مرکز آموزش نیـــرا سیستم

nirasystem.com

RS-485/RS-422

Ali Mirghasemi

Introduction

- The RS-485 (Recommended Standard 485) protocol, also known as TIA-485 or EIA-485, is a widely used communication protocol in the realm of serial data transmission.
- It was developed as an improvement over its predecessor, RS-232, to address some of its limitations. RS-485 is a balanced, differential signaling protocol, designed for robust and noise-resistant communication over long distances.

Applications

- **Industrial Automation**
  - RS-485/RS-422 is commonly used in industrial settings for connecting sensors, actuators, and controllers. Its noise immunity and long-distance capabilities make it ideal for controlling and monitoring equipment and processes.
- **Building Automation**
  - Building management systems utilize RS-485/RS-422 for communication between HVAC systems, lighting control, security devices, and more. It can link devices spread throughout a large building or campus.
- **Telecommunications**
  - RS-485/RS-422 is utilized for data communication in telecommunications networks. It can connect devices like modems, multiplexers, and routers.
- **Instrumentation**
  - Many scientific instruments and test equipment employ RS-485/RS-422 for data exchange. It allows precise measurements to be transmitted without interference.
- **Renewable Energy**
  - RS-485/RS-422 is used in solar power installations, wind farms, and other renewable energy applications to monitor and control inverters, battery systems, and other components.

Parameters

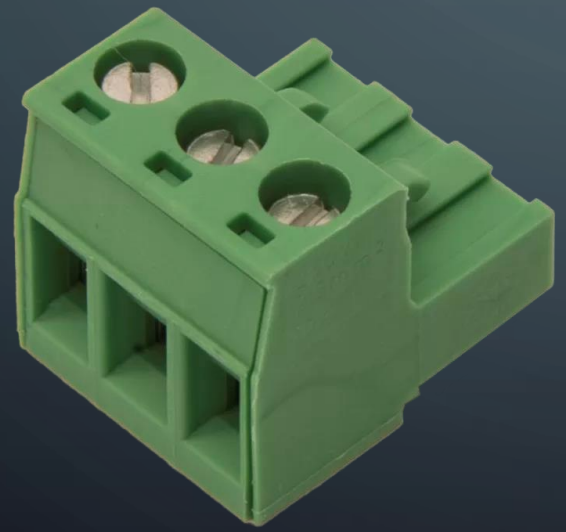
Baud Rate (bps)	Maximum cable length (meter)	Maximum cable length (feet)
< 90,000	1219.2 m	4000 ft
115,200	990.6 m	3250 ft
921,600	299.923 m	984 ft
> 10,000,000	4.572 m	15 ft

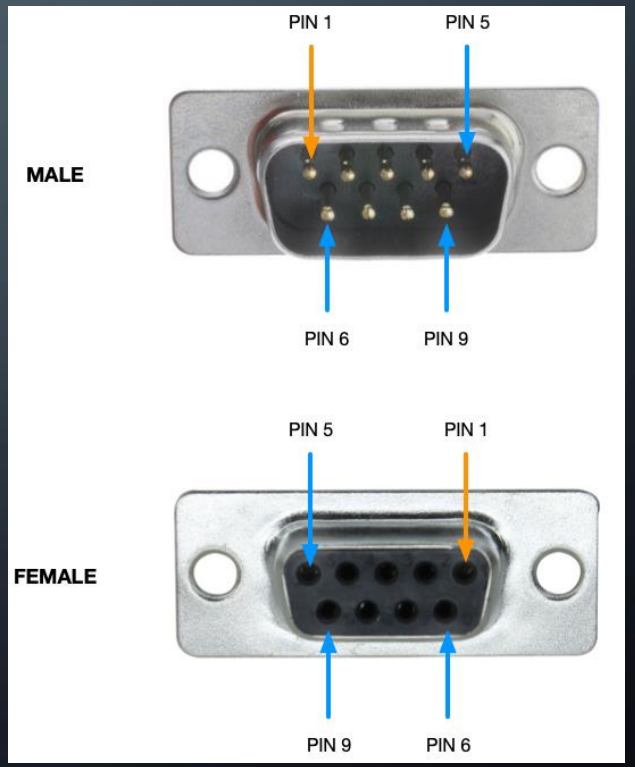
Differences

- RS-485
  - Half-Duplex
  - Multi drop communication
- RS-422
  - Full-Duplex
  - 1 Sender, Multi Listener

Connector

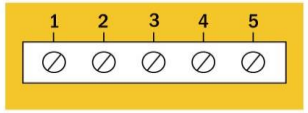
- RS-485/RS-422 typically uses a 9-pin D-sub connector (DB9) or a 3-pin/5-pin screw terminal connector.



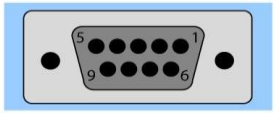


Pinout

Screw Terminals

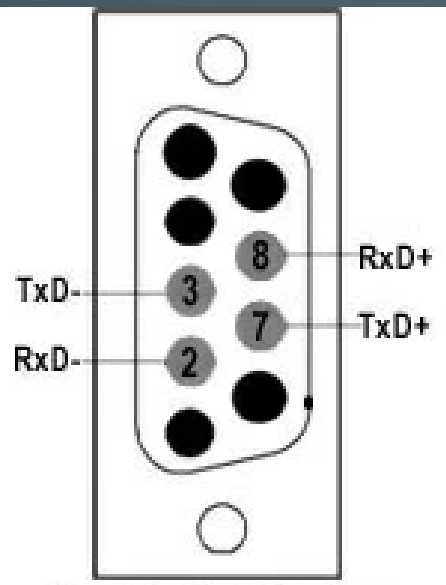


DB9F Connector

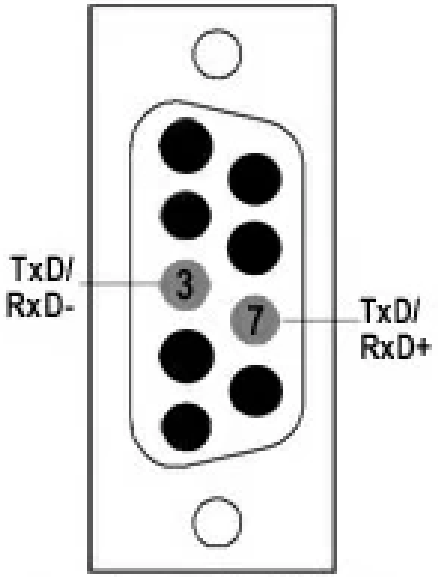


RS422/485 Pinout

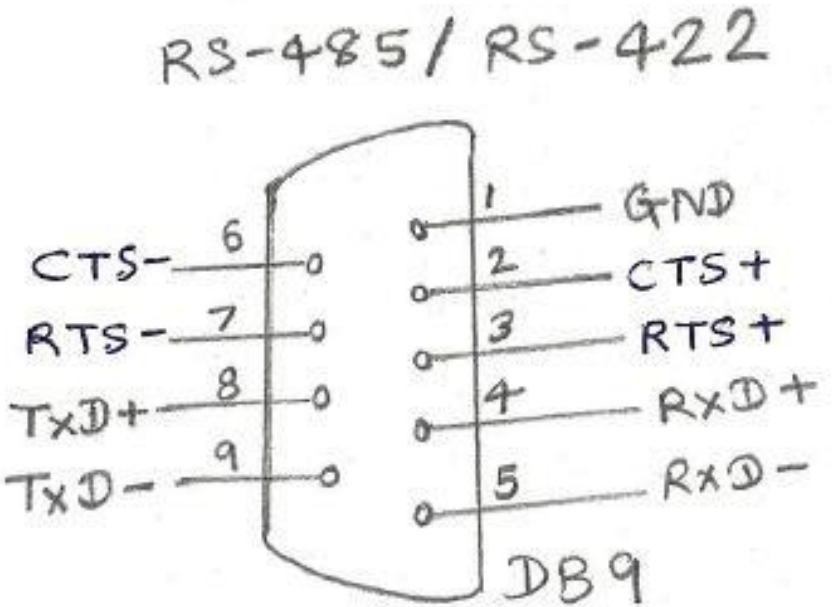
Screws	Signal	DB-9F
1	RX+	1
2	RX-	2
3	TX+/D+	4
4	TX-/D-	3
5	GND	5



RS-485 Full Duplex



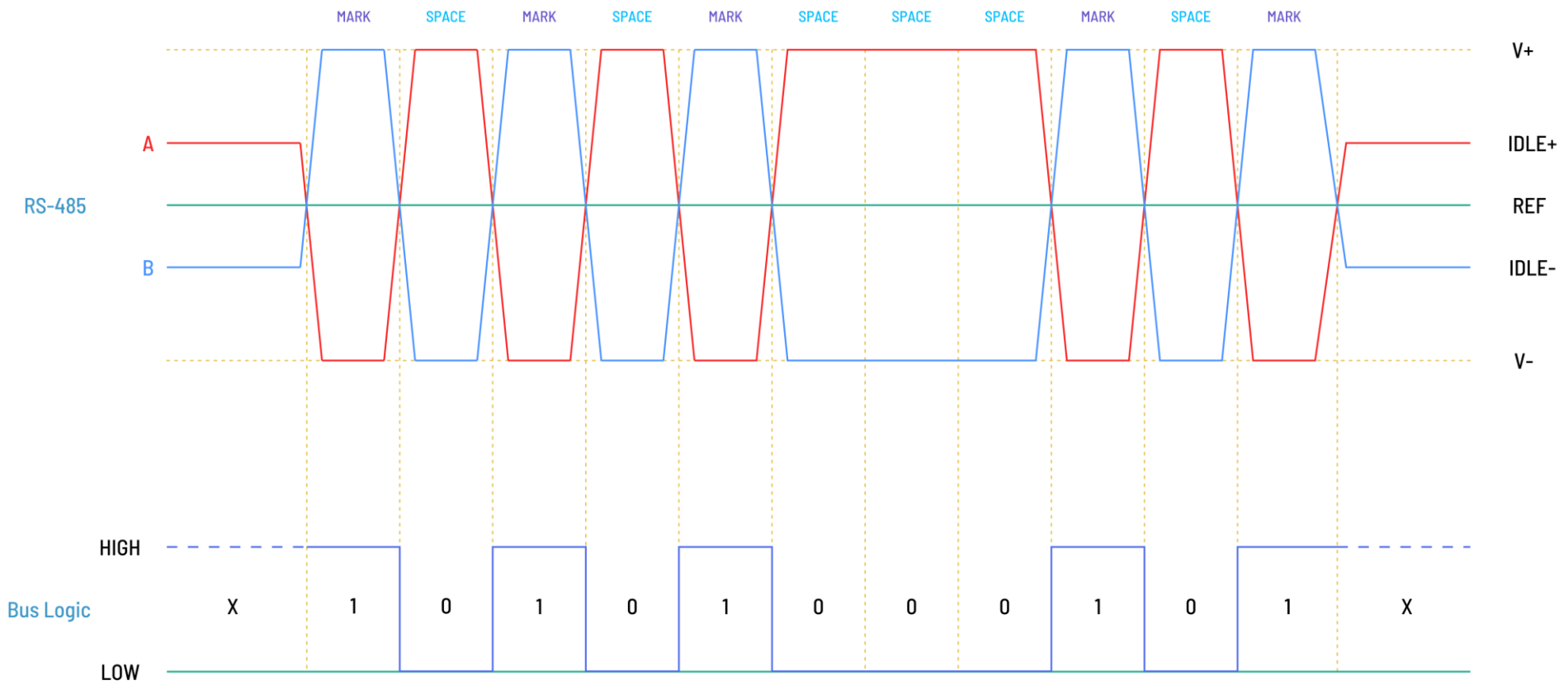
RS-485 Half Duplex



Voltage State

- RS-485/RS-422 is a differential signaling protocol, which means it uses two wires to transmit data.
- When transmitting binary data, the voltage state on one wire (A) is the complement of the other wire (B).
- For example, a logical '1' might be represented as 0V on A and +5V on B, while a logical '0' could be +5V on A and 0V on B.
- This differential signaling provides inherent noise immunity, making RS-485 suitable for noisy industrial environments.

Signal



RS-485 Waveform

Cable

- The choice of cable is crucial for maintaining signal integrity and noise immunity.
- Commonly used cables for RS-485/RS-422 include twisted-pair cables, with the most popular being twisted-pair shielded cables.
- The twisted pairs help reduce electromagnetic interference, and the shield provides additional protection against external noise sources

Phy (MAX485)

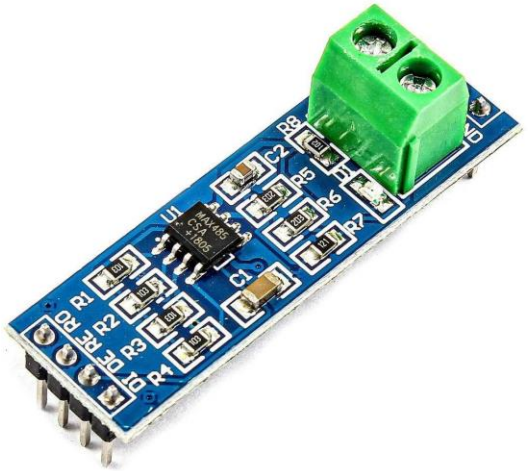
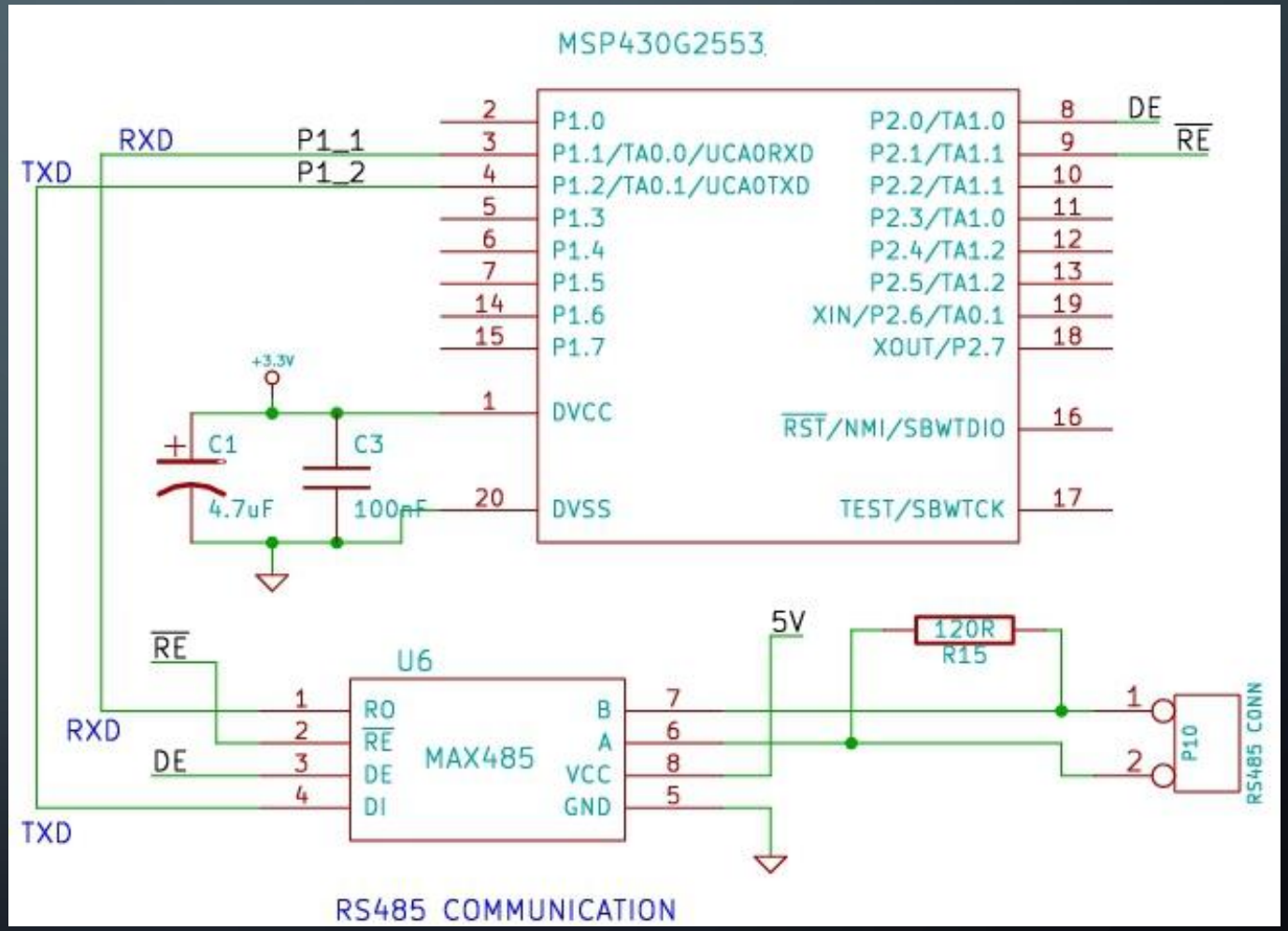


Photo by CafeRobot


MSP430G2553
P1.0
P1.1/TA0.0/UCA0RXD
P1.2/TA0.1/UCA0TXD
P1.3
P1.4
P1.5
P1.6
P1.7
DVCC
DVSS
P2.0/TA1.0
P2.1/TA1.1
P2.2/TA1.1
P2.3/TA1.0
P2.4/TA1.2
P2.5/TA1.2
XIN/P2.6/TA0.1
XOUT/P2.7
RST/NMI/SBWTDIO
TEST/SBWTCK
RXD
TXD
P1_1
P1_2
DE
RE
+3.3V
C1
4.7uF
C3
100nF
5V
U6
MAX485
RO
RE
DE
DI
B
A
VCC
GND
120R
R15
P10
RS485 CONN
RS485 COMMUNICATION