

# Lecture (10)

## Serial interface

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- Serial interface
- Assignment01: automatic water tank controller
- Assignment02, Telecom Room air Conditions Controller

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## Introduction to serial UART, RS232 communication

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- Serial communication is the most simplistic form of communication between two devices.
- RS-232 is a standard by which two serial devices communicate:
  - The connection must be no longer than 50 feet.
  - Transmission voltages are  $-15V$  and  $+15V$ .
  - It is designed around transmission of characters (of 7 bits of length).
- One important aspect of RS-232 is that it is an asynchronous form of communication.
- Asynchronous communication is important because it is efficient; if no data needs to be sent, the connection is “idle.” No additional CPU overhead is required for an idle serial line.

### Logical Voltages

- RS-232 is a little non-intuitive at first.
- Logical 1 is  $-15VDC$ .
- Logical 0 is  $+15VDC$ .
- When the connection is idle, the hardware ties the connection to logical 1.

### How Can You Transmit Data?

- RS-232 communication is dependent on a set timing speed at which both pieces of hardware communicate. In other words, the hardware knows how long a bit should be high or low.
- RS-232 also specifies the use of “start” and “stop” bits.

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### Sending One Character

- Every time a character is sent, the same communication occurs:
1. Start bit sent.
  2. Seven data bits sent.
  3. Stop bit sent.
- This communication is dependent on the fact that both devices are sampling the bits at the same rate! We'll see what happens if this doesn't happen...

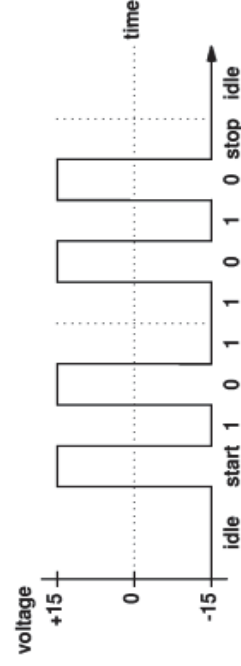
### What's the Start Bit?

- The start bit is a logical 0 sent on the line to tell the other device to start sampling.
- Remember, the logical 0 is **+15VDC**.

### And the Stop Bit?

- The stop bit is a logical 1. **-15VDC**.
- A stop bit is always sent (per RS-232 standards).
- We've mentioned that both devices must have the same speeds to talk, but they must also know to handle problems.
- The transmission rate of serial devices is called *baud*. It is the number of changes in the signal per second.

### A Sample Transmission

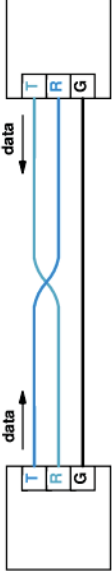


### Common Serial Settings

- Most settings are read in the following form:
  - Bits per second
  - Number of data bits
  - Parity
  - Number of Stop bits
- If you want to know what Parity is right now, read chapter 6.7. Otherwise, wait.

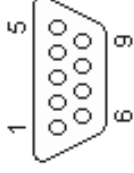
## Full Duplex Transmission

- Full duplex transmission (FDX) occurs when data is transmitted (or can be transmitted) simultaneously by both devices. Special wiring is needed for FDX.



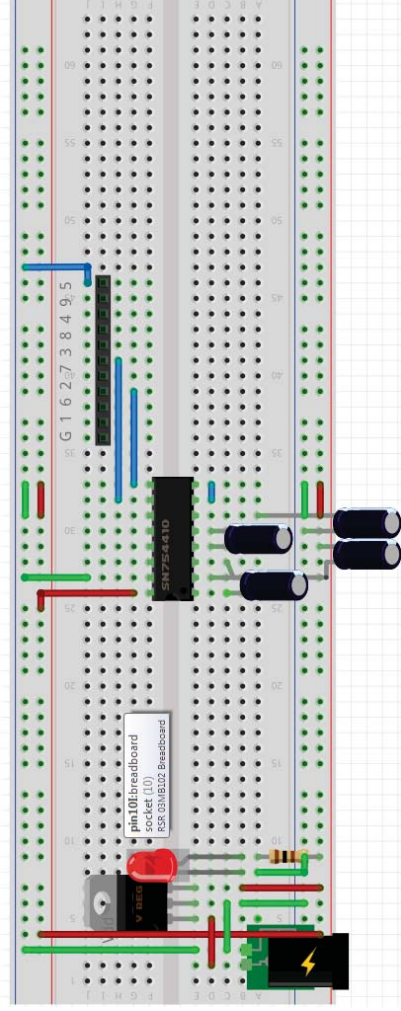
### Wiring RS-232

Pin #	Function	Abbreviation
Pin #1	Data Carrier Detect	CD
Pin #2	Receive Data	RD or RX or RXD
Pin #3	Transmitted Data	TD or TX or TXD
Pin #4	Data Terminal Ready	DTR
Pin #5	Signal Ground	GND
Pin #6	Data Set Ready	DSR
Pin #7	Request To Send	RTS
Pin #8	Clear To Send	CTS
Pin #9	Ring Indicator	RI



- For ease-of-use, a computer will transmit on pin 2 and receive on pin 3 (the CTE, remember).
- Vice versa: a modem will transmit on pin 3, and receive on pin 2 (for the DTE).

## PC serial Echo



## Assignment01: automatic water tank controller

- Search for suitable sensors that can detect water level inside a 1000L water tank. At least we need to detect two levels one for full tank alarm , and another almost empty alarm
- Build suitable interface to connect sensor to a 16F84A microcontroller.
- Build suitable interface to drive a 12V water pump or 12 volt water valve to fill tank with water.
- Your project should be equipped with LCD that indicate the current operating status (full-standby-almost empty-filling)
- Your project should be equipped with indicator (led) indicating the operating status (as possible)

## Assignment02, Telecom Room 2 x air Conditions Controller

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- Telecom room has two air conditions, that operate in series four hours each.
- When room temperature reach 27C both ACs turned on.
- Temp is measured using thermostat giving free-contact feedback to controller, when temp become above the pre-selected temp free contacts become close otherwise it's open.
- When temperature becomes below 27C, ACs start working in series again.
- Controlled gets feedback from fire control panel, it turns both ACs off when if fire alarm received, till alarm is cleared, ACs started normal operation (fire alarm makes free contact close, otherwise, it's open).

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Thanks,..  
See you next week (ISA),...

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- Build suitable interface, and write code.
  - Controller has LCD that displays the current operating status, and alarms.