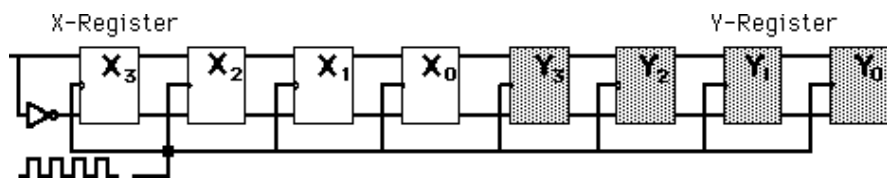
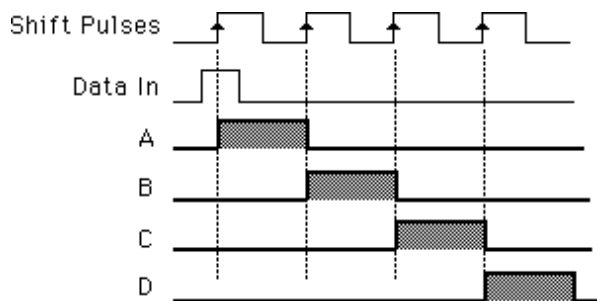
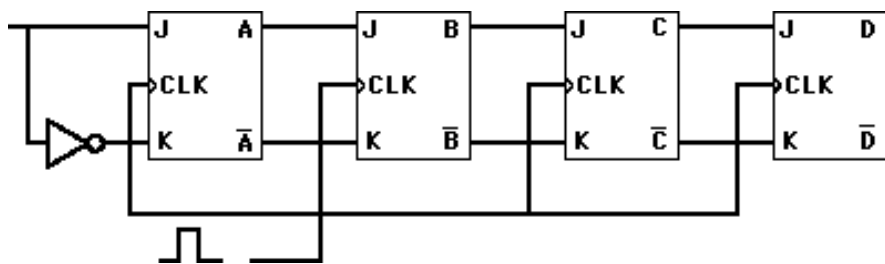


Soros adatátvitel

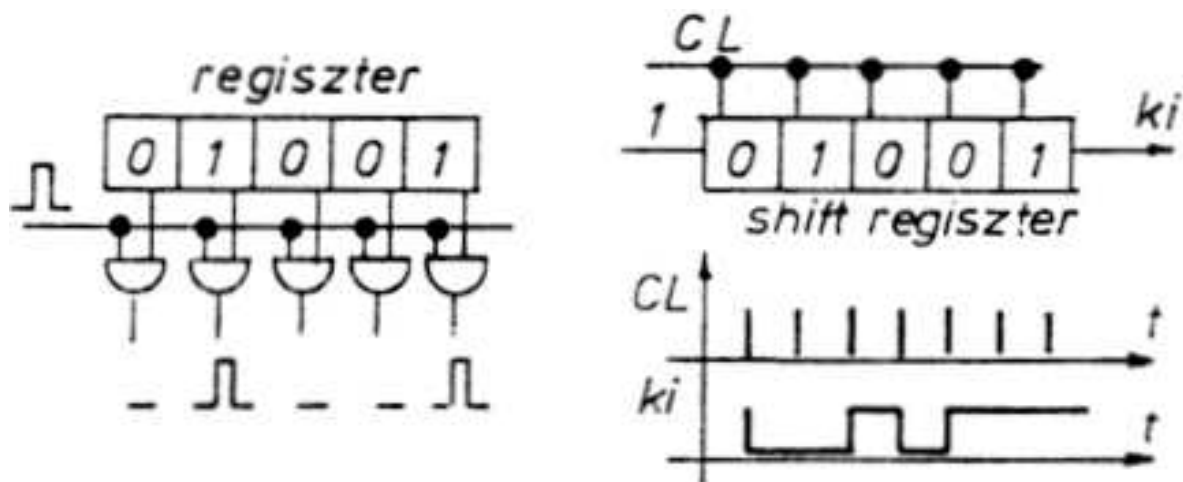


X_3	X_2	X_1	X_0	Y_3	Y_2	Y_1	Y_0
1	1	0	1	0	0	0	0
0	1	1	0	1	0	0	0
0	0	1	1	0	1	0	0
0	0	0	1	1	0	1	0
0	0	0	0	1	1	0	1

Visszaalakítás:



Adatok átalakítása soros és párhuzamos formára:



Billentyűzet:

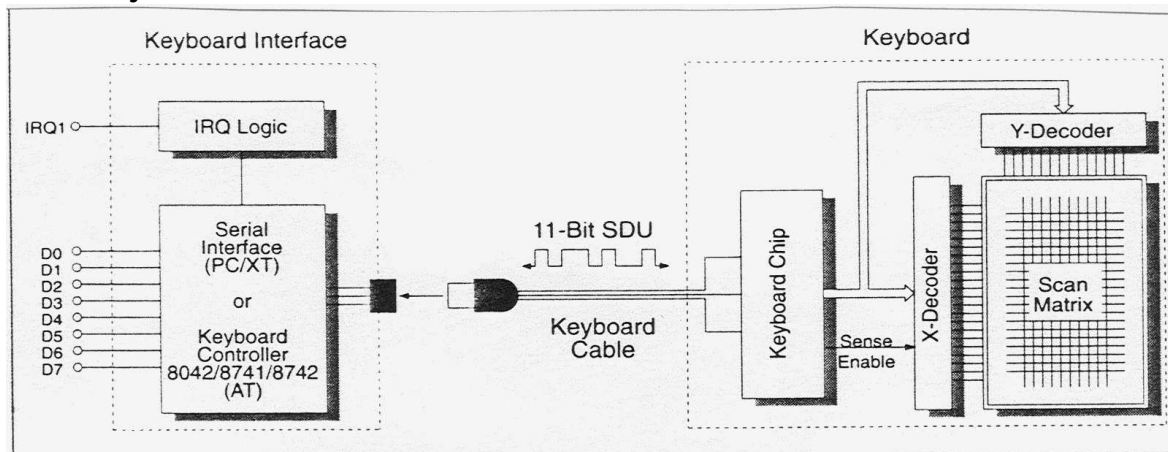
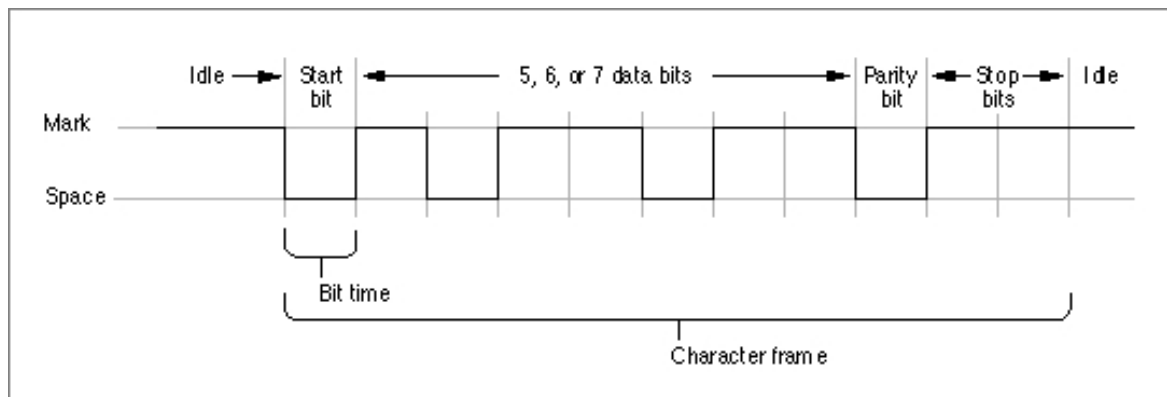
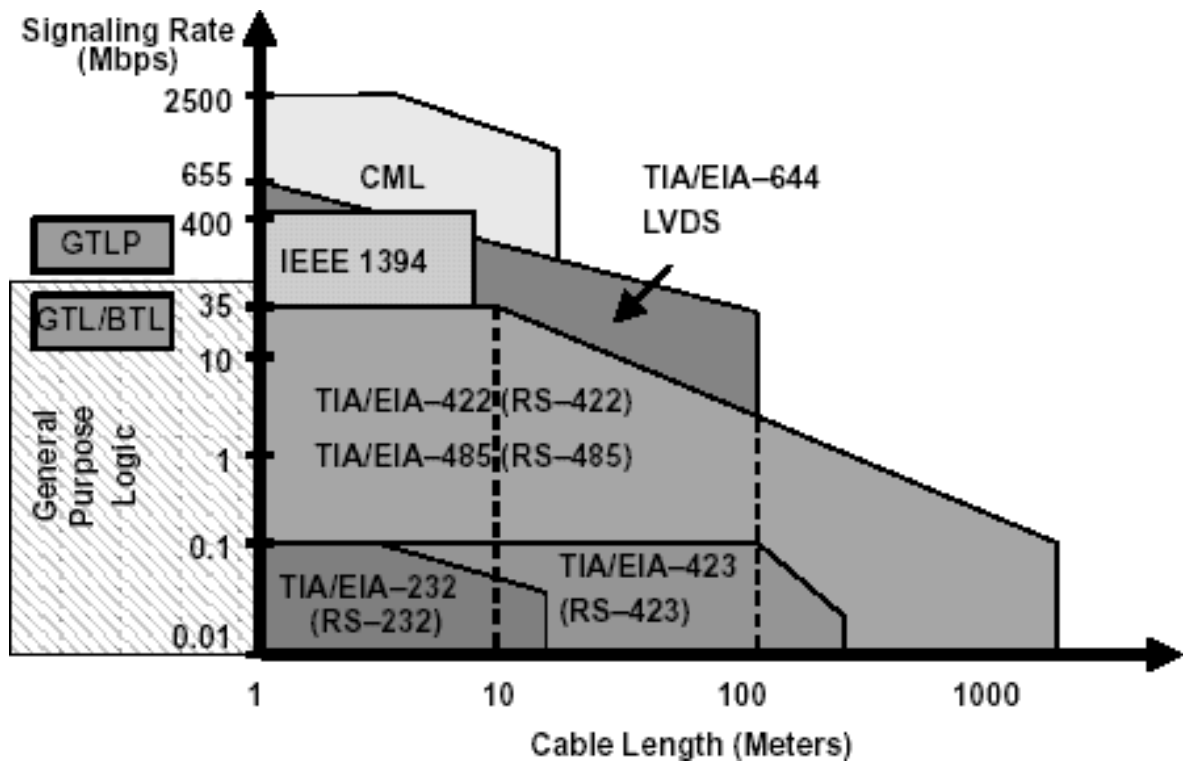


Figure 31.1: Structure of keyboard and keyboard interface.

RS-232

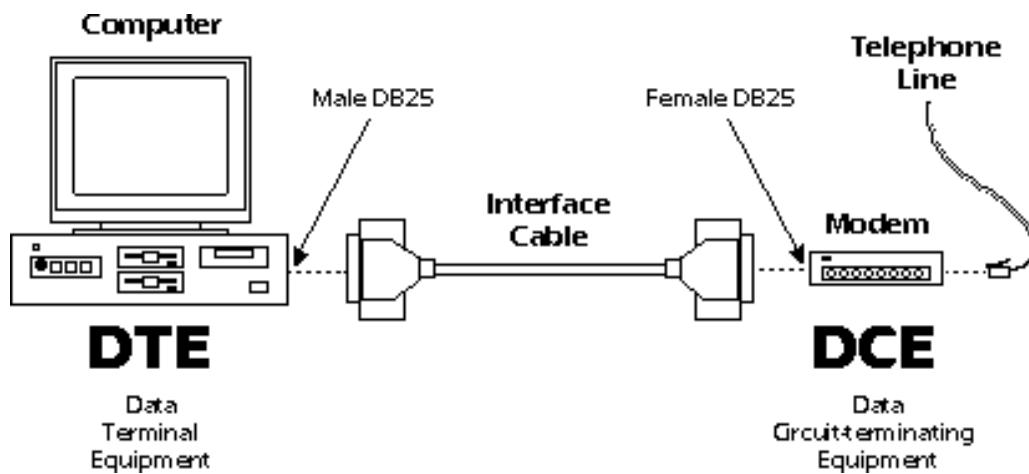




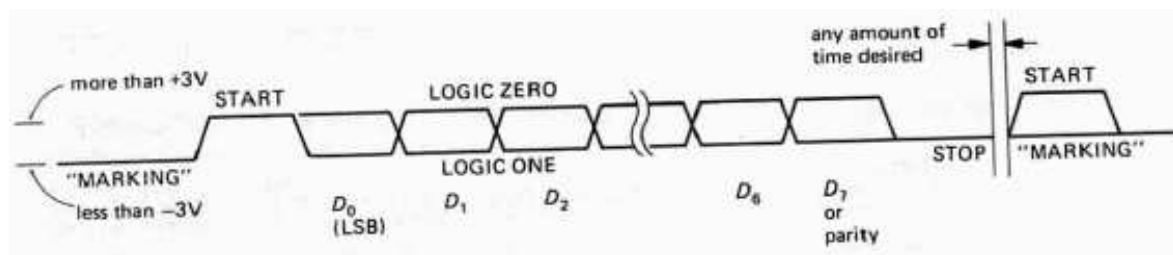
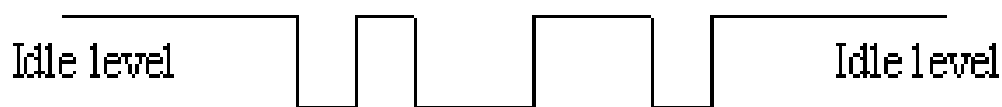
USB, IEC, parallel port

RS-232,

non-printing					printing			printing			printing		
Name	Control char	Char	Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char	Hex	Dec
null	ctrl-@	NUL	00	00	SP	20	32	@	40	64	'	60	96
start of heading	ctrl-A	SOH	01	01	!	21	33	A	41	65	a	61	97
start of text	ctrl-B	STX	02	02	"	22	34	B	42	66	b	62	98
end of text	ctrl-C	ETX	03	03	#	23	35	C	43	67	c	63	99
end of xmit	ctrl-D	EOT	04	04	\$	24	36	D	44	68	d	64	100
enquiry	ctrl-E	ENQ	05	05	%	25	37	E	45	69	e	65	101
acknowledge	ctrl-F	ACK	06	06	&	26	38	F	46	70	f	66	102
bell	ctrl-G	BEL	07	07	'	27	39	G	47	71	g	67	103
backspace	ctrl-H	BS	08	08	(28	40	H	48	72	h	68	104
horizontal tab	ctrl-I	HT	09	09)	29	41	I	49	73	i	69	105
line feed	ctrl-J	LF	0A	10	*	2A	42	J	4A	74	j	6A	106
vertical tab	ctrl-K	VT	0B	11	+	2B	43	K	4B	75	k	6B	107
form feed	ctrl-L	FF	0C	12	,	2C	44	L	4C	76	l	6C	108
carriage return	ctrl-M	CR	0D	13	-	2D	45	M	4D	77	m	6D	109
shift out	ctrl-N	SO	0E	14	.	2E	46	N	4E	78	n	6E	110
shift in	ctrl-O	SI	0F	15	/	2F	47	O	4F	79	o	6F	111
data line escape	ctrl-P	DLE	10	16	0	30	48	P	50	80	p	70	112
device control 1	ctrl-Q	DC1	11	17	1	31	49	Q	51	81	q	71	113
device control 2	ctrl-R	DC2	12	18	2	32	50	R	52	82	r	72	114
device control 3	ctrl-S	DC3	13	19	3	33	51	S	53	83	s	73	115
device control 4	ctrl-T	DC4	14	20	4	34	52	T	54	84	t	74	116
neg acknowledge	ctrl-U	NAK	15	21	5	35	53	U	55	85	u	75	117
synchronous idle	ctrl-V	SYN	16	22	6	36	54	V	56	86	v	76	118
end of xmit block	ctrl-W	ETB	17	23	7	37	55	W	57	87	w	77	119
cancel	ctrl-X	CAN	18	24	8	38	56	X	58	88	x	78	120
end of medium	ctrl-Y	EM	19	25	9	39	57	Y	59	89	y	79	121
substitute	ctrl-Z	SUB	1A	26	:	3A	58	Z	5A	90	z	7A	122
escape	ctrl-[ESC	1B	27	;	3B	59	[5B	91	{	7B	123
file separator	ctrl-\	FS	1C	28	<	3C	60	\	5C	92	 	7C	124
group separator	ctrl-]	GS	1D	29	=	3D	61]	5D	93	}	7D	125
record separator	ctrl-^	RS	1E	30	>	3E	62	^	5E	94	~	7E	126
unit separator	ctrl-_	US	1F	31	?	3F	63	_	5F	95	DEL	7F	127



Start bit = 0 0 1 0 0 1 1 0 1 1 1 Stop bit = 1



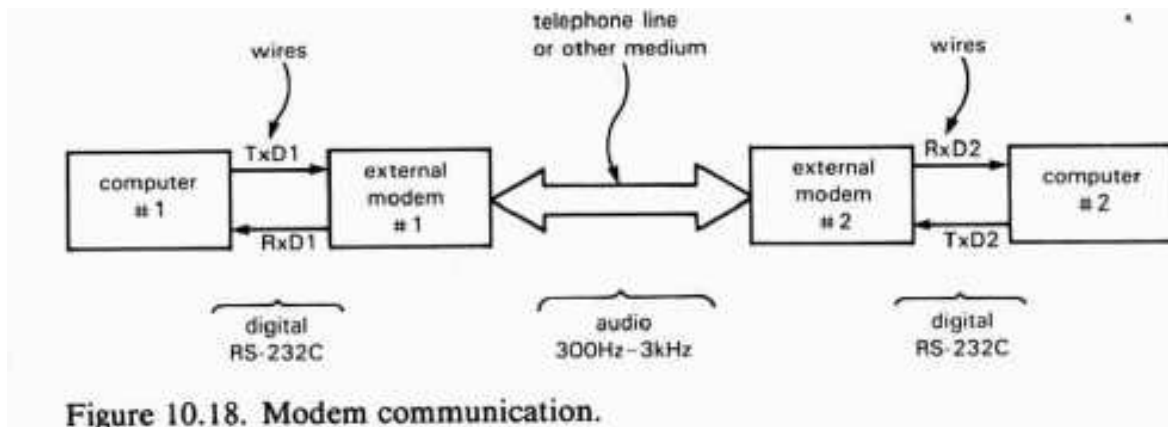
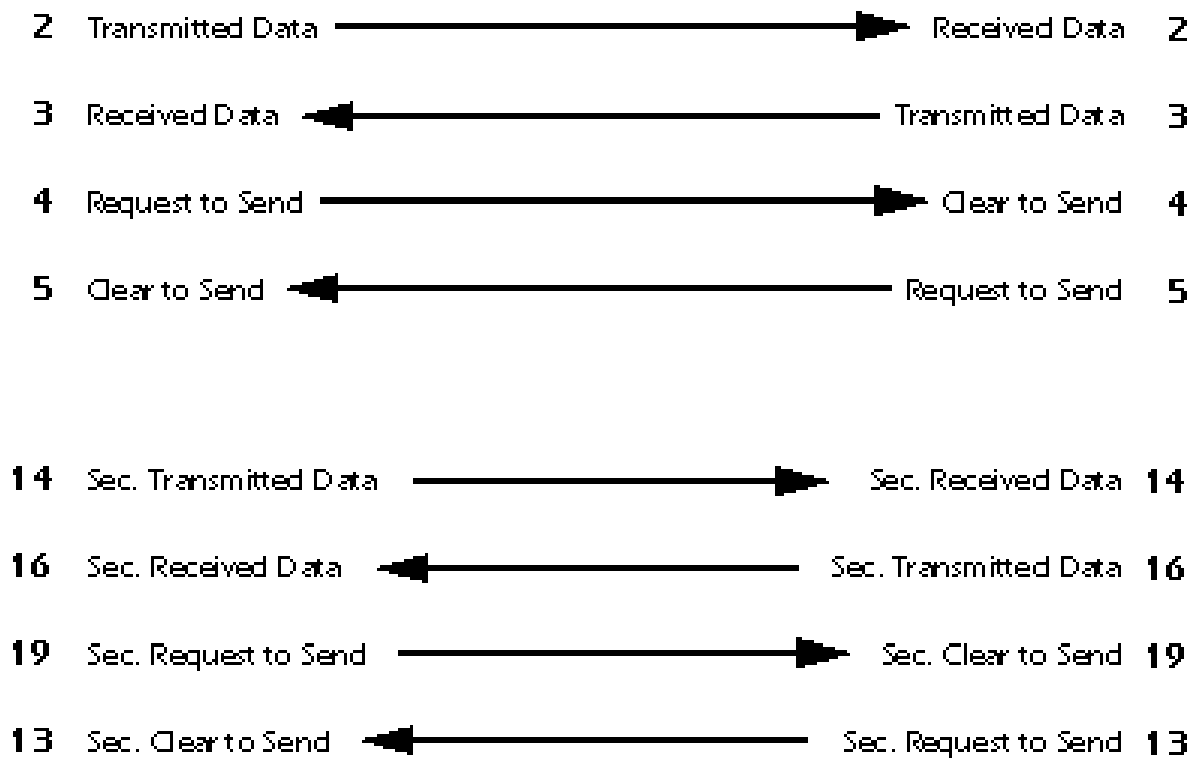


Figure 10.18. Modem communication.

**DTE
Side**

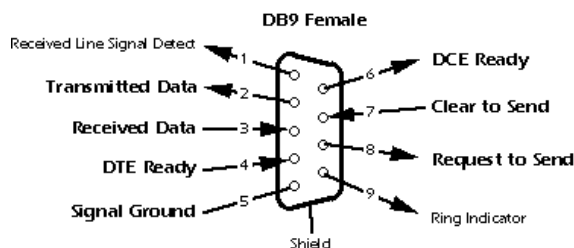
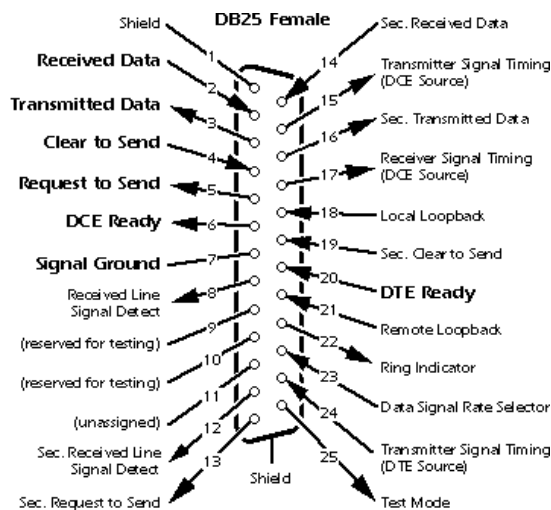
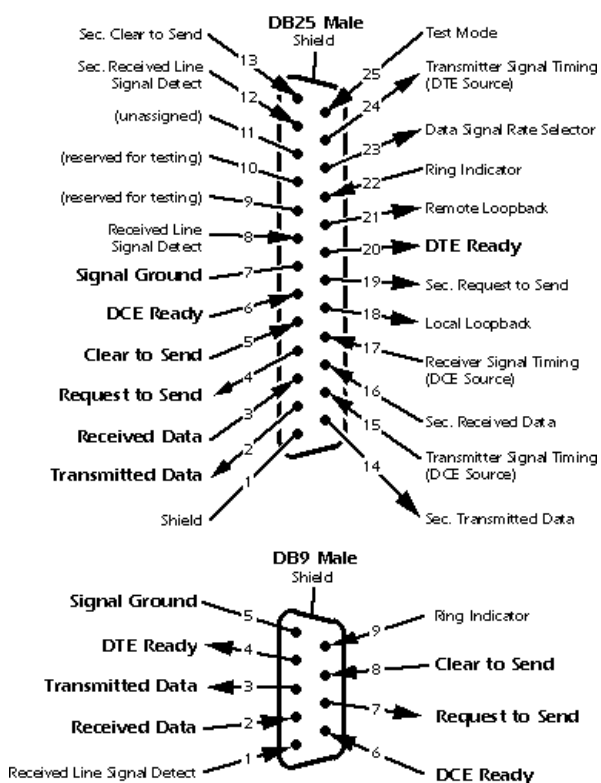
**DCE
Side**



TXD Trasmitted Data
 RXD Received Data
 DTR Data Terminal Ready
 DSR Data Set Ready
 RTS Request To Send
 CTS Clear To Send
 GND Ground

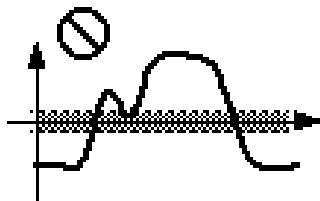
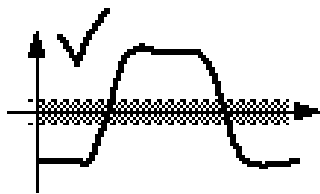
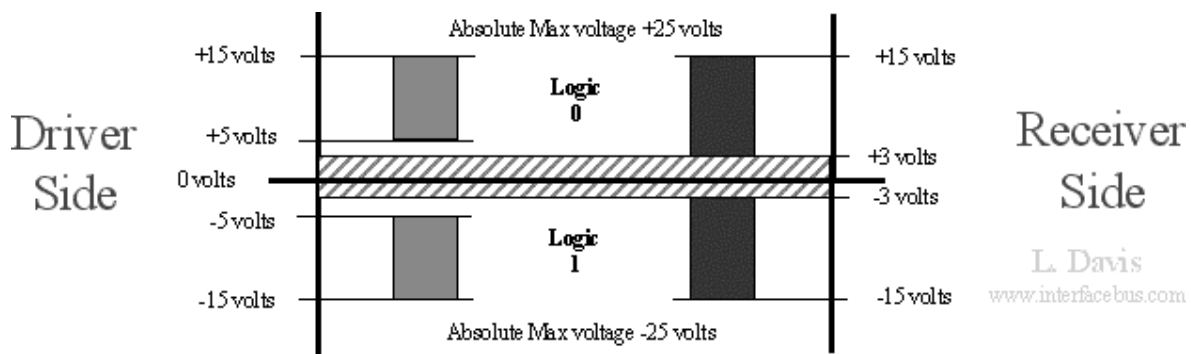
Továbbított adat
 Vett adat
 Adatterminál kész
 Adatkészülék kész
 Adáskérés
 Adáskérés a másik készüléktől
 Föld

Looking Into the DTE Device Connector

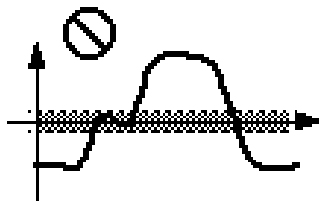


● ← Received by DTE Device
 ● → Transmitted from DTE Device

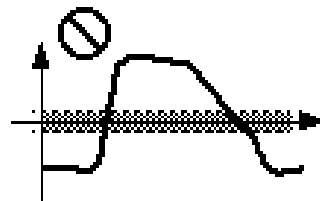
● ← Received by DCE Device
 ● → Transmitted from DCE Device



Reenters Transition Region



Reverses Within Transition Region



Fall Time Too Slow

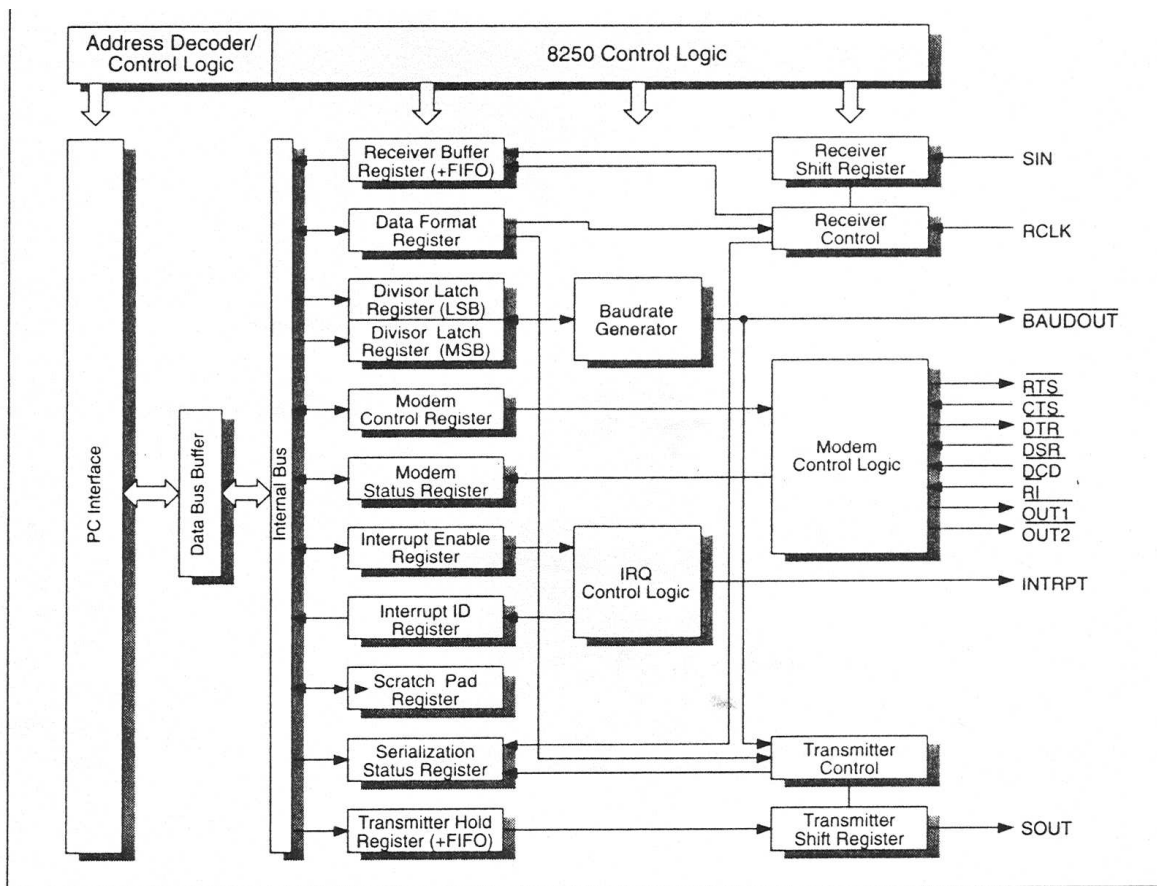
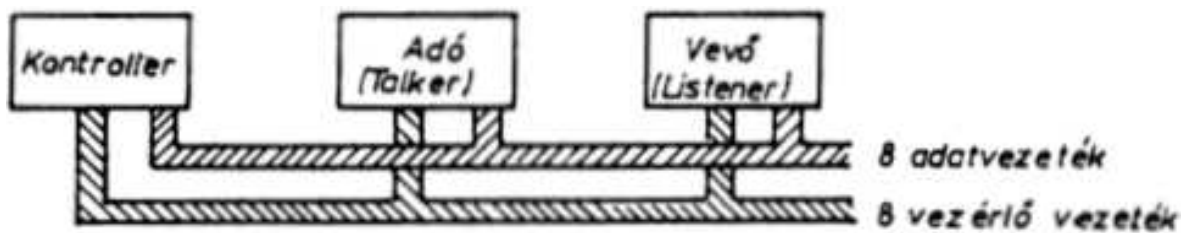
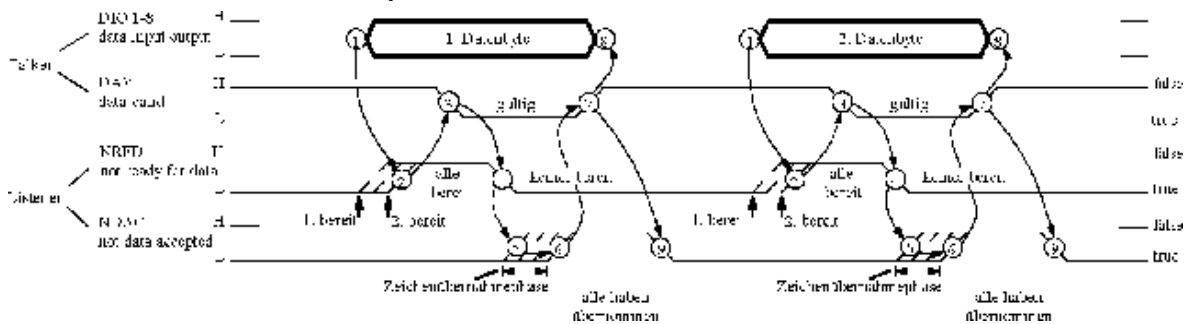


Figure 29.21: UART 8250/16450/16550 block diagram. Note that only the 16550 incorporates a FIFO buffer in the receiver buffer and transmitter hold registers.

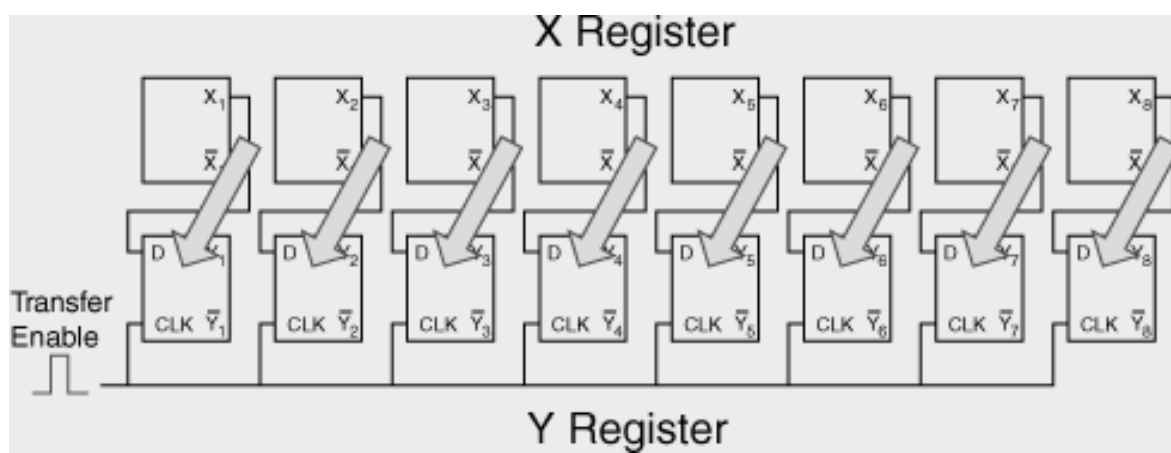
IEC-busz

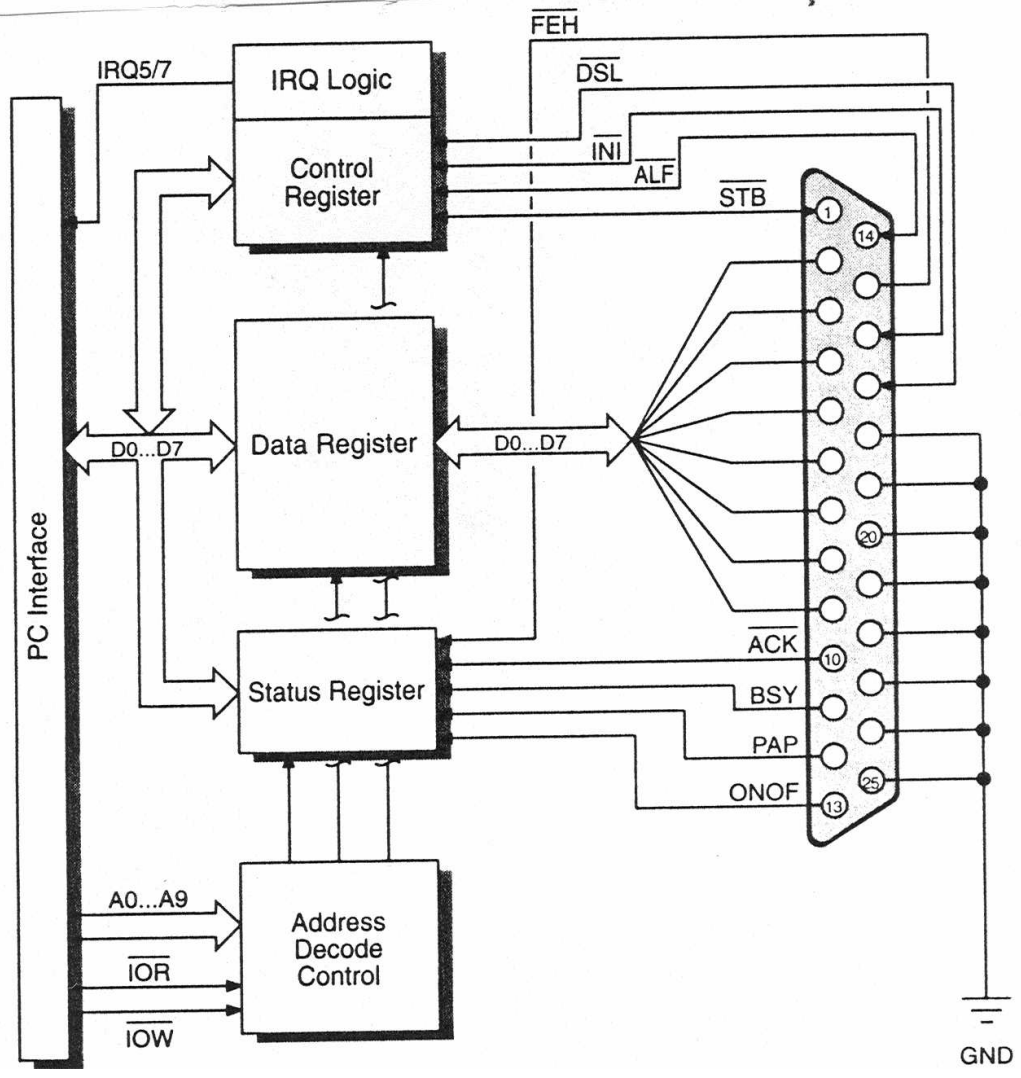


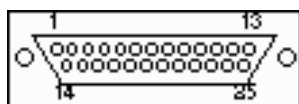
- DAV Data Valid
- DAC Data Accepted
- RFD Ready for data
- EOI End of Identify
- ATN Attention
- REN Remote Enable
- IFC Interface Clear
- SRQ Service Rquest



Parallel port







View is looking at
Connector side of
DB-25 Male Connector.

Pin **Description**

1	$\overline{\text{Strobe}}$	PC Output
2	Data 0	PC Output
3	Data 1	PC Output
4	Data 2	PC Output
5	Data 3	PC Output
6	Data 4	PC Output
7	Data 5	PC Output
8	Data 6	PC Output
9	Data 7	PC Output
10	$\overline{\text{ACK}}$	PC Input
11	Busy	PC Input
12	Paper Empty	PC Input
13	Select	PC Input
14	$\overline{\text{Auto Feed}}$	PC Output
15	$\overline{\text{Error}}$	PC Input
16	Initialize Printer	PC Output
17	$\overline{\text{Select Input}}$	PC Output

Pin Assignments

Note: 8 Data Outputs
4 Misc Other Outputs

5 Data Inputs

Note: Pins 18-25 are
Ground

Nyomtatók, lapolvasók:

Printer	Data Port	Status	Control
LPT1	0x03bc	0x03bd	0x03be
LPT2	0x0378	0x0379	0x037a
LPT3	0x0278	0x0279	0x027a

TTL szintek, időzítés

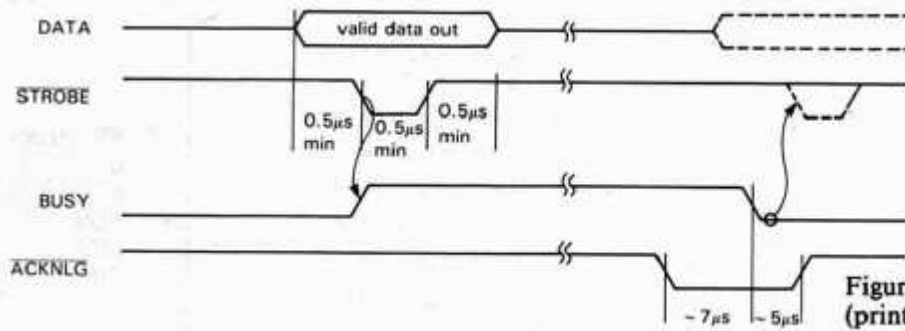


Figure 10.20. Centronics (printer) interface timing.

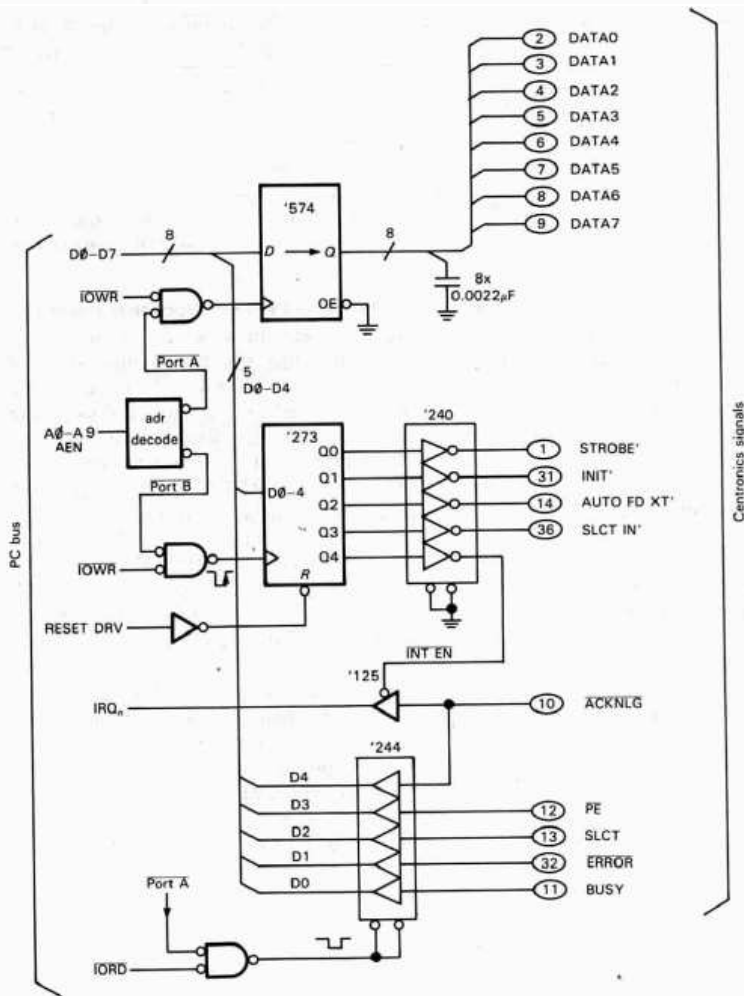
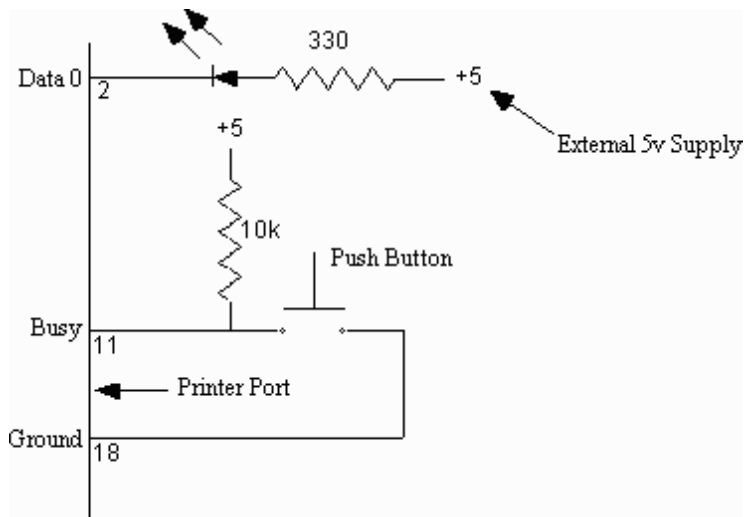


Figure 10.21. Centronics port for PC.

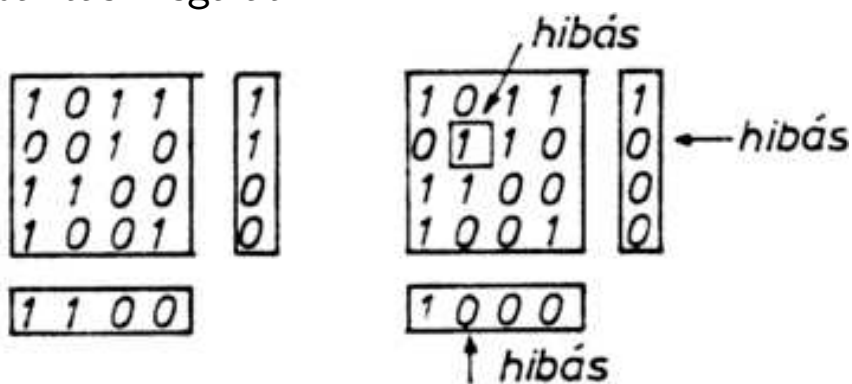


```
#include <stdio.h>
#define DATA 0x03bc
#define STATUS DATA+1
#define CONTROL DATA+2
void main(void)
{
    int in;
    while(1)    {
        in = inportb(STATUS);
        if (((in^0x80)&0x80)==0)    /* if BUSY bit is at 0 (sw clod
        {
            outportb(DATA,0x00);    /* turn LED on */
            usleep(10000);
            outportb(DATA, 0x01);    /* turn it off */
            usleep(10000);
        }
        else    {
            outportb(DATA,0x01);    /* if PB not depressed, turn LED
        }
    }
}
```

Információ ellenőrzése

Hiba az átvitel során.

Ellenőrző bitek: paritásvizsgálat.



7.5.1. ábra

Példa: Hamming-féle kód

4 információs bit + 3 speciálisan képzett paritásbit

1 hiba helye megállapítható

Kódolás: x_1, x_2, x_3, x_4 információs bitek $\rightarrow x_5, x_6, x_7$ paritásbitek

$$x_1 + x_2 + x_3 + x_5 = \text{páros}$$

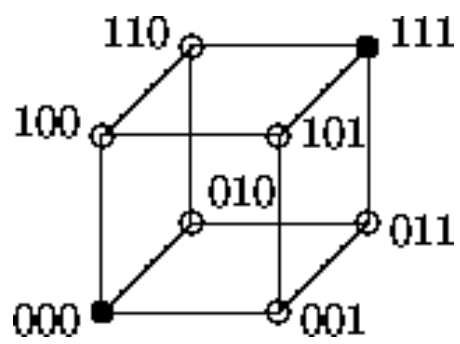
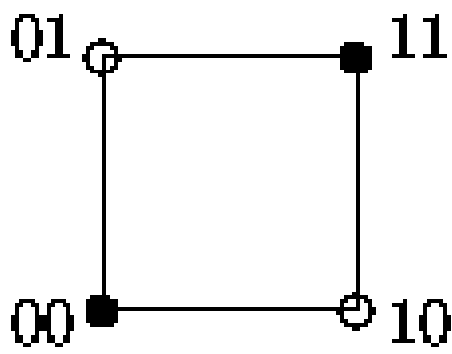
$$x_1 + x_2 + x_4 + x_6 = \text{páros}$$

$$x_1 + x_3 + x_4 + x_7 = \text{páros}$$

$$\text{Pl. } 1010 \rightarrow 1010010$$

	hibás	hiba helye
Hiba detektálás:	p5	x5
	p6	x6
	p7	x7
	p5p6	x2
	p5p7	x3
	p6p7	x4
	p5p6p7	x1

Zavar/zaj: metrika -> „legtávolabbi” kódok a jók!
Zajhoz illesztett kódjavítás!



Információmennyiség, entrópia

Shannon : p_i valószínűségű esemény információmennyisége”

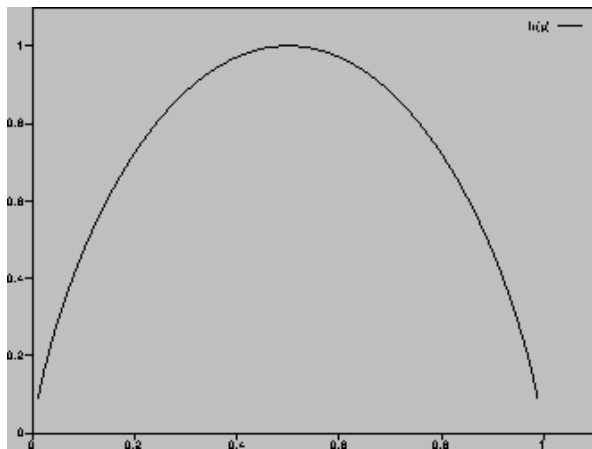
$$I = -\log_2 p_i$$

Eseményhalmaz megfigyelése során nyert átlagos információ:

$$H = -\sum_i p_i \log_2 p_i$$

Példa bináris esemény p és $1 - p$ valószínűséggel:

$$H = -p \log_2 p - (1 - p) \log_2(1 - p)$$



Bit: $p = 0.5$.

Tömörítés, titkosítás.