# USB

# Physical

Since the steering wheel will be a low speed device, there are 4 pins we use:

* 1 – Vbus – Red/Orange – 5 Volts – for power
* 2 – D- – White/Gold – Data- – for data transmission
* 3 – D+ – Green – Data+ – for data transmission
* 4 – GND – Black/Blue – Ground – for power

# Electrical

For a low speed device, the transmitted signal level for a logical low is 0.0V – 0.3V, and the transmitted signal level for a logical high is 2.8V – 3.6V.

# Software

There are 2 data transmission pins, which both can be high or low. This gives four different combinations, which are the different USB signals:

J – Idle – line transition or waiting for a new packet – D+ low, D- high

K – Inverse J – line transition – D+ high, D- low

SE0 – Single-ended 0 – End of packet signal or detached USB device – D+ low, D- low

SE1 – Single-ended 1 – Illegal state and error – D+ high, D- high

USB communicates using packets that are sent by the host, in this case, the computer. Some of them require a response from the device.

There are four types of packets:

* OUT
* IN
* SETUP
* Control transfer