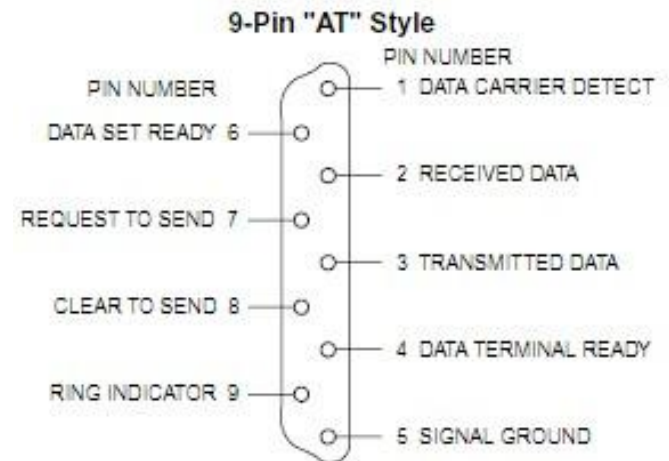
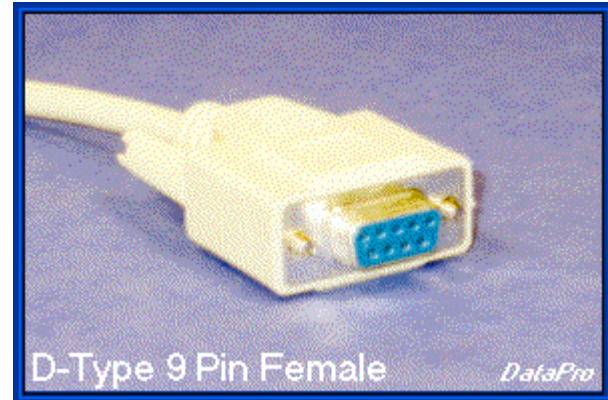


# Serial Interface Basics

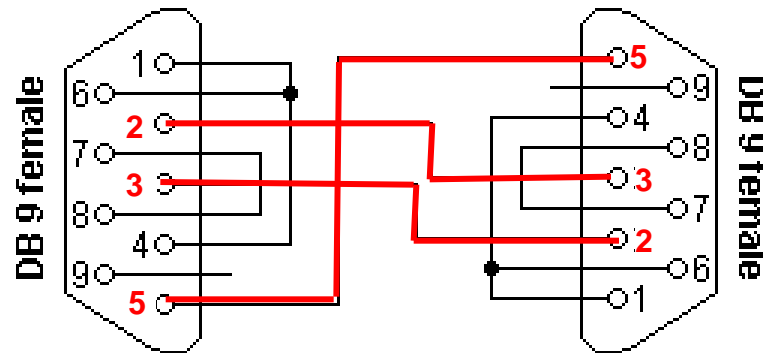
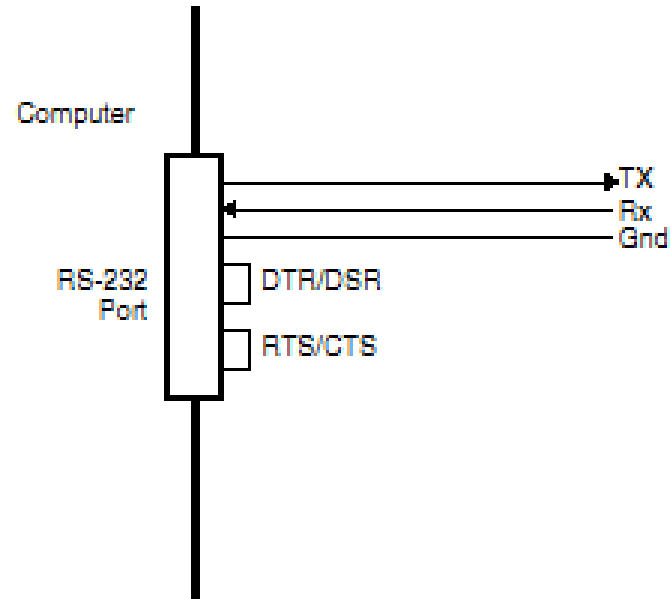
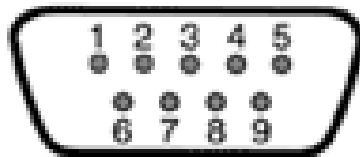
- Also called Universal Asynchronous Receiver/ Transmitter (UART)
- or after the I standards:
  - RS232 (-C) or EIA232



# Typical 3-wire Interface

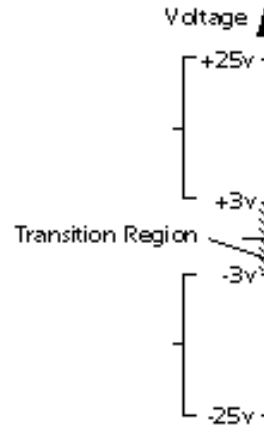
DCD	: Pin 1
ROD	: Pin 2
TXD	: Pin 3
DTR	: Pin 4
GND	: Pin 5
DSR	: Pin 6
RTS	: Pin 7
CTS	: Pin 8
RI	: Pin 9

RS232 [9 Pin] Pinouts



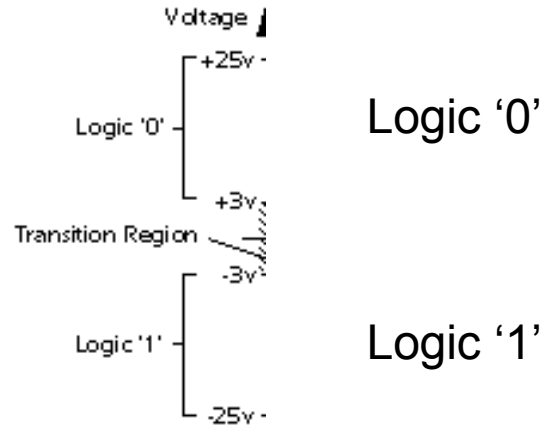
# RS232 Signals

- Signals between +25V and -25V;  
some say  $\pm 15V$   
usually +12V to -12V



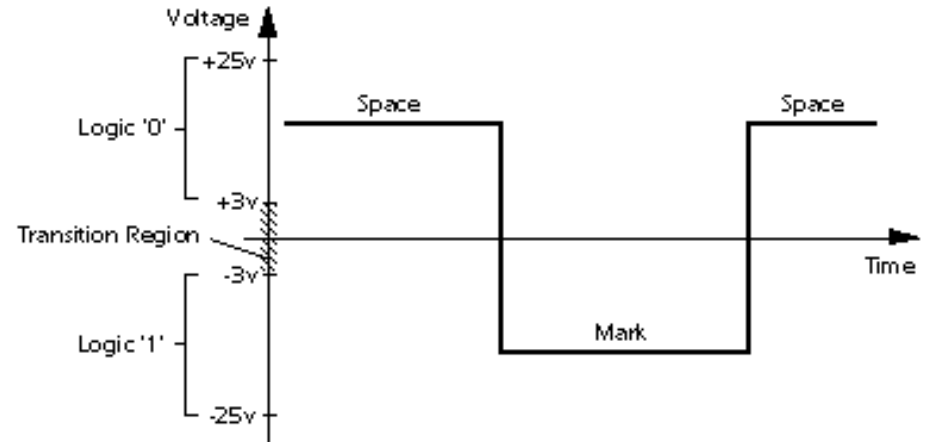
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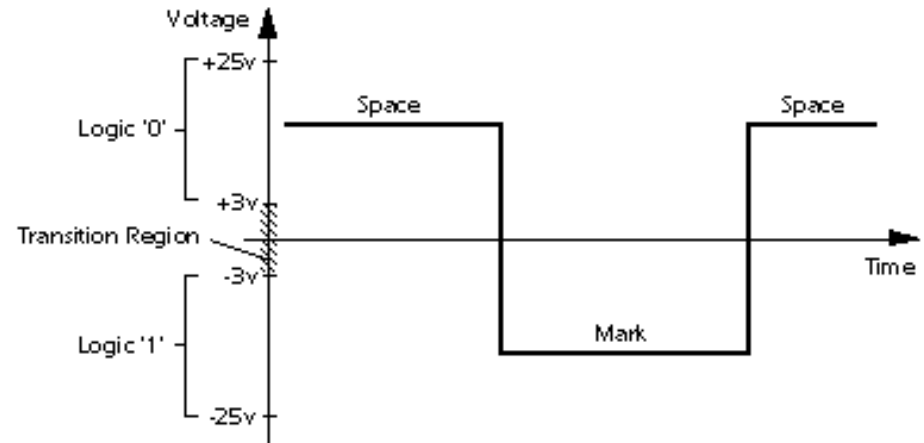
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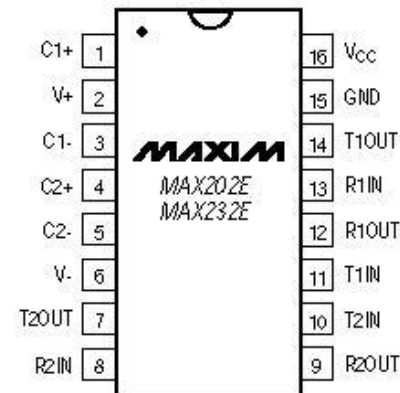
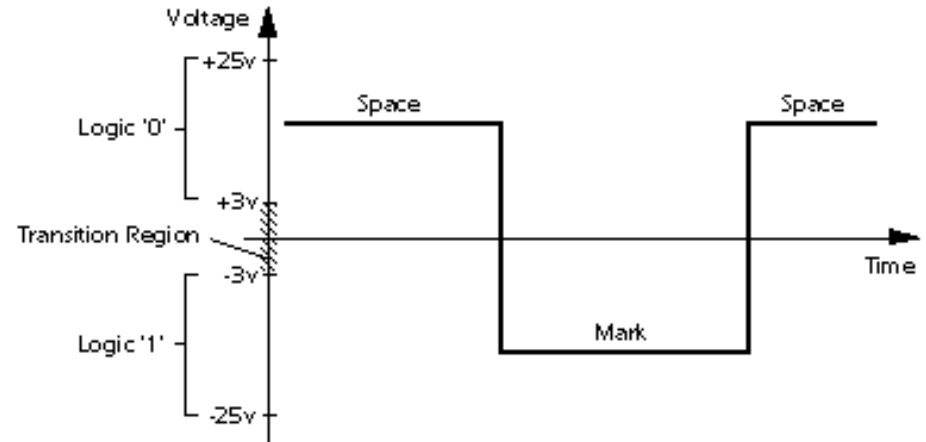
# RS232 Signals

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usually +12V to -12V
- AVR runs on 3V or 5V

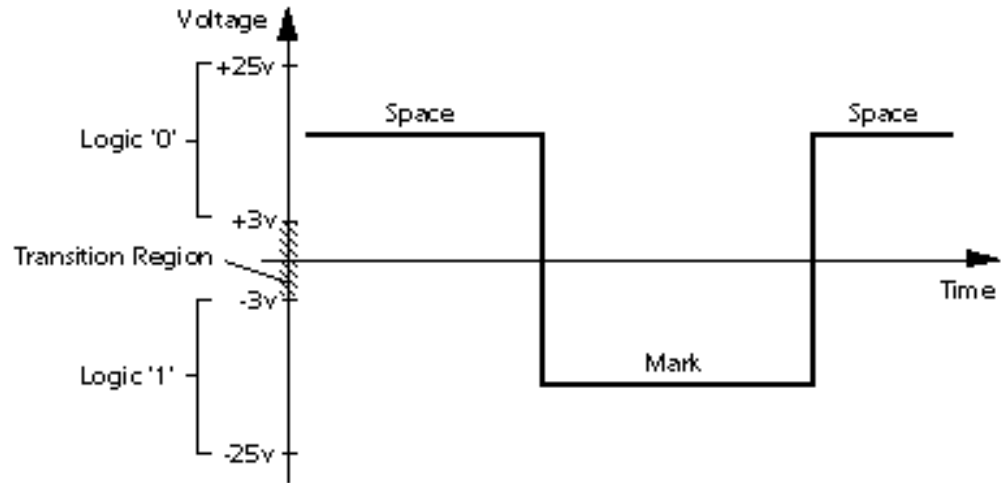


# RS232 Signals

- Signals between +25V and -25V;  
some say  $\pm 15V$   
usually +12V to -12V
- AVR runs on 3V or 5V
- Driver chip translates between voltages

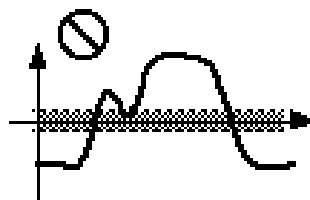
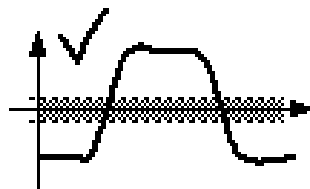
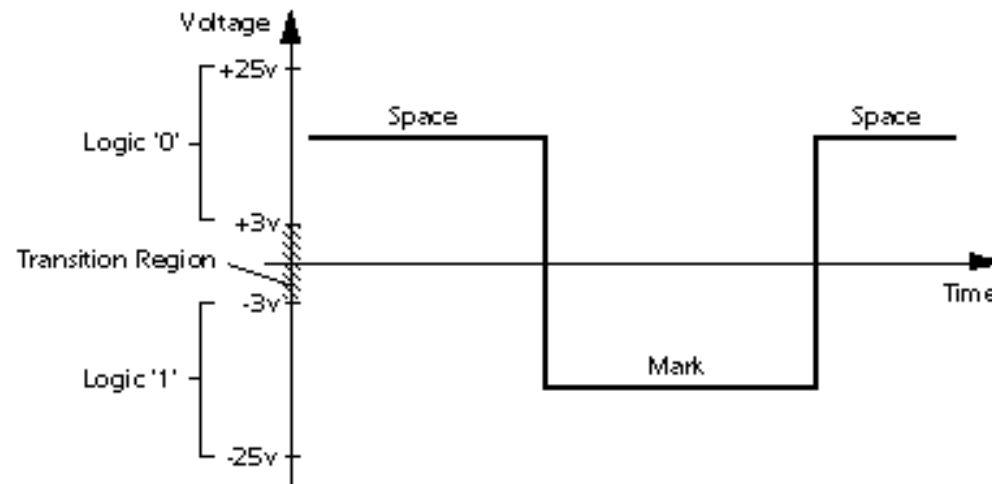


# Valid Signals

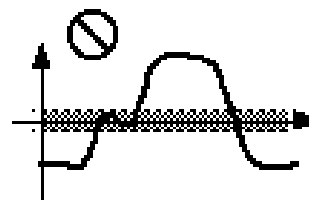




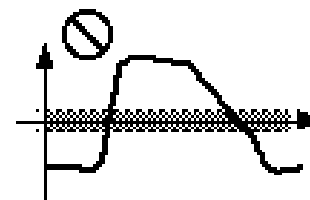
# Valid Signals



Reenters Transition Region



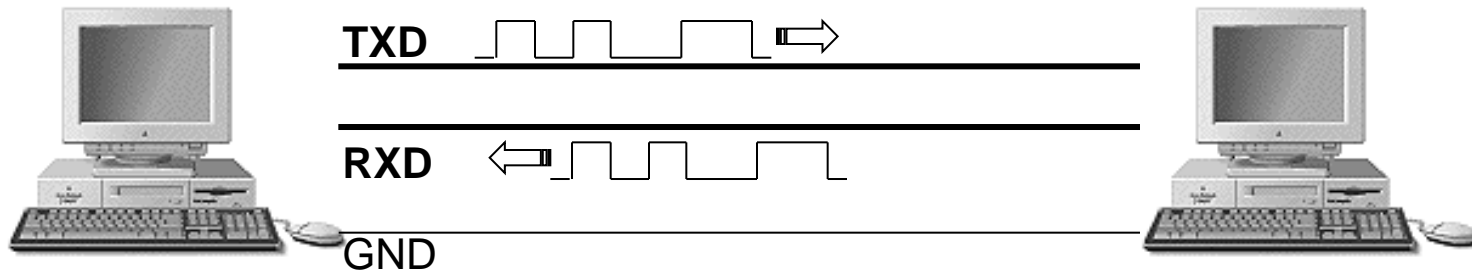
Reverses Within Transition Region



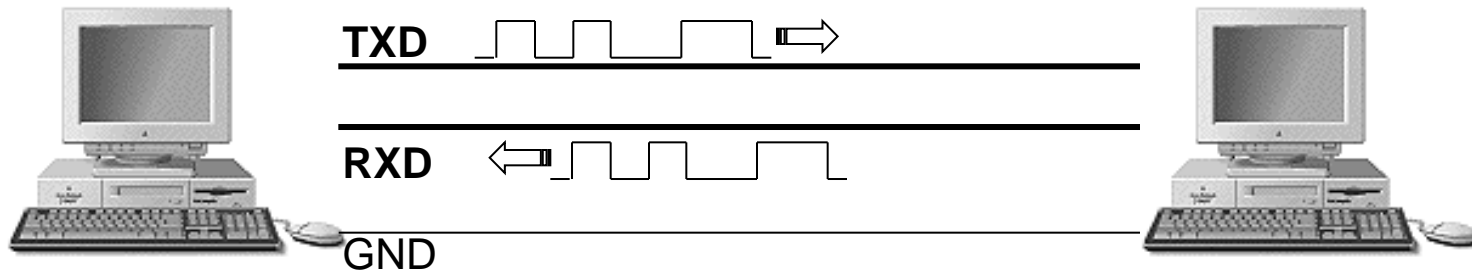
Fall Time Too Slow

Figure courtesy of <http://www.camiresearch.com>

# Basic 3-Wire Connection of Machines



# Basic 3-Wire Connection of Machines



**What goes over these wires?**

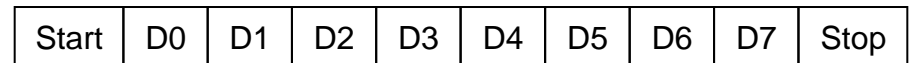
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# RS-232 Frame

- Every RS-232 consists of:
  - 1 start bit
  - 8 data bits
  - 1 stop bit
  - (optional 1 parity bit)

# RS-232 Frame

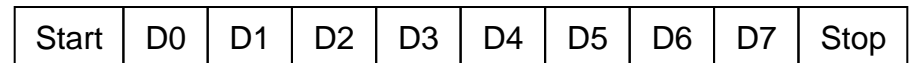
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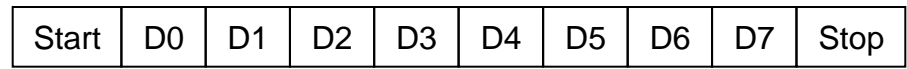


- 'a' = 0x61 = 0110 0001

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- 8 data bits
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- (optional 1 parity bit)



1 1 1 1

0

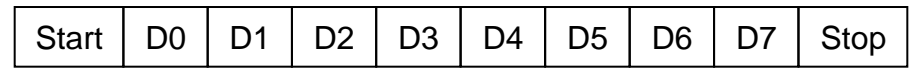
1 —

- 'a' = 0x61 = 0110 0001

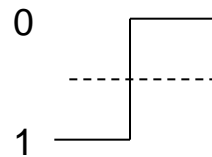
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1 1 1 1 0



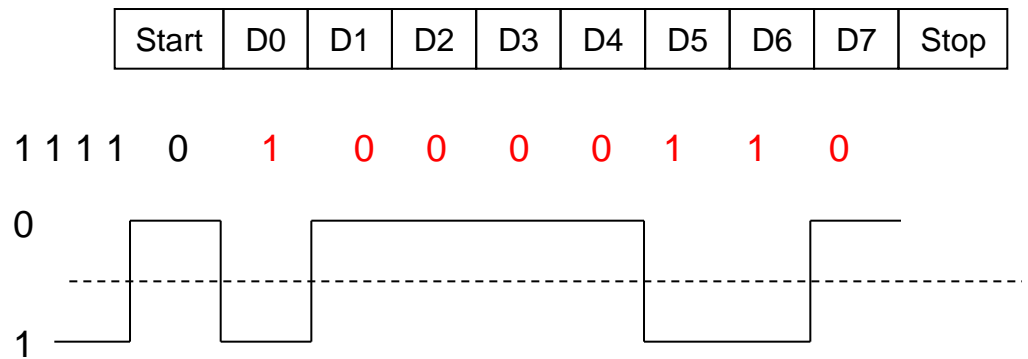
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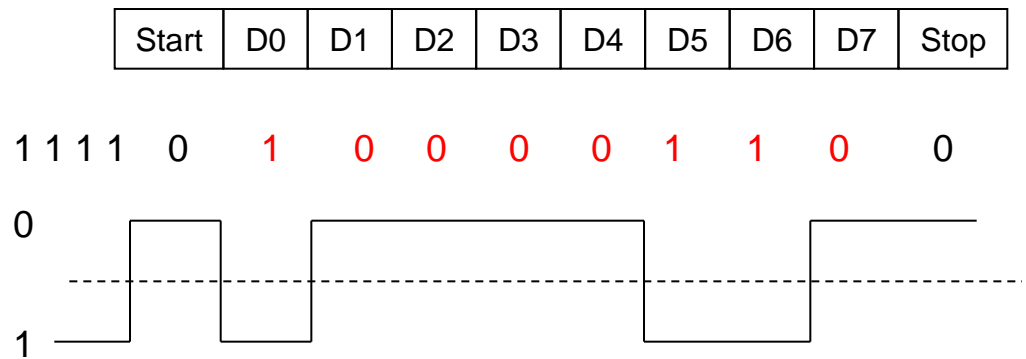


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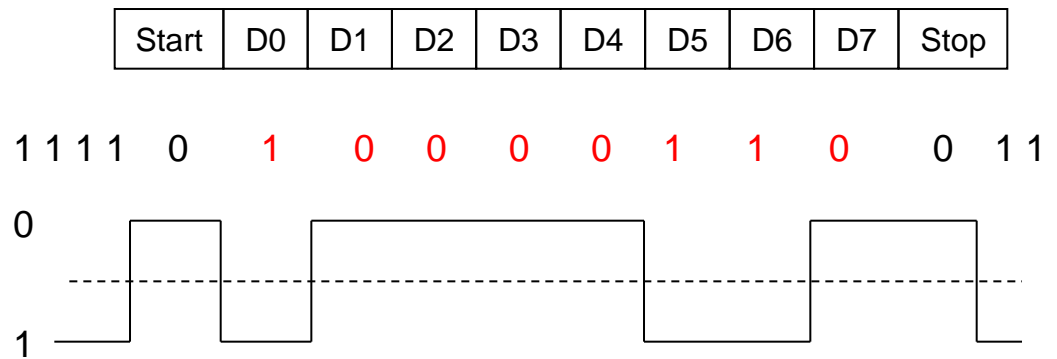


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# RS-232 Frame

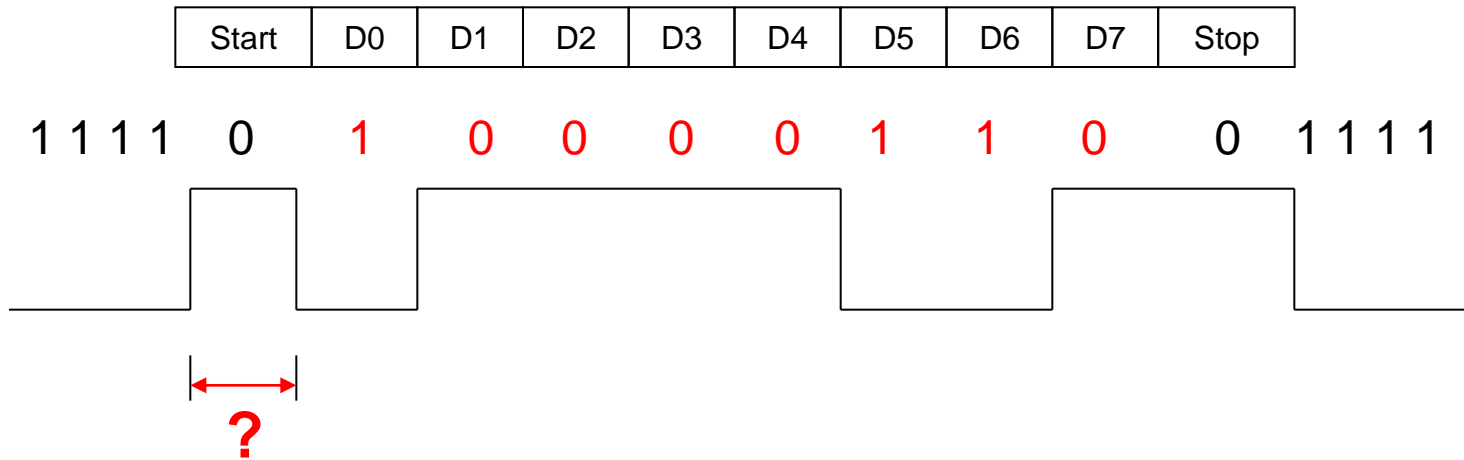
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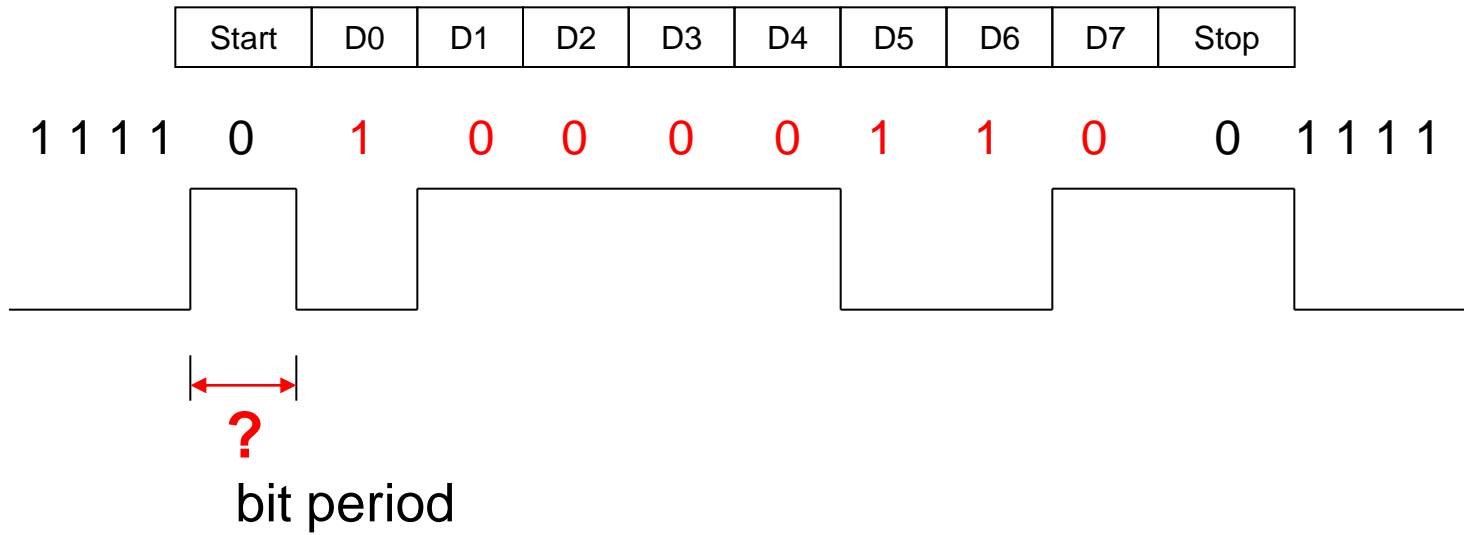


- 'a' = 0x61 = 0110 0001

# Signal Timing



# Signal Timing (continued)



# Baud Rate

- Baud specifies the inverse of the bit-period  
e.g. 9600 Baud = a bit-period of  $1/9600$  second  
= 104.2 microseconds
- Typical data rates: 75, 110, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 33600, 56000, 115000 and (rarely) 330000 baud.