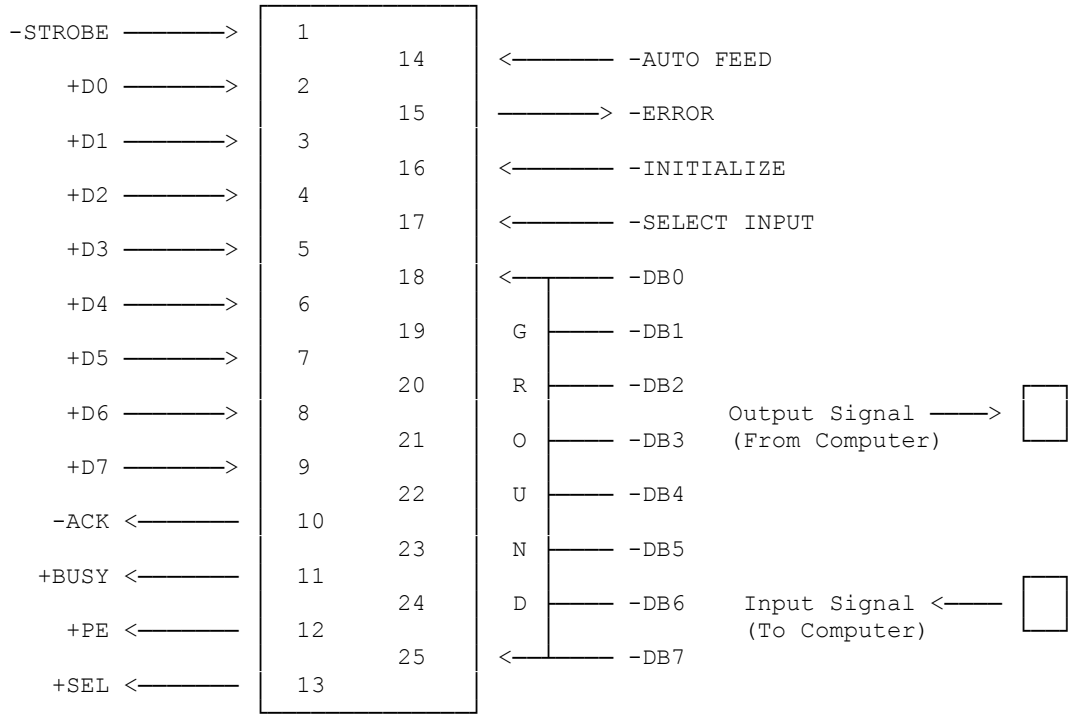
# Parallel Ports and The IBM PC

This document details the parallel printer ports of the IBM-PC. Each of the printer ports conforms to a modified Centronics Parallel Interface. The connection to the PC is through a DB25 25 pin connector. The IBM-PC will support up to three parallel ports. Each port provides 12 TTL outputs and 5 TTL inputs.

This document contains the following data:

a. DB25 PINOUT, and signal names where known.
b. PORT addresses of each parallel port.
c. DATA, CONTROL, and INPUT PORTS pinouts w/bit positions within each byte.
d. Example programs written in C highlighting input and output to the ports.
e. Clock display circuit diagram w/parts list.

**DB25 PINOUT**




Pins 1, 11, 14, 17 are negative TTL, meaning 0 is ON & 1 is OFF

**PARALLEL Port Addresses  DATA PORT (Output from computer)**

LPT1: 956  3BC Hex
LPT2: 888  378 Hex
LPT3: 632  278 Hex

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIN # | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 |
| BIT # | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| VALUE | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

**PARALLEL Port Addresses  CONTROL PORT (Output from computer)**

LPT1: 958  3BE Hex
LPT2: 890  37A Hex
LPT3: 634  27A Hex

| NA | NA | NA | NA | -? | INIT | -AF | -ST |
|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIN # | - | - | - | - | 17 | 16 | 14 | 1 |
| BIT # | - | - | - | - | 3 | 2 | 1 | 0 |
| VALUE | - | - | - | - | 8 | 4 | 2 | 1 |

Notes:

1. -? denotes negative TTL signal, name unknown.
2. INIT is INITIAL.
3. -AF is negative TTL signal, AUTOFEED is signal name.
4. -ST is negative TTL siganl, STROBE is signal name.
5. NA not applicable.

**PARALLEL Port Addresses  INPUT PORT (Input to computer)**

LPT1: 957  3BD Hex
LPT2: 889  379 Hex
LPT3: 633  279 Hex

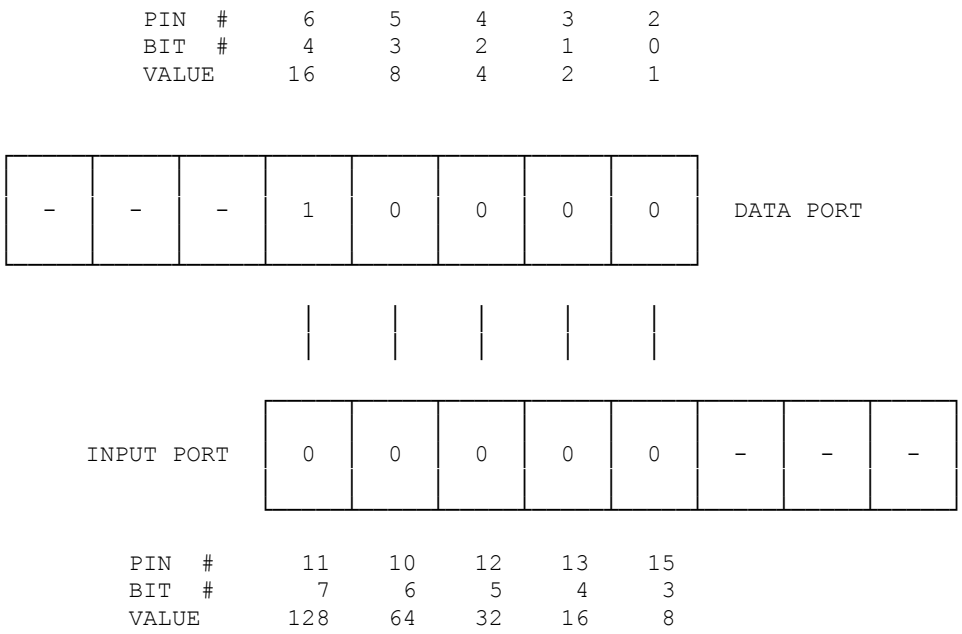
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -BUSY | ACK | PE | SEL | ? | NA | NA | NA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIN # | 11 | 10 | 12 | 13 | 15 | - | - | - |
| BIT # | 7 | 6 | 5 | 4 | 3 | - | - | - |
| VALUE | 128 | 64 | 32 | 16 | 8 | - | - | - |

Notes:

1. ?  signal name unknown.
2. NA not applicable.
3. -BUSY is negative TTL signal.

**Example of Negative TTL logic:**




Notes:

1. A 1 bit in the DATA port causes 2.5 to 5.0 volts to appear on the corresponding pin on the DB25 connector. In the example above PIN # 6 is on.

2. BIT # 7 of the INPUT port has negative TTL logic, where 2.5 to 5.0 volts on PIN # 11 is logic level zero. The other bits of the INPUT port are normal TTL logic.

```
/* CLOCKC.C ==> This program runs the binary clock */

#include "conio.h"
#define PORT_HR         634
#define PORT_MIN        632
#define OFF_MIN         0
#define OFF_HRS         0x0b
#define WINK            64  /* bit 7 of minute byte used for seconds */

main()
{
   unsigned char ctr_min, ctr_hr, status, hours, minutes, seconds,
                 hundrds, lastsec, second_on();
   void time(), turn_on(), turn_off();

   /* start by turning off all circuits */

   ctr_min = OFF_MIN;
   ctr_hr = OFF_HRS;

   outp (PORT_HR, ctr_hr);
   outp (PORT_MIN, ctr_min);

   /* the clock will run indefinately */

   for (;;) {

       /* get the time */
       time(&hours, &minutes, &seconds, &hundrds);

       /* the hours require special handling, DOS returns hours in 24  */
       /* hour format. Convert to 12 hr format. Next XOR hours against */
       /* OFF_HRS to get the proper bit pattern for the hours.         */

       ctr_hr = ((hours = hours % 12) ? hours : 12) ^ OFF_HRS;

       /* the minutes are easy, output ASIS */

       ctr_min = minutes;

       /* Display the hours and minutes */

       outp (PORT_HR, ctr_hr);
       outp (PORT_MIN, ctr_min);

       /* wink the seconds, up to the next minute */
```

```
        for (lastsec = seconds; seconds <= 59; ) {

            time (&hours, &minutes, &seconds, &hundrds);

            if (lastsec != seconds) { /* seconds has changed */

                lastsec = seconds;

                /* if second is on turn off, else turn on */

                if (!second_on(ctr_min, WINK))

                  turn_on (PORT_MIN, &ctr_min);
                else

                  turn_off (PORT_MIN, &ctr_min);

            }

            /* seconds up to 59, exit loop */

            if (seconds == 59)
                break;


        }
    }

}

unsigned char second_on(control, sec)
unsigned char control, sec;
{
   return (control & sec);

}

void turn_on (port, control)
unsigned char *control;
int port;
{
   *control = *control | WINK;

   outp (port, *control);

}

void turn_off (port, control)
unsigned char *control;
int port;
{
   *control = *control & ~WINK;

   outp (port, *control);

}
```

```
/* PORTTST.C -- This program is used to determine if the info  */
/* I have gathered about Input Ports is correct.  The program  */
/* is to send pre-determined values to PORT 632 bits 0-4       */
/* the bits correspond to pins 2-6 of a printer parallel port. */
/* Pins 2-6 are then connected to Pins 15,13,12,10,11 respec-  */
/* tively.  Pins 10-13,15 correspond to Bits 7-3 of Input PORT */
/* 633.  For a given input a pre-determined set of values will */
/* be returned. Pin 11 of the Input port is negative TTL       */

#define PORTE     633
#define PORTD     632
#include "conio.h"

main()
{
    static char test_values [] = {16, 17, 18, 20, 24, 0};

    /* test_value =>  16        return 0  */
    /* test_value =>  17        return 1  */
    /* test_value =>  18        return 2  */
    /* test_value =>  20        return 4  */
    /* test_value =>  24        return 8  */
    /* test_value =>  0         return 16 */

    unsigned char bit, send;
    void porttst();

    /* turn off all bits in send */

    for (bit = 0; bit < sizeof(test_values); bit++) {

        porttst (PORTD, PORTE, *(test_values + bit));

    }

}
void porttst (pd, pe, send)
int pd, pe;
unsigned char send;
{
    unsigned char result;
    int bits();

    outp (pd, send);

    result = inp(pe);

    /* display the bit patterns sent and received */

    printf ("\nOut Value ");
    bits (4, 0, send);
    printf (" In Value ");
    bits (7, 3, result);

}
```

OUTPUT from PORTTST.C

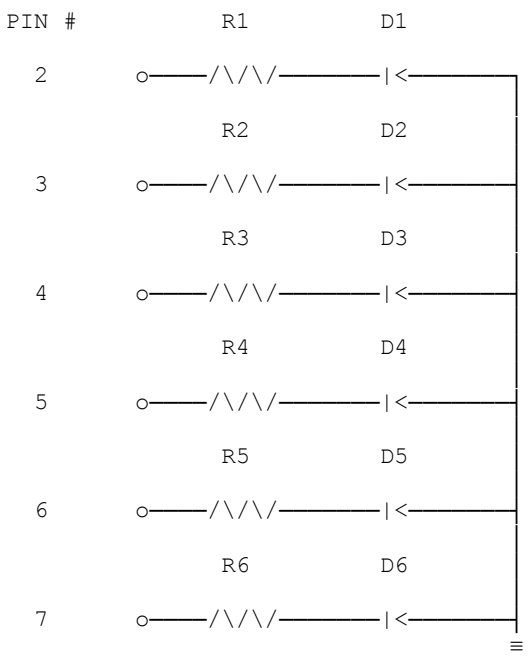
```
C>porttst

    Out Value 10000 In Value 00000
    Out Value 10001 In Value 00001
    Out Value 10010 In Value 00010
    Out Value 10100 In Value 00100
    Out Value 11000 In Value 01000
    Out Value 00000 In Value 10000
```

```
/* DTIME.C ==> This program generates binary code representing    */
/* 0 to 12, which are then output from the computers control port */
/* (actually part of the parallel printer port) to 4 LED's that   */
/* are connected to pins 1, 14, 16 & 17 of the parallel port      */
/* with the first being binary digit 0 and the latter being digit */
/* 3.                                                             */
/* See diagram of the Control Port for more data.                 */

#define CONTROL_PORT  634
#define XOR           0xb

main()
{
    char count, send;
    int bits();

    printf("\nCOUNT\tHOUR\t\tXOR\t    ACTUAL BITS\n");

    for (count = 0; count <= 12; count++) {

        send = count ^ XOR;
        outp(CONTROL_PORT, send);

        /* in practice the following is not used. it exists */
        /* for illustration purposes only.                  */

        printf ("\n%4d\t", count);
        bits (3, 0, count);

        printf ("\t\t");
        bits (3, 0, XOR);

        printf ("\t\t");
        bits (3, 0, send);

        }

}
```

```
COUNT  HOUR          XOR        ACTUAL BITS

   0   0000          1011          1011
   1   0001          1011          1010
   2   0010          1011          1001
   3   0011          1011          1000
   4   0100          1011          1111
   5   0101          1011          1110
   6   0110          1011          1101
   7   0111          1011          1100
   8   1000          1011          0011
   9   1001          1011          0010
  10   1010          1011          0001
  11   1011          1011          0000
  12   1100          1011          0111
```

## CLOCK CIRCUIT

### Minutes Display (uses DATA PORT)




<—— Ground uses pins 18 - 25.

Parts List:

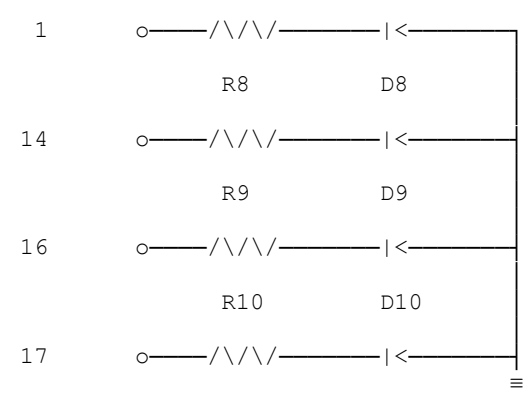
R1 - R10: 220µ ½w resistors
D1 - D10: 2.5vdc @20ma LED's

Misc:

1 - DB25 male connector
snap on is best.

1 - 25 line ribbon cable

### Hours Display (uses CONTROL PORT)




<—— Ground uses pins 18 - 25.