Microcontroller
Display Interfacing Techniques

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BiPOM Electronics, Inc.

16301 Blue Ridge Road, Missouri City, Texas 77489
Telephone: 1-713-283-9970 Fax: 1-281-416-2806
E-mail: info@bipom.com
Web: www.bipom.com

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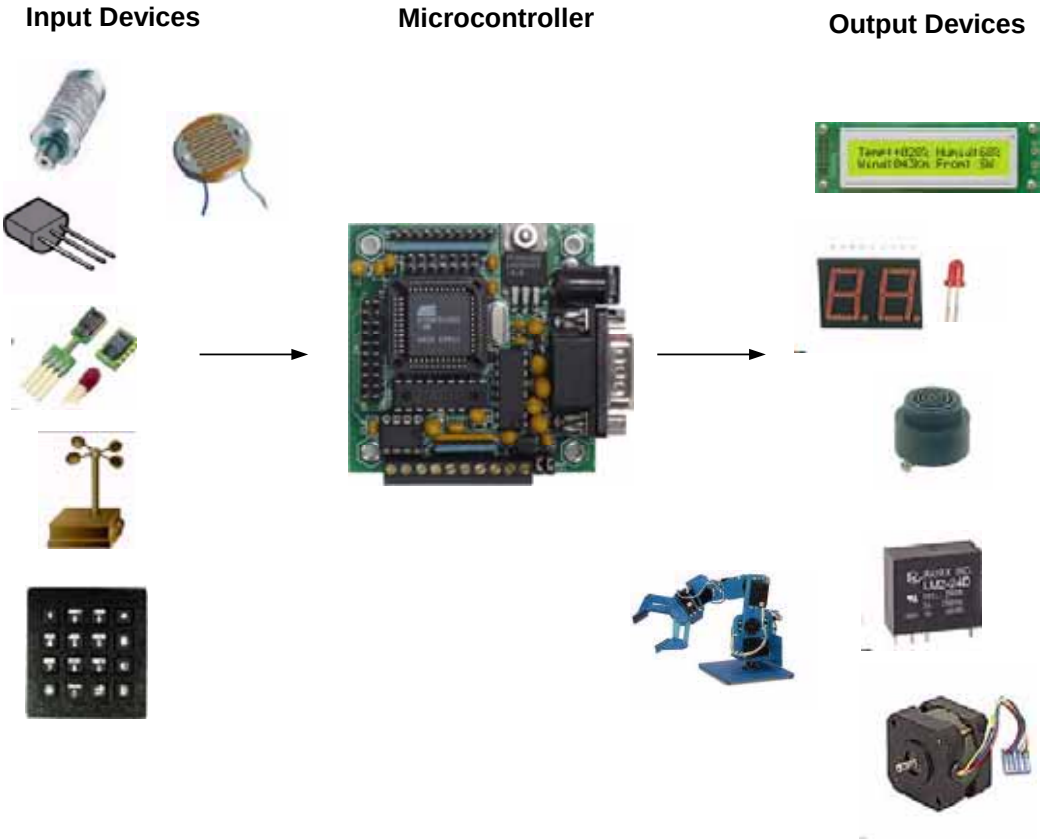
Overview

Micro-controllers are useful to the extent that they communicate with other devices, such as sensors, motors, switches, keypads, displays, memory and even other micro-controllers.

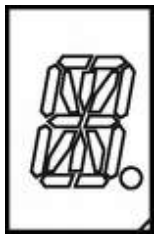
Many interface methods have been developed over the years to solve the complex problem of balancing circuit design criteria such as features, cost, size, weight, power consumption, reliability, availability, manufacturability.

Many microcontroller designs typically mix multiple interfacing methods. In a very simplistic form, a micro-controller system can be viewed as a system that reads from (monitors) inputs, performs processing and writes to (controls) outputs.



Commonly Used Display Types

LED (Light Emitting Diode) **Displays:**



Discrete LED's
LED Bar Graphs
7-Segment LED's
Alphanumeric LED's
Multi-color LED's

LCD (Liquid Crystal Display):

Visible in light. Visible in dark using backlighting.
Low cost.
Available in many formats.
Low current consumption. High current with backlight.

Parallel
- Alphanumeric
  - 4-bit mode
  - 8-bit mode
- Graphical (includes computer monitors)

Serial (I2C, RS232, USB)
- Alphanumeric
- Graphical

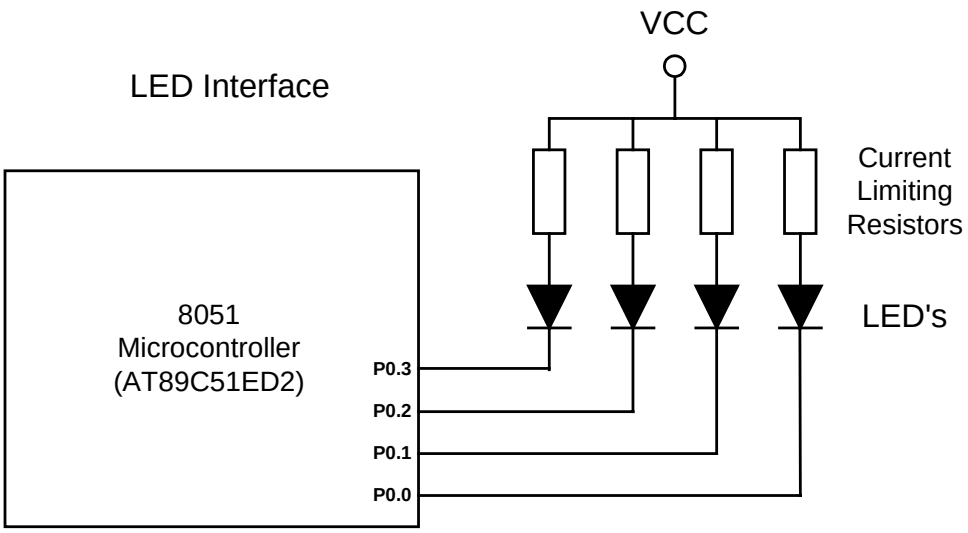
VFD (Vacuum Fluorescent Displays):

Good visibility in the dark. No need for backlight.
Suitable for cost-insensitive applications such as automobiles, media PC's.
High current consumption.

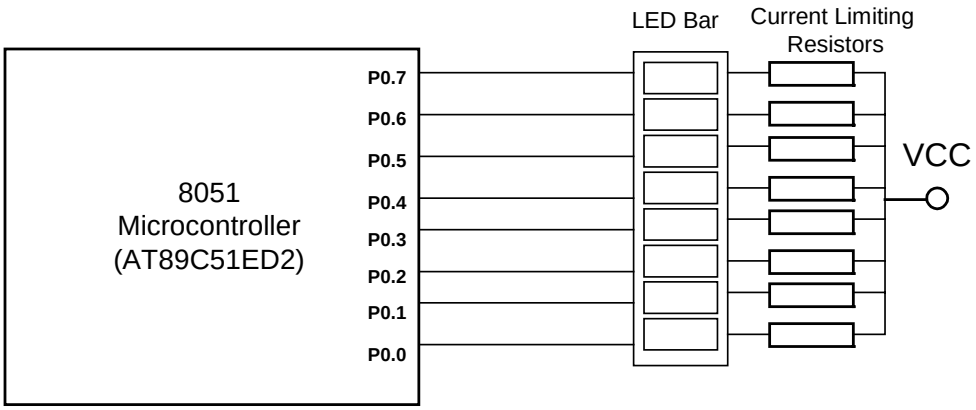
OLED (Organic LED) Displays:

Organic LED.
High visibility under all light conditions.
No need for backlight.
Requires high voltage driver.
Moderate current consumption.

Digital Output Example: LED control

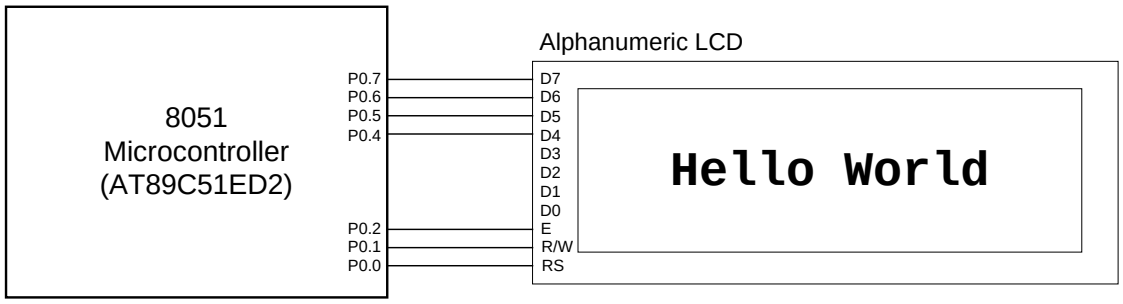


LED Bar Graph Interface

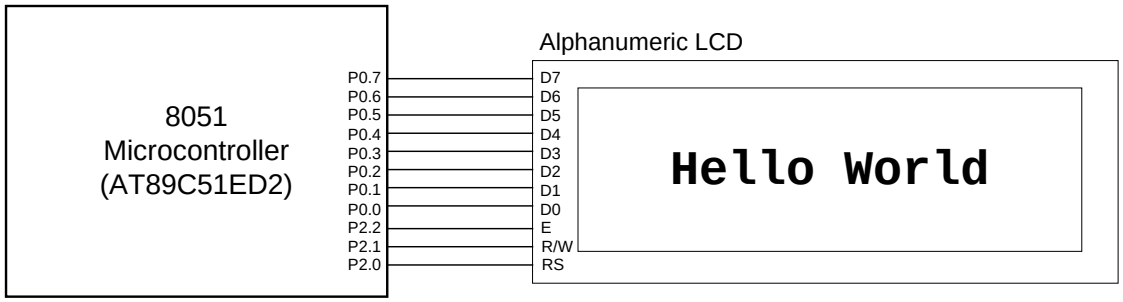


Parallel LCD interface

4-bit LCD Interface



8-bit LCD Interface



Matrix Orbital Serial Displays

I2C, RS232 or USB Options
Software programmable contrast, backlight and fonts. Easy to use
Supply Current: 10mA typical. Backlight Supply Current: 90mA typical

Character Display:

Graphical Display:

Interfaces:
Up to a 25-key keypad

RS232 or I2C

Two 100mA @ +5V General Purpose Outputs

RS232 mode: 9600 baud to 115,200 baud

I2C mode: Serial transfers of up to 100 Kbps

VFD Display:

Typical Supply current: 290mA (up to 550mA inrush)

OLED Displays

Definition of OLED from Wikipedia:

An **organic** **light-emitting diode** (**OLED**) is a special type of light-emitting diode (LED) in which the emissive layer comprises a thin-film of certain organic compounds. The emissive electroluminescent layer can include a polymeric substance that allows the deposition of very suitable organic compounds, for example, in rows and columns on a flat carrier by using a simple "printing" method to create a matrix of pixels which can emit different colour light.

Matrix Orbital:

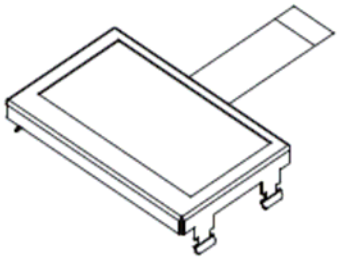
- They are less expensive than a VFD and incredibly bright
- Incredible viewing angle of 160 degrees
- Self-luminous, no backlight required
- Low power consumption
- Fast response time and pixel refresh rate
- Extended temperature available from -20° to +70° C
- Lifespan of 10,000+ hours
- Excellent for LCD or VFD replacement applications

OSRAM Pictiva:

Opto Semiconductors OSRAM

OLED DISPLAY SOLUTIONS

Pictiva™ 128x64 display



OS128064PK16MY0AXX

Features:

- Graphics display matrix
- Single Color with 4-bit per pixel grayscale
- True emissive technology
- 160° viewing angle
- Passive matrix driven by an industry standard compatible IC
- Fast response, video frame rate capable
- High contrast
- Wide operating temperature range
- Thin profile

Specifications:

Display Format	128 Columns x 64 Rows
Pixel Pitch	0.265 mm Square
Pixel Size	0.255 mm Square
Color	Yellow x=0.455, y=0.540
Grayscale	4-bit
Active Area	36.46 (W) x 18.22 mm (H)
Module Size	47.75(W) x 22.17 (H) x 3.96mm (T) excluding latches
Luminance	100 cd/m² typical
Lifetime	10,000 Hours @ 25°C
Viewing Angle	160°
Contrast Ratio	100:1 minimum
Temp Range	-30° to +70°C
Logic Voltage	2.4 – 3.5V
Supply Voltage	12 –13V typical
Sleep Mode Power	0.05mW
Interface	Parallel/Serial
OLED Driver/$_{w\ controller}$	0323
Packaging	COF (chip-on-flex)
Interconnect	ZIF (zero insertion force)
Weight	6.5 g nom. (excluding bezel)