

LCD1602 Indicator. Connection Discussion and Release Information.

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ABSTRACT: The article describes how to connect to the LCD 1602 indicator and how it outputs information. Using Arduino software, the code for the devices and their practical application are described. There are structural, functional and mounting schemes for connecting the device.

KEY WORDS: LCD1602, LED, Arduino Uno, display, home screen, I2C module.

I. INTRODUCTION

LCD1602 is an industrial device with 16x02 or 32 characters simultaneously. The principle of LCD1602 liquid crystal display is that the physical properties of a liquid crystal come from the voltage to control its display area, that is, a map.



Figure 1. The front and back of the LCD1602 labeled device
photo from the back



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An industrial LCD is a 16x02 or 32 character at a time. (16 columns and 2 rows) 1602 Liquid Crystals 16x2 = 32 characters are called Liquid Crystals, which is a dot matrix type liquid crystal module specially used to display letters, numbers, symbols, and the like. It contains several 5X7 or 5X11 dot matrix characters. Each dot symbol may indicate a single character. There is a dot gap between each bit. There is also a gap between each line that plays the character spacing and the line. The spacing effect does not show the graphics well because of this (the screen is not good with the help of special CGRAM).

1602LCD means that the displayed content is 16x2, that is, a two-line LCD display with 16 characters (display characters and numbers).

Most of the LCD displays displayed on the market are based on the HD44780 liquid crystal chip and the controls are completely the same. For this reason, the HD44780-based control software can be easily applied to many crystal fluids on the market.

LCD is an acronym for liquid crystal display. Its structure essentially places liquid crystals in two parallel bottles. There are vertical and horizontal small wires between the two parallel bottles, and the rod is governed by crystal energy or not. Molecules change direction and emit light.

The LED is an acronym for the light-emitting diode. Its operating principle is that minority carriers injected in some PN compounds of semiconductor materials, together with most vehicles, combine excessive energy in the form of light. Electricity is converted directly into light energy; The PN junction is joined by reverse voltage and minority carriers are difficult to inject and no light is released. The diode produced by the principle of electromagnetic injection is called a diode that emits light, we call it LED.

The biggest difference between LCD and LED is the use of two different display technologies. LCD is a display consisting of liquid crystals and LED is a display with LEDs. Key differences are also derived here.

b7- b3 -b0	b4	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)		0	a	P	`	F		-	9	ε	α	ρ	
0001	(2)	!	1	A	Q	a	q	u	7	7	4	ä	q	
0010	(3)	"	2	B	R	b	r	l	ı	ı	ı	β	θ	
0011	(4)	#	3	C	S	c	s	j	ı	ı	ı	ε	∞	
0100	(5)	\$	4	D	T	d	t	\	ı	ı	ı	μ	∞	
0101	(6)	%	5	E	U	e	u	.	ı	ı	ı	ε	ü	
0110	(7)	&	6	F	V	f	v	ı	ı	ı	ı	ρ	Σ	
0111	CG RAM (8)	'	7	G	W	g	w	ı	ı	ı	ı	g	π	
1000	CG RAM (1)	(	8	H	X	h	x	ı	ı	ı	ı	ı	ı	ı
1001	(2)	)	9	I	Y	i	y	ı	ı	ı	ı	ı	ı	ı
1010	(3)	*	:	J	Z	j	z	ı	ı	ı	ı	ı	ı	ı
1011	(4)	+	;	K	[	k	[	ı	ı	ı	ı	ı	ı	ı
1100	(5)	,	<	L	¥	ı	ı	ı	ı	ı	ı	ı	ı	ı
1101	(6)	-	=	M	]m	ı	ı	ı	ı	ı	ı	ı	ı	ı
1110	(7)	.	>	N	^	n	ı	ı	ı	ı	ı	ı	ı	ı
1111	CG RAM (9)	/	?	O	_	o	ı	ı	ı	ı	ı	ı	ı	ı

Figure 2. Available on the LCD1602 screen symbols list

II. INFORMATION ABOUT ARDUINO UNO.

Arduino Uno is a controller built on the ATmega328 microcontroller and the platform has 14 digital inputs / outputs (six of which can be used as KIM (Shirotno-Impulsion modulation)), 6 analog inputs, quartz generator with 16MHz, USB port, voltage port. , ICSP port and reload button.

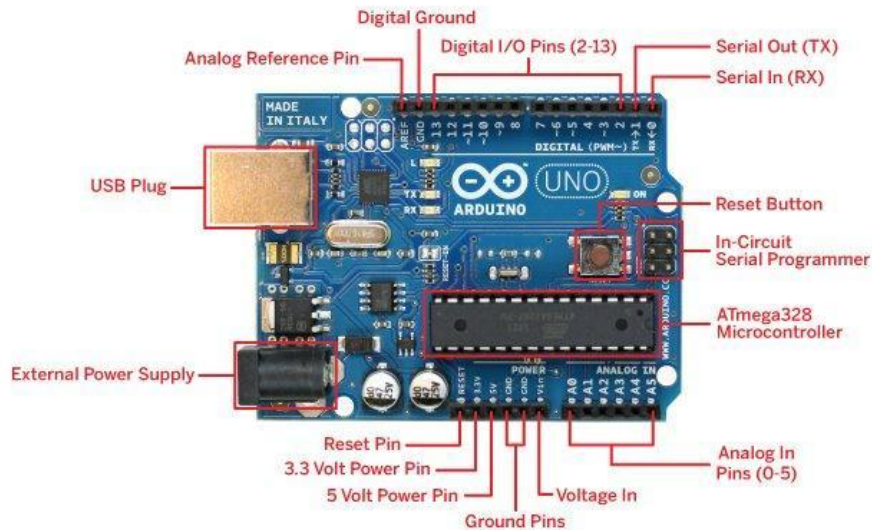


Figure 3. Structure of the Arduino UNO microcontroller.

The word "uno" means one in Italian. It is no accident that the creators of Arduino Uno have tried and succeeded in creating this new controller in the Arduino controller family. This is because the Arduino Uno Arduino is much more compact, comfortable, quick, simple and certainly cheaper than the other "brothers" in the controller family.

Briefly about ArduinoUno:

Microcontroller	ATmega328
Operating voltage	5 V
Input voltage (recommended)	7-12 V
Input voltage (highest)	6-20 V
Digital Input / Output	14 (6 of them can be used as KIM)
Analog Introduction	6
Unchanged current at the input / output	40 mA
3.3 V induction current	50 mA
Flash memory	32 kV (ATmega328) is used as a 0.5 kV loader
Memory	2 kV(ATmega328)
EEPROM	1 kV(ATmega328)
Frequency	16 MGs

In addition, the Arduino Uno device can receive power from a USB or external source connected to it. In this case, if there are multiple sources, one of them will be selected automatically.

The Arduino Uno controller is based on the ATmega328 microcontroller. This microcontroller has 32 kV of flash memory, 0.5 kV of which is dedicated to boot, plus 2 kV of RAM and 1 kV of EEPROM.

Each of the 14-digit outputs can be configured either for input or output. It uses the pinMode (), digitalWrite () and digitalRead () functions. At the same time, each outlet can withstand 20-50 kms of resistance and up to 40 mA of current.

Arduino Uno controller is created using Arduino software. For this, in Arduino, select Tools> Board from the menu and then "Arduino Uno".

As mentioned earlier, this controller has a very compact size, with sides of 6.9 and 5.3 cm. This in turn makes him more interesting.

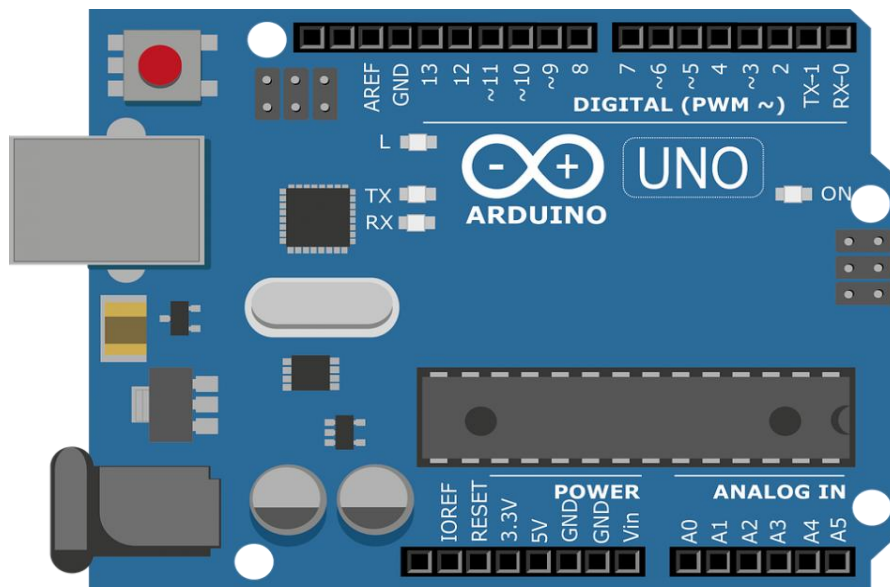


Figure 4. Arduino UNO full view.

There are many types of Arduino, for example: Arduino Yun, Arduino Uno, Arduino Duemilanove, Arduino Diecimila, Arduino Nano, Arduino Mega, Mega 2560, Mega ADK, Arduino Leonardo, Arduino Micro, and so on. Arduino is useful for young people who are interested in robotics and electronics, because they can do a variety of devices, robots, and other interesting experiments with the development of software, algorithms, both small and large. In other words, Arduino is a device that combines software and hardware.

III. LCD DISPLAY'S HOME SCREEN

LCD liquid crystal screen display LiquidCrystalDisplay. Liquid crystals are placed on two parallel bottles. There are vertical and horizontal small wires between the two bottles, and rod crystal molecules are energy-controlled or absent. A direction that distracts light for image production. The LCD displays are divided into two glass plates approximately one millimeter thick, with a five-micron regular interval containing liquid crystal materials. The liquid crystal material itself does not emit light, on either side of the display screen there is a light tube as a light source, and the back of the LCD screen has a backlight plate and a reflective film. the backlight is a fluorescent substance that emits light and its function is mainly provided by a single background light source.

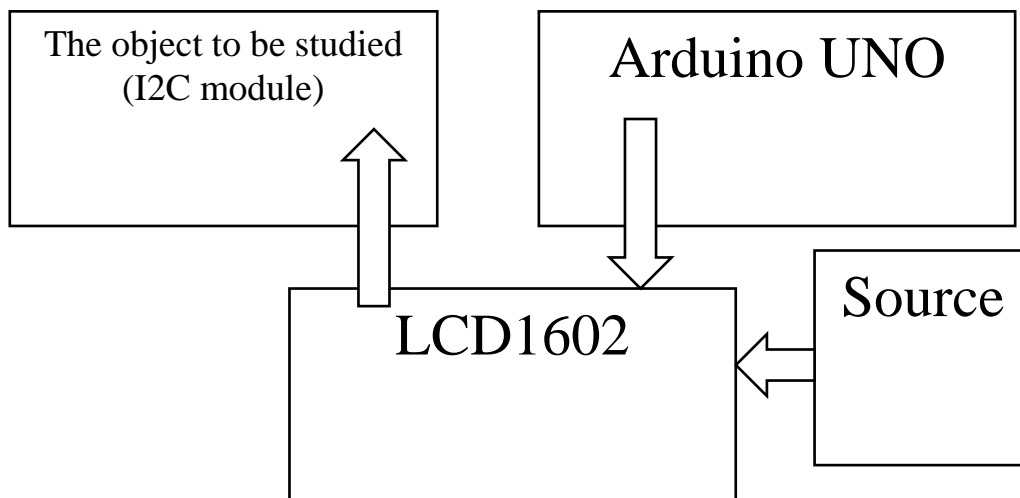
The light released from the backlight passes through the first polarization filter layer and enters the liquid crystal layer containing thousands of liquid crystal droplets. The droplets in the liquid crystal layer are present in small cell contents, with one or more cells on the screen being one pixel. There is a transparent electrode between glass plates and liquid crystal materials, the electrode is split into rows and columns, and the liquid crystal material acts like a small light valve, changing the voltage to change the optical rotation of the liquid crystal. A portion of a control circuit and one an excitation circuit around a liquid crystal material. When the electrodes on the LCD form an electric field, the

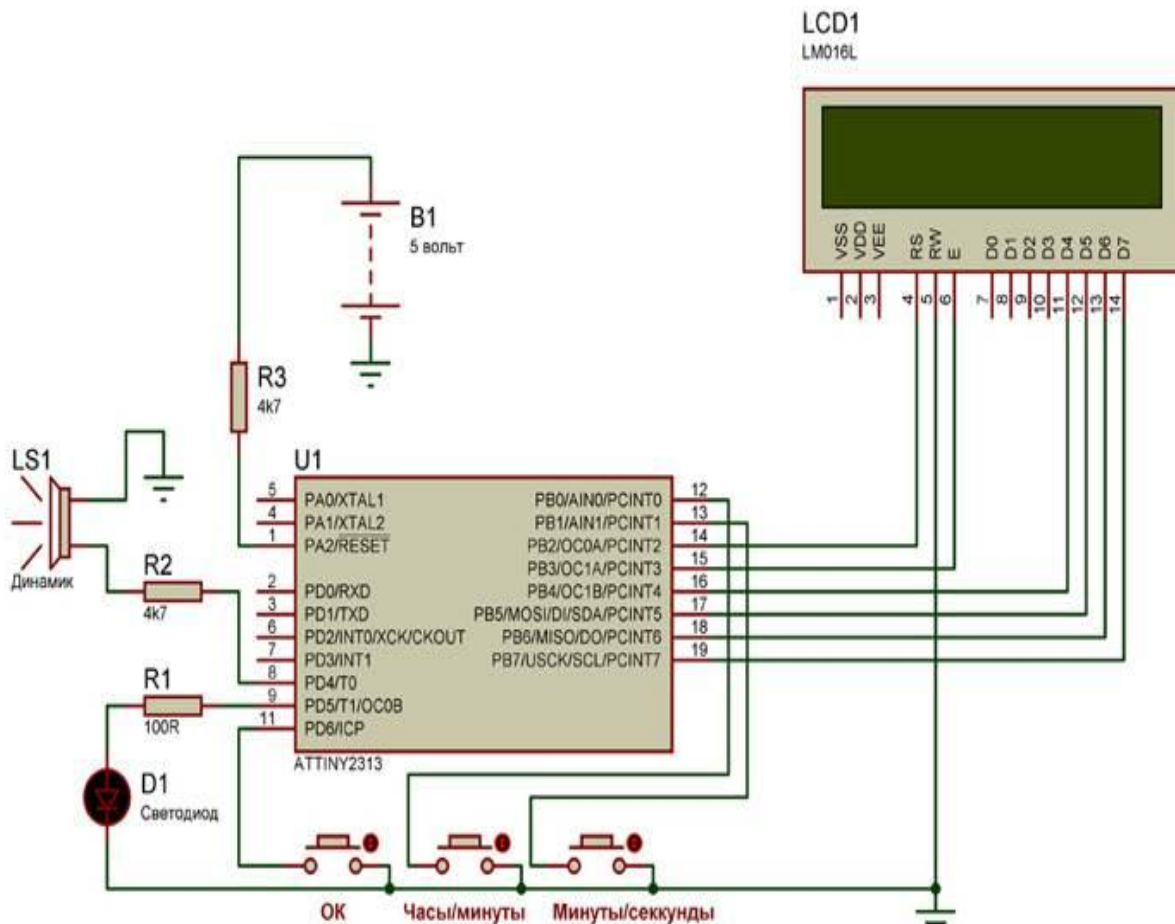
liquid crystal molecules are disrupted, and the light that passes through them is regularly broken and filtered through the second layer of the filter layer displayed on the screen.

DLP attachment and LP dispersion (liquid crystal bonding) is a new spinning technology that has emerged in recent years after PDP fixation. The LCD screen has the benefits of low power consumption, lightweight, longevity, radiation, and uniform brightness. However, its biggest drawback is that it cannot be seamlessly integrated, which is sad for industrialists who need very good display screens. The LCD displays a frame when combined with the LCD so that it can be a frame after leaving the factory. For example, the frame of one 21-inch LCD screen is usually six to ten millimeters, with two LCDs having twelve stitches. Twenty millimeters. There are several methods available in the industry for reducing liquid crystal bonding space: one for narrow-band coupling, the other for micro-coupling, micro-attachment - manufacturer's LCD display shell and glass and glass intersexual compound; but this approach is more risky. If the LCD screen is not removed properly, it will impair the quality of the entire LCD screen. China currently has very few manufacturers using this method.

Currently, the most common dimensions of the LCD display are 40 inches, 42 inches, 46 inches, 47 inches, 55 inches, 60 inches, depending on customer needs, up to 10X10, backlight lighting, up to 50,000 hours. Second, the dot of the liquid crystal is small and the physical resolution can be easily achieved by a high standard. In addition, liquid crystal panels have low power consumption and low heat output. The screen of a 40 inch or more liquid crystal screen is about 150 W and is 1/1 in the plasma. 4 and operation is stable and low maintenance costs.

There are screens mounted, wall-mounted, ceiling-mounted and extensible in layered styles. Installation of a Juyou colored LCD display can design the screen display method and support system adapted to the actual environment of the installation, as well as the requirements of pre-existing system maintenance or maintenance.

**FUNCTIONAL DIAGRAM OF THE DEVICE**



THE PRINCIPAL SCHEME OF THE DEVICE

IV. DEVICE OPERATION PLANNING.

In this case study, the liquid crystal indicator Winstar is used to extract the labeled information. In this case study, Arduino explores the implementation of libraries in projects and the creation of a project to display the temperature sensors LM335.

Required items:

- ArduinoUNO controller;
- Schema for plumbing collection;
- LCD-monitorWH1602;
- Resistance with 2,2 kOm;
- Resistance with 51 Om;
- 1 kOm variable resistance;
- Temperature sensor LM335;
- +5 V external source;
- wires with rods on both ends.

Liquid crystal indicator (LCD), LCD is a cheap and easy way to display information. The WH1602 Character Indicator has two 16-bit information on the screen (5x7 or 5x10 plus cursor). The display is controlled by the controller. Figure 5 shows the Winstar SKI HD44780 controller.

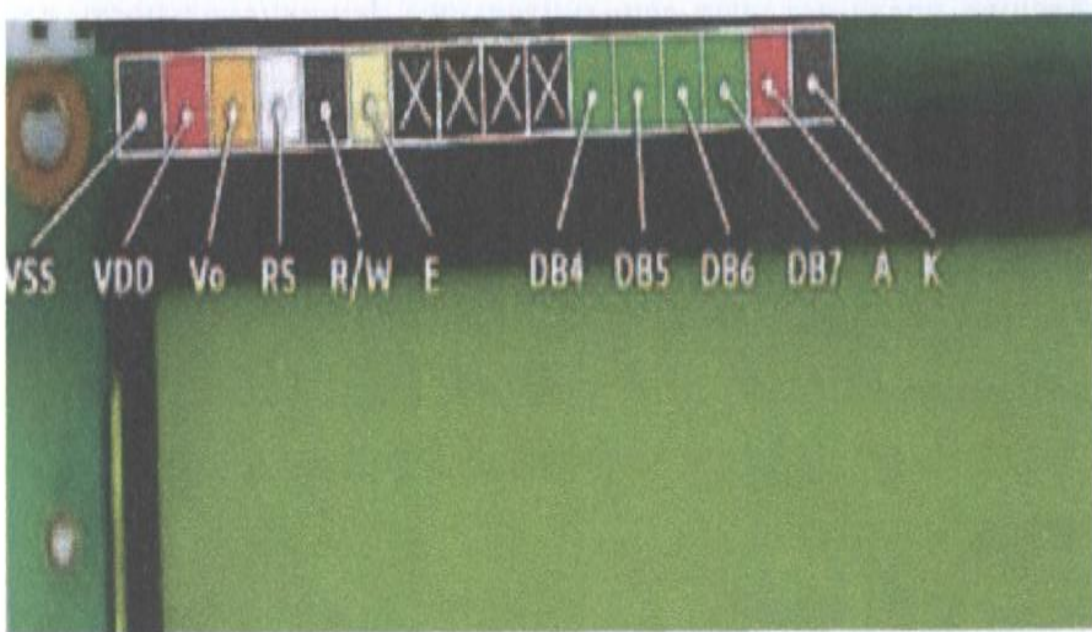


Figure 5. SKI WH1602 with HD44780 controller

Functions of controller feet:

- DB0-DB7 Footprints - Responsible for Input / Output of Information;
- RS - high value indicates signal information in DB0- DB7 output, low - indicates command;
- R / W - Determines the direction of information (read / write). Since the read-only operation of the indicator is usually unnecessary, this entry can be set to a constant value;
- The YE determines the signal read / write data from the footprints DB0- DB7, RS and W / R with a pulse duration of less than 500 ms.;
- V0 - used to illuminate the image;
- A, K - source lighting (anode and cathode), if it has;
- VSS;
- VDD – SK-source of indicator.

It is required to have 6 or 10 feet of Arduino depending on whether the 4- or 8-bit mode is used in the information exchange mode to control the LCD. A microcontroller can work in a 4-bit mode to reduce the number of feet required. In this case, the information / commands from the indicator DB4-DB7 output are first transmitted into four large bits, and then the smaller four bits. DB0-DB3 footprints will no longer be used.

Sketching begins. Arduino's functions can be expanded through the use of the library. Arduino's libraries provide additional functionality for sketching and make writing software much easier. A number of major libraries are installed in conjunction with the ArduinoIDE environment, and there are many extensions that you can install on your own. When using the HD44780 controller with Arduino's SKI display, the LiquidCrystal library is used. The following line will be added to connect the library to the sketching start

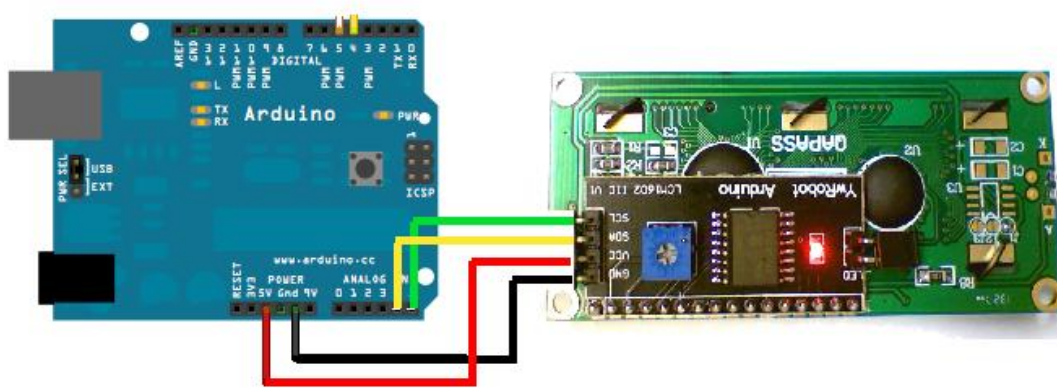


Figure 6. Scheme of connecting the temperature sensor and SKI to the Arduino

V. CONCLUSION

In summary, we can say that it is very difficult to imagine humanity today without technology. While their entry into each area is rather complicated, the result is many conveniences. The age of information technology opens up different possibilities for us. We know that many things around us are automated and have their own built-in systems. Using the article, you can learn how to display the thermal temperature data on the celestial and kelvin scale by connecting the LCD1602 and the Arduino microcontroller to the I2C.

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