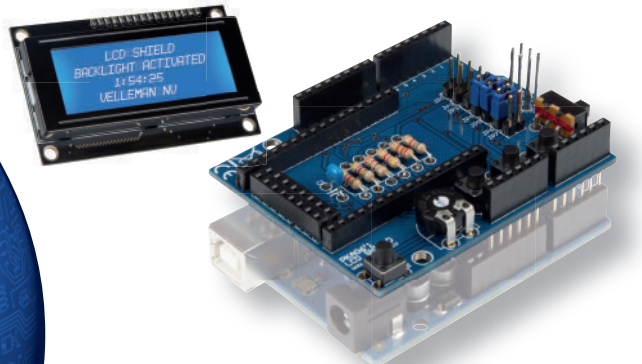
KA06

ILLUSTRATED ASSEMBLY MANUAL HKA06IP'1

LCD shield for Arduino®



Add an LCD to your projects and visualize measurements, parameters, data, messages, etc...

Features

- for Hitachi HD44780 or compatible LCD's
- requires 1 Arduino UNO™ (not included)
- stackable design: the shield can be stacked with other shields

Specifications

- supplied with 20 character / 4 lines display with white backlight
- contrast adjust trimmer
- backlight on/off switch
- reset button
- 3 user configurable pushbuttons (3 digital inputs / 1 analog input)
- dimensions: 68 x 53mm / 2.67 x 2.08"

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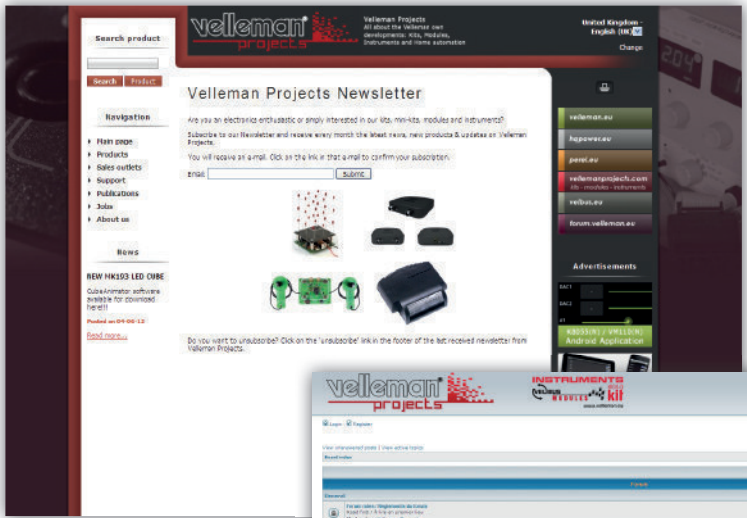
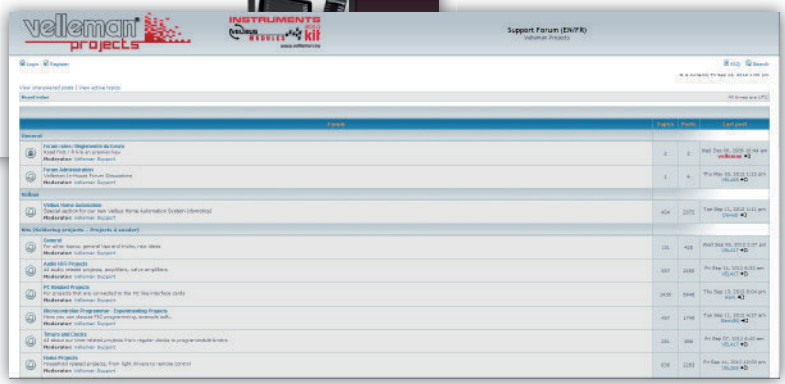
Made for ARDUINO





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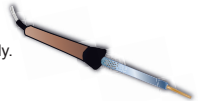
assembly hints

1. Assembly (Skipping this can lead to troubles !)

Ok, so we have your attention. These hints will help you to make this project successful. Read them carefully.



1.1 Make sure you have the right tools:

- A good quality soldering iron (25-40W) with a small tip.
- Wipe it often on a wet sponge or cloth, to keep it clean; then apply solder to the tip, to give it a wet look. This is called 'thinning' and will protect the tip, and enables you to make good connections. When solder rolls off the tip, it needs cleaning.
- Thin raisin-core solder. Do not use any flux or grease.
- A diagonal cutter to trim excess wires. To avoid injury when cutting excess leads, hold the lead so they cannot fly towards the eyes.
- Needle nose pliers, for bending leads, or to hold components in place.
- Small blade and Phillips screwdrivers. A basic range is fine.

For some projects, a basic multi-meter is required, or might be handy.

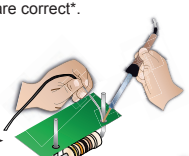
1.2 Assembly Hints :

- Make sure the skill level matches your experience, to avoid disappointments.
- Follow the instructions carefully. Read and understand the entire step before you perform each operation.
- Perform the assembly in the correct order as stated in this manual.
- Position all parts on the PCB (Printed Circuit Board) as shown on the drawings.
- Values on the circuit diagram are subject to changes, the values in this assembly guide are correct*.
- Use the check-boxes to mark your progress.
- Please read the included information on safety and customer service.

* Typographical inaccuracies excluded. Always look for possible last minute manual updates, indicated as 'NOTE' on a separate leaflet.

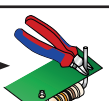
1.3 Soldering Hints :

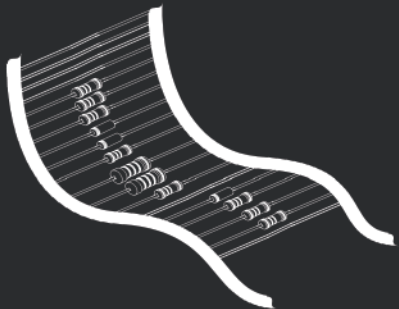
1. Mount the component against the PCB surface and carefully solder the leads.



2. Make sure the solder joints are cone-shaped and shiny.

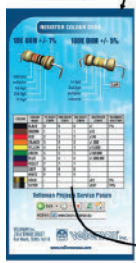
3. Trim excess leads as close as possible to the solder joint.



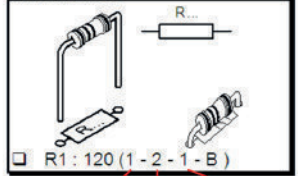


REMOVE THEM FROM THE TAPE ONE AT A TIME !

Included in this kit



2. RESISTOR



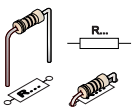
❑ R1 : 120 (1 - 2 - 1 - B)

COLOUR	COLOUR NAME	1ST DIGIT/ STRIPE	2ND DIGIT/ STRIPE	3RD DIGIT/ STRIPE	MULTIPLIER STRIPE	TOLE 4TH
	BLACK	0	0	0	x1	1%
	BROWN	1	1	1	x10	
	RED	2	2	2	x100	
	ORANGE	3	3	3	x1.000	
	YELLOW	4	4	4	x10.000	
	GREEN	5	5	5	x100.000	
	BLUE	6	6	6	x1.000.000	

DO NOT BLINDLY FOLLOW THE ORDER OF THE COMPONENTS ON THE TAPE. ALWAYS CHECK THEIR VALUE ON THE PARTS LIST!

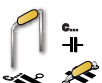
I CONSTRUCTION

1 Resistors



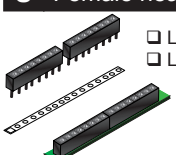
- ❑ R1: 4K7 (4 - 7 - 2 - B)
- ❑ R2: 470 (4 - 7 - 1 - B)
- ❑ R3: 22 (2 - 2 - 0 - B)
- ❑ R4: 4K7 (4 - 7 - 2 - B)
- ❑ R5: 2K2 (2 - 2 - 2 - B)
- ❑ R6: 6K8 (6 - 8 - 2 - B)

2 Ceramic capacitor on tape

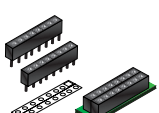


- ❑ C1: 100nF (104)

3 Female headers

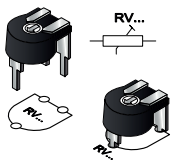


- ❑ LCD1: 2 x 8p
- ❑ LCD2: 2 x 8p



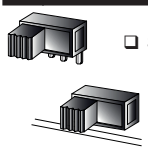
- ❑ LCD3: 2 x 8p

4 Trimmer



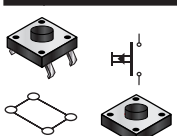
- ❑ VR1: 10K (Contrast)

5 Switch



- ❑ SW5: Backlight

6 Push buttons



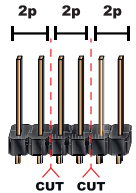
Digital inputs

- ❑ SW1
- ❑ SW2
- ❑ SW3

Reset

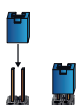
- ❑ SW4

7 Male headers



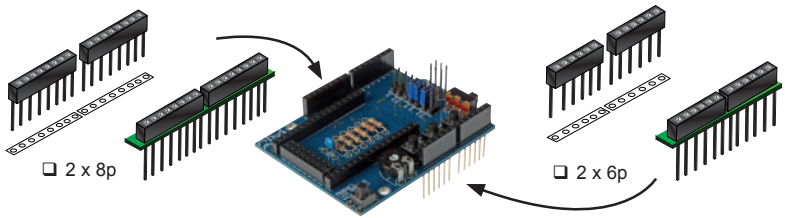
- ❑ JP1
- ❑ JP2
- ❑ JP3
- ❑ JP4
- ❑ JP5
- ❑ JP6
- ❑ JP7

Selection analog / digital interface



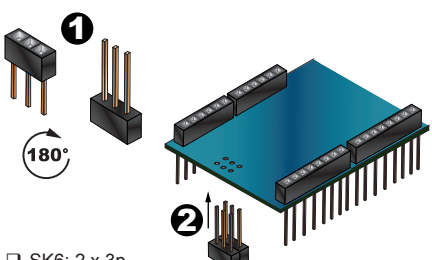
8 Female headers

Do not cut the connector pins!

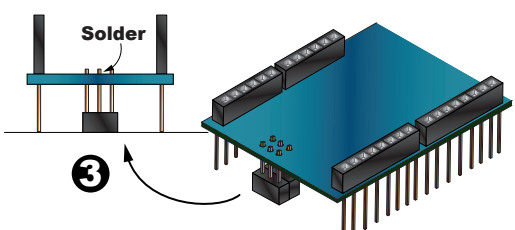


❑ 2 x 8p

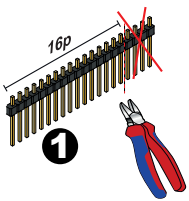
❑ 2 x 6p

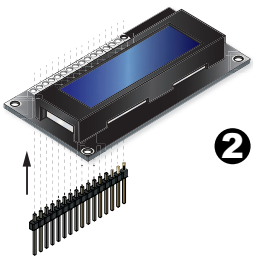


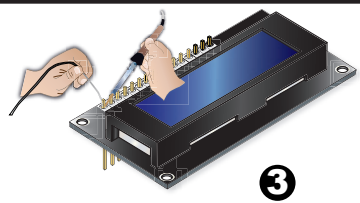
❑ SK6: 2 x 3p



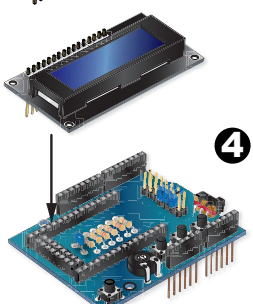
9 LCD

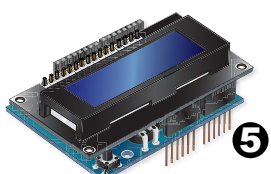




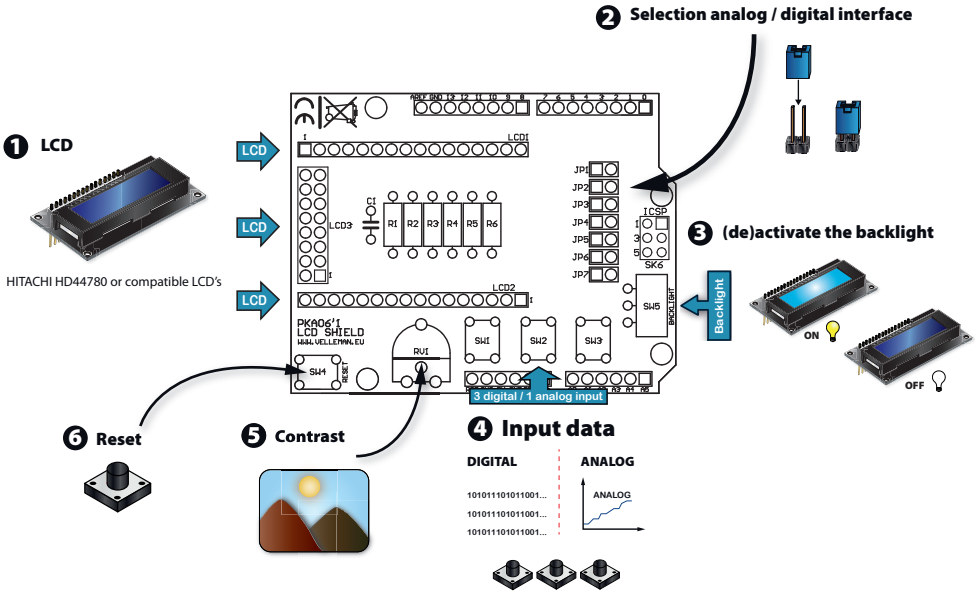


Follow these steps if the supplied LCD is not provided with a male header connector.





II CONNECTION DIAGRAM



III GENERAL INFORMATION

All displays based on the HD44780 have the same interface, regardless of the connector type or the pin arrangement. This interface consists of eight data lines, three control lines, a power supply, a GND and a line for contrast setting. The arrangement of these lines varies from model to model, so you will have to refer to the data sheet. Some models feature a built-in backlight connected via two lines.

Pin LCD	function	Pin Arduino UNO
VDD	+5 V Power supply	+5 V
Vss	GND	GND
Vo	contrast voltage	Trimmer
RS	Selection: write data or commands	8
R / W	Selection: writing or reading	GND
Enable	'Enable'-line	9
DB0	Data line 0	Not used
DB1	Data line 1	Not used
DB2	Data line 2	Not used
DB3	Data line 3	Not used
DB4	Data line 4	4
DB5	Data Line 5	5
DB6	Data Line 6	6
DB7	Data Line 7	7
BL +	LED Backlight +	+5 V
BL -	LED Backlight -	GND

UNO Connections Assigned to the Buttons

Push button	Arduino connection (digital mode)	Arduino PIN (analogue mode)
S1	10	AN3
S2	11	AN3
S3	12	AN3

The shield has three different connector types and is thus compatible with a large array of displays.

The connectors are arranged so as to leave room for the three push buttons and the reset button.

To work properly, each LCD requires a small voltage to adjust the contrast. This voltage is obtained from the +5 V through a trimmer.

Three push buttons are provided for your own applications. For maximum flexibility, we provide two ways to interface with these buttons. The first is the classic way, which makes use of three digital Arduino lines, specifically pins 10, 11 and 12. In this case, the available digital lines are 0, 1, 2, 3 and 13. Activate this mode by shortcutting jumpers JP4, JP5 and JP6.

To use the push buttons with the digital inputs, activate the internal pull-up resistors via your firmware. Do this for each push button with following code: pinMode (buttonPin, INPUT_ PULLUP). The push buttons will work in negative logic, i.e. the value at rest is 1, the value at pressed push button is 0 (zero).

A second way involves the use of one analogue line, pin A3. In this case, the digital lines remain free for other purposes. Activate this mode by shortcutting jumpers JP1, JP2, JP3 and JP7.

How does it work? Study the diagram and in particular the network formed by R4, R5 and R6. These resistors, in series, form a voltage divider.

When no button is pressed, the AN3 line is at +5 V as there is no current flowing. If we press S1, AN3 will be shorted to GND and the voltage is zeroed.
If we press S2, the node between R5 and R6 is grounded, so that line AN3 reaches 1.6 V. If we press S3, the node at R6 is grounded so AN3 goes to 3.3 V.

This means that, for each button, the Arduino ADC converter will get a different voltage. The analogRead(A3) function will provide a different value according to which push button is pressed (see table).

Push button	AN3 voltage	ADC value
None	5v	1024
P1	0v	0
P2	1.6 v	328
P3	3.3v	676

Analog mode of reading of the buttons

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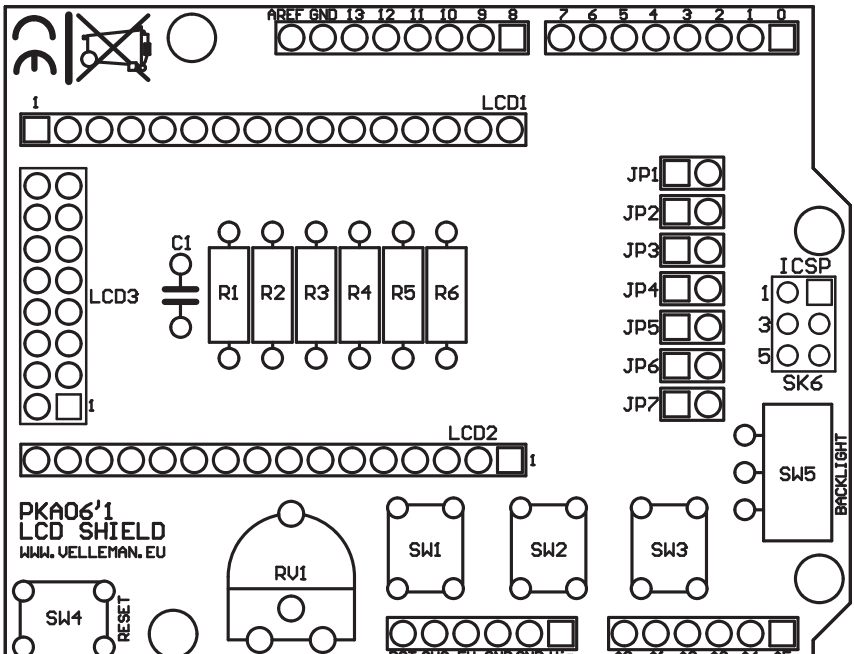
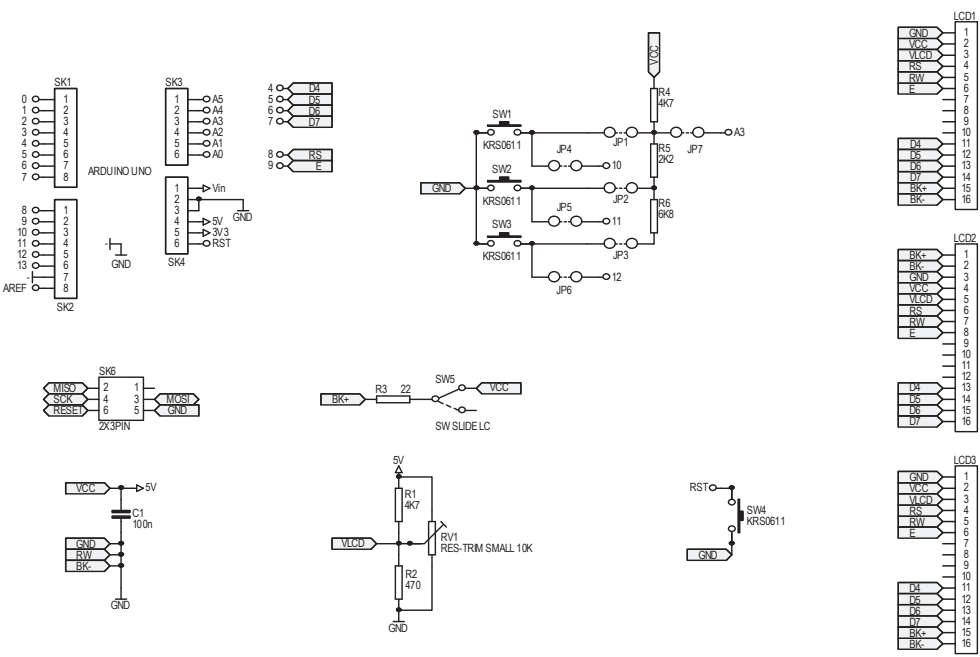
IV PROGRAMMING

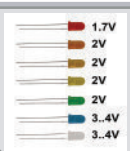
Programming via the Arduino IDE is straightforward, as it does not require no additional library. The system library LiquidCrystal already includes all necessary functions.

A programming code is available on www.velleman.eu.

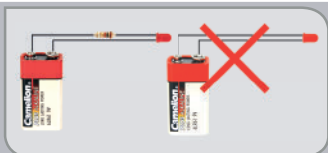

AREF GND 13 12 11 10 9 8
7 6 5 4 3 2 1 0
LCD1
LCD3
C1
R1 R2 R3 R4 R5 R6
JP1
JP2
JP3
JP4
JP5
JP6
JP7
ICSP
SK6
LCD2
SW5
BACKLIGHT
PKA06'1
LCD SHIELD
WWW.VELLEMAN.EU
RV1
SW1
SW2
SW3
SW4
RESET
RST 3V3 5V GND GND Vin
A0 A1 A2 A3 A4 A5


SK1
SK2
SK3
SK4
ARDUINO UNO
GND
AREF
A5
A4
A3
A2
A1
A0
Vin
5V
3V3
RST
D4
D5
D6
D7
RS
E
SW1
SW2
SW3
KRS0611
JP1
JP2
JP3
JP4
JP5
JP6
JP7
VCC
R4
4K7
R5
2K2
R6
6K8
A3
10
11
12
LCD1
LCD2
LCD3
BK+
BK-
RW
SK6
MISO
SCK
RESET
MOSI
2X3PIN
SW5
SW SLIDE LC
R3
22
C1
100n
R1
4K7
R2
470
RV1
RES-TRIM SMALL 10K
VLCD
SW4
KRS0611

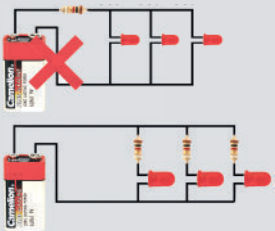
Leds and how to use them



Leds feature a specific voltage drop, depending on type and colour. Check the datasheet for exact voltage drop and rated current !



Never connect leds in parallel



How to Calculate the series resistor:

Example: operate a red led (1.7V) on a 9Vdc source.
Required led current for full brightness: 5mA (this can be found in the datasheet of the led)

$$\frac{\text{Supply voltage (V) - led voltage (V)}}{\text{required current (A)}} = \text{series resistance (ohms)}$$

$$\rightarrow \quad \frac{9V - 1.7V}{0.005A} = 1460 \text{ ohm}$$

closest value : use a 1k5 resistor

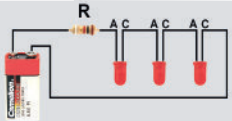
Required resistor power handling=
voltage over resistor x current passed trough resistor

$\rightarrow$ (9V - 1.7V) x 0.005A = 0.036W

a standard 1/4W resistor will do the job

LEDs in series:

Example: 3 x red led (1.7V) on 9V battery
Required led current for full brightness: 5mA
(this can be found in the datasheet of the led)



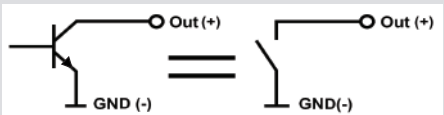
$$\frac{\text{Supply voltage (V) - (number of leds x led voltage (V))}}{\text{required current (A)}} = \text{series resistance (ohms)}$$

$$\rightarrow \quad \frac{9V - (3 \text{ x } 1.7V)}{0.005A} = 780 \text{ ohm}$$

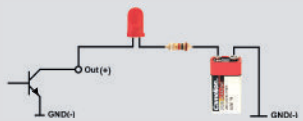
use an 820 ohm resistor

open collector outputs

An open collector output can be compared to a switch which switches to ground when operated



Example: How to switch an LED by means of an open collector output



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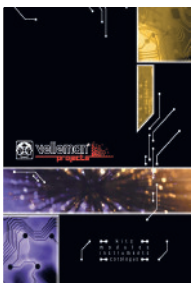

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