DESN2000 (Computer Engineering)

Serial Communication- UART

Hasindu Gamaarachchi

Parallel Communication

- Multiple wires to transfer several bits simultaneously
  - e.g.: LCD interfacing

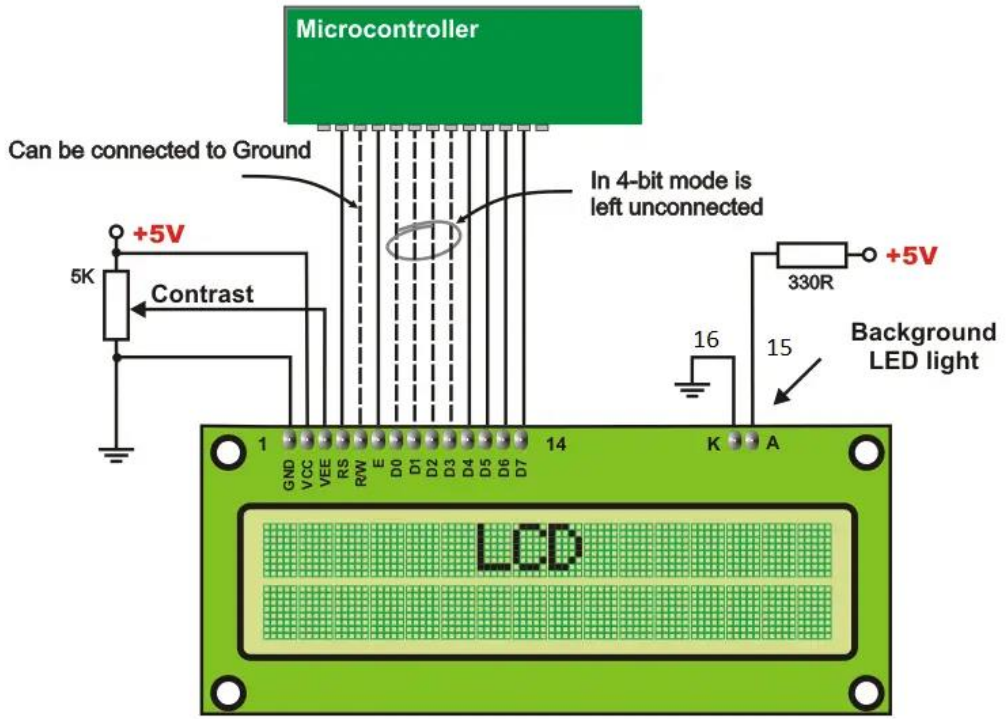


Image from: https://deepbluembedded.com/stm32-lcd-16x2-tutorial-library-alphanumeric-lcd-16x2-interfacing

Serial Communication

- Single wire to transfer one bit at a time
  - universal asynchronous receiver/transmitter (UART)
  - Serial Peripheral Interface (SPI)
  - Inter-Integrated Circuit (I2C)
  - Universal Serial Bus (USB)

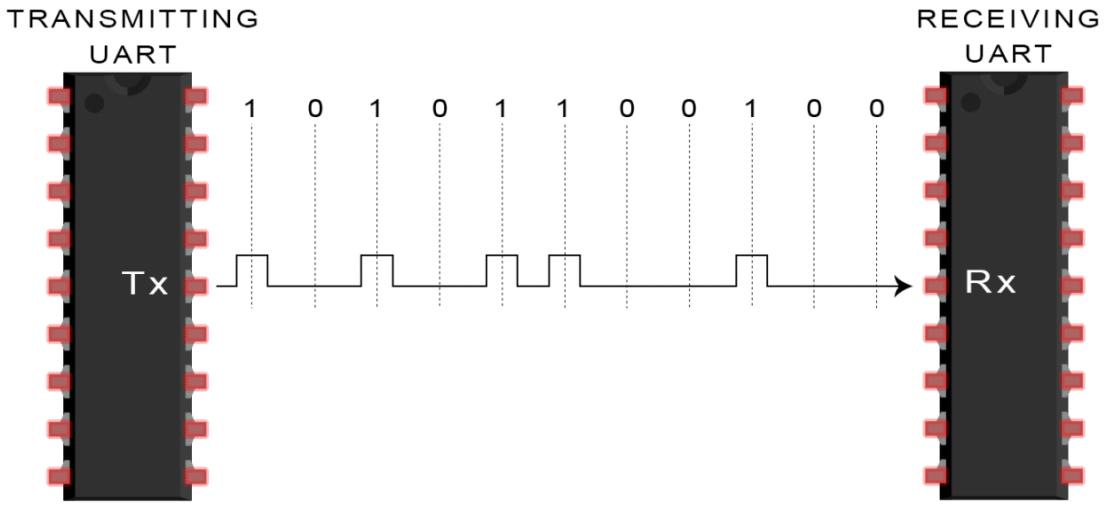
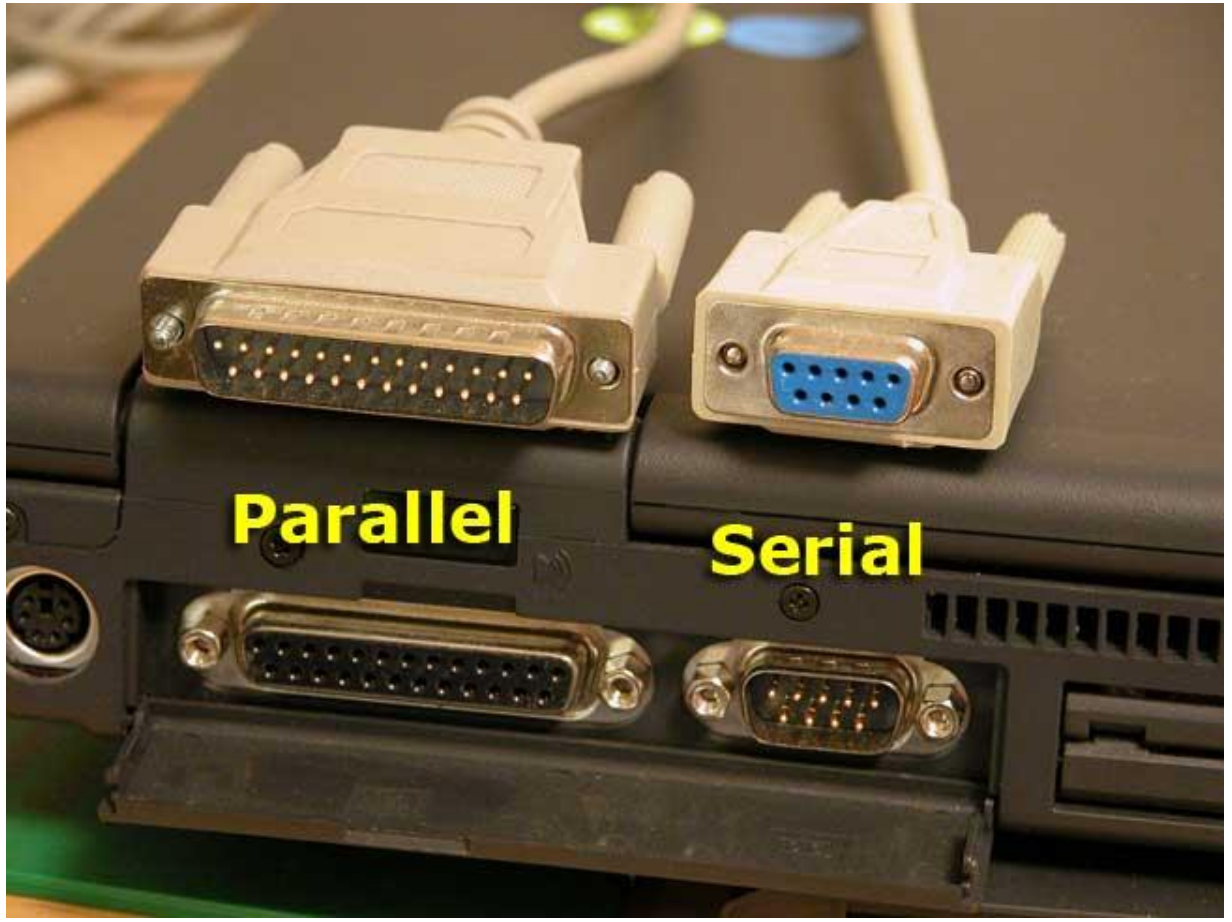


Image from https://www.circuitbasics.com/basics-uart-communication/

Parallel and Serial Communication



https://www.unm.edu/~tbeach/terms/figures/oldports.html

Parallel and Serial Communication

https://www.flickr.com/photos/126940499@N05/15413982448

UART – Microcontroller to Microcontroller

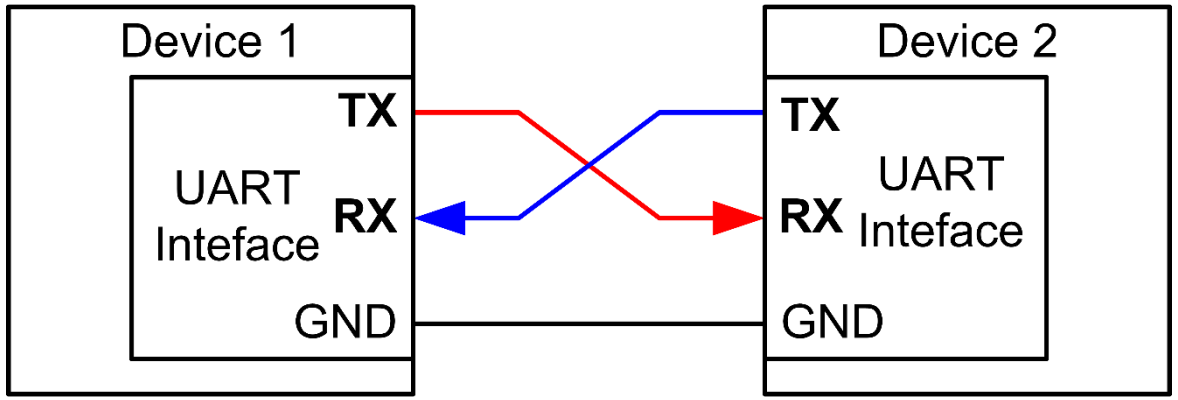
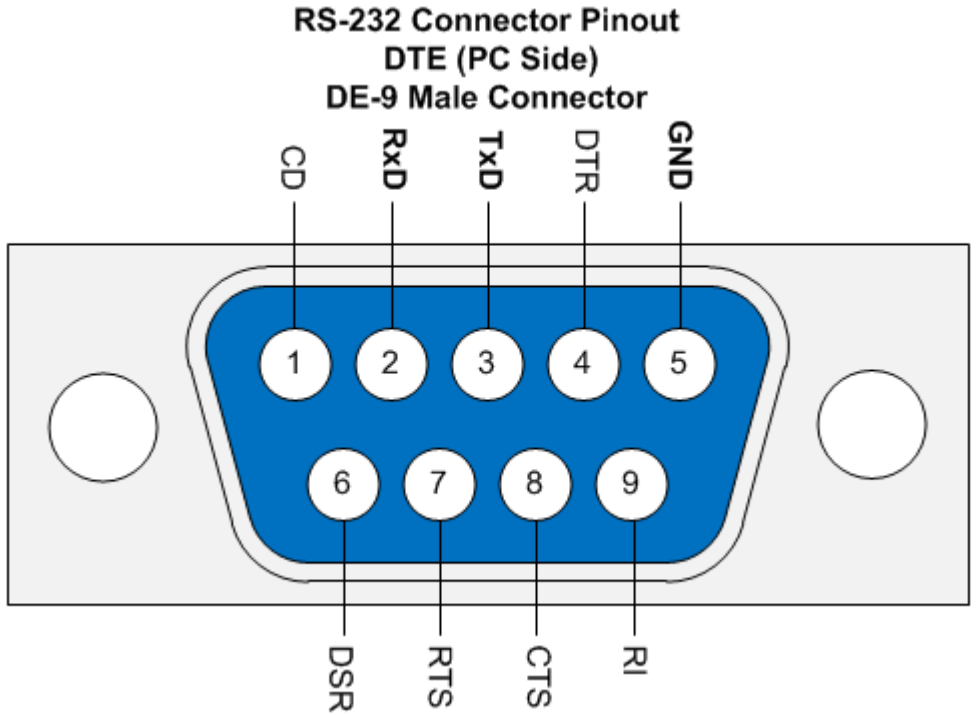


Figure from: Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (Fourth Edition)" – Yifeng Zhu

UART to PC

https://commons.wikimedia.org/wiki/File:Serial_port_%289-pin%29.jpg



https://upload.wikimedia.org/wikipedia/commons/2/29/RS-232_DE-9_Connector_Pinouts.png

UART to PC

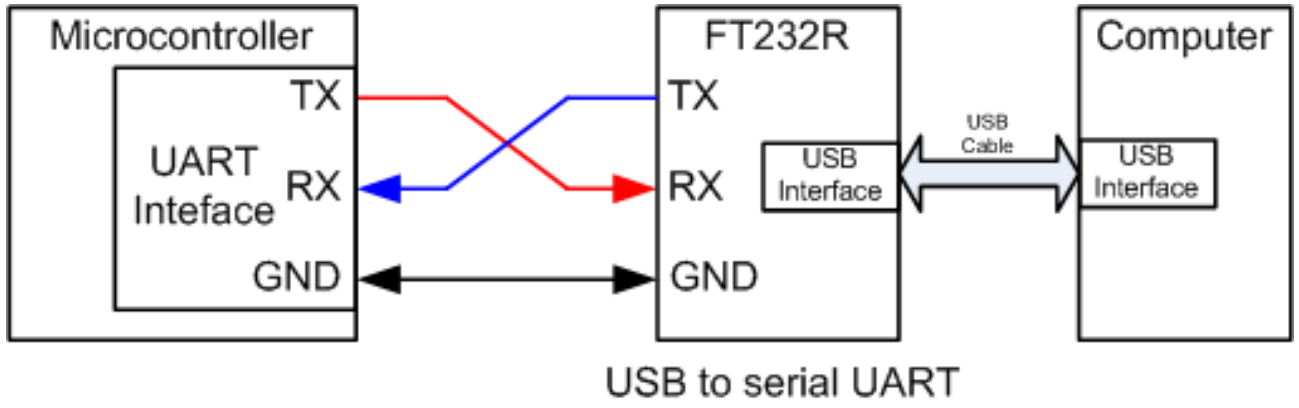


Figure from: Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (Fourth Edition)" – Yifeng Zhu

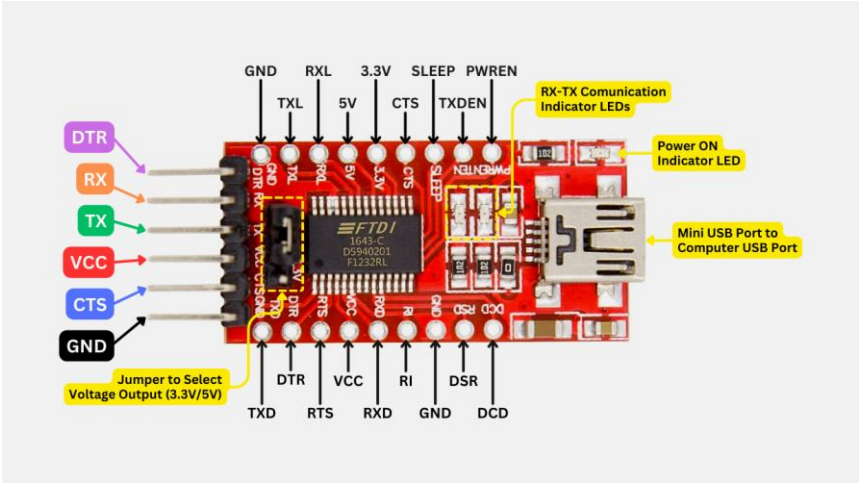


Figure from: https://www.electrothinks.com/2024/02/ft232rl-usb-to-serial-uart-module.html

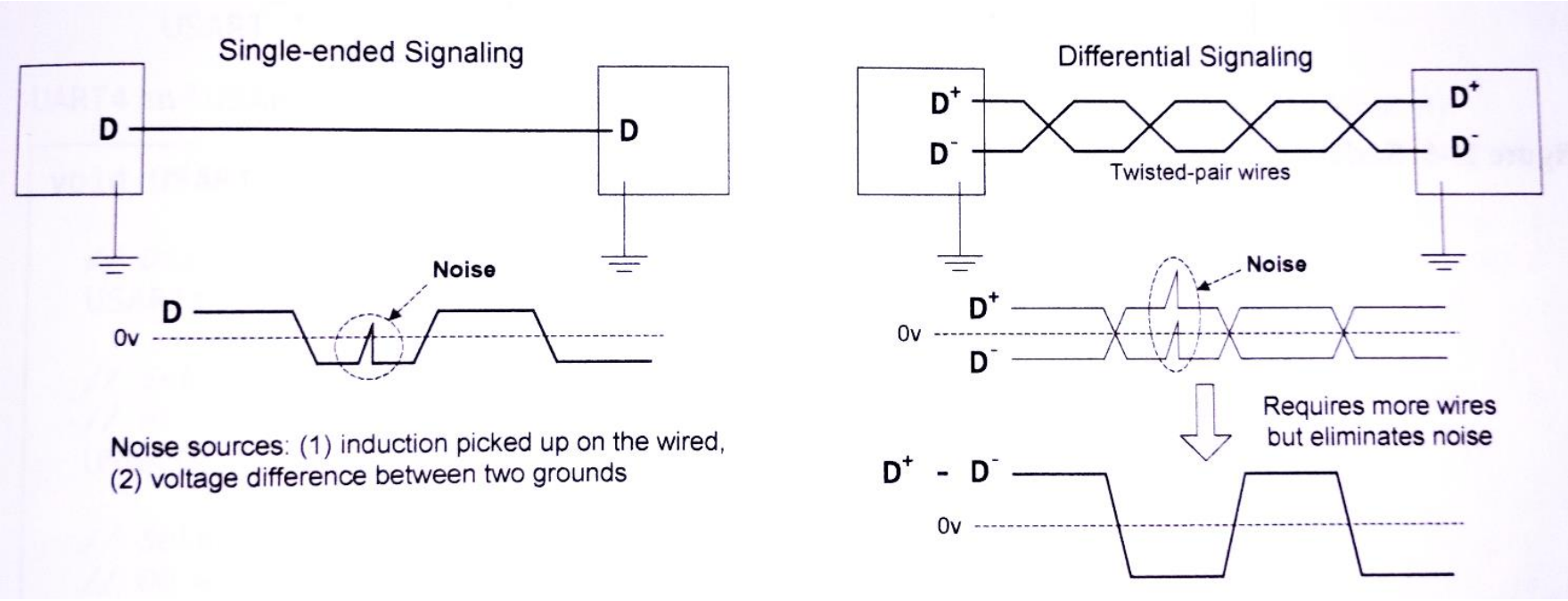
Voltage Levels

Standard	Voltage signal	Max distance	Max speed	Number of devices supported per port
RS-232	Single end (logic 1: +5 to +15V, logic 0: -5 to -15 V)	100 feet	115Kbit/s	1 master, 1 receiver
RS-422	Differential (-6V to +6V)	4000 feet	10Mbit/s	1 master, 10 receivers
RS-485	Differential (-7V to +12V)	4000 feet	10Mbit/s	32 masters, 32 receivers

RS stands for recommended standards

Slide from Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (Fourth Edition)" – Yifeng Zhu

Single-ended vs Differential-ended Signaling



Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (Fourth Edition)" – Yifeng Zhu

Learning Resources

"Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (Fourth Edition)" – Yifeng Zhu

- Serial communication protocols- chapter 19

- To the whiteboard and a live demo