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RS-232 Cables: Maximum acceptable length depends on data rate

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TOPIC ----------

Is there a way to figure out the maximum length of RS-232 cables?

DISCUSSION ----------

The maximum length of RS-232 cables is related to the data rate. Thus, you can calculate maximum cable length based on the data rate. The table below provides the maximum length of RS-232 cables (average cable and special cable) for the various data rates.

Data rate (baud)	Maximum acceptable Feet of average cable	Maximum acceptable Feet of special cable
19200	50	83
9600	100	163
4800	200	326
2400	400	652
1200	800	1304
600	1600	2608
300	3200	5216

Average cable is defined by its capacitance, 50 picofarads (pf) per foot. Special cable is defined by a lower capacitance, 30 pf/foot, which makes special cable more costly.

The top line of the table is defined by interface standard RS-232C. We have made the remaining lines stay within the standard by taking the next highest line and halving the baud rate to double the length.

How the Top Line Was Determined

The RS-232C interface standard was set by and is available from the Electronic Industries Association (EIA), Engineering Department, 2001 Eye St., Washington, D.C., 20006. Several data reference manuals and booklets also contain and explain the standard. Apple uses the EIA RS-232C interface standard for all of its serial printer and communications interface equipments (excluding any parallel interface or item on AppleTalk).

We have used this standard to determine maximum cable length by referring to the specified amount of integrity of the transmission of data through the cable. This amount of integrity is specified in terms of maximum signal distortion at the maximum cable capacitance and at the maximum data rate.

For cables, the standard specifies the following maximum limits:

- Time Data Signal Distortion: 1 millisecond or 4 percent, whichever is greater.

- Cable Capacitance: 2500 picofarads (pf)

- Data Rate: 20,000 bits/sec.

Because the highest supported data rate is 20Khz (only the Macintosh can go as fast as this), there is some "fudging" allowed for cable distance. As no maximum distance between units is called out, all the cable has to do is provide a connection that meets the distortion and capacitance limits while supporting the data rate.

Most data cable has an average capacitance of 50 picofarads per foot. 50 feet of such cable would have a capacitance of 2500 picofarads, the maximum allowable capacitance.

Special, more costly, low-capacitance cable with less than 30 pf/foot would have a capacitance of 2500 pf or less in a length of around 83 feet. Depending on the actual capacitance, the low capacitance cable could be a lot longer, as long as its total capacitance stayed under 2500 pf.

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