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|--|---|---------|------------------------|--|--|-------------------------------------|--------|
| 12 pin escon socket (1 pin discarded) | 3 | 1593465 | | | €0.16 MULTICOMP 2212S-125G-85 SOCKET, PCB, 1 ROW, 12WAY | | €0.48 |
| Encoder driver | 3 | 1103045 | | | €1.02 TEXAS INSTRUMENTS AM26LS32ACD IC, DIFF LINE RECEIVER QUAD, 26LS32 | | €3.06 |
| | | | | | | | €0.00 |
| Wooden/Heplics DAQ Extension Board | | | | | | | €0.00 |
| PCB manufacturing (price based on order of 6 units) | 1 | | pcb-pool.com | | €15.70 | | €15.70 |
| 50 pin daq connector | 1 | 2215272 | | | €1.93 AMPHENOL T816150A1S102CEU HEADER, LLATCH, STR, 2.54MM, 50WAY | Should be replaced with low profile | €1.93 |
| 26 pin daq connector | 1 | 2217535 | | | €1.71 AMPHENOL T816126A1S102CEU HEADER, LLATCH, STR, 2.54MM, 26WAY | Should be replaced with low profile | €1.71 |
| 44 pins (50) ext. board | 1 | 3418388 | | | €2.76 TE CONNECTIVITY / AMP- 5-626629-0 HEADER, 1ROW, 50WAY | | €2.76 |
| | | | | | | | €0.00 |
| Box Enclosure Mounting | | | | | | | €0.00 |
| Distance screws | 4 | 1466725 | | | €0.30 ETTINGER SPACER, M3X, 5-VZK ETTINGER-05.13.051-SPACER, M3X, 5-VZK | | €1.21 |
| M3x6 screws (preferably M3x4 screws that comes with computers) | 4 | 1419986 | | | €0.02 DURATOOL-M36 PRSTMC2100- SCREW, STEEL, B2P, 6MM, M3, PK100 | | €0.09 |
| M3 washers | 4 | 1377536 | | | €0.01 DURATOOL, M3 BRASS FULL WASHER WASHER, FULL, BRASS, M3 | | €0.04 |
| | | | | | | | €0.00 |
| Recommended Equipment for Electronics Workbench | | | | | | | €0.00 |
| Proper soldering station | 0 | 1447700 | | | €375.13 WELLER WD 1000T (EU) SOLDERING STATION, 80W, 50DEG-450DEG, EU | | €0.00 |
| Proper oscilloscope (not really needed, for testing only) | 0 | 2191868 | | | €823.17 TEKTRONIX DPO2002B OSCILLOSCOPE, 2CH, 70MHZ, 1GSPS | | €0.00 |
| Solder cleaner | 0 | 1792731 | | | €4.86 WELER CLEANER, WOOL, BRASS, WDC, PK2 WELER-10051384099-CLEANER, WOOL, BRASS, WDC, PK2 | | €0.00 |
| Solder activator | 0 | 873695 | | | €8.76 WELER TIP-ACTIVATOR, LOW TEMP, 25G WELER-TIP-ACTIVATOR-TIP-ACTIVATOR, LOW TEMP, 25G | | €0.00 |
| Solder 1.2 mm tip | 0 | 1282099 | | | €4.86 WELER TIP, SOLDERING IRON, ROUND, BENT, 1.2MM WELER-LTIF-TIP, SOLDERING IRON, ROUND, BENT, 1.2MM | | €0.00 |
| Solder 0.5 mm tip | 0 | 1282096 | | | €4.97 WELER TIP, SOLDERING IRON, ROUND, 0.5MM WELER-LT1SA-TIP, SOLDERING IRON, ROUND, 0.5MM | | €0.00 |
| Organizer cabinet (Sortimentskåp) | 0 | 1367091 | | | €21.67 RAACO CABINET, ORGANISER, 44COMPARTMENT | | €0.00 |
| De-soldering | 0 | | | | | | €0.00 |
| Tweezers | 0 | 1617218 | | | €81.80 DURATOOL-D00840-TWEEZERS SET, ESD SAFE, 6PC | | €0.00 |
| Hack-cables | 0 | | | | | | €0.00 |
| Thin lead | 0 | | | | | | €0.00 |
| Thicker lead | 0 | | | | | | €0.00 |
| Scalpel | 0 | | | | | | €0.00 |
| Precision cutter | 0 | | | | | | €0.00 |
| Electrostatic mat kit with wristband and earth connector | 0 | 1736631 | | | €110.69 MULTICOMP 069-0007 ESD WORKSTATION KIT, BLACK 0.7X1M | | €0.00 |
| Heat gun | 0 | 2473569 | | | €126.24 STEINEL HL 2020 E EURO | | €0.00 |
| Heat gun accessory for (reflector) for crimp tubes | 0 | 3116797 | | | €15.34 STEINEL-070519-NOZZLE, REFLECTOR, SMALL | | €0.00 |
| | | | | | | | €0.00 |
| | | | | | | | €0.00 |
| COMPUTER (OPTIONAL) | | | | | | | |
| ITX Motherboard AM1 (MSI AM1) | 0 | | Komplett se 611857 | | €25.29 MSI AM11, Socket-AM1 mini-ITX, DDR3, 1x-PCIe-x16, GbLAN, USB3.0, VGA, DVI, HDMI | | €0.00 |
| CPU (AMD Athlon 5350 APU) | 0 | | Komplett se 609078 | | €46.48 AMD Athlon 5350 Socket-AM1, Quad Core, 2.05GHz, 2MB, 25W, 28nm, Radeon R3-series, Boxed w/fan | | €0.00 |
| PSU Small form factor | 0 | | Komplett se 602785 | | €39.37 SilverStone ST305F 300W PSU SFX, 80 Plus Bronze, Standard, 1x 6pin PCIe, 3x SATA, 2x Molex, 1x FD | | €0.00 |
| Wireless keyboard/trackpad combo | 0 | | Komplett se 645476 | | €24.55 Logitech Wireless Touch Keyboard K400 | | €0.00 |
| Case SilverStone Milo ML05B Black | 0 | | ust.ac | | €63.39 SilverStone Milo ML05B Svart | | €0.00 |
| PCIe flexible riser | 0 | | ust.ac | | €10.48 ASRock BTCPro Kit (PCIe riser) | | €0.00 |

| Part Name | Quantity | Part Number | Description | Unit Cost | Total Cost | Notes |
|-------------------------------|----------|------------------------|------------------------|-----------|------------|-------|
| MECHANICS | | | | | | |
| MECHANICAL ASSEMBLY | | | | | | |
| 1 | 1 | MECHANICAL ASSEMBLY | MECHANICAL ASSEMBLY | 1.00 | 1.00 | |
| MECHANICAL SUBASSEMBLY | | | | | | |
| 1 | 1 | MECHANICAL SUBASSEMBLY | MECHANICAL SUBASSEMBLY | 1.00 | 1.00 | |
| MECHANICAL PARTS | | | | | | |
| 1 | 1 | MECHANICAL PARTS | MECHANICAL PARTS | 1.00 | 1.00 | |
| MECHANICAL FASTENERS | | | | | | |
| 1 | 1 | MECHANICAL FASTENERS | MECHANICAL FASTENERS | 1.00 | 1.00 | |
| MECHANICAL TOOLS | | | | | | |
| 1 | 1 | MECHANICAL TOOLS | MECHANICAL TOOLS | 1.00 | 1.00 | |
| MECHANICAL MATERIALS | | | | | | |
| 1 | 1 | MECHANICAL MATERIALS | MECHANICAL MATERIALS | 1.00 | 1.00 | |
| MECHANICAL ELECTRICAL | | | | | | |
| 1 | 1 | MECHANICAL ELECTRICAL | MECHANICAL ELECTRICAL | 1.00 | 1.00 | |
| MECHANICAL SOFTWARE | | | | | | |
| 1 | 1 | MECHANICAL SOFTWARE | MECHANICAL SOFTWARE | 1.00 | 1.00 | |
| MECHANICAL SERVICES | | | | | | |
| 1 | 1 | MECHANICAL SERVICES | MECHANICAL SERVICES | 1.00 | 1.00 | |
| MECHANICAL OTHER | | | | | | |
| 1 | 1 | MECHANICAL OTHER | MECHANICAL OTHER | 1.00 | 1.00 | |
| MECHANICAL TOTAL | | | | | | |
| | | | | | | |
| ELECTRONICS | | | | | | |
| ELECTRONIC ASSEMBLY | | | | | | |
| 1 | 1 | ELECTRONIC ASSEMBLY | ELECTRONIC ASSEMBLY | 1.00 | 1.00 | |
| ELECTRONIC SUBASSEMBLY | | | | | | |
| 1 | 1 | ELECTRONIC SUBASSEMBLY | ELECTRONIC SUBASSEMBLY | 1.00 | 1.00 | |
| ELECTRONIC PARTS | | | | | | |
| 1 | 1 | ELECTRONIC PARTS | ELECTRONIC PARTS | 1.00 | 1.00 | |
| ELECTRONIC FASTENERS | | | | | | |
| 1 | 1 | ELECTRONIC FASTENERS | ELECTRONIC FASTENERS | 1.00 | 1.00 | |
| ELECTRONIC TOOLS | | | | | | |
| 1 | 1 | ELECTRONIC TOOLS | ELECTRONIC TOOLS | 1.00 | 1.00 | |
| ELECTRONIC MATERIALS | | | | | | |
| 1 | 1 | ELECTRONIC MATERIALS | ELECTRONIC MATERIALS | 1.00 | 1.00 | |
| ELECTRONIC ELECTRICAL | | | | | | |
| 1 | 1 | ELECTRONIC ELECTRICAL | ELECTRONIC ELECTRICAL | 1.00 | 1.00 | |
| ELECTRONIC SOFTWARE | | | | | | |
| 1 | 1 | ELECTRONIC SOFTWARE | ELECTRONIC SOFTWARE | 1.00 | 1.00 | |
| ELECTRONIC SERVICES | | | | | | |
| 1 | 1 | ELECTRONIC SERVICES | ELECTRONIC SERVICES | 1.00 | 1.00 | |
| ELECTRONIC OTHER | | | | | | |
| 1 | 1 | ELECTRONIC OTHER | ELECTRONIC OTHER | 1.00 | 1.00 | |
| ELECTRONIC TOTAL | | | | | | |
| | | | | | | |
| COMPUTER (OPTIONAL) | | | | | | |
| COMPUTER ASSEMBLY | | | | | | |
| 1 | 1 | COMPUTER ASSEMBLY | COMPUTER ASSEMBLY | 1.00 | 1.00 | |
| COMPUTER SUBASSEMBLY | | | | | | |
| 1 | 1 | COMPUTER SUBASSEMBLY | COMPUTER SUBASSEMBLY | 1.00 | 1.00 | |
| COMPUTER PARTS | | | | | | |
| 1 | 1 | COMPUTER PARTS | COMPUTER PARTS | 1.00 | 1.00 | |
| COMPUTER FASTENERS | | | | | | |
| 1 | 1 | COMPUTER FASTENERS | COMPUTER FASTENERS | 1.00 | 1.00 | |
| COMPUTER TOOLS | | | | | | |
| 1 | 1 | COMPUTER TOOLS | COMPUTER TOOLS | 1.00 | 1.00 | |
| COMPUTER MATERIALS | | | | | | |
| 1 | 1 | COMPUTER MATERIALS | COMPUTER MATERIALS | 1.00 | 1.00 | |
| COMPUTER ELECTRICAL | | | | | | |
| 1 | 1 | COMPUTER ELECTRICAL | COMPUTER ELECTRICAL | 1.00 | 1.00 | |
| COMPUTER SOFTWARE | | | | | | |
| 1 | 1 | COMPUTER SOFTWARE | COMPUTER SOFTWARE | 1.00 | 1.00 | |
| COMPUTER SERVICES | | | | | | |
| 1 | 1 | COMPUTER SERVICES | COMPUTER SERVICES | 1.00 | 1.00 | |
| COMPUTER OTHER | | | | | | |
| 1 | 1 | COMPUTER OTHER | COMPUTER OTHER | 1.00 | 1.00 | |
| COMPUTER TOTAL | | | | | | |
| | | | | | | |

| | | | |
|----|--|-------------------|--|
| 6 | | CB3-10 | |
| 6 | | CB3-35 | |
| 4 | | CB3-50 | |
| 6 | | CB5-90 | |
| 10 | | CB3-22 | |
| 6 | | WSSB10-6-1 | |
| 1 | | SFRMHP10-55-F5-P4 | |
| 2 | | SB6900ZZ | |
| 1 | | CPL12-4-5 | |
| 4 | | MS3-20 | |
| 7 | | MS3-40 | |
| 5 | | MS3-40 | |
| 12 | | CB3-10 | |
| 2 | | B608ZZ | |
| 4 | | SB6900ZZ | |
| 7 | | CB3-22 | |
| 16 | | CB3-18 | |
| 6 | | CB3-45 | |
| 1 | | LBNR6 | |
| 1 | | ACB4-45 | |
| 1 | | LBNR4 | |
| 1 | | MSB8-60 | |
| 1 | | MSB8-110 | |
| 1 | | SSRBW8 | |
| 6 | | CIMR8-14-0.5 | |
| 2 | | CPL12-4-5 | |
| 2 | | SFRMHP10-55-F5-P4 | |
| 1 | | CIMR8-14-0.5 | |
| 1 | | SSRBW8 | |
| 9 | | MS3-25 | |
| 11 | | CB3-22 | |
| 4 | | B608ZZ | |
| 1 | | ACB4-45 | |
| 1 | | LBNR4 | |
| 4 | | CB3-30 | |
| 2 | | CB3-18 | |
| 2 | | MS3-20 | |
| 4 | | MS3-35 | |
| 1 | | MSB8-60 | |
| 9 | | CIMR8-14-0.5 | |
| 1 | | SSRBW8 | |
| 1 | | LBNR6 | |
| 1 | | ACB4-45 | |

| | | | | |
|---|--|--|--------------|--|
| 1 | | | LBNR4 | |
| 7 | | | CB3-22 | |
| 2 | | | B608ZZ | |
| 4 | | | MS3-35 | |
| 3 | | | CB3-35 | |
| 6 | | | CIMR8-14-0.5 | |

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|---------------------|---|---|--------------|----------------|-------------------|-------------------|
| | | | | | | Eur |
| | <u>WoodenHaptics.org Bill of Materials and Recommended Equipment</u> | Mechanics | | | | 0 |
| | | Motors, encoders and current drivers | | | | 0 |
| | We will try to reduce the number of distributors to reduce complexity | Other electronics | | | | 0 |
| | Maxon, Farnell and Misumi is easy to access globally | Estimated total* part cost for kit: | | | | 0 |
| | Other distributors might be tricky in some parts of the world | | | | | |
| | Let us know your experience in the forum of woodenhaptics.org | Estimated required tools cost: | | | | 0 |
| | | | | | | |
| | *) No labour cost included, i.e. for laser-cutting or soldering. | 1 EUR in SEK | | | | kr9.48 |
| | Largest costs are in the motors, drivers and PCIe card that could | 1 EUR in USD | | | | \$1.06 |
| | be re-used in several projects if you so wish. Required tools | 1 EUR in CHF | | | | CHF1.07 |
| | (except laser-cutter and soldering tools) are included. | | | | | |
| | Suggested distributor (Europe) part number | | | | | |
| Alter-native | Our Name | quantity | Maxon | Farnell | Misumi | Elektrokit |
| | MECHANICS | | | | | |
| | <i>Raw Material</i> | | | | | |
| | 6 mm birch plywood A2 sheet (594 x 420 mm) (alternatives possible) | 5 | | | | |
| | <i>Construction Hardware: Base</i> | | | | | |
| | M3x10 (for motor) | 6 | | | CB3-10 | |
| | M3x35 | 6 | | | CB3-35 | |
| | M3x50 | 4 | | | CB3-50 | |
| | M5x90 | 6 | | | CB5-90 | |
| | M3x22 | 10 | | | CB3-22 | |
| | 6x10x1 washer | 6 | | | WSSB10-6-1 | |
| | 10x55x4x5 capstan (10x55 shaft (RDOF10-55) ok if 10mm coupler) | 1 | | | SFRMHP10-55-F5-P4 | |
| | 10x22x6 bearing | 2 | | | SB6900ZZ | |
| | Flexible Coupler that fits 5mm motor shaft and 4 mm capstan | 1 | | | CPL12-4-5 | |
| ALT | For other motor shafts use CPL12-3-4 etc (from your shaft to 4mm) | 0 | | | | |
| | 3x20 dowel pin | 4 | | | MS3-20 | |
| | 3x40 dowel pin | 7 | | | MS3-40 | |
| | 3x60 dowel pin (Substitute with MS3-40) | 5 | | | MS3-40 | |
| | <i>Construction Hardware: Body A</i> | | | | | |
| | M3x10 (for motor) | 12 | | | CB3-10 | |
| | 8x22x7 bearing | 2 | | | B608ZZ | |
| | 10x22x6 bearing | 4 | | | SB6900ZZ | |
| | M3x22 | 7 | | | CB3-22 | |
| | M3x18 | 16 | | | CB3-18 | |
| | M3x45 | 6 | | | CB3-45 | |
| | M6/1.0 nut | 1 | | | LBNR6 | |
| | M4x45 full thread (thread M4/0.75) | 1 | | | ACB4-45 | |
| | M4/0.75 nut | 1 | | | LBNR4 | |
| | 8x60 Shoulder bolt | 1 | | | MSB8-60 | |
| | 8x110 Shoulder bolt (thread M6/1.0) | 1 | | | MSB8-110 | |
| | 8x05 Belleville (spring) washer | 1 | | | SSRBW8 | |
| | 8x14x05 shim | 6 | | | CIMR8-14-0.5 | |
| | Flexible Coupler that fits 5mm motor shaft and 4 mm capstan | 2 | | | CPL12-4-5 | |
| | 10x55x4x5 capstan (10x55 shaft (RDOF10-55) ok if 10mm coupler) | 2 | | | SFRMHP10-55-F5-P4 | |

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|--|----|--|--|---------------|--|
| <i>Construction Hardware: Body B</i> | | | | | |
| 8x14x05 shim | 1 | | | CIMR8-14-0.5 | |
| 8x05 Belleville (spring) washer | 1 | | | SSRBW8 | |
| 3x25 pin | 9 | | | MS3-25 | |
| M3x22 | 11 | | | CB3-22 | |
| 8x22x7 bearing | 4 | | | B608ZZ | |
| M4x45 full thread (thread M4/0.75) | 1 | | | ACB4-45 | |
| M4/0.75 nut | 1 | | | LBNR4 | |
| <i>Construction Hardware: Body C</i> | | | | | |
| M3x30 | 4 | | | CB3-30 | |
| M3x18 | 2 | | | CB3-18 | |
| 3x20 dowel pin | 2 | | | MS3-20 | |
| 3x35 dowel pin (3x30 preferred) | 4 | | | MS3-35 | |
| 8x60 shoulder bolt | 1 | | | MSB8-60 | |
| 8x14x05 shim | 9 | | | CIMR8-14-0.5 | |
| 8x05 belleville (spring) washer | 1 | | | SSRBW8 | |
| M6 nut (1mm thread) | 1 | | | LBNR6 | |
| M4 35 mm screw with "nut" cap | 1 | | | HXN-STC-M4-35 | |
| Red ball door knob | 1 | | | | |
| <i>Construction Hardware: Body C'</i> | | | | | |
| M4x45 full thread (thread M4/0.75) | 1 | | | ACB4-45 | |
| M4/0.75 nut | 1 | | | LBNR4 | |
| M3x22 | 7 | | | CB3-22 | |
| 8x22x7 bearing | 2 | | | B608ZZ | |
| 3x35 dowel pin | 4 | | | MS3-35 | |
| M3x35 | 3 | | | CB3-35 | |
| 8x14x05 shim | 6 | | | CIMR8-14-0.5 | |
| <i>Construction Hardware: Cabling</i> | | | | | |
| Wire rope 7x7 core, 0.54 mm (more threads preferable) | 10 | | | | |
| Double ferrule (for crimping onto wire rope) | 20 | | | | |
| Turnbuckle (spanschloss) | 1 | | | | |
| <i>Required Tools for Mechanics Workbench</i> | | | | | |
| Arbor Press | 1 | | | | |
| Wire rope cutter | 1 | | | | |
| Wire rope ferrule crimper (you really need this) | 1 | | | | |
| Torch | 1 | | | | |
| Torch gas | 1 | | | | |
| Hex keys | 1 | | | | |
| Mini-hex key 1.3mm (M2.5) for flexible couplers | 1 | | | | |
| Adjustable wrench | 1 | | | | |
| <i>Other</i> | | | | | |
| Rubber feet (from a computer case; SilverStone Milo ML05B Black) | 4 | | | | |
| ELECTRONICS | | | | | |

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|--|--------|--------|---------|----------|
| <i>Electronics Box</i> | | | | |
| WoodenHaptics Motherboard (see below) | 1 | | | |
| WoodenHaptics DAQ Extension board (see below) /or/ mbed.org M3 extension board (for USB experimental) | 0 1 | | 1761179 | |
| <i>Power Supply</i> | | | | |
| 19.5V power supply 5A | 1 | | | |
| <i>Electric Cables</i> | | | | |
| 12mm sleeves (5m) | 1 | | 1297228 | |
| Male 10 pin cable head (for extending enc.cables) | 3 | | | 41011859 |
| Female 10 pin cable head (for extending enc. cables) | 3 | | | 41000574 |
| 10 pin flat cable, per meter (for extending enc. cables) | 5 | | | 31670207 |
| <i>PC Connection</i> | | | | |
| Sensoray S826 | 0 | | | |
| DAQ Cable 26-pin | 0 | | 2217642 | |
| DAQ Cable 50-pin | 0 | | 2217646 | |
| <i>Motors, Encoders & Current driver</i> | | | | |
| Maxon 30mm (310009) & 500 CPR Encoder combination | 3 | 310009 | | |
| Maxon 50/5 driver module (could eventually be custom made) | 3 | 438725 | | |
| ELECTRONICS CIRCUIT BOARDS | | | | |
| <i>WoodenHaptics Motherboard</i> | | | | |
| PCB manufacturing (price based on order of 2 units) | 1 | | | |
| motor & high pwr connectors | 4 | | 1761541 | |
| cable block high pwr | 4 | | 1761532 | |
| 10 pin encoder connector | 3 | | 2215290 | |
| micro usb connector, smd (non-reversed) SWITCH | 1 | | 1645325 | |
| 20 pin socket (to ext. board) | 2 | | 1593469 | |
| 4 pin socket (to ext. board) | 1 | | 1593460 | |
| 18 pin (2x9) escon socket | 3 | | 1668305 | |
| 12 pin escon socket (1 pin discarded) | 3 | | 1593465 | |
| Encoder driver | 3 | | 1103045 | |
| <i>WoodenHaptics DAQ Extension Board</i> | | | | |
| PCB manufacturing (price based on order of 6 units) | 0 | | | |
| 50 pin daq connector | 0 | | 2217539 | |
| 26 pin daq connector | 0 | | 2217535 | |
| 44 pins (50) ext. board | 0 | | 3418388 | |
| <i>Box Enclosure Mounting</i> | | | | |
| Distance screws | 4 | | 1466725 | |
| M3x6 screws (preferably M3x4 screws that comes with computers) | 4 | | 1419986 | |
| M3 washers | 4 | | 1377536 | |
| <i>Recommended Equipment for Electronics Workbench</i> | | | | |
| 0.85mm hex key for encoders (these will be shipped with some enc.) | 0 | | | |

