### Parts list for standard configuration

The table below illustrates the parts needed to populate the LCDuino-1 board. This list does not include the power supply, wires, hardware 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/lcduino1/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 | LCDuino-1 PCB | AMB audio shop | | | | - |
| Resistors | | | | | | | |
| R1 | 1 | miniature 1/8W resistor 10KΩ | 270-10K-RC | S10KCACT-ND | 9342419 | - | - |
| R2, R3 | 2 | miniature 1/8W resistor 1KΩ | 270-1K-RC | S1KCACT-ND | 9342400 | - | - |
| R4 | 1 | miniature 1/8W resistor 220Ω | 270-220-RC | S220CACT-ND | 9342826 | - | see Note 11 |
| Potentiometers | | | | | | | |
| VR1 | 1 | 3/8" multi-turn cermet trimpot 10KΩ | 72-T93YA-10K | 490-2875-ND | 9353186 | 154-2050 | - |
| - | 1 | panel-mount potentiometer 100KΩ linear taper, with 5V DC motor-drive | 688-RK16812MG099 | - | - | - | see Note 8 |
| Capacitors | | | | | | | |
| C1 | 1 | aluminum electrolytic capacitor 100µF 6.3V | 647-USA0J101MDD or 667-ECE-A0JKG101 | P904-ND or P958-ND | 1144644 | 116-767 | - |
| C2, C3, C4, C5 | 4 | multilayer ceramic capacitor 0.1µF X7R | 80-C320C104K5R | 399-4264-ND | 1457655 or 1141775 | 538-1310 | - |
| C6 | 1 | tantalum capacitor 1µF 25V | 80-T356A105K25AT or 581-TAP105K025SCS | 399-3603-ND or 478-1834-ND | 1457569 | 538-1988 | see Note 8 |
| Cs | 1 | supercapacitor 0.022F 5.5V | 80-FR0H223ZF | - | - | 572-508 | see Notes 1 and 2 |
| Integrated circuits | | | | | | | |
| U1 | 1 | Atmel ATmega328P-PU microcontroller | AMB audio shop (pre-flashed with bootloader and Volu-Master or γ3 firmware) | | | | see Note 3 |
| U2 | 1 | Dallas/Maxim DS1302+ real time clock | 700-DS1302 or 700-DS1302N | DS1302+-ND or DS1302N+-ND | 1188041 | 540-2704 | see Note 1 |
| U3 | 1 | Microchip MCP23008-E/P I²C port expander | 579-MCP23008-E/P | MCP23008-E/P-ND | 1439387 | 403-563 | - |
| U4 | 1 | Vishay TSOP34838 38KHz 5V infrared receiver | 782-TSOP34838 | 751-1386-5-ND | 4913139 | - | - |
| U5 | 1 | L293D quad half-H drivers | 595-L293DNE or 511-L293D | 296-9518-5-ND or 497-2936-5-ND | 1470423 | 714-0622 | see Note 8 |
| Crystals & resonators | | | | | | | |
| X1 | 1 | ceramic resonator 16.00MHz | 520-ZTT1600MX | X908-ND or 490-1214-ND | 1448129 | 526-6154 | - |
| X2 | 1 | cylinder crystal 32.768KHz 6pF | 695-CFS206-327KB-U or 520-ECS327-6-13-X | SER3205-ND or 728-1000-ND | 1641085 or 1216227 | - | see Note 1 |
| LEDs | | | | | | | |
| LED13 | 1 | T-1 (3mm) LED (amber or yellow) | 859-LTL-1CHA or 604-WP7104YD | 751-1143-ND | 1581116 or 1581115 | 262-2933 or 229-2504 | see Note 7 |
| LEDP | 1 | T-1 (3mm) LED (green) | 604-WP7104GD or 78-TLHG4400 | 160-1142-ND | 1652498 | 228-5944 |
| Switches & relays | | | | | | | |
| SW1 | 1 | Omron B3F-1000 PCB-mount momentary switch | 653-B3F-1000 | SW400-ND | 176432 | - | - |
| PWR/CFG switch | 1 | panel-mount momentary-NO switch | (your choice) | | | | see Note 5 |
| SSR | 1 | solid state relay, AC load, DC control (5V TTL logic level) | (your choice) | | | | see Note 13 |
| IC sockets | | | | | | | |
| - | 1 | DIP-28 socket, tin or gold | 575-11044328 or 575-11043328 | ED90054-ND or ED90038-ND | 1023066 | 801-768 or 801-796 | for U1 |
| - | 1 | DIP-8 socket, tin or gold | 575-144308 or 575-11043308 | ED90048-ND or ED90032-ND | 1103844 | 197-2647 | for U2, see Note 1 |
| - | 1 | DIP-18 socket, tin or gold | 575-11044318 or 575-11043318 | ED90051-ND or ED90035-ND | 1077318 | 813-143 | for U3 |
| - | 1 | DIP-16 socket, tin or gold | 575-11044316 or 575-11043316 | ED90034-ND or ED90050-ND | 1077315 | - | for U5 |
| Connectors | | | | | | | |
| - | 1 | 3P single row pin receptacle | AMB audio shop | | | | see Note 15 |
| J1, J2 | 2 | 6P single row pin header | AMB audio shop | | | | - |
| J1', J2' | 2 | 6P single row pin receptacle | AMB audio shop | | | | see Note 6 |
| J3, J4 | 2 | 6P Molex KK 254 headers, tin or gold | 538-22-23-2061 or 538-22-11-2062 | WM4204-ND or WM2704-ND | 1462922 or 1462951 | 679-5593 or 679-5530 | see Note 10 |
| 2 | 6P Molex KK 254 crimp housing | 538-22-01-3067 | WM2004-ND | 1654529 | 679-5391 |
| J5, J6, J8 | 3 | 2P Molex KK 254 headers, tin or gold | 538-22-23-2021 or 538-22-11-2022 | WM4200-ND or WM2700-ND | 1462926 | 679-5583 or 679-5515 | see Notes 9 and 10 |
| 3 | 2P Molex KK 254 crimp housing | 538-22-01-3027 | WM2000-ND | 1462825 | 679-5363 |
| J7 | 1 | 3P Molex KK 254 headers, tin or gold | 538-22-23-2031 or 538-22-11-2032 | WM4201-ND or WM2701-ND | 1462950 | 679-5587 or 679-5524 | see Note 12 |
| 1 | 3P Molex KK 254 crimp housing | 538-22-01-3037 | WM2001-ND | 1462838 | 679-5375 |
| J9 | 1 | 5P Molex KK 254 headers, tin or gold | 538-22-23-2051 or 538-22-11-2052 | WM4203-ND or WM2703-ND | 1462952 | 679-5599 or 679-5521 | see Note 8 |
| 1 | 5P Molex KK 254 crimp housing | 538-22-01-3057 | WM2003-ND | 1462874 | 679-5385 |
| - | 26 | 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 J3-J9 |
| \_D*n* | 1 | 9P single row pin header .100" pitch | AMB audio shop | | | | see Note 14 |
| 2 | 3P Molex KK 254 crimp housing | 538-22-01-3037 | WM2001-ND | 1462838 | 679-5375 |
| 1 | 2P Molex KK 254 crimp housing | 538-22-01-3027 | WM2000-ND | 1462825 | 679-5363 |
| 8 | 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 |
| USB interface cable | | | | | | | |
| - | 1 | FTDI TTL-232R-3V3 cable | 895-TTL-232R-3V3 | 768-1015-ND | 1329311 | 429-307 | see Note 4 |
| Display module | | | | | | | |
| LCD 2x16 80x36mm | 1 | Newhaven 0216K1Z-FSPG-GBW-L | 763-0216K1Z-FSPG-GBW | - | - | - | STN transflective grey/green |
| Newhaven 0216K1Z-FSB-GBW-L | 763-0216K1Z-FSB-GBW | - | - | - | STN transflective grey/blue |
| Newhaven 0216K1Z-FSO-GBW-L | 763-0216K1Z-FSO-GBW | - | - | - | STN transflective grey/orange |
| Newhaven 0216K1Z-FSA-GBW-L | 763-0216K1Z-FSA-GBW | - | - | - | STN transflective grey/amber |
| Newhaven 0216K1Z-FSR-GBW-L | 763-0216K1Z-FSR-GBW | - | - | - | STN transflective grey/red |
| Newhaven 0216K1Z-FSW-GBW-L | 763-0216K1Z-FSW-GBW | - | - | - | STN transflective grey/white |
| Newhaven 0216K1Z-NSW-BBW-L | 763-0216K1Z-NSW-BBW | NHD-0216K1Z-NSW-BBW-L-ND | - | - | STN transmissive white/blue |
| Newhaven 0216K1Z-FSPG-FBW-L | 763-0216K1Z-FSPG-FBW | - | - | - | FSTN+ transflective grey/green |
| Newhaven 0216K1Z-FSB-FBW-L | 763-0216K1Z-FSB-FBW | - | - | - | FSTN+ transflective grey/blue |
| Newhaven 0216K1Z-FSO-FBW-L | 763-0216K1Z-FSO-FBW | - | - | - | FSTN+ transflective grey/orange |
| Newhaven 0216K1Z-FSA-FBW-L | 763-0216K1Z-FSA-FBW | - | - | - | FSTN+ transflective grey/amber |
| Newhaven 0216K1Z-FSR-FBW-L | 763-0216K1Z-FSR-FBW | - | - | - | FSTN+ transflective grey/red |
| Newhaven 0216K1Z-FSW-FBW-L | 763-0216K1Z-FSW-FBW | - | - | - | FSTN+ transflective grey/white |
| Newhaven 0216K1Z-NSPG-FBW-L | 763-0216K1Z-NSPG-FBW | - | - | - | FSTN- transmissive green/black |
| Newhaven 0216K1Z-NSB-FBW-L | 763-0216K1Z-NSB-FBW | - | - | - | FSTN- transmissive blue/black |
| Newhaven 0216K1Z-NSO-FBW-L | 763-0216K1Z-NSO-FBW | - | - | - | FSTN- transmissive orange/black |
| Newhaven 0216K1Z-NSA-FBW-L | 763-0216K1Z-NSA-FBW | - | - | - | FSTN- transmissive amber/black |
| Newhaven 0216K1Z-NSR-FBW-L | 763-0216K1Z-NSR-FBW | - | - | - | FSTN- transmissive red/black |
| Newhaven 0216K1Z-NSW-FBW-L | 763-0216K1Z-NSW-FBW | - | - | - | FSTN- transmissive white/black |
| Everbouquet MC1602C8-SBLW | - | - | 9449043 | - | STN transflective white/blue |
| Everbouquet MC1602C8-SYL | - | - | 1220432 | - | STN transflective grey/yellow-green |
| Displaytech 162C-GC-BC-4LP | - | - | - | 532-6458 | STN transflective blue/black |
| Displaytech 162C-CC-BC-3LP | - | - | - | 532-6436 | STN transflective white/blue |
| Displaytech 162C-GC-BC-3LP | - | - | - | 532-6442 | STN transflective white/black |
| Displaytech 162C-BC-BC | - | - | - | 532-6414 | STN transflective grey/yellow-green |
| Infrared remote control | | | | | | | |
| - | 1 | IR remote control | (Your choice) | | | | see selection guide below |

#### Notes

1. Optional: populate for real-time clock capability. Do not populate these with γ3.
2. Optional: to maintain time when power is disconnected. If you use the Kemet/NEC/Tokin FR0H223ZF then you should mount it on the back side of the PCB due to its height. Do not populate with γ3.
3. If you do not purchase the pre-flashed chips from AMB, then you will need to initialize the bootloader (one time only) with a special AVR programmer that is compatible with the Arduino development software, unless you purchase a chip with the bootloader already flashed from a third party. In addition, you will need to flash the firmware, either with the AVR programmer or with the FTDI cable listed above.
4. Optional: to update or customize microcontroller firmware. Be sure to use a cable made by FTDI chip. Recent FTDI Windows drivers may ["kill" cables containing a non-genuine chip](http://www.eevblog.com/forum/reviews/ftdi-driver-kills-fake-ftdi-ft232/) and render them useless! The specified part numbers are all genuine FTDI.
5. Choose a switch style that complements your enclosure design.
6. Install on LCD module to mate with LCDuino-1 J1 and J2.
7. LED colors and part numbers are examples only, many others will work.
8. Optional: populate for analog motor pot capability.
9. J5 - Required  
   J6 - Optional: populate for power on/off control with solid state relay.  
   J8 - see Note 11.
10. You may optionally combine J4, J5 and J6 into one 10P Molex KK 254 header (Molex 22-23-2101 or 22-11-2102) and one 10P crimp housing (Molex 22-01-3107).
11. Optional: populate for IR-send feature (currently not implemented).
12. Optional: populate for aux sensor (currently not implemented).
13. Choose a unit with appropriate mains voltage and current ratings.
14. Needed only for γ3. Break the 9P pin header into two 3P and one 2P pieces (with 1 pin leftover) for use on the \_D2/\_D3/\_D4, \_D5/\_D6 and \_D10/\_D11/\_D12 pads on the LCDuino-1 board.
15. Optional: use for wiring the IR receiver.

### Parts selection guide

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

#### Resistors

All resistors are miniature through-hole 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 [RNF 1/8 or RNMF 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)
* Multicomp [MCRE series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mcre)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* other similar

#### Potentiometers

VR1: 100KΩ multi-turn cermet trimpot

* Vishay-Sfernice [T93YA](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=vishay_sfernice_t93)
* Vishay-Spectrol [64W](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=vishay_spectrol_64)
* Vishay-BC [CT-94W](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=vishay_bc_ct-94)
* Bourns [3296W](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=bourns_3296)
* Bourns/Murata [PV36W](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=bourns_pv36)
* other similar

Panel-mount potentiometer: This is an optional part that enhances the functionality of LCDuino-1. It must be 10KΩ to 100Ω and have a linear taper. A 5V DC motor-drive is recommended for best usage experience. The motor should draw no higher than 150mA of current while running, or the power supply should be uprated to account for the additional load. Also keep in mind that the L293D motor driver chip (U5) is rated at 600mA maximum.

* Alps [RK16812MG099](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=alps_rk16812mg_10Kbx2) (AMB audio shop)
* others

#### Capacitors

C1: aluminum electrolytic capacitor 100µF 6.3V, radial lead, lead spacing: 2.5mm;, diameter: 6.3mm, height: 9mm maximum

* Nichicon [SA series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=nichicon_sa_sr)
* Panasonic [KG series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_KG)
* Panasonic [KS series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_KS)
* other similar

C2, C3, C4, C5: X7R multilayer ceramic capacitor 0.1µF, radial lead, lead spacing 2.5mm

* Kemet [C315 or C320 series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=kemet-multilayer_ceramic)
* TDK [FK](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=tdk_fk) (10µF 16V available from AMB audio shop)
* Vishay [Mono-Kap](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=vishay-mono-kap)
* AVX [Skycap-SR](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=avx_skycap-sr)
* other similar

C6: dipped solid tantalum capacitor 1µF 25V, radial lead, lead-spacing 2.5mm

* Kemet [T350 series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=kemet_tantalum_dipped_radial)
* AVX [TAP series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=avx_tantalum_dipped_radial)
* Vishay-Sprague [Tantalex series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=vishay_sprague-199d)
* Multicomp [CB series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=multicomp_cb_tantalum_dipped_radial)
* other similar

Cs: supercapacitor 0.022F 5.5V, double-coin stacked, horizontal-mount style (vertical-mount style also possible on the bottom side of board)

* Kemet/NEC/Tokin [FR series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=kemet_nec_tokin_FR_supercap)
* Panasonic [SD series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_SD_supercap)
* Cornell-Dubilier [EDL series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=cornell_dubilier_EDL_supercap)
* other similar

#### Integrated circuits

* U1: Atmel [ATmega328P-PU](https://www.amb.org/cgi-bin/ds.cgi?c=processors_microcontrollers&f=atmel_ATmega328P) (AMB audio shop, pre-programmed with Volu-Master firmware)
* U2: Dallas/Maxim [DS1302+ or DS1302N+](https://www.amb.org/cgi-bin/ds.cgi?c=misc&f=DS1302)
* U3: Microchip [MCP23008-E/P](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=MCP23008)
* U4: Vishay [TSOP34838](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=TSOP348xx)
* U5: Texas Instruments or STMicroelectronics [L293D](https://www.amb.org/cgi-bin/ds.cgi?c=misc&f=L293D)

#### Crystals and resonators

X1: ceramic resonator 16MHz, radial 3-pins, lead-spacing 2.5mm inline

* ECS [ZTT-16.00MX](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=ecs_ztt_ceramic_resonators)
* Murata [Ceralock CSTLS16M0X55-B0](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=murata_ceralock)
* AEL Crystals [C16M000000L003](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=ael_ztt_ceramic_resonators)
* other similar

X2: cylinder crystal 32.768KHz 6pF

* Citizen [CFS206-32.768KDZB-UB](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=citizen_CFS206_CFS145)
* ECS [ECS-.327-6-13X](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=ecs_3x8x_2x6x_1x5x)
* Epson [C-001R or C-002R 32.7680K](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=epson_c_type)
* Seiko Instruments [VT200F-6PF20PPM](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=seiko_vt200f-6pf-20ppm)
* Euroquartz [MH32768L](https://www.amb.org/cgi-bin/ds.cgi?c=crystals_oscillators&f=euroquartz_MH)
* other similar

#### LEDs

T-1 (3mm) LED with tinted/diffused lens (wide range of choices). The recommended colors are shown as follows.

* LEDP: green
* LED13: yellow or amber

#### Switches & relays

* SW1: Omron [B3F-1000](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=omron_B3F-1xxx)
* PWR/CFG: Choose any panel-mount normally-open momentary contact switch to fit your needs.
* SSR: Choose a solid state relay with AC load and DC control (TTL logic level) with voltage and current ratings suitable for your needs. Do not use a conventional electro-mechanical relay.

#### IC sockets

* Mill-max [110 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=mill-max_110_dip_sockets)
* 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

Note: Some additional connectors not listed in the parts list above are needed for γ3. Please see the [γ3](https://www.amb.org/audio/gamma3/) website for details.

* J1, J2: 6P pin header, 0.100" pitch, 0.318" mating length (AMB audio shop)
* J1', J2': 6P pin receptacle, 0.100" pitch (AMB audio shop)
* J3-J9: Molex KK 254 series [pin headers](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) and [crimp terminals](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_crimp_terminal)

#### USB interface cable

* FTDI [TTL-232R-3V3](https://www.amb.org/cgi-bin/ds.cgi?c=wires_cables&f=ftdi_TTL-232R_cables) (with no additional suffix in the part number)  
  The correct cable has a USB A-type plug on one end and a SIP-6 pin receptacle on the other end.

#### Display module

LCDuino-1 currently supports the following 2x16 (two rows, 16 characters wide), 80mm x 36mm low-power LCD character displays with parallel interface, transmissive or transflective, with a wide selection of colors for the characters and the background:

* Newhaven [NHD-0216K1Z-*xxx-xxx*-L series](http://www.newhavendisplay.com/index.php?main_page=index&cPath=2_82) (Note: Newhaven products may also be ordered directly from their website)
* Everbouquet [MC1602C8 series](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=everbouquet-MC1602C8)
* Displaytech [162C series](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=displaytech-162C)
* other similar (check dimensions, pin locations, pin-out, supply voltage and current)

Note that these listed LCD display modules typically consume 20-30mA current. If you use a non low-power display that needs substantially more current, then it should have its own power supply. That is beyond the scope of this parts list.

#### Infrared remote control

LCDuino-1 is compatible with many hand-held IR remote controls such as those that come with DVD players, VCRs, or televisions. You may also use a universal remote control. The only requirement is that the remote control transmits with 38KHz carrier frequency, and that it uses the standard Sony, NEC, or Philips (RC5 and RC6) protocol. Many other brands also communicate in one of these protocols.   
  
It's likely you would not need to buy a new remote control for use with LCDuino-1. You can re-use the one from an old, retired audio or video component.   
  
If your audio system has other components with IR remote controls, then you should not use those same remote controls for your LCDuino-1. This is to avoid any ambiguity which component you would be commanding. If you use a universal remote control, set it up so that it transmits as a different brand or type of equipment for the LCDuino-1 than for the other components.   
  
In addition, the remote control for your LCDuino-1 should have at least 23 keys in order to support all the features as shown below:

|  |  |  |
| --- | --- | --- |
| **Up Arrow** **Down Arrow** **Right Arrow** **Left Arrow** **Mute** **Up Alias** **Down Alias** **Power** **Menu** | **Sleep** (Volu-Master only) **Anti-clip** (γ3 only) **Display** **Backlight** **1** **2** **3** **4** **5** | **6** **7** **8** **9** **0** **Multi-out** (Volu-Master only) **Filter** (γ3 only) |

The remote control's printed key labels are not required to match what's shown in the list above. *You* decide which key is assigned to each of the functions via LCDuino-1's remote control "Learn IR" procedure, described in the [Setup](https://www.amb.org/audio/lcduino1/setup.shtml) section. If the LCDuino-1 does not detect any key-presses during the "learn" procedure, then the remote control is not compatible.   
  
**Note**: NEC-protocol remote controls are supported, but they sometimes misbehave if a key is pressed too soon after another one. LCDuino-1 may not respond to the key and it needs to be pressed again, or it causes the wrong command to be sent (as if a different key was pressed). This quirk is most often seen with the arrow keys but could happen with other keys. The workaround is to wait a moment between each key-press, or use a remote control with a different brand-protocol. This issue may or may not be fixed in a later firmware release.