RS-232

TECH3812

Daniel Kohn

THE UNIVERSITY OF MEMPHIS

1

STANDARDS ORGANIZATIONS

- A "standard" is an agreed upon method for accomplishing a given task
- In data communications standards are used to define interfaces, transmission methods, protocols, etc.
- Standards can arise in different ways
  - Manufacturer's product becomes default standard.
  - Federal government develops a requirement that becomes a standard .
  - Organizations can develop and publish the standard and manufacturers can adhere to it.
  - Other organizations can adopt similar standards and "rename" them using a different nomenclature.

THE UNIVERSITY OF MEMPHIS

2

STANDARDS ORGANIZATIONS (cont.)

- ANSI - American National Standards Institute
- IEEE - Institute of Electrical and Electronics Engineers
- EIA - Electrical Industry Association
- NIST - National Institute of Standards and Technology
  - Formerly NBS, National Bureau of Standards
- ITU - International Telecommunications Union
  - CCITT - Consultative Committee on International Telephone and Telegraph
- ISO - International Standards Organization

THE UNIVERSITY OF MEMPHIS

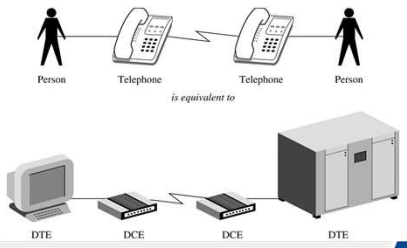
3

INTERFACE TYPES

- What is an interface?
  - The point at which one device connects to another
- What is an interface standard?
  - A description which exactly defines the electronic signals required for communication between two devices
- In data communication, we look at a standard from two perspectives:
  - DTE - Data Terminal Equipment
  - DCE - Data Circuit-terminating Equipment
    - a.k.a., Data Communications Equipment

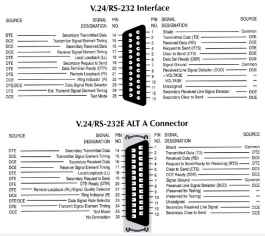
4

FIGURE 4-3: DTEs AND DCEs



5

DB25 CONNECTORS

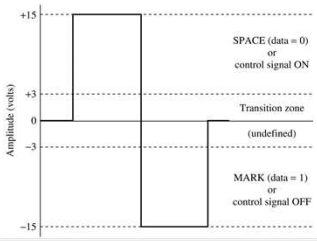


6

DB9 connectors

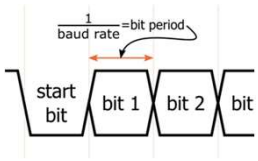
7

RS-232-C VOLTAGE LEVELS



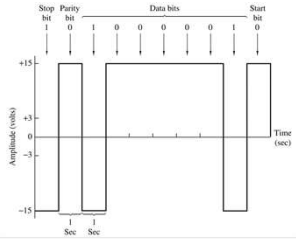
8

Baud Rate



9

RS-232-C TRANSMISSION OF THE ASCII CHARACTER "A"



10

MINIMUM RS-232-C SIGNALS

- Asynchronous Transmission
  - TD - Transmit Data
  - RD - Receive Data
  - SG - Signal Ground

11

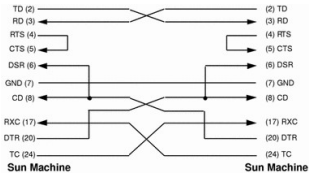
RS-232-C CONTROL SIGNALS

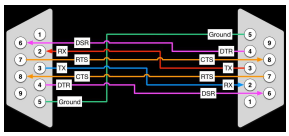
- Uses voltages to send for control purposes rather than transmission of data
  - +3 - +15 volts: On, Raised, Asserted
  - -3 - -15 volts: Off, Lowered, False
- Common Control Signals:

From DTE to DCE	From DCE to DTE
DTE - Data Terminal Ready	DSR - Data Set Ready
RTS - Request to Send	CTS - Clear to Send
	RI - Ring Indicator
	DCD - Data Carrier Detect
	SQ - Signal Quality
DRS - Data Rate Select	DRS - Data Rate Select

12

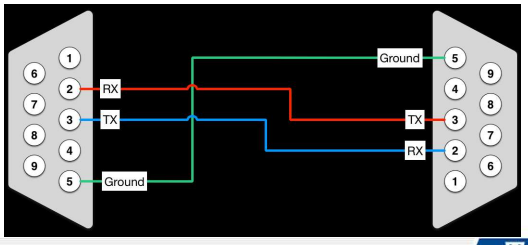
Null Modem (full)





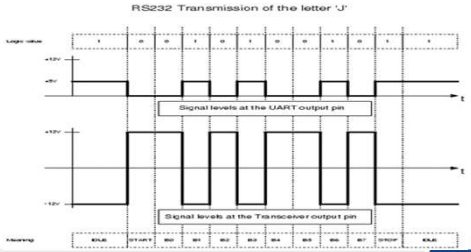
13

Null Modem (Minimum)



14

TTL RS-232 VS RS-232



15

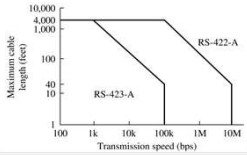
PROBLEMS WITH RS-232-C

- Uses one wire for each signal, with no return, and a common signal ground
  - System has poor common-mode noise rejection
  - Cross-talk and increase of bias distortion
- ±12V supply needed, inconvenient
- Top transmission speed - 20 Kbps
  - *(often used at higher rates but violates original standard).*
- Distance - 50' between DTE and DCE
- Not suitable for long distances
  - Motivation for new standards like RS-422, RS-423

16

Other Standards

- RS-422-A uses two wires for each signal. It can be used at data rates up to 10 Mbps. (Fully balanced, differential inputs)
- RS-423-A uses one wire for each signal, with a common return for each direction. It can be used at data rates up to 100 Kbps.



17

20mA Current Loop

- Historically, current controlled encoding
- Now implemented with optoisolators
- High immunity to noise
- Distance limited by voltage available
  - If source has 20V and 750Ω internal resistance, we can add 300Ω wire resistance and still get 18mA → 3650ft.
- Pros:
  - High common mode rejection and high isolator
- Cons:
  - Not standardized
  - Creates crosstalk in adjacent wires

18

INFORMATION CONTENT

MESSAGE TYPE	BITS
• A typical airline reservation	200
• A typical telegram	400
• A typical electronic funds transfer	500
• A videophone frame	100,000
• A newspaper-quality photograph	100,000
• A document page in facsimile form	200,000
• A brief telephone voice message	1,000,000
• A color television frame	1,000,000
• A high-quality color photograph	2,000,000

THE UNIVERSITY OF MEMPHIS.

19

DETERMINING BANDWIDTH REQUIREMENTS

- Amount of data transmitted
- Overhead Associated with transmission method
  - Start/Stop bits, Parity, Sync Characters, etc.
- Anticipated Error Rate
- Time allowed to complete transmission
  - How long you're willing to wait

- What you want is a figure in "bits per second"

THE UNIVERSITY OF MEMPHIS.

20

CARRIER SERVICES BY BANDWIDTH

- Voice Grade Channel (DS-0)
  - Up to 56 Kbps analog
  - 64 Kbps digital
  - Dial up or leased line
- T-1 Carrier (DS-1)
  - 1.544 Mbps
  - 24 VG Channels using Time Division Multiplexing (TDM)
  - Voice digitized using Pulse Code Modulation (PCM)
  - Uses two twisted pair, one for transmit and one for receive

THE UNIVERSITY OF MEMPHIS.

21

COMMON MODEM STANDARDS

Speed	Standard	Modulation method	Maximum baud rate
300 bps	Bell 103/113	Frequency modulation	300 baud
1200 bps	Bell 212A	Phase modulation	600 baud
2400 bps	V.22bis	Quadrature amplitude modulation	600 baud
4800 bps	V.32	Quadrature amplitude modulation/trellis coding	2400 baud
9600 bps	V.32	Quadrature amplitude modulation/trellis coding	2400 baud
14.4 kbps	V.32bis	Quadrature amplitude modulation/trellis coding	2400 baud
28.8 kbps	V.34	Quadrature amplitude modulation/trellis coding	3429 baud
33.6 kbps	V.34	Quadrature amplitude modulation/trellis coding	3429 baud
56 kbps	V.90	Digital: G.711 Analog: Quadrature amplitude modulation/trellis coding	Digital: 8000 baud Analog: 3429 baud

THE UNIVERSITY OF MEMPHIS

22

References

- University of Florida CGS3285 Chapter 4 notes (http://www.cs.ucf.edu/courses/cgs3285.spr2003/Chapter04.ppt)
- Ohio State University ECE766 Interfaces (http://www2.ece.ohio-state.edu/~klein/ece766/766-12n.ppt)
- https://www.arcelect.com/rs232.htm
- https://www.cable-tester.com/rs232-pin-out/

THE UNIVERSITY OF MEMPHIS

23