# Let's Get Serial!

History and current state of everyone's favourite interface
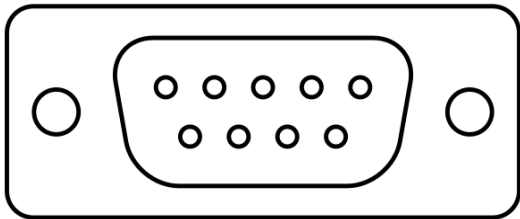
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FOSDEM 2022, February 5$^{\text{th}}$

## About the Speaker

- IT Consultant for FourEnergy GmbH, Berlin
- Background in IIoT
- Upbringing in close proximity to an IBM PC/XT

# Introducing: RS-232!

## Agenda

- Technical Specifications
- Historical Uses
- Current Situation
- Outlook

# General

- point-to-point
- binary
- asynchronous
- half- or full-duplex

## Standardisation

- First published in May 1960 as 'Interface Between Data Terminal Equipment & Data'
- RS-232C in August 1969
- Last ammended in 2012 as TIA-232-F

## Some Terminology

- **DTE**: Data Terminal Equipment
- **DCE**: Data Communications[1] Equipment

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[1]alternatively: 'circuit-terminating'
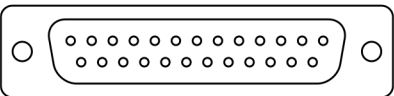
# Electrical Specs

- Voltage levels: $\pm15V$
- (usually) ten connections:

  - GND
  - PG
  - RX(D)
  - TX(D)

  - RI
  - DCD
  - CTS
  - RTR

  - RTS
  - DSR
  - DTR

## Connections

| Abbreviation | Name |
|---|---|
| GND | Ground |
| PG | Protective Ground |
| RXD | Receive Data |
| TXD | Send Data |
| RI | Ring Indicator |
| DCD | Data Carrier Detect |
| CTS | Clear to Send |
| RTR | Ready to Receive |
| RTS | Request to Send |
| DSR | Data Set Ready |
| DTR | Data Terminal Ready |

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# DB-25



- 'D-subminiature'
- 25 pin connector
- Enough room for *two* serial connections

# DE-9
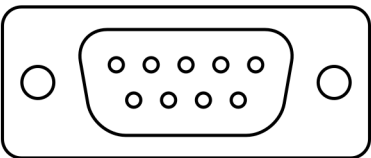


- 9 pin connector
- not exclusive to RS-232!

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# Modified Modular Jack



- Not unsimilar to RJ11/RJ12
- 6P6C

# RJ45



- 8P8C
- Incompatible with Ethernet on RJ45
- Commonly found on dedicated network equipment

## Bare Headers

- Alternatively: Just soldering pads somewhere on a PCB
- Usually[2] not voltage-compatible
- Regular sight on SoCs, and SBCs

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[2]read: almost certainly

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# Data Rates [bps]

- 75
- 300
- 1,200
- 2,400
- 4,800
- 9,600

- 14,400
- 28,800
- 38,400
- 57,600
- 115,200

## On-Wire Format

- Start Bit
- Vector
- Parity Bit
- Stop Bit(s)

## Historical Use

- Mostly for peripherals (DCE-to-DTE)
- Also System-to-System (DTE-to-DTE)

# VT-220

# Limitations of RS-232

- Limited wire length
- At most two comm. partners involved
- Bitrates unfit for many contemporary applications

## On the other hand, though . . .

- Low adoption cost
- High availability in both, hard- and software
- Easy to debug

## Industrial Applications

- Still relevant in nieches
- Largely dispelled by RS-485 (or 'proper' fieldbusses)

## Consumer Electronics

Ouright: no.[3]

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[3]Well, except . . .

# Embedded, SoCs, SBCs, etc

- Hidden almost everywhere
- Often used for:
    - Debugging
    - In-System Programming
    - Flashing firmware
    - Controlling UEFI, bootloader

# Network Equipment

Very present. For when all else fails.

## Virtual Machines, Containers

- `virsh console ...` is emulating a serial console
- Docker and systemd-machined are pulling tricks

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# Alternatives (?)

- rlogin[4]
- telnet
- ssh
- netconsole

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[4]yes, really

## Outlook

- w/o proper successor in some areas
- Left out of automation efforts

## Conclusion

- Still standing strong in 2022!
- Moved quite a bit from its original purpose
- Surprisingly high rate of interoperability

Thanks!

Thank you for your attention!

## Colophon

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