

RS-232 Serial Protocol Standard

What is the RS-232 Standard?

RS-232 is a standardised serial data interface that defines the mechanical and electrical characteristics for connecting Data Terminal Equipment (DTE) to Data Communication Equipment (DCE). It was developed by the EIA (Electrical Industries Association) in the U.S.A. The official name of the standard is now "EIA/TIA-232-E", however the original name "RS-232-C" is more generally used.

RS-232-C specifies electrical specifications, types of signal cables and connector specifications, and is originally referred to as an interface standard to connect modems and data pins (such as a PC) to each other.

The main characteristics of RS-232-C are shown below.

Characteristics of driver block

Item	Standard Value	Unit
Data transfer rate	MAX.: 20	kbps
Output voltage	MAX.: ± 15 (Unloaded)	V
Output voltage	MIN.: ± 5 (3 k Ω)	V
Slew rate	MAX.: 30	V/ μ s

Characteristics of receiver block

Item	Standard Value	Unit
Load capacitance ²	MAX.: 2500 ²	pF
Threshold voltage	MAX.: ± 3	V
Input resistance	3 to 7	k Ω
Input voltage	MAX.: ± 25	V

Notes: ²Load capacitance is determined by type and length of signal cable and others, however, cable length is not specified in the standard.

Signal Level

Signal levels are specified in the RS-232-C standard.

Status	Low		High	
	Driver output	Receiver input	Driver output	Receiver input
Voltage level	-5 to -15 V	-3 to -25 V	+5 to +15 V	+3 to +25 V
Logical level	"1" (Mark level)		"0" (Space level)	

The signal levels in the cable are in "negative logic", that is, they are reversed from the logical level in the table above. Therefore, an inverter must be inserted for a driver to output signals to the cable and, conversely, a receiver must be inserted to input signals from the cable to match the internal logic. This is the function of ICs used for RS-232 line driver/receivers.

Since there is a potential difference (2 V) between the driver output voltage and receiver input voltage, a noise margin or level drop of up to 2 V is allowed.