

Moving Away from RS232 for Digital Interfaces

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Where We Started

- 1990's – Explosive growth of digital modes with introduction of BPSK31
- Use PC Sound Card & Serial Port (or VOX) for PTT
- Free Ham Software From a Variety of Sources

Where We Are

- **Variety of Software sources**
- **Full Featured Interfaces**
 - **CAT**
 - **FSK**
 - **CW**
 - **In Addition to Sound Card Modes**
- **PC Without Serial Ports &**
- **PC Sound Card is used for PC related functions, not ham interfacing**

Why Switch to USB from RS232?

This (almost) says it all ...

a typical computer spec in 2008

Ports, Slots, Chassis

Externally Accessible

Video: 1 DVI, VGA and 1 S-Video (with add-in PCI-Express)
USB: 6 Ports (2 Front, 4 Back) + 2 internal
Audio: Six back-panel connectors for line-in, line-out, microphone, headphones/microphone, integrated 7.1 channel sound
Network: Integrated 10/100 network interface

Expansion Slots

PCI: 2 Slots
PCIe x1: 1 Slot
PCIe x16 (Graphics): 1 Slots

But there are other reasons to switch to USB

- **Much Simpler cabling**
 - One cable to the computer
 - Repeatabe PORT assignments
- **Improved performance**
 - Quieter External Sound Cards
 - Faster control functions
- **Powered Supplied by the USB cable**
- **Lower cost**

Interface General Requirements

- Application software compatibility
- Multiple Operating System Support
- Support Sound Card Applications
 - Provide Dedicated Sound Card Independent of PC
- Support CW
- Support FSK RTTY
- CAT control for full spectrum of transceivers

Application Software Drives Design

- Digipan
- DX4WIN
- Hamscope
- Ham Radio Deluxe
 - DM780
 - PSK Deluxe
- MixW
- MMTTY
- MMVARI
- WriteLog
- N1MM
- WinPSK
- WinWarbler

Port Addressing Model

Basic PORT Requirements

- CAT Serial Port Tx/Rx to 115K Baud
- PTT & CW Serial Port RTS & DTR
- CW WinKey Serial Port Tx/Rx
- FSK RTTY Serial Port Tx at 45.45 Baud

Additional PORT Product Features

- Aux RS232 Serial Port RS232 DCE
- Interface Config Serial Port Tx/Rx

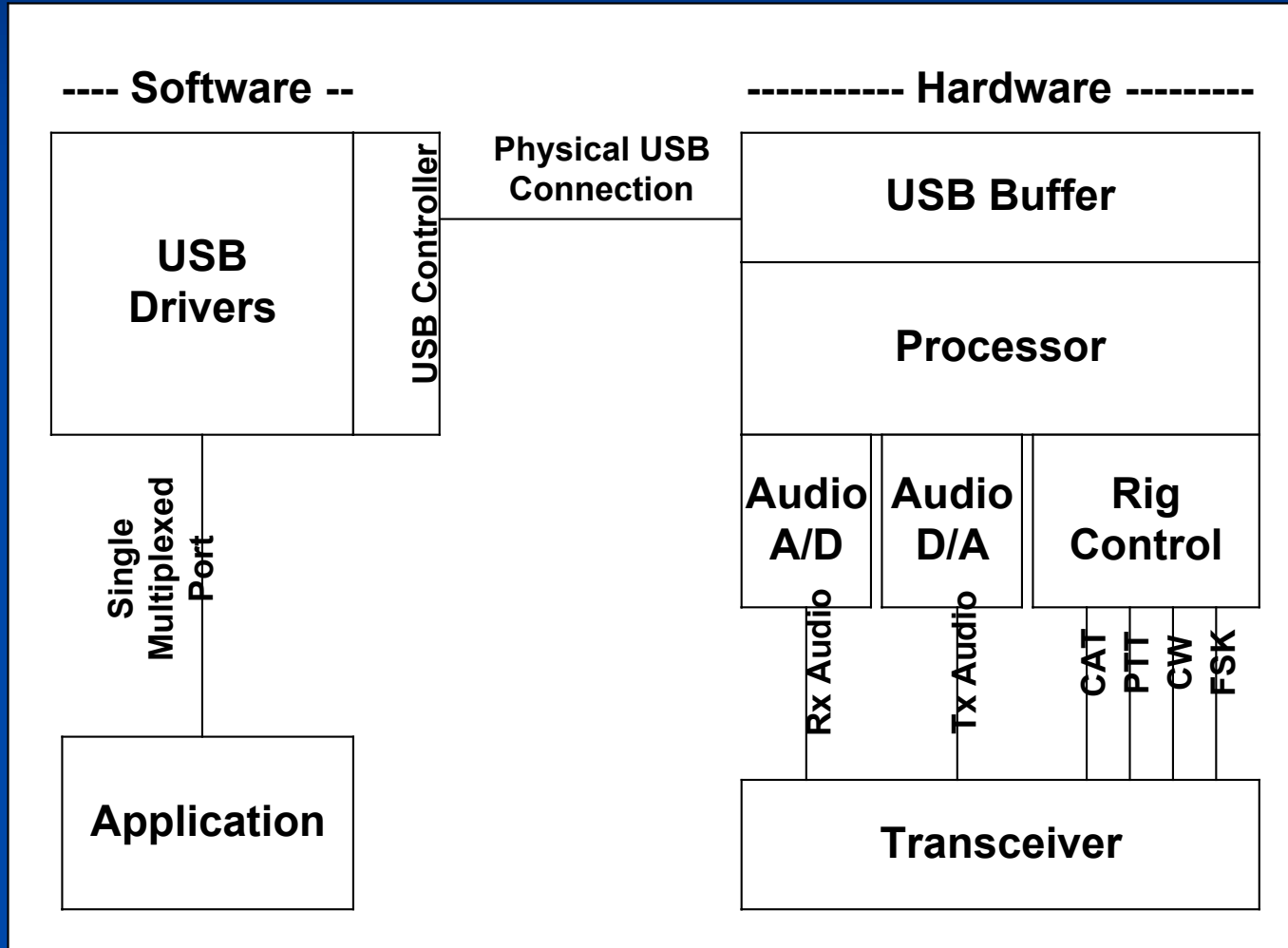
CAT PORT

- Serial Data Port to 115K Baud
- Support a wide variety of transceiver makes and models
 - Half Duplex - ICOM, YAESU
 - RS232 – ELECRAFT, KENWOOD, TEN TEC, YAESU
 - TTL – KENWOOD, YAESU
 - Inverted TTL - KENWOOD

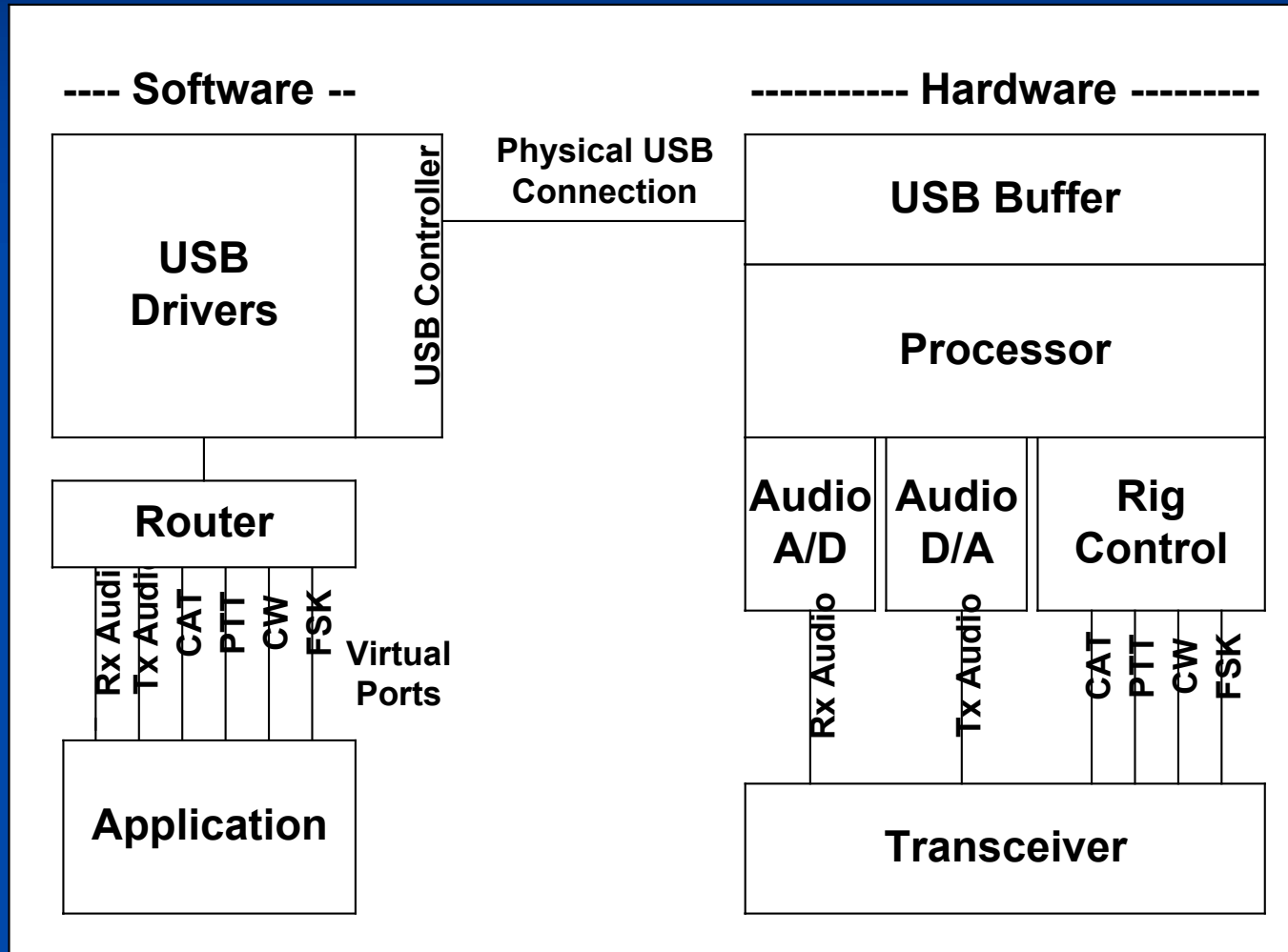
COM Port Addressing

- Some Applications Are limited to COM1 – COM8
 - May require re-assignment of PORT addresses to fit within the limitation
- Others can use full 255 range of PORT addressing

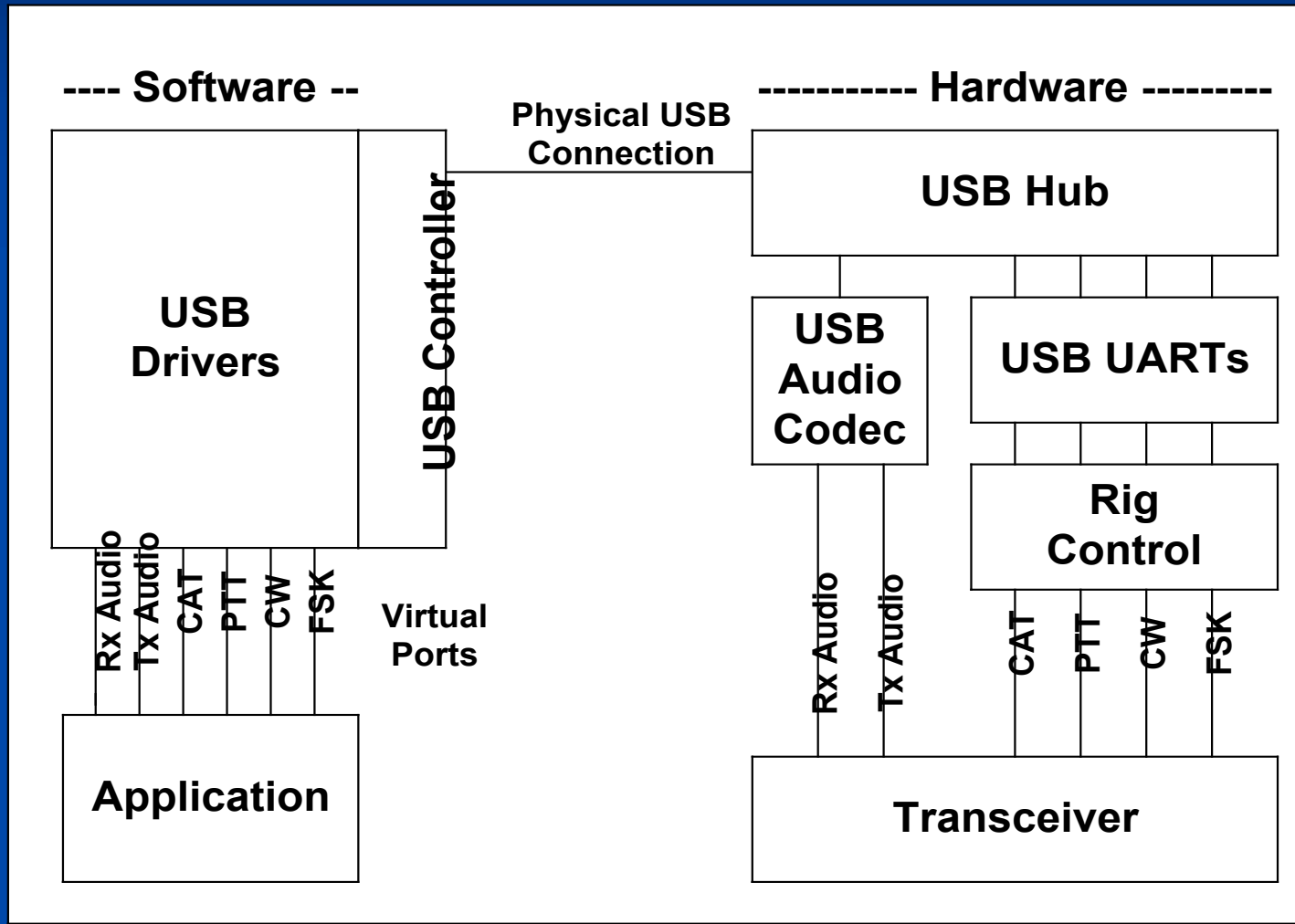
USB Interface Software Centric Proprietary Control Channel



USB Interface Software Centric Generalized



USB Interface Hardware Centric Generalized



Trade Off Considerations

Ordered by priority

SW
Model

Hdwr
Model

- Time to Market
- Support Costs
- Design Strengths
- Manufacturing Costs

✓

✓

✓

✓

Case Study – Navigator Interface



Requirements - USB

- Single USB Connection
- Integrated 4 Channel Hub
- Power sequencing controlled by hub control
- Power requirements consistent with 4 port hub
 - Typical 160 ma.
 - No additional power required from transceiver or wall wart supply

Requirements – Audio

- USB Audio Codec – 16 bit stereo
 - Uses standard AC97 drivers
 - TI / Burr Brown – PCM2904/6
- Transformer isolated audio input / output
- One output channel
 - One output to transceiver
 - One output used for audio monitor
- Two input channel – Main and Sub receivers
- Potentiometer controls for audio
- Audio 100 Hz to 5 KHz, 100 dB dynamic range

Requirements – Operating Modes

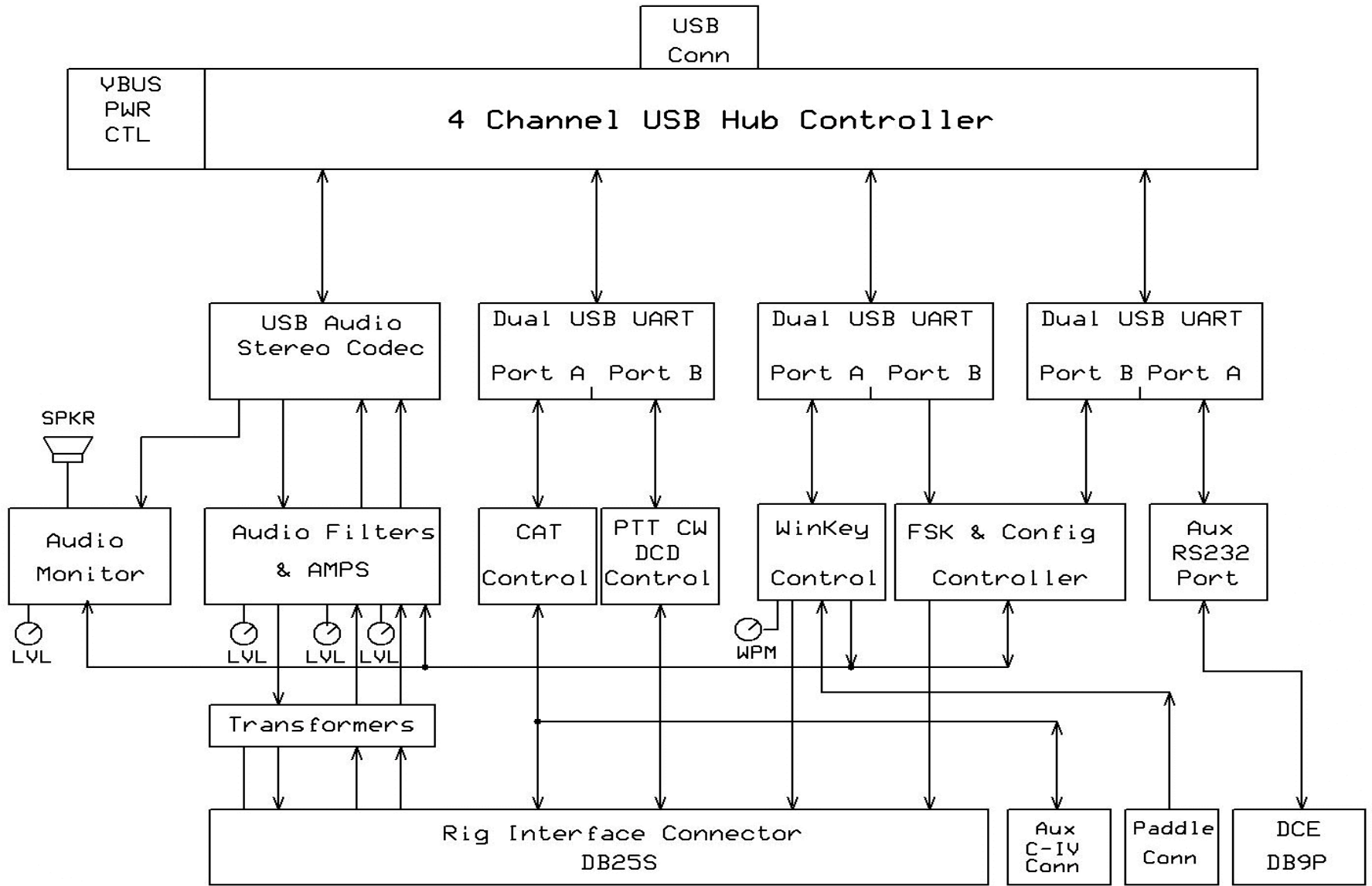
- All popular sound card modes
- RTTY
 - FSK using integrated FSK Controller
 - True 45.45 Baud
- CW using the K1EL WinKeyer2
 - Keyboard & Paddle or Straight key
 - Speed controlled by front panel pot
 - Supports transceiver and linear amp

Other Requirements

- Hardware PTT control
- Audio monitor built in to interface
 - Sound card modes
 - FSK
 - CW
- CAT – supports all popular transceivers
 - Half duplex – (ICOM CI-V)
 - Full duplex - RS232
 - Full duplex TTL
 - Full duplex TTL Reverse

More requirements

- Auxiliary RS233 Port provided for general ham use
 - Packet controller
 - Antenna rotator
- Interface physical options software controlled
 - No jumpers to set
- Transceiver variations handled within the cable



Navigator Block Diagram

USB Building Blocks

- **Hub Control – Atmel 43301**
 - 4 Port Hub
 - Power Sequencing Control
- **Mic2025 Power Control**
- **Port Devices – FTDI FT2232C**
 - Two COM Ports per Hub channel
 - Supports UART or High Speed Parallel Buffer Mode
 - Drivers for XP, Vista, Linux, Mac

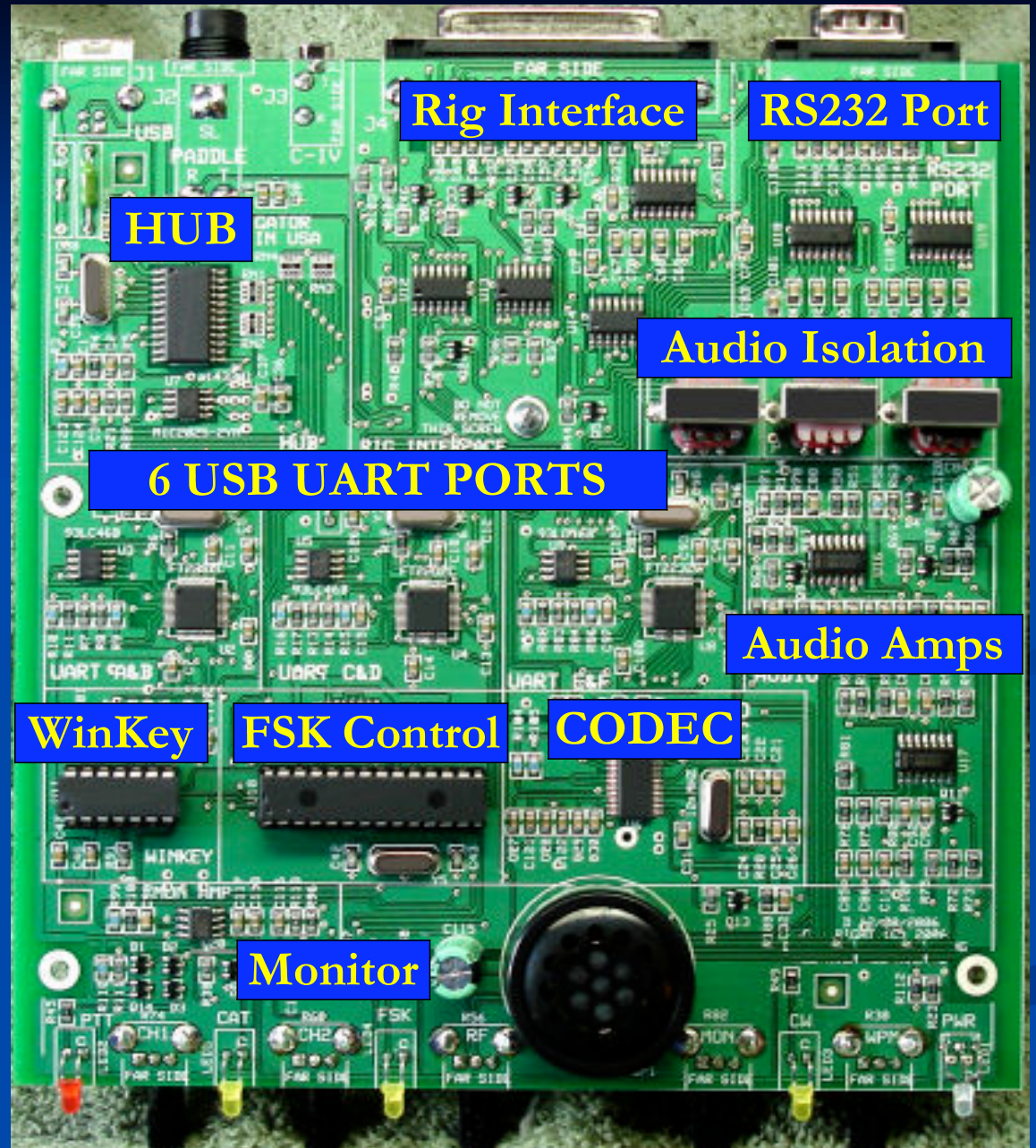
USB Building Blocks

- TI PCM2904/6 USB Audio Codec
 - Stereo 16 bit Codec
 - AC97 Compliant
 - Single voltage device
 - Supports sampling rates to 48,000 samples/sec

Other Building Blocks

- PIC 16F870
 - FSK Controller
 - Interface Configuration Controller
- PIC 16F688
 - WinKey Controller
 - Supplied Pre-Programmed by K1EL

US Interface Navigator



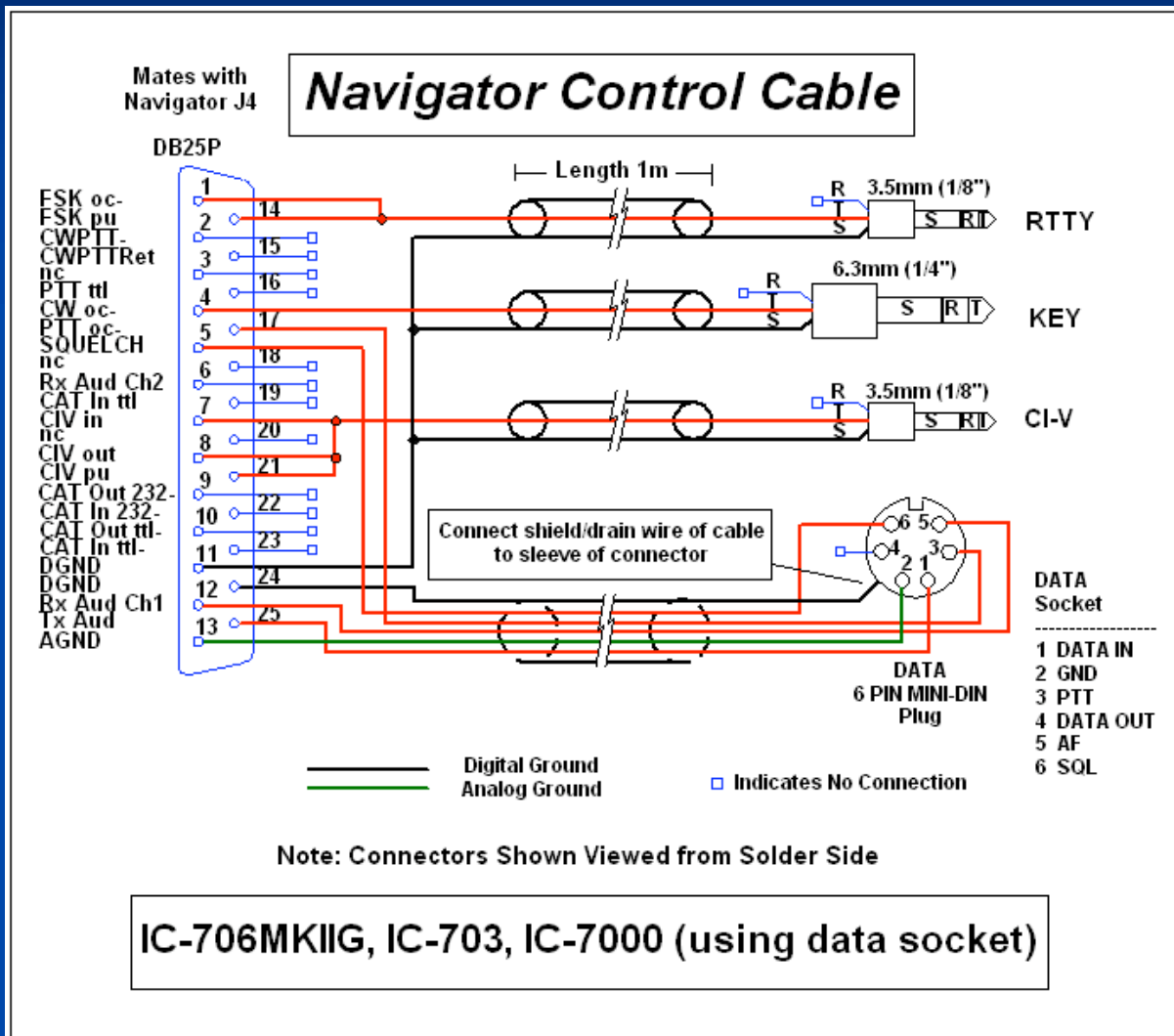
Challenges

- **Single 5V power source**
 - Noisy, limits audio output to 1.5v rms
 - Shutdown, power off voltages vary from one computer to another
- **FCC Part 15 Compliance**
- **USB Related Radiated Noise**

Challenges

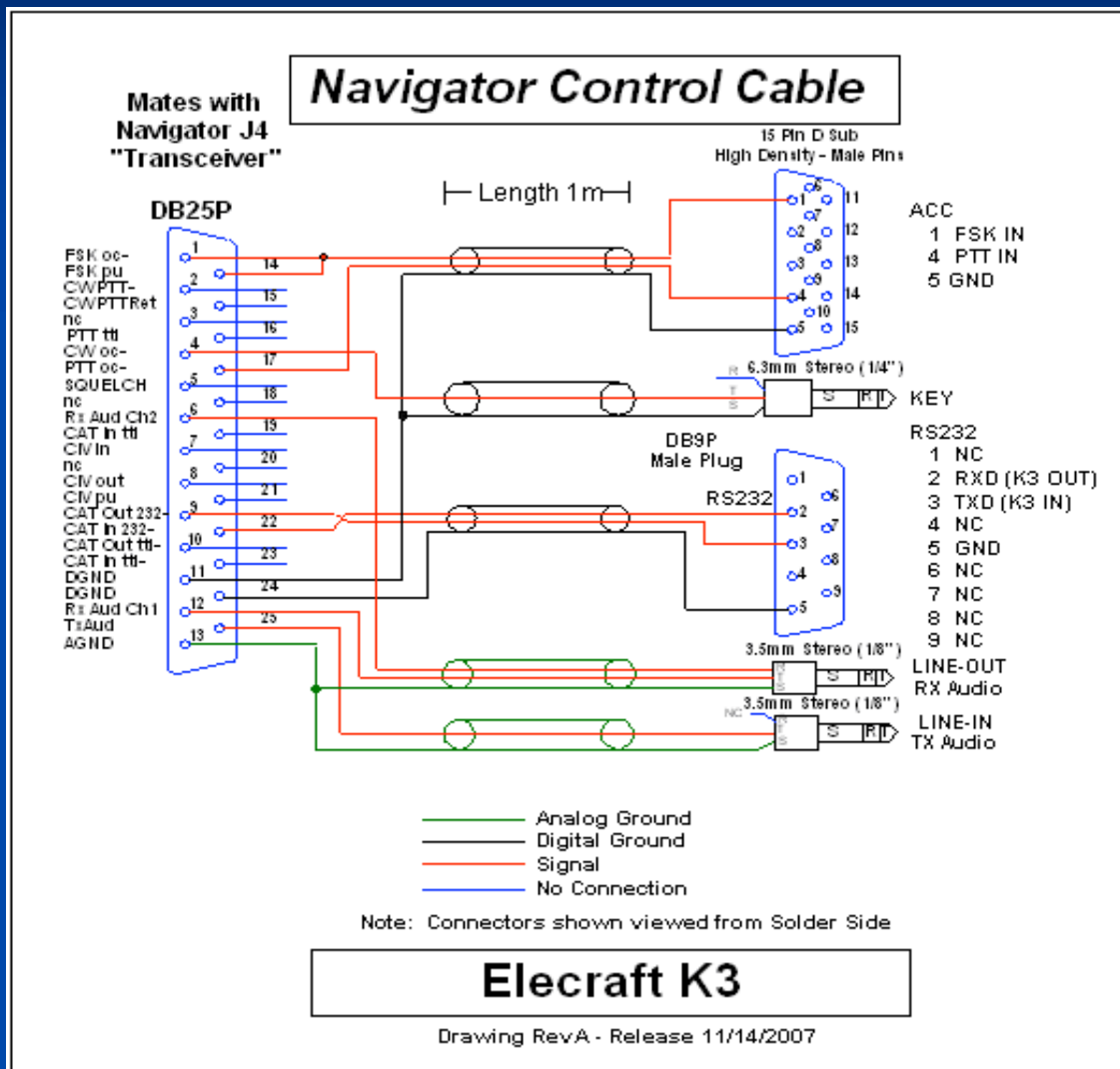
- Some Application Software is limited to COM port addresses COM1 – COM8 Only
 - Installation requires user to reconfigure other devices to avoid conflicts

ICOM Control Cable



FSK RTTY
 CW KEY
 CAT (CI-V)
 PTT, AUDIO

Elecraft K3 Control Cable



FSK RTTY

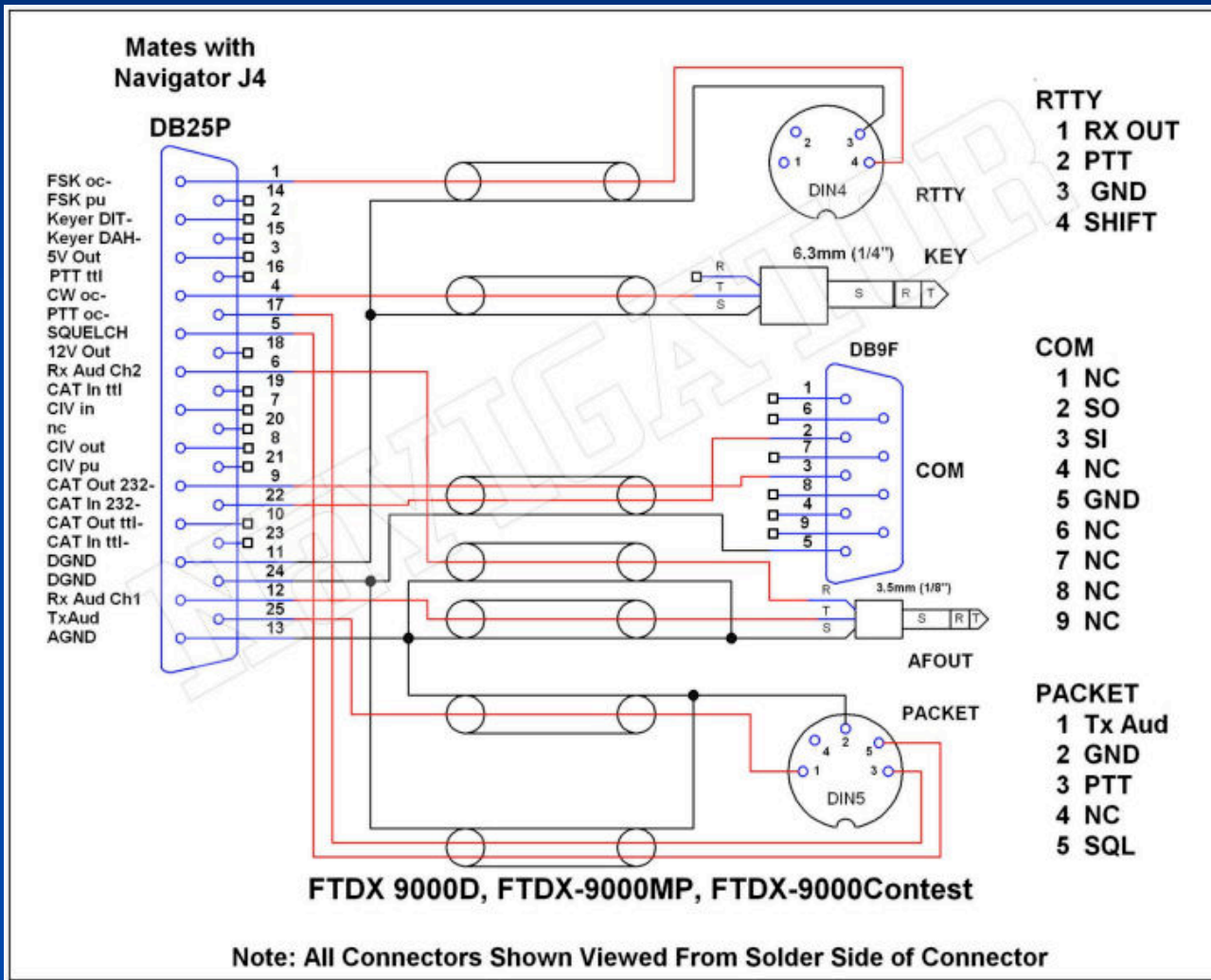
CW Key

CAT (RS232)

RX AUDIO

TX AUDIO

Yaesu Control Cable



FSK RTTY

CW KEY

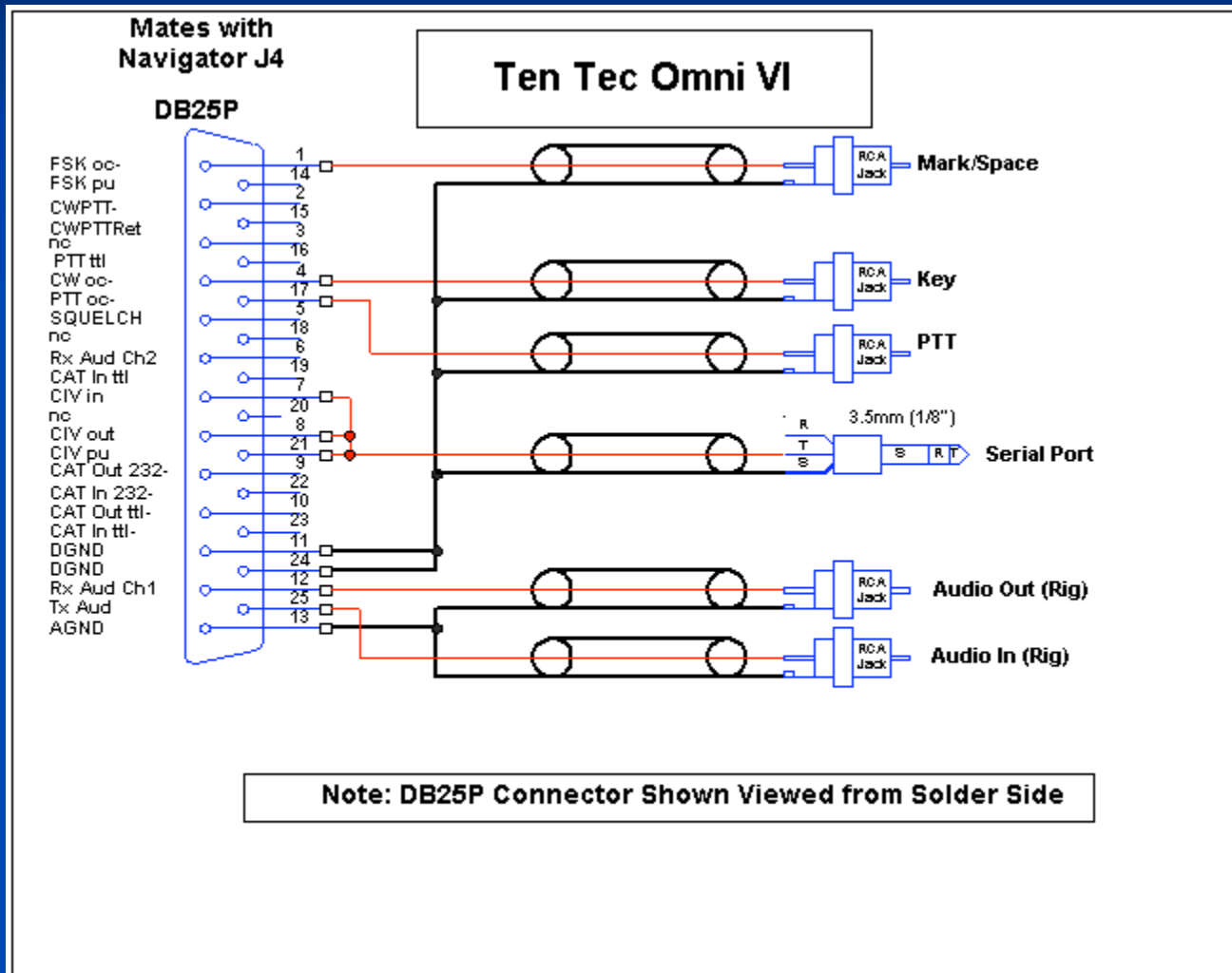
CAT (RS232)

RX AUDIO

PTT

TX AUDIO

Ten Tec Omni VI Control Cable



FSK RTTY

CW KEY

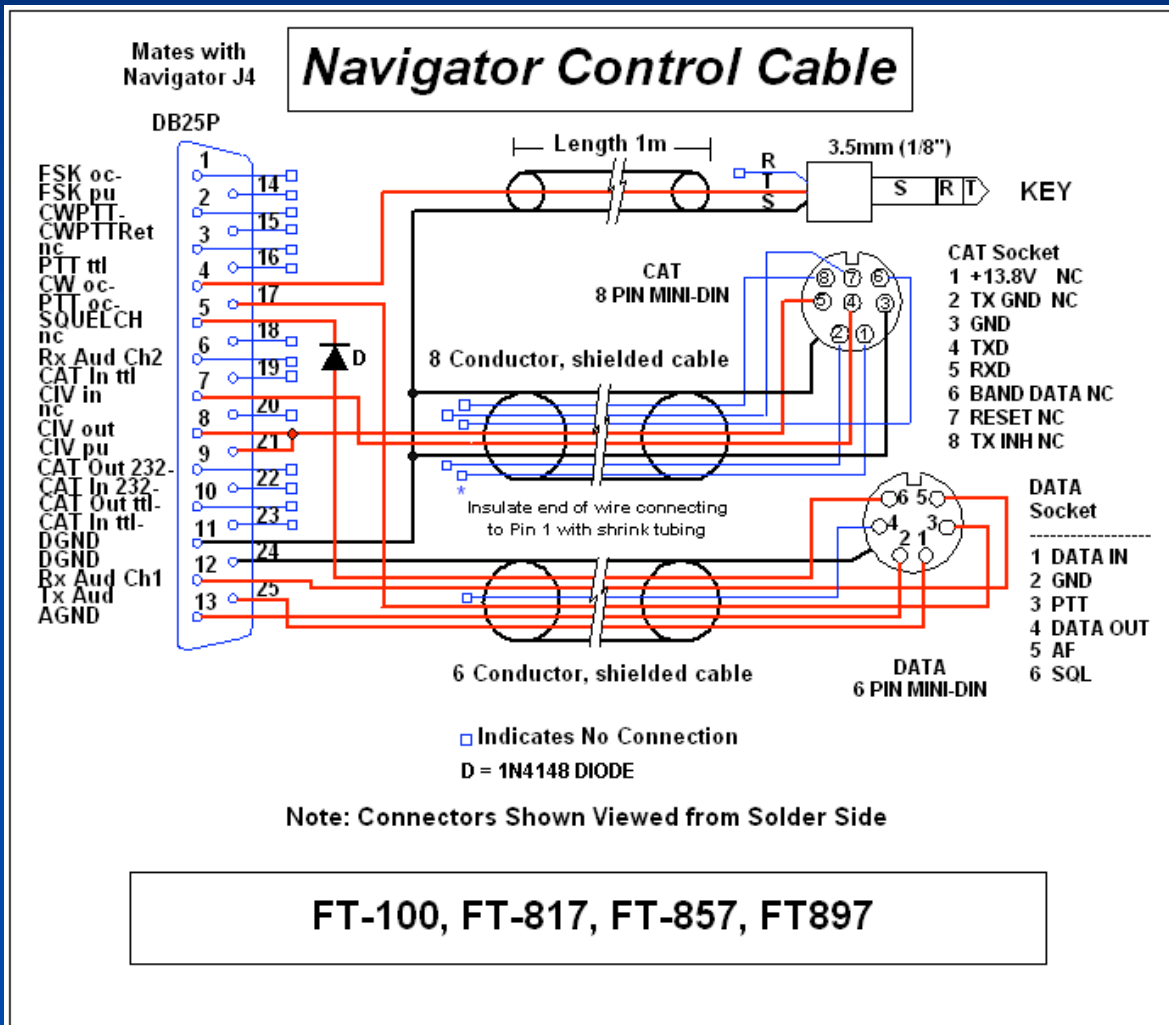
PTT

CAT (CI-V)

TX AUDIO

RX AUDIO

YAESU Control Cable



FT-100, FT-817, FT-857, FT897

CW KEY

CAT (TTL)

PTT
AUDIO

References

- Digital Radio KK7UQ.com
- Rig Cabling www.USInterface.com
- DM780 www.hrd.ham-radio.ch
- MixW www.mixw.net
- MMTTY
 - mmhamsoft.amateur-radio.ca/mmtty/

Some USB Interface Suppliers

- Black Cat www.blackcatsystems.com
- MFJ www.mfj.com
- microHAM www.microham.com
- Navigator www.USInterface.com
- Signal Link www.tigertronics.com
- RigBlaster www.westmountainradio.com
- RigExpert www.rigexpert.com

