

4 Serial communication (RS232)

Serial communication means that individual bits of data are transferred sequentially (as opposed to parallel communication where groups of bits are transferred at the same time). Serial communication comes in many shapes and formats. We will begin with RS232, and cover a few other types (USB, SPI and I²C) later in this course.

RS232³⁵ was defined in 1969 as a standard for communication between computers and devices, usually teletypes, a combination of printer and keyboard that was used before electronic screens. Given its age it is not surprising that the signals look a bit odd to us. While modern computers use 0V for a zero and +5V or +3.3 V for a one the RS232 signal uses a negative voltage between -3 and -12V as one, and a positive voltage between +3 and +12 for a zero. The range -3 to +3 is not defined, to prevent interference of noise on long lines.

All characters that a computer can transmit have a unique number, called the ASCII³⁶ code. The first 128 numbers are fixed, and the same for every computer. That allows different brands and types of computers to communicate with each other. Higher numbers are in use, particularly 128 to 255, but they have different meanings on different computers. If computers want to communicate with ASCII numbers over 127 they need to make sure that both are using the same code table. In this course we will only use the official 128 characters so the PC will understand our microcontroller and vice versa.

ASCII	Character	ASCII	Character	ASCII	Character
0	ctl@	43	+	86	V
1	ctlA	44	,	87	W
2	ctlB	45	-	88	X
3	ctlC	46	.	89	Y
4	ctlD	47	/	90	Z
5	ctlE	48	0	91	[
6	ctlF	49	1	92	\
7	ctlG	50	2	93]
8	backspace	51	3	94	^
9	ctlI	52	4	95	_
10	line feed	53	5	96	`
11	ctlK	54	6	97	a
12	form feed	55	7	98	b

³⁵ Recommended Standard number 232 by the Electronics Industries Association (EIA).

³⁶ American Standard Code for Information Interchange. The code was first published in 1963. The reason that it includes 127 characters is that in those days most computers were 7 bits, so 127 was the highest number that one could make with one byte. During the late 1960's 8 bit computers became the norm. Modern PC's use 64 bits. Microcontrollers still use bytes of 8 bits.