INTEGRATED TECHNICAL EDUCATION CLUSTER
AT ALAMEERIA

E-626-A
Data Communication and Industrial Networks (DC-IN)

Lecture #3
RS232 & 485 protocols

Instructor:

Dr. Ahmad El-Banna

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Agenda

- What is RS232
  - Signals, Line Driver, Speed & SW settings
- What is RS-485
  - Line Driver, Network, Half-duplex, Full-duplex & DL devices
- RS-232 vs RS-458

RS232

What is RS-232

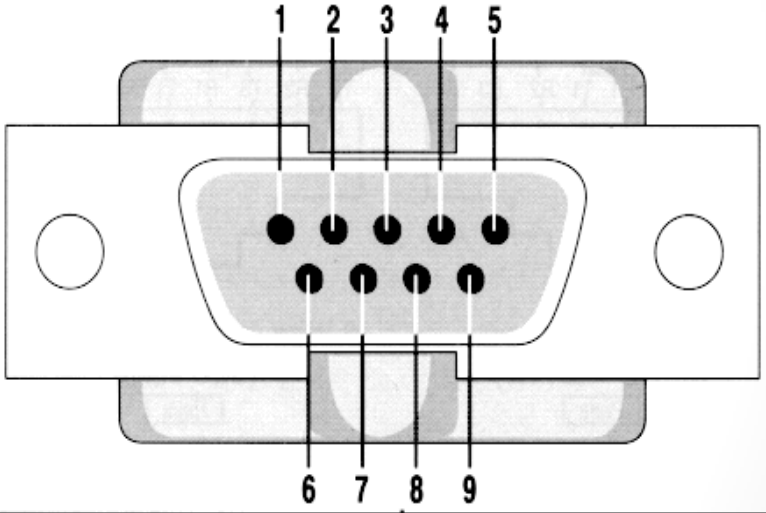
- RS-232 is a popular communications interface for connecting modems and data acquisition devices (i.e. GPS receivers, electronic balances, data loggers, ...) to computers.
- RS-232 can be plugged straight into the computer's serial port (know as COM or Comm port).

RS-232 Signals

- Architecturally RS-232 is a bi-directional point to point link.

(serial port - PC side)

- Two independent channels are established for two-way (full-duplex) communications.
- RS-232 can also carry additional signals used for flow control (RTS, CTS) and modem control (DCD, DTR, DSR, RI).

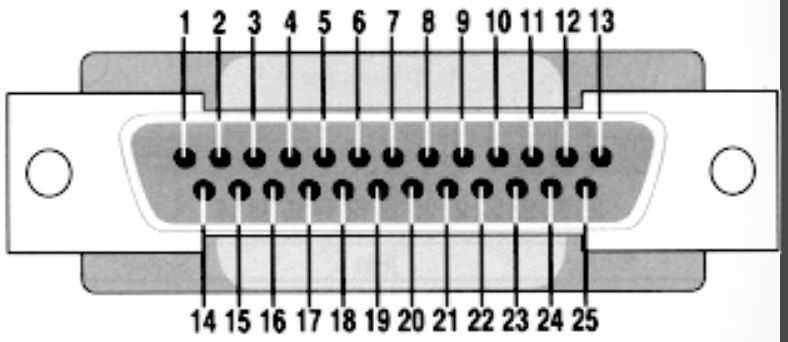


Pin	Signal	Pin	Signal
1	Data Carrier Detect	6	Data Set Ready
2	Received Data	7	Request to Send
3	Transmitted Data	8	Clear to Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

RS-232 Signals..

- Common 25 pin D-shell connector pinout used for asynchronous data communications.

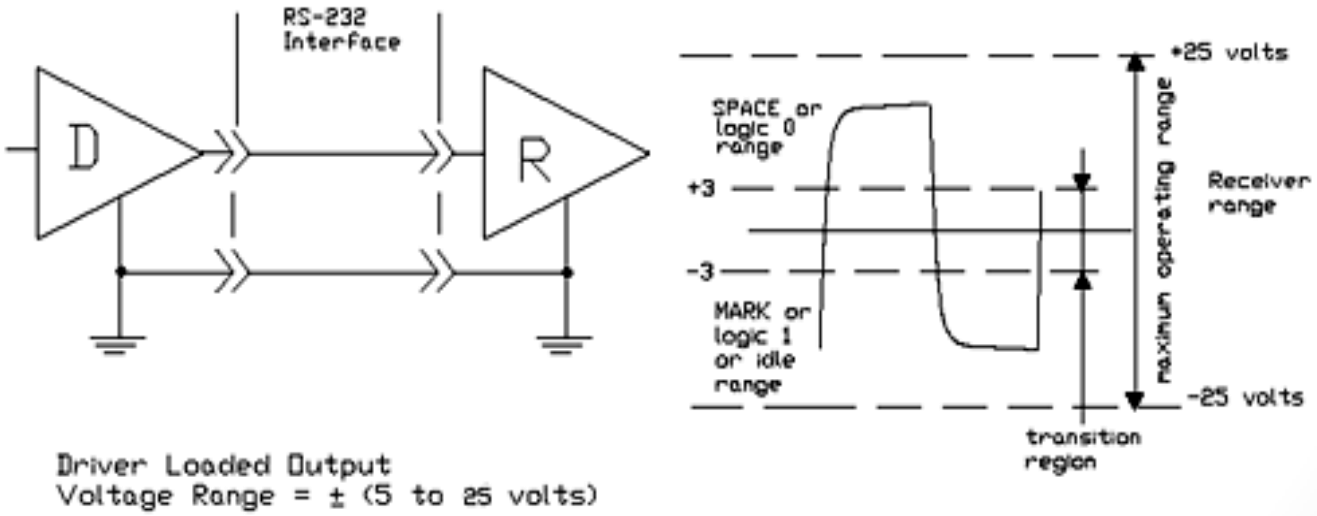
Pin	Signal
1	PGND Protective Ground
2	TXD Transmit Data
3	RXD Receive Data
4	RTS Ready To Send
5	CTS Clear To Send
6	DSR Data Set Ready
7	SG Signal Ground
8	CD Carrier Detect
20	DTR Data Terminal Ready
22	RI Ring Indicator



(serial port - PC side)

RS-232 Line Driver

- Unbalanced Line Drivers
  - Each signal appears on the interface connector as a voltage with reference to a signal ground.
  - The “idle” state (MARK) has the signal level negative with respect to common whereas the active state (SPACE) has the signal level positive respest to the same reference.



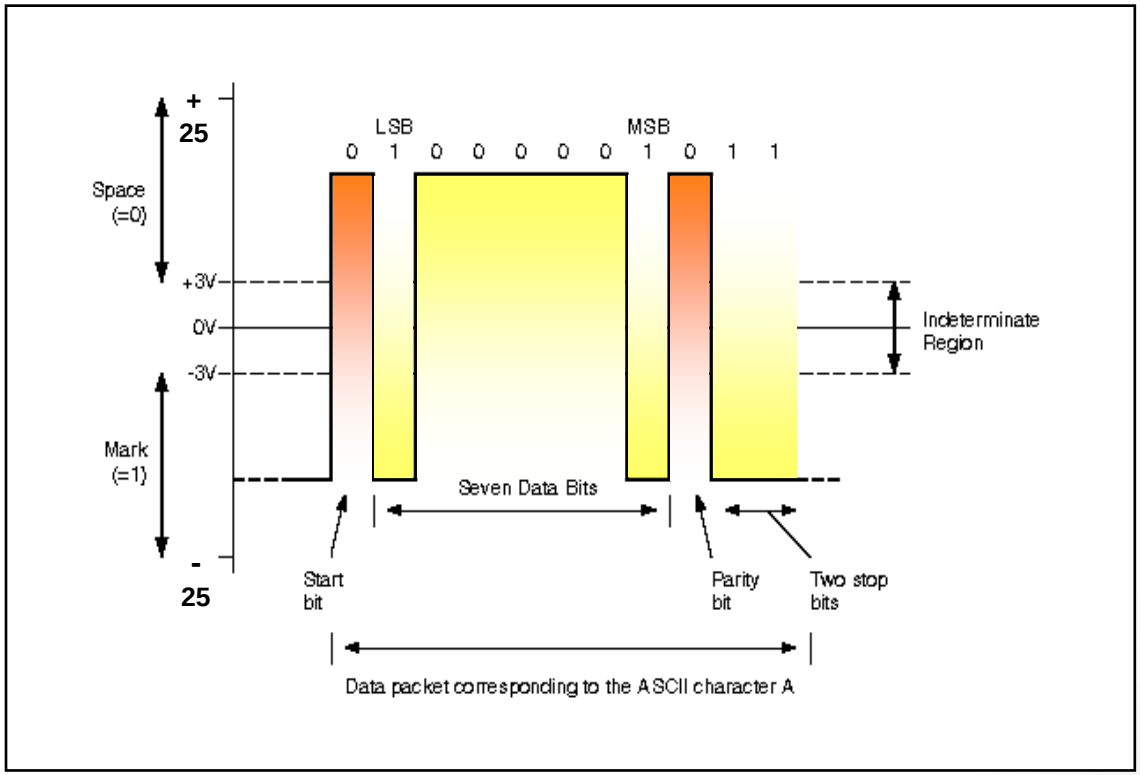
RS-232 Interface Circuit

RS-232 Speed

- How fast can RS-232 be?
  - The maximum speed, according to the standard, is 20kbit/s. However, modern equipment can operate much faster than this. (i.e. Lynx can reach 115200 baud.)
  - The length of the cable also plays a part in maximum speed. The longer the cable the slower the speed at which you can obtain accurate results.
  - A large wire capacitance and inductance limits the maximum length of the cable and/or the maximum speed; Moreover higher is the capacitance of the cable higher is the interference between two adjacent signal wire.
    50 feet (15m) @ max baudrate is commonly quoted as the maximum distance.

RS-232 sw settings

- One byte of async data has:
  - Start Bit = 1 (always)
  - Data Bits = 8 (or 7)
  - Stop bits = 1 (or 2)
  - Parity = NONE (or EVEN or ODD)



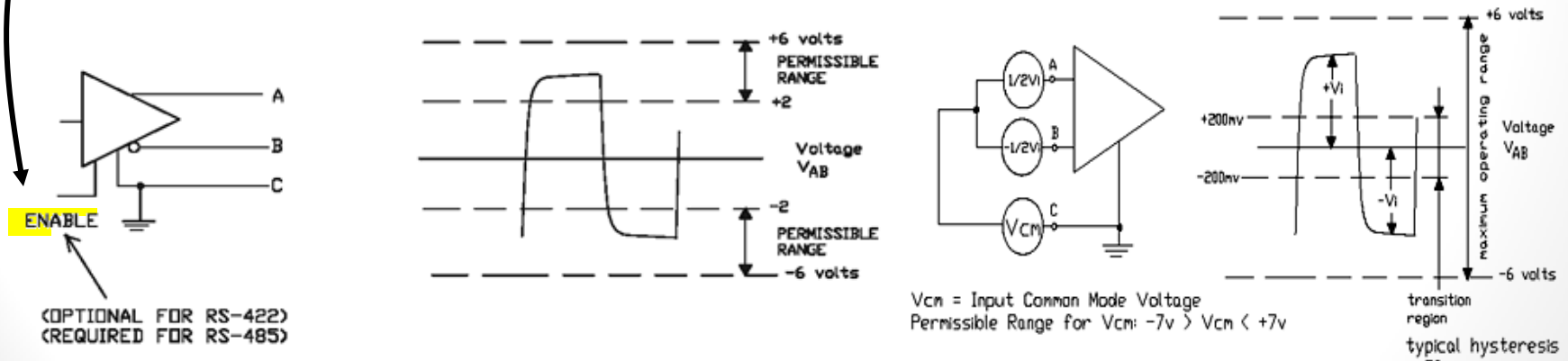
RS485

What is RS-485

- What is RS-485?
  - RS-485 is a EIA standard interface which is very common in the data acquisition world
  - RS-485 provides balanced transmission line which also can be shared in Multidrop mode.
  - It allows high data rates communications over long distances in real world environments.
- How fast can RS-485 be?
  - RS-485 was designed for greater distance and higher baudrates than RS-232.
  - According to the standard, 100kbit/s is the maximum speed and distance up to 4000 feet (1200 meters) can be achieved.

RS-485 Line Driver

- Balanced Line Drivers
  - Voltage produced by the driver appears across a pair of signal wires that transmit only one signal. Both wires are driven opposite.
  - RS-485 driver has always the “Enable” direction control signal.
  - Differential system provides noise immunity, because much of the common mode signal can be rejected by the receiver. So ground shifts and induced noise signals can be nullified.



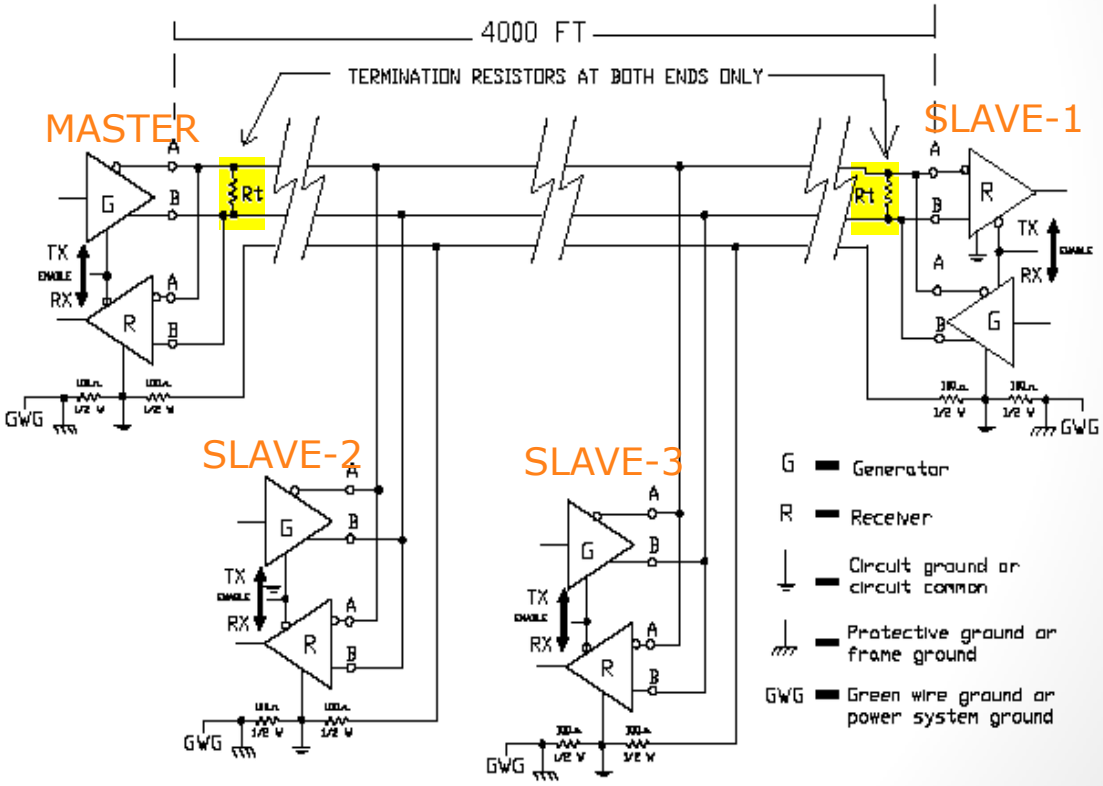
BALANCED DIFFERENTIAL OUTPUT LINE DRIVER

BALANCED DIFFERENTIAL INPUT LINE RECEIVER

RS-485 Network

- RS-485 provides Half-Duplex, Multidrop communications over a single twisted pair cable.

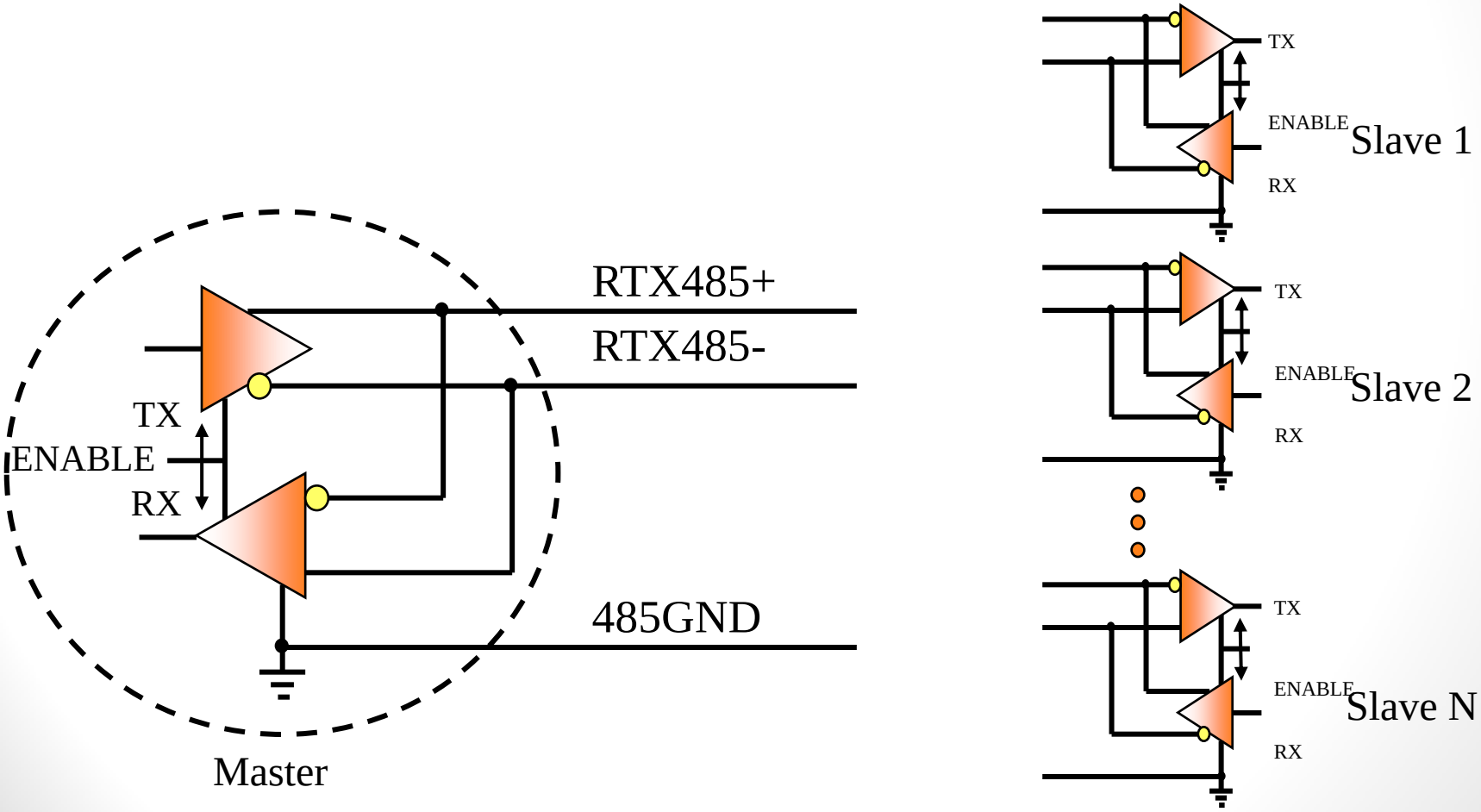
- The standard specifies up to 32 drivers and 32 receivers can share a multidrop network
- Terminator resistors avoid reflected signal



TYPCIAL RS-485 TWO WIRE MULTIDROP NETWORK

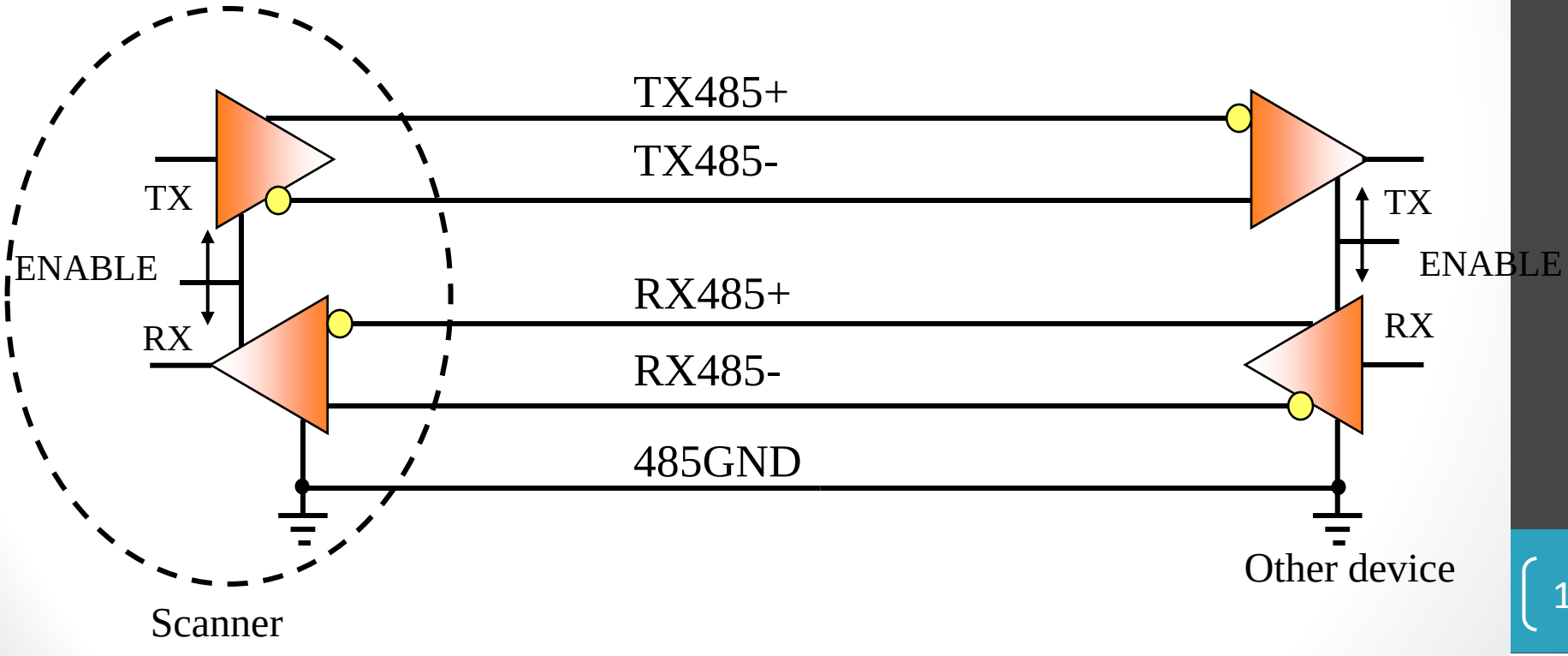
RS-485 Half-duplex

- Datalogic uses Half-Duplex configurations for Data Collecting and Master/Slave layouts.



RS-485 Full-duplex

- Potentially RS-485 interface can also use 4-wires to communicate in multidrop mode.



RS-232 VS RS-485

RS-232 vs RS-485

- The architectural difference between RS-232 and RS-485 is that 232 is a bi-directional point to point link, whereas 485 is a single channel bus.
- Electrically, each 232 signal uses a single wire with symmetric voltages about a common ground wire. 485 uses two wires to carry the single signal differentially.
- The big difference to the software is that only one device on a 485 bus can transmit at a time, whilst there is not similar limitation on RS232 because is a peer-to-peer link .

RS-232 vs RS-485

	RS-232	RS-485
Mode of Operation	SINGLE-ENDED	DIFFERENTIAL
Total Number of Drivers and Receivers on One Line	1 DRIVER 1 RECEIVER	32 DRIVER 32 RECEIVER
Maximum Cable Length	50 FEET	4000 FEET
Maximum Data Rate @Max length	20kb/s	100kb/s
Driver Output Signal Level (Loaded Min.) Loaded	+/-5V to +/-15V	+/-1.5V
Driver Output Signal Level (Unloaded Max) Unloaded	+/-25V	+/-6V
Driver Load Impedance	3kΩ to 7kΩ	54Ω
Max. Driver Current in High Z State Power On	N/A	N/A
Max. Driver Current in High Z State Power Off	+/-6mA @ +/-2v	+/-100uA
Slew Rate (Max.)	30V/μS	N/A
Receiver Input Voltage Range	+/-15V	-7V to +12V
Receiver Input Sensitivity	+/-3V	+/-200mV
Receiver Input Resistance	3kΩ to 7kΩ	≥ 12kΩ

Data Format and Protocols

- Information content passing through peer-to-peer connection is packed in a very simple structure:
  - <Header-string> <Code identifier ><INFO-FIELD><Terminator-string>
  - <Header-string> and <Terminator-string> are both configurable via software (device configuration parameters)
- Most common generic *Handshake* are available/selectable with RS232 interface:
  - Hardware (RTS-CTS)
  - Software XON/XOFF

- For more details, refer to:
  - Online tutorials on RS232/485.
- The lecture is available online at:
- Lecture notes are found at:
  - http://bu.edu.eg/staff/ahmad.elbanna-courses/12133
- For inquires, send to:
  - ahmad.elbanna@feng.bu.edu.eg