### Parts list for standard configuration

The table below illustrates the parts needed to populate the δ1 board. This list does not include any parts for the LCDuino-1 board, the power supply, wires or enclosure-related items. For parts not offered by [AMB audio shop](https://www.amb.org/shop/), [Mouser](https://www.amb.org/cgi-bin/redir.cgi?t=http://www.mouser.com/), [Digi-Key](https://www.amb.org/cgi-bin/redir.cgi?t=http://www.digikey.com/), [Newark](https://www.amb.org/cgi-bin/redir.cgi?t=http://www.newark.com/), [Farnell](https://www.amb.org/cgi-bin/redir.cgi?t=http://www.farnell.com/), [RS Components](https://www.amb.org/cgi-bin/redir.cgi?t=http://www.rs-online.com/) stock numbers for the recommended parts are listed below for your convenience. Additional alternative parts are listed in the [Parts selection guide](https://www.amb.org/audio/delta1/parts.shtml" \l "guide) section below.   
  
Some parts are optional, if they are not populated then certain features will either be disabled or degraded. While it is recommended that you install all parts for maximum functionality, you should look carefully at the notes below to find the combination of features that best fits your needs.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Part ID | Qty | Description | Mouser # | Digi-Key # | Farnell # | RS # | Notes |
| Circuit board | | | | | | | |
| PCB | 1 | δ1 PCB | AMB audio shop | | | | - |
| Resistors | | | | | | | |
| R1+, R1- | 2 | resistor array 1KΩx10, bussed (SIP-11) | AMB audio shop | | | | see Note 5 |
| R2+, R2- | 2 | resistor array 47Ωx8, bussed (SIP-9) | - |
| R5+, R5- | 2 | resistor array 47KΩx8, bussed (SIP-9) | - |
| R3, R4 | 2 | miniature 1/8W resistor 3.3KΩ | 270-3.3K-RC | S3.3KCACT-ND | 9343040 | 165-0296 | see Note 1 |
| RS*n*L, RS*n*R, RP*n*L, RP*n*R, RTL, RTR | 22-34 | attenuator resistors | (your choice) | | | | see Note 2 |
| RGL, RGR | 2 | wirewound resistor 10Ω 5W | 280-CR5-10-RC, 71-CW5-10 or 594-AC05W10R00J | PPC5W10.0CT-ND | 1735130 | 683-0983 | see Note 3 |
| Capacitors | | | | | | | |
| C1, C3 | 2 | aluminum electrolytic capacitor 470µF 10V | 647-UHE1A471MPD | P10221-ND | 9691944 | 315-0338 | - |
| C2+, C2-, C4 | 3 | multilayer ceramic capacitor 0.1µF 50V X7R | 80-C320C104K5R | 399-4264-ND | 1457655 or 1141775 | 538-1310 | - |
| CGL, CGR | 2 | suppression capacitor 0.1µF 250V | 539-158X104 | P11116-ND | 1198295 | 148-474 | see Note 3 |
| Ferrite bead | | | | | | | |
| L1 | 1 per δ1/δ2 stack | Ferrite bead, axial-lead | AMB audio shop | | | | See Note 1 |
| Integrated circuits | | | | | | | |
| U1+, U1- | 2 | PCF8574A or PCF8574 I²C port expander (DIP-16) | AMB audio shop (PCF8574A only) | | | | See Note 4 |
| U2+, U2- | 2 | ULN2803A darlington transistor array (DIP-18) | 511-ULN2803A | 497-2356-5-ND | 1094428 | 714-1167 | - |
| LEDs | | | | | | | |
| LED+, LED- | 2 | 10-LED bargraph array (DIP-20) | 604-DC-10EWA | 754-1176-5-ND | 1208882 | 247-3056 | see Notes 5, 6 |
| Relays | | | | | | | |
| K0-K7 | 5-8 | miniature latching DPDT relay Panasonic AGN2104H | AMB audio shop | | | | - |
| IC sockets | | | | | | | |
| - | 2 | DIP-16 low-profile socket, gold contacts | 575-393316 | ED5316-ND | 1077315 | 813-137 | for U1+, U1- |
| - | 2 | DIP-18 low-profile socket, gold contacts | 575-393318 | ED5318-ND | 1077318 | 813-143 | for U2+, U2- |
| Connectors | | | | | | | |
| J1 | 1 | 6P Molex KK 254 headers, right angle, tin or gold | 538-22-05-3061 or 538-22-12-2064 | WM4304-ND or WM2715-ND | 1756799 or 1756808 | 679-5473 or 679-5565 | see Note 7 |
| 1 | 6P Molex KK 254 crimp housing | 538-22-01-3067 | WM2004-ND | 1654529 | 679-5391 |
| J2, J3 | 1 | 6P vertical pin headers tin or gold | 538-22-03-2061 or 538-22-10-2061 | WM4004-ND or WM2726-ND | 9731113 | 479-181 |
| 1 | SIP-6 pin receptacle | AMB audio shop | | | |
| J4 | 1 | 16P dual-row header, right-angle, unshrouded | 538-10-88-3161 | SAM1049-08-ND | 1248191 | 681-2581 | see Note 8 |
| J5 | 1 | 16P dual-row receptacle, right-angle | - | SAM1006-08-ND | 1766333 | - |
| J4, J5 | 2 | 16P dual-row header, right-angle, shrouded | 517-D2516-5002-AR | MHE16E-ND | 1099247 | 542-8920 | see Note 9 |
| 2 | 16P dual-row IDC socket with strain-relief | 517-D89116-0131HK and 517-D3448-89116 | MKC16E-ND and  MESR16-ND | 1099238 | 192-7372 |
| 1 | 16-conductor 0.050" ribbon cable | 517-3365/16FT | MC16G-5-ND | 297318 | 289-9874 |
| INPUTL, INPUTR, OUTPUTL, OUTPUTR | 4 | 2P Molex KK 254 headers, right angle, tin or gold | 538-22-05-3021 or 538-22-12-2024 | WM4300-ND or WM2711-ND | 1756797 or 1756806 | 679-5448 or 679-5555 | see Note 10 |
| 4 | 2P Molex KK 254 crimp housing | 538-22-01-3027 | WM2000-ND | 1462825 | 679-5363 |
| INOUTL, INOUTR | 2 | 3P Molex KK 254 headers, right angle, tin or gold | 538-22-05-3031 or 538-22-12-2034 | WM4301-ND or WM2712-ND | 1462932 | 679-5451 or 679-5559 | see Note 10 |
| 2 | 3P Molex KK 254 crimp housing | 538-22-01-3037 | WM2001-ND | 1462838 | 679-5375 |
| - | 20 | Molex KK 254 crimp terminals, tin or gold | 538-08-50-0114 or 538-08-55-0102 | WM1114-ND or WM2312-ND | 1462641 or 1462642 | 172-9178 or 678-3149 | for all Molex KK 254 crimp housings |
| Miscellaneous | | | | | | | |
| JP1A+, JP1B+, JP1C+, JP1A-, JP1B-, JP1C-, JP2, JP3 | 1 | 36P pin headers, break-apart | 517-647-01-36 | S1011E-36-ND | 1097955 | - | for all jumpers |
| - | 8 | jumper shunts, 2P, 0.100" | 649-68786-202LF | S9001-ND (10-pack) | 1097979 (10-pack) | - |
| - | - | PCB standoffs, 0.5" or 13mm long, imperial #4-40 or metric M3 threaded | (your choice) | | | | [McMaster-Carr](http://www.mcmaster.com/), etc. |
| - | - | Machine screws, imperial #4-40 or metric M3 | (your choice) | | | | [McMaster-Carr](http://www.mcmaster.com/), etc. |

#### Notes

1. If you will be stacking multiple δ1/δ2 boards, then only one of them needs to have R3, R4 and L1 installed. L1 connects the driver section's digital ground to the chassis through the mounting hole.
2. Use the [Resistor calculator](https://www.amb.org/audio/delta1/rcalc.cgi) to calculate the resistor values, and select your preferred resistor type. See Parts selection guide below.
3. Optional: Install these if your build requires a ground loop breaker. See the [δ1 board assembly instructions](https://www.amb.org/audio/delta1/instructions.shtml" \l "pcb_assembly) section for details.
4. PCF8574A and PCF8574 occupy different I²C addresses spaces. AMB recommends that you use the same chip type for U1+ and U1- on a per-board basis. See the [Initial setup](https://www.amb.org/audio/delta1/instructions.shtml" \l "initial_setup) section and the [LCDuino-1](https://www.amb.org/audio/lcduino1/) website for more information.
5. Optional: Install these if you want relay coil activity indicators, useful for debugging purposes.
6. No IC socket is specified for LED+ and LED- because it would make them too tall to fit between stacked boards. Solder them directly to the board.
7. If you are building the [α10 stereo pre-amplifier](https://www.amb.org/audio/alpha10/) using the special backplane board, use the α10 parts list for these parts.
8. If your δ1 board's driver and attenuator sections will remain in one piece, use these for J4 and J5.
9. If your δ1 board's driver and attenuator sections will be snapped apart, use these for J4 and J5.
10. δ1 supports two styles of input and output connection options:
    * **INPUTL**, **INPUTR**, **OUTPUTL**, **OUTPUTR**:  
      Separate 2P input and output Molex KK connectors per channel.
    * **INOUTL**, **INOUTR**:  
      3P input/output Molex KK connector per channel (similar to conventional volume potentiometer).

You need to populate only one of these options. If you use the 3P option, then install wire jumpers in JP4L and JP4R.

### Parts selection guide

The following is a list of recommendations and options. Please read through this carefully before you order any parts.

#### Resistors

R1+, R1-, R2+, R2-, R5+, R5-: These are all "bussed" resistor networks. R1+ and R1- are SIP-11, each with ten internal 1KΩ resistors. R2+, R2- are SIP-9, each with eight internal 47Ω resistors. R5+ and R5- are SIP-9, each with eight internal 47KΩ resistors. One pin of each of them are connected to a common bus. The lead pitch is 0.1" (2.5mm) for all of these.

* Bourns [4600X series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=bourns-4600x_resistor_network) (AMB audio shop)
* Bourns [4300R series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=bourns-4300r_resistor_network)
* other similar

R3, R4: These resistors are 3.3KΩ miniature axial lead types with a body length no longer than about 4mm and no wider than 1.9mm. Carbon film, thin film or metal film types are acceptable, with 5% tolerances or less.

* Xicon [MF-RC 270 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-mf-rc)
* Xicon [CF-RC 299 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-cf-rc)
* Vishay-Beyschlag [MBA 0204 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-beyschlag_thin_film_leaded)
* Stackpole [RN 1/8 or RNM 1/4 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-RNF_RNMF)
* Stackpole [CF18 or CFM14 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-CF_CFM)
* Multicomp [MF12 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mf)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* other similar

RS*n*L, RS*n*R, RP*n*L, RP*n*R, RTL, RTR: These are the main resistors for the R-2R ladder attenuator network. The δ1 PCB accommodates through-hole resistors with lead-pitch from 5mm to 12.5mm, and several intermediate sizes. Please use the [Resistor calculator](https://www.amb.org/audio/delta1/rcalc.cgi) to determine the appropriate resistor values. The calculator shows one channel, you'll need to obtain two of each resistor per board (for stereo). The resistor type to use depends on your preference and budget. These resistors will dissipate negligible power so the wattage rating is not important. Carbon-film, carbon-composition and wirewound types are not recommended.   
  
You should save a record of your resistor calculator parameters (such as doing a screen-dump or printing a hardcopy) for future reference.

* Vishay-Dale [RN60 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF60 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [RN55 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF55 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [RN50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [PTF series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_ptf)
* Vishay-Beyschlag [MBA 0204 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-beyschlag_thin_film_leaded)
* Vishay Precision Group [S series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-s)
* Vishay Precision Group [Z foil series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-z)
* Vishay Precision Group [VAR series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-var)
* Texas Components [TX2352 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=texas_components-tx2352)
* Texas Components [TX2575 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=texas_components-tx2575)
* Texas Components [TXA100 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=texas_components-txa)
* Texas Components [TZA100 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=texas_components-tza)
* Xicon [MF-RC 270 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-mf-rc)
* Stackpole [RNF 1/8 or RNMF 1/4 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-RNF_RNMF)
* Multicomp [MF12 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mf)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* others

RGL, RGR: Optional resistors for ground loop breaker, 10Ω 5W wirewound type, axial lead, lead spacing 23mm.

* Xicon [CR-RC series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-cr-rc)
* Vishay-Dale [CW series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cw)
* Vishay-Dale [CP series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cp)
* Vishay-Draloric [AC series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_draloric_ac_acat)
* other similar

#### Capacitors

C1, C3: Aluminum electrolytic capacitor 470µF 10V, radial lead, lead spacing: 3.5mm;, diameter: 8mm, height: 11.5mm maximum

* Nichicon [HE series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=nichicon_he)
* Panasonic [FC series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_FC)
* other similar

C2+, C2-, C4: X7R multilayer ceramic capacitor 0.1µF, radial lead, lead spacing 2.5mm

* Kemet [C320 series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=kemet-multilayer_ceramic)
* Vishay [Mono-Kap series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=vishay-mono-kap)
* other similar

CGL, CGR: Optional capacitors for ground loop breaker, 0.1µF 250V, suppression capacitor, class X or Y rated, radial lead, lead spacing 15mm, 12.5mm, 10mm or 7.5mm.

* Mallory [158X series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=mallory_158x)
* Panasonic [ECQUG series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_ECQUG)
* Vishay-Roederstein [F1772-2200](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=vishay_roederstein_f1772-2200)
* other similar

#### Ferrite bead

L1: Ferrite bead, axial-lead (AMB audio shop)

#### Integrated circuits

U1+, U1-: I²C port expander (DIP-16)

* NXP [PCF8574AP](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_nxp) (AMB audio shop)
* NXP [PCF8574P](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_nxp)
* Texas Instruments [PCF8574AN](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574A_ti)
* Texas Instruments [PCF8574N](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_ti)

U2+, U2-: Darlington transistor array (DIP-18)

* STmicro [ULN2803A](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=ULN2803A_STmicro)

#### LEDs

LED+, LED-: 10-LED bargraph array (DIP-20)

* Kingbright [DC10EWA](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=kingbright_DC10EWA_10_segment_LED)
* Opto Images [LL10000HR](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=opto_images_G10000_10_segment_LED)
* other similar

#### Relays

K0-K7: Miniature DPDT relay 4.5V DC latching

* Panasonic [AGN2104H](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=panasonic_AGN) (AMB audio shop)
* Omron [G6JU-2P-Y-DC4.5](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=omron_G6J-Y)
* **Note**: You may use another single-coil latching relay in the Omron G6JU-2P-Y or Panasonic AGN series with a different coil voltage, but you need to have a separate power supply. See [Power options](https://www.amb.org/audio/delta1/instructions.shtml" \l "power_options) for details.

#### IC sockets

DIP-16 and DIP-18 low profile sockets with machined contacts

* Mill-Max [115 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=mill-max_115_dip_sockets)
* Aries [518 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=aries-518_dip_sockets)
* TE-Connectivity [800 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=TE_Connectivity_800_dip_sockets)
* Winslow Adaptics [DIP sockets](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=winslow_adaptics_dip_sockets)
* other similar

#### Connectors

J1, INPUTL, INPUTR, OUTPUTL, OUTPUTR, INOUTL, INOUTR:

* Molex KK 254 series

[headers with friction lock](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_headers)

[crimp housings](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_crimp_housings)

[crimp terminals](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_crimp_terminal)

J2, J3: (for board stacking)

* Vertical 6P single-row pin header with solder tails, .100" pitch, .318" mating length
* Vertical 6P single-row pin receptacle with solder tails, .100" pitch (AMB audio shop)

J4, J5: (one-piece δ1 board option)

* J4: Samtec [TSW-108-08-T-D-RA](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=samtec_TSW_pin_receptacles) 16P dual-row pin header, right-angle, unshrouded
* J5: Samtec [BCS-108-L-D-HE](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=samtec_BCS_series_socket) 16P dual-row pin receptacle, right-angle
* other similar

J4, J5: (separated δ1 board option)

* 3M [D2516-5002-AR](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d2500_series_shrouded_header) 16P dual-row pin header, right angle, shrouded
* 3M [D89116-0131HK](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d89_series_IDC_socket) 16P dual-row IDC socket
* 3M [D3448-89116](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d89_series_IDC_socket) strain relief
* 3M [3365/16](https://www.amb.org/cgi-bin/ds.cgi?c=wires_cables&f=3M_3365_series_ribbon_cable) 16P 0.05" ribbon cable
* other similar

Main: [δ1 Main](https://www.amb.org/audio/delta1/) | Prev: [Circuit board](https://www.amb.org/audio/delta1/pcb.shtml) | Next: [Resistor calculator](https://www.amb.org/audio/delta1/rcalc.cgi)