

Summary of RS-232, RS-422, and RS-485 Interface Standards

RS-232

RS-232 or EIA-232-F is one of the most well known interface standards. RS-232 is an unbalanced or single-ended standard. It allows for data transmission from one transmitter to one receiver at data rates up to 20 kbps. Because the maximum load capacitance is defined at 2,500 pF, the maximum cable length is 15m (50ft). However, it is possible to increase this length by using low capacitance cable or error correction mechanisms.

RS-232 cables are commonly available in 4, 9 or 25 pin configurations. However, the 4 and 9 pin configurations do not use many of the uncommonly used connections while the 25-pin configuration connects every pin for full handshaking capabilities. Voltage levels with respect to a common ground represent the signals. For transmission, a binary 0, also called a space, is +5 to +15 Vdc and a binary 1, called a mark, is -5 to -15 Vdc. For receiving, a binary 0 is +3 to +15 Vdc and a binary 1 is -3 to -15 Vdc.

Advantages of RS-232:

- Commonly available
- Simple wiring
- Low cost

Disadvantages of RS-232:

- Short lengths
- Slow data rates
- Subject to noise

RS-422

RS-422 or EIA-422-B is a balanced or differential electrical standard. Because it uses voltage differences to determine logical signals, RS-422 is ideal for noisy environments. Unlike RS-232, which is a point-to-point configuration, RS-422 is a multidrop configuration. However, it is not multipoint. The cable lengths and data rates of RS-422 are also much higher than RS-232. RS-422 can transmit data up to 4000 feet and up to 10 Mbps. However, cable length and data rate are inversely proportional. That is, at maximum cable length, maximum data rate is not possible and vice versa.

A RS-422 driver can drive up to 10 unit loads, where 4k Ω is one unit load. With the Toshiba JK-UC1, it can drive up to 255 IK-DP01A or IK-DP02A cameras. However, at long distances or high data rates, termination is recommended to reduce reflections caused by mismatches in the impedance of the cable and the impedance of the receiver. For RS-422, commonly used cabling consists of 24 AWG, 16 pF/ft,

twisted pair cable. However, a range of 22 AWG to 28 AWG and untwisted pair is acceptable for most applications. Twisted pair has an advantage because it couples noise more symmetrically and helps preserve the noise rejection limits.

Advantages of RS-422:

- Higher data rates
- Longer cable lengths
- Noise rejection

Disadvantages of RS-422

- Only one transmitter for most applications
- Not as common
- Unidirectional

RS-485

RS-485 or EIA-485-A is similar to RS-422 and provides all the advantages of RS-422. However, RS-485 is a multipoint configuration. That is, it can support multiple drivers and multiple receivers. It is a bi-directional interface that can support up to 32 unit loads, where one load is 4k Ω . RS-485 is the best choice for multipoint applications. The data rates and cable lengths of RS-485 are similar to RS-422. RS-485 can send data up to 10 Mbps and up to 4000 feet.

There are 3 main problems when using RS-422 in a multipoint application. The first is when a ground potential difference exists between drivers. One of the drivers can clamp the transmission line below ground potential. The second is contention between active drivers. Errors can occur if there are two enabled drivers that cause high currents resulting in thermal damage. The third problem deals with drive current. For bi-directional data flow, termination should occur at both ends of the cable. Therefore, drivers would have to source twice the current needed.

Advantages of RS-485:

- Multipoint applications
- Low cost
- Noise immunity

Disadvantages of RS-485:

- More cabling required
- Not as common

For more information on RS-232, RS-422, RS-485 and other interfaces, refer to the Electronics Industries Alliance at www.eia.org.

Summary of RS-232, RS-422,
and RS-485 Interface Standards

RS-232	RS-422	RS-485
Single Ended	Differential	Differential
Unidirectional	Unidirectional	Bi-directional
Point-to-Point	Multiple Receiver	Multiple Transmitter and Receiver
20 Kbps max	10 Mbps max @ 40 ft	10 Mbps max @ 40 ft
50 ft	4000 ft max length @ 100 Kbps	4000 ft max length @ 100 Kbps

Figure 1. Comparison of RS-232, RS-422, and RS-485

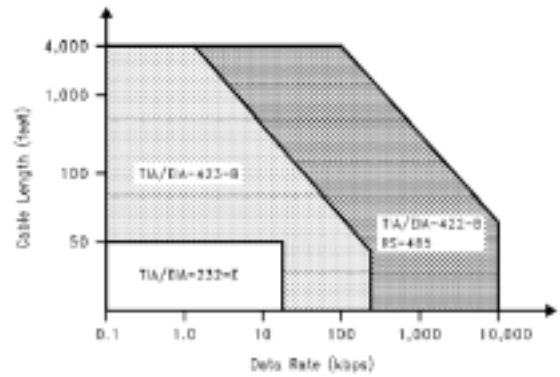


Figure 2. Cable Length vs. Data Rate