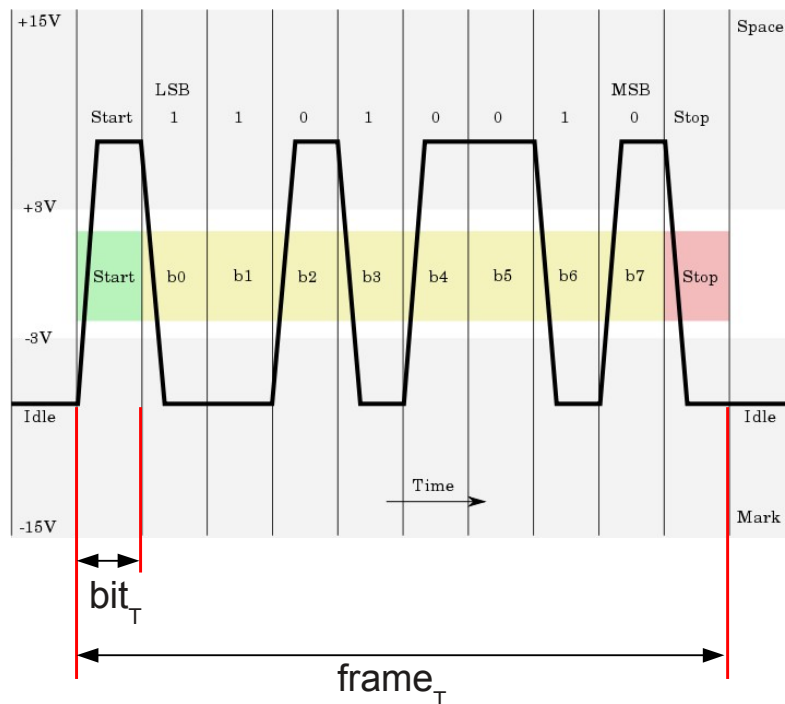


RS232 - Transfer calculations



Time needed to transfer one bit (bit period) : $bit_T = \frac{1}{\text{baudrate}}$ [s]

Time to transfer n bits : $t = n_{\text{bits}} \cdot bit_T = \frac{n_{\text{bits}}}{\text{baudrate}}$ [s]

Time to transfer a frame (frame period) :

- We have always one start bit (1)
- We can have 7 or 8 data bits (n_{databits})
- We can have 0 or 1 parity bit ($n_{\text{paritybits}}$)
- We can have 1 or 2 stop bits (n_{stopbits})

$$\rightarrow frame_T = \frac{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}}{\text{baudrate}} \text{ [s]}$$

We can find the frame rate :

$$frame_{\text{rate}} = \frac{1}{frame_T} = \frac{\text{baudrate}}{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}} \left[\frac{1}{\text{s}} \right]$$

Wat is the data bits rate for a given baudrate ?

We know that n_{databits} are transmitted during one frame period frame_T .

$$\rightarrow \text{databits}_{\text{rate}} = \frac{n_{\text{databits}}}{\text{frame}_T} \left[\frac{1}{s} \right] \text{ and } \text{frame}_T = \frac{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}}{\text{baudrate}} \quad [s]$$

$$\rightarrow \text{databits}_{\text{rate}} = \frac{n_{\text{databits}}}{\frac{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}}{\text{baudrate}}}$$

We find :

$$\boxed{\text{databits}_{\text{rate}} = \frac{n_{\text{databits}}}{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}} \cdot \text{baudrate}} \quad \left[\frac{\text{bit}}{s} \right]$$

In bytes :

$$\boxed{\text{databytes}_{\text{rate}} = \frac{1}{8} \cdot \frac{n_{\text{databits}}}{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}} \cdot \text{baudrate}} \quad \left[\frac{B}{s} \right]$$

Or

$$\boxed{\text{databytes}_{\text{rate}} = \frac{\text{databits}_{\text{rate}}}{8}} \quad \left[\frac{B}{s} \right]$$

How many time does it take to transfer n bits ?

$$\boxed{\text{datatransfer}_{\text{time}} = \frac{n}{\text{databits}_{\text{rate}}}} \quad [s]$$

How many time does it take to transfer n bytes ?

$$\boxed{\text{datatransfer}_{\text{time}} = \frac{n}{\text{databytes}_{\text{rate}}}} \quad [s]$$

A example with a baudrate of 9600, 8 data bits, 1 stop bit and no parity :

$$\text{databits}_{\text{rate}} = \frac{n_{\text{databits}}}{1 + n_{\text{databits}} + n_{\text{paritybits}} + n_{\text{stopbits}}} \cdot \text{baudrate} = \frac{8}{1 + 8 + 0 + 1} \cdot 9600 = 7680 \quad \left[\frac{\text{bit}}{s} \right]$$

$$\text{databytes}_{\text{rate}} = \frac{\text{databits}_{\text{rate}}}{8} = \frac{7680}{8} = 960 \quad \left[\frac{B}{s} \right]$$

To transfer the « Hello world ! » string, wich is a length of 13 bytes, we need :

$$\text{datatransfer}_{\text{time}} = \frac{n}{\text{databytes}_{\text{rate}}} = \frac{13}{960} \approx 13.5 [ms]$$