

Experiment No: 04

Experiment Name: Print 2 lines in 16×2 LCD with Arduino.

Introduction:

LCDs are widely used in everything from household gadgets to DIY electronics projects. A common type of LCD is the 16x2 display, which shows two rows of 16 characters, making it useful for simple messages or data. Displays are key parts of electronic devices, allowing users to see information clearly. One popular type is the Liquid Crystal Display (LCD), which uses very little power and is easy to work with. LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs are widely used in everything from household gadgets to DIY electronics projects. A common type of LCD is the 16x2 display, which shows two rows of 16 characters, making it useful for simple messages or data.

Explanation:

LCD (Liquid Crystal Display)

A 16×2 LCD display is a liquid crystal display that can show 16 characters in each of its two rows, providing a total of 32 characters of information. It's commonly used to display alphanumeric information in various electronic devices. A 16×2 LCD display works by controlling the liquid crystals to either block or allow light to pass through, creating characters and symbols on the screen. It's controlled by sending data and commands to its controller, which in turn manages the display of information.

Pins of LCD:

- Pin1 (Ground Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.

- **Pin3 (V0/VEE/Control Pin):** This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- **Pin4 (Register Select/Control Pin):** This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).

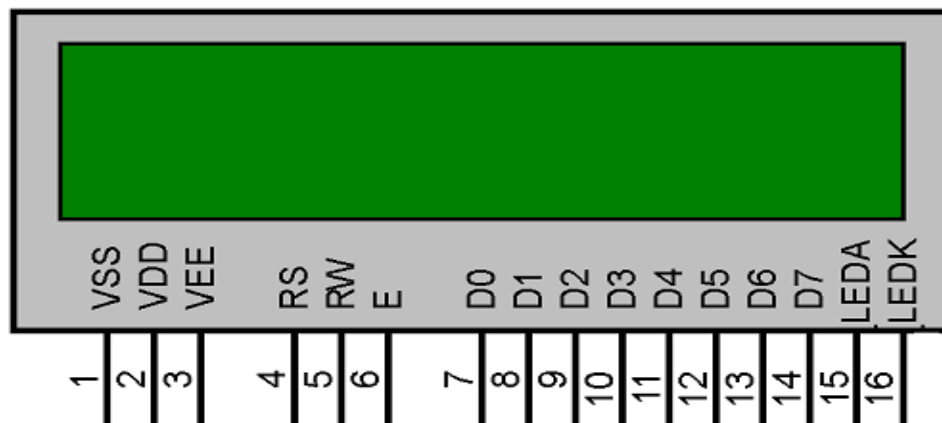


Figure No 01: Pin diagram of LCD.

- **Pin5 (Read/Write/Control Pin):** This pin switches the display between reading and writing. It connects to a microcontroller pin and takes either a 0 or 1 value:
 - 0 = Write Operation
 - 1 = Read Operation
- **Pin 6 (Enable/Control Pin):** This pin should be kept "high" (connected to power) to enable reading and writing operations. It connects to the microcontroller and stays in the "high" position throughout the process.
- **Pins 7-14 (Data Pins):** The data pins on an LCD (Pins 7 to 14) are used to send data from the microcontroller to the display. These pins can operate in two modes:
 - **4-Bit Mode:** Only four data pins (D4 to D7) are connected to the microcontroller. This mode uses fewer pins on the microcontroller, making it

ideal when pins are limited. Data is sent in two parts, or "nibbles" (4 bits each), which the LCD combines to display the information.

- **8-Bit Mode:** All eight data pins (D0 to D7) are connected to the microcontroller. This mode sends a full byte (8 bits) at once, allowing faster data transmission but using more of the microcontroller's pins.
- **Pin15 (+ve pin of the LED):** This pin is connected to +5V
- **Pin 16 (-ve pin of the LED):** This pin is connected to GND.

Components Required

- Arduino Board
- LCD Screen (compatible with Hitachi HD44780 driver)
- 10k ohm potentiometer
- 1k ohm resistor
- Connecting wires
- Breadboard

Working Procedure

The Arduino uno connects with the LCD display and display the lines that are stored in the Arduino chipset. The LCD has 16 pins and they are connected to the Arduino in the order of:

- LCD RS pin to digital pin 12
- LCD Enable pin to digital pin 11
- LCD D4 pin to digital pin 5
- LCD D5 pin to digital pin 4
- LCD D6 pin to digital pin 3
- LCD D7 pin to digital pin 2
- LCD R/W pin to GND
- LCD VSS pin to GND
- LCD VCC pin to 5V

- LCD LED+ to 5V through a 1k ohm resistor
- LCD LED- to GND

A breadboard is used to connect all the components.

Initialize the LCD in Code:

- Define the pins used to connect the LCD to the Arduino in the code.
- Use the `lcd.begin(16, 2);` command to set up the LCD for a 16x2 display.

Write the Code to Display Text:

- Write code to display text on the LCD screen. Use `lcd.print("Text")` to display text on the screen, where "Text" is the message.
- Set the cursor position using `lcd.setCursor(column, row);` to control where the text appears.

Upload the Code and Test:

- Connect your Arduino to your computer using a USB cable.
- Upload the code to the Arduino board from the Arduino IDE.
- Observe the LCD display to check if the text appears as programmed.

Adjust the Contrast: Use the potentiometer to adjust the LCD contrast to make the text readable.

Code Explanation:

- **#include <LiquidCrystal.h>** : Include the LiquidCrystal library.
- **const int rs** : Define the pin numbers for the LCD.
- **LiquidCrystal lcd** : Create an instance of the LiquidCrystal class.
- **lcd.begin** : Initialize the LCD with given column and row numbers.
- **lcd.print** : Print the first name on the first line.
- **lcd.setCursor** : Move the cursor to the beginning of the second line.
- **lcd.print** : print the second name of the second line.
- **void loop()** : The loop function is intentionally left empty.

Conclusion: This experiment demonstrates how to interface a 16x2 LCD display with an Arduino to display text. By following the wiring and coding procedures, we can effectively show messages on both lines of the LCD. This capability allows for various applications, such as displaying sensor readings or user prompts, showcasing the versatility and utility of LCD displays in embedded systems. Understanding this process is fundamental for further advancements in Arduino projects involving user interfaces and data presentation.

END

