACLE		€1.48

20 pin socket (to ext. board)	2	1593469		€1.76 MULTICOMP 2212S-20SG-85 SOCKET, PCB, 1 ROW, 20WAY		€3.5
4 pin socket (to ext. board)	1	1593460		€0.39 MULTICOMP 2212S-04SG-85 SOCKET, PCB, 1 ROW, 4WAY		€0.3
18 pin (2x9) escon socket	3	1668305		€3.66 SAMTEC SSQ-109-01-G-D RECEPTACLE, 2.54MM, DUAL, 18WAY		€10.9
12 pin escon socket (1 pin discarded)	3	1593465		€0.16 MULTICOMP 2212S-12SG-85 SOCKET, PCB, 1 ROW, 12WAY		€0.4
Encoder driver	3	1103045		€1.02 TEXAS INSTRUMENTS AM26LS32ACD IC, DIFF LINE RECEIVER QUAD, 26LS32		€3.0
						€0.0
WoodenHaptics DAQ Extension Board						€0.0
PCB manufacturing (price based on order of 6 units)	1		pcb-pool.com	€15.70		€15.7
50 pin daq connector	1	2215272		€1.93 AMPHENOL T816150A1S102CEU HEADER, L/LATCH, STR, 2.54MM, 50WAY	Should be replaced with low profile	€1.9
26 pin daq connector	1	2217535		€1.71 AMPHENOL T816126A1S102CEU HEADER, L/LATCH, STR, 2.54MM, 26WAY	Should be replaced with low profile	€1.7
44 pins (50) ext. board	1	3418388		€2.76 TE CONNECTIVITY / AMP 5-826629-0 HEADER, 1ROW, 50WAY		€2.7
Box Enclosure Mounting						€0.0
Distance screws	4	1466725		€0.30 ETTINGER SPACER, M3X, 5-VZK ETTINGER-05.13.051-SPACER, M3X, 5-VZK		€1.2
M3x6 screws (preferably M3x4 screws that comes with computers)	4	1419986		€0.02 DURATOOL-M36 PRSTMCZ100~SCREW, STEEL, BZP, 6MM, M3, PK100		€0.0
M3 washers	4	1377536		€0.01 DURATOOL M3 BRASS FULL WASHER WASHER, FULL, BRASS, M3		€0.0
		1017000		and some state of the state of		€0.0
Recommended Equipment for Electronics Workbench						€0.0
Proper soldering station	0	1447700		€375.13 WELLER WD 1000T (EU) SOLDERING STATION, 80W, 50DEG-450DEG, EU		€0.0
Proper oscilloscope (not really needed, for testing only)	0	2191868		€823.17 TEKTRONIX DPO2002B OSCILLOSCOPE, 2CH, 70MHZ, 1GSPS		€0.0
Solder cleaner	0	1792731		64.86 WELLER CLEANER, WOOL, BRASS, WDC, PK2 WELLER-T0051384099-CLEANER, WOOL, BRASS, WDC, PK2		€0.0
Solder activator	0	873895		68.76 WELLER TIP ACTIVATOR, LOW TEMP, 25G WELLER-TIP ACTIVATOR-TIP ACTIVATOR, LOW TEMP, 25G		€0.0
Solder 1.2 mm tip	0	1282099		64.86 WELLER TIP, SOLDERING IRON, ROUND, BENT, 1.2MM WELLER-LTF-TIP, SOLDERING IRON, ROUND, BENT, 1.2MM		€0.0
Solder 0.5 mm tip	0	1282096		64.97 WELLER TIP, SOLDERING IRON, ROUND, 0.5MM WELLER-LT1SA-TIP, SOLDERING IRON, ROUND, 0.5MM		€0.0
Organizer cabinet (Sortimentskåp)	0	1367091		€21.67 RAACO CABINET, ORGANISER, 44COMPARTMENT		€0.0
De-soldering	0					€0.0
Tweezers	0	1617218		€81.80 DURATOOL-D00840-TWEEZERS SET, ESD SAFE, 6PC		€0.0
Hack-cables	0					€0.0
Thin lead	0					€0.0
Thicker lead	0					€0.0
Scalpel	0					€0.0
Precision cutter	0					€0.0
Electrostatic mat kit with wristband and earth connector	0	1736631		€110.69 MULTICOMP 069-0007 ESD WORKSTATION KIT, BLACK 0.7X1M		€0.0
Heat gun	0	2473569		€126.24 STEINEL HL 2020 E EURO		
Heat gun accessory for (reflector) for crimp tubes	0	3116797		€15.34 STEINEL-070519-NOZZLE, REFLECTOR, SMALL		
	0					€0.0
						€0.0
COMPUTER (OPTIONAL)						€0.0
ITX Motherboard AM1 (MSI AM1I)	0		Komplett.se 811857	€25.29 MSI AM1I, Socket-AM1 mini-ITX, DDR3, 1x-PCIe-x16, GbLAN, USB3.0, VGA, DVI, HDMI		€0.0
CPU (AMD Athlon 5350 APU)	0		Komplett.se 809078	€46.48 AMD Athlon 5350 Socket-AM1, Quad Core, 2.05GHz, 2MB, 25W, 28nm, Radeon R3-series, Boxed w/fan		€0.0
PSU Small form factor	0		Komplett.se 802785	€39.37 Silverstone ST30SF 300W PSU SFX, 80 Plus Bronze, Standard, 1x 6pin PCle, 3x SATA, 2x Molex, 1x FD		€0.0
Wireless keyboard/trackpad combo	0		Komplett.se 645476	€24.55 Logitech Wireless Touch Keyboard K400		€0.0
Case SilverStone Milo ML05B Black	0		<u>inet.se</u>	€63.39 SilverStone Milo ML05B Svart		€0.0
PCIe flexible riser	0		inet.se	€10.48 ASRock BTCPro Kit (PCle riser)		€0.00