PCM-3640
PC/104 4-port RS-232 Module

Introduction

The PCM-3640 is a PC/104-compatible 4-port RS-232 serial interface module. It works with PC/104 CPU modules or CPU cards which accept PC/104 expansion modules. It provides four independent serial interfaces, accessed through male DB-9 connectors.

The module's industry-standard 16C550 asynchronous communication chip is fully programmable. The module requires no special commands or control codes if you use the standard COM1 ~ COM4 port addresses.

Features

- Four RS-232 serial interfaces
- High speed data transmission—up to 115,200 Bps.
- Switch selectable addresses (COM1 ~ COM4 or any other address from hex 200 to 3F8)
- 16 bytes FIFOs
- Jumper selectable interrupt level
- Eight LEDs indicate status of TX, RX lines (red LED represents TX, green LED represents RX)
- Supported by PC-ComLib serial communication programming library (optional)

Specifications

- **Dimensions:** 3.775" x 3.550" (9.6 cm x 9.0 cm)
- **Bus:** PC/104
- **Baud rate:** 50 to 115,200 bps
- **Character length:** 5, 6, 7 or 8 bits
- **Parity**: Even, odd or none
- **Stop bit:** 1, 1.5 (5-bit data only) or 2
- **I/O connectors:** Four male DB-9
- **Interrupt level:** IRQ 3, 4, 5, 6, 7 or 9
- **Clock input:** 1.8432 MHz
- **Power consumption**: +5 V @ 220 mA max.

Initial inspection

We carefully inspected the PCM-3640 both mechanically and electrically before we shipped it. It should be free of marks and scratches and in perfect electrical order on receipt.

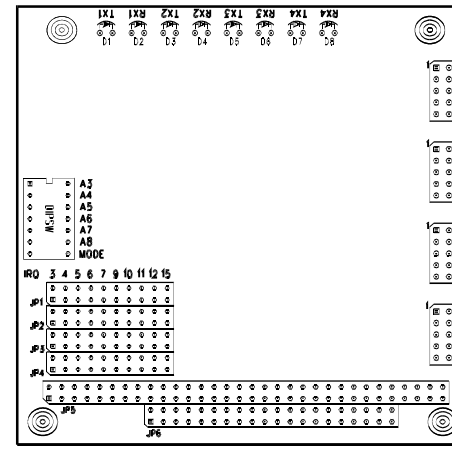
Handle the board only by its edges. The static charge on your body may damage its integrated circuits. Keep the card in its anti-static package whenever it is not installed. You can use this package to return the card if it should need repair.

Switches and jumpers

The following chart shows the switches and jumpers used to configure the PCM-3640:

Switch	Function
SW1	I/O base address (enhanced mode)
JP1	Channel 1 Interrupt level
JP2	Channel 2 Interrupt level
JP3	Channel 3 Interrupt level
JP4	Channel 4 Interrupt level

Board Layout



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Default jumper settings

The PCM-3640 will be shipped in standard mode, with the following I/O address and IRQ settings:

Port	I/O address	IRQ no.
Port 1	3F8	IRQ4
Port 2	2F8	IRQ3
Port 3	3E8	IRQ12
Port 4	2E8	IRQ15

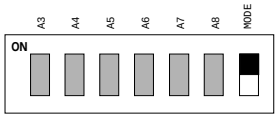
Jumper and Switch settings

The PCM-3640 can be used in two modes: standard or enhanced mode. In standard mode the I/O addresses are compatible with the standard PC communication ports, COM1 ~ COM4. In enhanced mode you can select a different base address. The offset of each port from the base address is fixed.

Standard / Enhanced mode selection

Switch 7 of DIP switch SW1 selects between standard and enhanced mode.

Standard mode

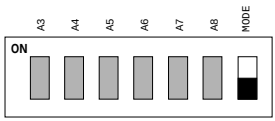


SW1

In standard mode, the I/O address of the ports are as follows:

Port	I/O address	Interrupt No
Port1	3F8	Selectable (see p.3)
Port2	2F8	Selectable (see p.3)
Port3	3E8	Selectable (see p.3)
Port4	2E8	Selectable (see p.3)

Enhanced mode



SW1

Base address selection(SW1)

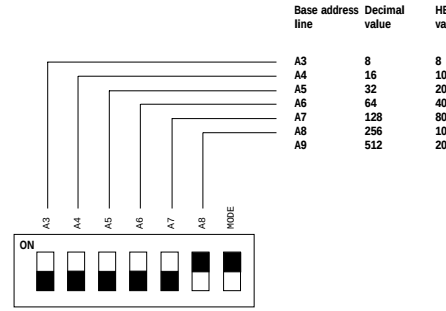
In enhanced mode, you can select a different base address. The base address determines the address for each of the four ports.

The I/O addresses for the four ports are as follows:

Port	I/O address
Port 1	Base + 00H
Port 2	Base + 08H
Port 3	Base + 10H
Port 4	Base + 18H

You use switches 1~6 of DIP switch SW1, a 7-position DIP switch, to set the base address. You can set the base address anywhere from hex 200 to 3F8.

To set the base address, you have to calculate the base address as follows:



NOTE: On the PCM-3640 the address line A9 does not appear on the DIP switch as it is permanently hard-wired to HEX 200 on the card.

The following table shows different base address settings.

Port base address (SW1)

Base address	A3	A4	A5	A6	A7	A8
200-207	●	●	●	●	●	●
208-20F	○	●	●	●	●	●
- -						
2E8-2EF	○	●	○	○	○	●
- -						
3E8-3EF	○	●	○	○	○	○
- -						
*3F8-3FF	○	○	○	○	○	○

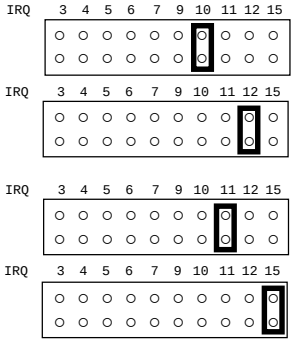
●:ON ○:OFF ***:Default**

***Note**: If your CPU module or card has serial interface ports, you will need to adjust the I/O port addresses (or disable the ports) to avoid conflicts.*

Interrupt level selection (JP1~ JP4)

You can set the interrupt level for each port from 3 to15, except 8, 13 and 14. Jumpers JP1, JP2, JP3 and JP4 sets the interrupt level for port 1, port 2, port 3 and port 4 respectively.

Simply short the pins on the jumper corresponding to the interrupt level required (as illustrated below).

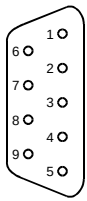


Note: *Do not use interrupts that are used by other cards/ports, unless you have made provision for interrupt sharing in your programs.*

Signal wiring

Connector pin assignments

You access the PCM-3640's ports through four external male DB-9 connectors. RS-232 connector pin assignments are as follows :



Pin	description	
1	DCD	receive line signal detector
2	RD	received data
3	TD	transmitted data
4	DTR	data terminal ready
5	GND	ground
6	DSR	data set ready
7	RTS	request to send
8	CTS	clear to send
9	RI	ring indicator

RS-232 Signal wiring

Since the RS-232 interface is not strictly defined, many devices have their own connection methods which may ignore some signal lines or define reserved lines to other functions. It is best to refer to the user's manual for your device for installation instructions. You may find the following helpful.

In general, DTE (Data Terminal Equipment) refers to the device that is leading the communication. Examples include PC's, terminals and some printers. DCE refers to the device being communicated with or controlled. Examples include modems, DSU's (digital service units), printers and lab/ factory equipment.

In some situations you may be able to get by with just three lines: data on TxD, a Signal Ground and a handshaking line. Examples are printer or plotter connections, troubleshooting and situations where you require only one-wire communication.

Terminal or PC (DTE) connections

PCM-3640 (DTE): (DB-9)		Terminal (DTE):DB-25	
Pin	**Signal**	**Pin**	**Signal**
3	TxD	3	RxD
2	RxD	2	TxD
7	RTS	5	CTS
8	CTS	4	RTS
6	DSR	20	DTR
5	GND	7	GND
4	DTR	6	DSR
1	DCD	8	DCD

Modem connections

PCm-3640: DB-9 Male		Modem (DCE)	
Pin	**Signal**	**Pin**	**Signal**
3	TxD	2	RxD
2	RxD	3	TxD
7	RTS	4	CTS
8	CTS	5	RTS
6	DSR	6	DTR
5	GND	7	GND
4	DTR	20	DSR
1	DCD	8	DCD

For DTE to DCE connection, use straight through cable connections, i.e. you don't have to reverse lines 2 and 3, lines 4 and 5, and lines 6 and 20. Because in general DCE RS-232 interfaces are reversed themselves.

Terminal without handshake

PCM-3640: DB-9 MALE		Terminal (DTE)	
Pin	Signal	Pin	Signal
3	TxD	3	RxD
2	RxD	2	TxD
7	RTS		
8	CTS		
6	DSR		
5	GND	7	GND
4	DTR		
1	DCD		

The maximum length of a RS-232 cable is 100 ft. If you need to connect over longer distances, (longer than 100 ft), you will have to use another standard (like RS-422 or RS-485).

If you do not use CTS, RTS, DSR, DTR signals, please loop them back, otherwise the PC-ComLIB software will not function correctly. PC-ComLIB always checks for handshake signals.

Hardware installation

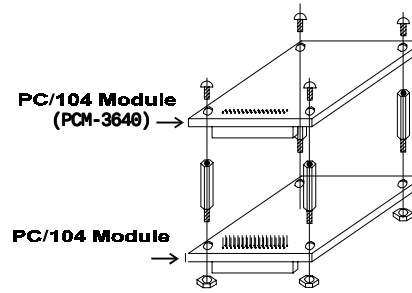
Warning! *TURN OFF your PC power supply whenever you install or remove the PCM-3640 or connect and disconnect cables.*

Installing the module on a CPU card

1. Turn the PC's power off. Turn the power off to any peripheral devices such as printers and monitors.
2. Disconnect the power cord and any other cables from the back of the computer.
3. Remove the system unit cover (see the user's guide for your chassis if necessary).
4. Remove the CPU card from the chassis (if necessary) to gain access to the card's PC/104 connector.
5. Screw the brass spacer (included with the module) into the threaded hole on the CPU card. Do not tighten too much, or the threads may be damaged.
6. Carefully align the pins of the PCM-3640 with the PC/104 connector. Slide the module into the connector. The module pins may not slide all the way into the connector; do not push too hard or the module may be damaged.
7. Secure the module to the CPU card to the threaded hole in the CPU card using the included screw.
8. Attach any accessories to the PCM-3640.
9. Reinstall the CPU card and replace the system unit cover. Reconnect the cables you removed in step 2. Turn the power on.

Connecting to another PC/104 module

1. Insert the pins of connector JP6 (on the end of the PCM-3640 module) into the piggyback connector on the other PC/104 module.



2. Screw the PCM-3640 to the brass spacer.

This completes the hardware installation.

Programming

Programming with COM1 or COM2

If you set the PCM-3640's ports as COM1 and COM2, you can send and receive data using the normal communication functions found in high-level languages. The following examples use BASIC to demonstrate PCM-3640 programming.

The BASIC communication process starts with the `OPEN "COMn: , , ..."` statement. This statement assigns a buffer for communication purposes and sets up the communication parameters.

Command format

```
OPEN "COMn: [speed][,parity][,data][,stop]
[,RS][,CS[n]][,DS[n]][,CD[n]][,LF][,PE]"
AS [#]filenum
```

Example:

```
OPEN "COM1:9600,N,8,,CS,DS,CD" AS #1
```

Where:

COMn: n is 1 or 2, indicating either COM1 or COM2

speed: An integer constant specifying the baud rate in bits per second

parity: One of the following characters:
- S: space
- O: odd
- M: mark
- E: even
- N: none

data: An integer constant indicating the number of data bits. Valid values are 4, 5, 6, 7 and 8. The default is 7.

stop: The number of stop bits. Valid values are 1 and 2. The default is 2 for 75 and 110 bps, 1 for all others.

RS: Suppresses RTS

CS: Controls CTS

DS: Controls DSR

CD: Controls CD

LF: Sends a line feed following each carriage return

PE: Enables parity checking

filenum: filenum is an integer expression which evaluates to a valid file number

You must put the speed, parity, data and stop parameters in this position and order, but you can put the RS, CS, DS, CD, LF and PE parameters in any order. The n argument in the CS, DS and CD parameters specifies the number of milliseconds to wait for the signal before returning a "device timeout" error. n may range from 0 to 65535. If you omit n or set it equal to 0, then the line status is not checked at all.

Refer to the IBM BASIC reference manual for more detailed information.

Programming example — standard COM ports

You can use the following BASIC program to test the PCM-3640's send and receive functions.

```
10   /'**************************************************
20   '* Program: DEMO01.BAS                             *
30   '* Description: This demo program transmits a      *
40   '* string through COM1 and receives it through     *
50   '* COM2                                            *
70   '**************************************************
160  'Set the proper parameters
170  'COM1 & COM2: baud rate=9600 ; no parity check;
180  'Data bit=8; stop bit=1
190  'Ignore the CTS, RTS and DSR signals.
200  OPEN "COM1:9600,N,8,1,RS,CS,DS,CD" FOR RANDOM AS #1
210  OPEN "COM2:9600,N,8,1,RS,CS,DS,CD" FOR RANDOM AS #1
220  INPUT "INPUT COMMAND:";CMD$
230  IF CMD$="Q" OR "q" THEN CLOSE:END ELSE GOSUB 250
240  GOSUB 300:GOTO 220
250  '****** Transmit data sub-routine ******
260  PRINT #1,CMD$
270  RETURN
300  '****** Receive data sub-routine ******
310  T=TIMER:TEMP$="":RX$=""
320  IF TIMER>T+.5 THEN PRINT "TIMEOUT ERROR":RETURN
330  IF LOC(2)>0 THEN TEMP$=INPUT$(1,#2) ELSE GOTO 320
340  RX$=RX$+TEMP$
350  IF TEMP$=CHR$(13) THEN GOTO 360 ELSE GOTO 320
360  PRINT "RECEIVE DATA:";RX$:RETURN
```

Using other I/O port addresses

If you are going to use I/O ports other than COM1 or COM2, you will need to directly program the registers of the PCM3640's 16C550 chip.

See page 7 for information on the format and programming of these registers. See page 8 if you have trouble finding a free I/O port base address.

You can use the following program as a base as you develop your own driver. The program exchanges data (the numbers 0 to 256) between two ports. It uses I/O port addresses hex 2E8 and 3E8. Set JP4, JP5 and JP10 for RS485 or RS-422 mode (described on page 2).

Programming example—arbitrary I/O ports

```
10   '****************************************
20   'Clear the screen
30   CLS
40   'Set the I/O port base addresses for
50   'both cards
60   PORT1%=&H2E8
70   PORT2%=&H3E8
80   'Read all registers once to
90   'clear any random data
100  FOR I=PORT1% TO PORT1%+6
110  DUM=INP(I)
120  NEXT I
130  FOR I=PORT2% TO PORT2%+6
140  DUM=INP(I)
150  NEXT I
160  'Initialize the registers of
170  'port1. First, set DLAB = 1 so the
180  'desired baud rate can be programmed.
190  OUT PORT1%+3,&H80
200  'Write the value of divisor into
210  'registers: hex 180 = dec 384 = 300 BAUD
220  OUT PORT1%,&H80:OUT PORT1%+1,&H1
230  'Set word length = 8 bits, stop bits = 2,
240  'even parity, DLAB = 0.
250  OUT PORT1%+3,&H1F
260  'Do the same thing for port2.
270  OUT PORT2%+3,&H80
280  OUT PORT2%,&H80:OUT PORT2%+1,&H1
290  OUT PORT2%+3,&H1F
300  'Loop over data (0-255) and send it
310  'from port1 to port2
320  FOR BYTE=0 TO 255
330  'Wait until the transmitter buffer
340  'is empty.
350  IF (INP(PORT1%+5) AND 32)=0 GOTO 350
360  'Output the data through port1.
370  OUT PORT1%,BYTE
380  'See if the data is available by checking
390  'the Data Ready bit.
400  IF (INP(PORT2%+5) AND 1)=0 GOTO 400
410  J=INP(PORT2%)
420  'Print out the data byte received
430  PRINT "port ";HEX$(PORT2%)" = ";HEX$(J)
440  'If the value sent <> the received value then error
450  IF J<>BYTE GOTO 620
460  NEXT BYTE
470  'Loop over data (0-255) and send it
480  'from port2 to port1.
490  FOR BYTE=0 TO 255
500  'See if the transmitter buffer is empty.
510  IF (INP(PORT2%+5) AND 32)=0 GOTO 510
520  OUT PORT2%,BYTE
530  'See if the data is available by
540  'checking the Data Ready bit.
550  IF (INP(PORT1%+5) AND 1)=0 GOTO 550
560  J=INP(PORT1%)
570  PRINT "port ";HEX$(PORT1%)" = ";HEX$(J)
580  IF J<>BYTE GOTO 620
590  NEXT BYTE
600  'If everything is OK, then stop.
610  END
620  PRINT "Data transmission error!":BEEP:END
```

Programming example—communication

The following pair of example programs show how you can set up communication between two computers. The first program sends data then receives data. The second program receives data then sends data. Run the first program on one computer and the second on another.

Program for first computer

```
10   '************ STEP 1: INITIALIZATION *************
20   'Clear screen
30   CLS
40   'Define variables A to Z as integer
50   DEFINT A-Z
60   'Set port base address (must match hardware)
70   PORT = &H3F8
80   'Set baud rate to 300
90   OUT PORT + 3, &H80
100  OUT PORT, &H80
110  OUT PORT, 1
120  OUT PORT + 3, &H1F
130  '******** STEP 2: SEND DATA ********
150  FOR I = 65 TO 90
160  '
170  GOSUB 200
180  NEXT I
190  GOTO 260
200  STATUS = INP(PORT + 5) AND &H20
210  IF STATUS = 0 THEN 200
220  OUT PORT, I
230  FOR J = 0 TO 1200: NEXT J
240  RETURN
250  '****** STEP 3: RECEIVE DATA *****
260  FOR I = 65 TO 90: GOSUB 280: NEXT I
270  END
280  STATUS = INP(PORT + 5)
290  IF (STATUS AND &H1E) THEN 280
```

```
300  IF (STATUS AND &H1) = 0 THEN 280
310  D = INP(PORT)
320  PRINT “DATA= “; CHR$(D)
330  RETURN
```

Program for second computer

```
10   ‘********** STEP1: INITIALIZATION **********
20   ‘Clear screen
30   CLS
40   ‘Define variables A TO Z as integer
50   DEFINT A-Z
60   ‘Set port base address (must match hardware)
70   PORT = &H2F8
80   ‘Set baud rate to 300
90   OUT PORT + 3, &H80
100  OUT PORT, &H80
110  OUT PORT, 1
120  OUT PORT + 3, &H1F
130  ‘***** STEP 2: RECEIVE DATA FROM ANOTHER PC *****
140  FOR I = 65 TO 90: GOSUB 190: NEXT I
150  PRINT: PRINT: PRINT
160  PRINT”DATA RECEIVES END, THEN DATA SEND BEGINNING.”
170  PRINT: PRINT “PRESS ANY KEY...”
180  IF INKEY$ = “” THEN 180 ELSE 260
190  STATUS = INP(PORT + 5)
200  IF STATUS AND &H1E THEN GOTO 190
210  IF (STATUS AND &H1) = 0 THEN 190
220  d = INP(PORT)
230  PRINT “DATA= “; CHR$(d)
240  RETURN
250  ‘*************** STEP 3: SEND DATA ***************
260  FOR I = 65 TO 90
270  d = I
280  GOSUB 310
290  NEXT I
300  END
310  STATUS = INP(PORT + 5) AND &H20
320  IF STATUS = 0 THEN 310
330  OUT PORT, d
340  FOR J = 0 TO 1200: NEXT J
350  RETURN
```

C language test program

You can use the following C program to test the PCM-3640's send and receive functions.

```
/*********************************************************/
/*  Program:  DEMO01.C                                   */
/*  Description: This demo program transmits a string    */
/*  to COM1 and receives a string from COM2              */
/*  Compiler: Turbo C 2.0                                */
/*********************************************************/

#include <dos.h>
#include <io.h>
#include <stdio.h>
#include <conio.h>

#define   TIME_OUT   10000

static   int base0 = 0x3f8;  /* Base address of port 0 */
static   int base1 = 0x2f8;  /* Base address of port 1 */
static   char rec[16]; /* Buffer for received string */
static   char cmd[16]; /* Buffer for transmitted string /

void main()
{
   int i; /* Counter for character being sent/received */
   char flag; /* Flag for end of output/input data */
   int timeout; /* Timeout counter */

   outport((base0+2), 0xc9);  /* enable port 0 FIFO */
   outport((base1+2), 0xc9);  /* enable port 1 FIFO */

   /* Set communication parameters for port 0 */
   outp(base0+3, 0x80);  /* Set DLAB=1 */
   /* Set baud = 115200 */
   outp(base0, 0x01);
   outp(base1+1, 0);
   /* Set data=8, stop=1, no parity */
   outp(base0+3, 0x03);
   /* Disable port 0 interrupt */
   outp(base0+1, 0x00);

   /* Set communication parameters for port 1 */
   outp(base1+3, 0x80);  /* Set DLAB=1 */
   /* Set baud = 115200 */
   outp(base1, 0x01);
   outp(base1+1, 0);
   /* Set data=8, stop=1, no parity */
      outp(base1+3, 0x03);
   /* Disable port 1 interrupt */
   outp(base1+1, 0x00);

   printf("\nEnter a string to be transmitted "
          "(15 characters or less) or Q to quit:");
   gets(cmd);
   while (cmd[0] != 'q' && cmd[0] != 'Q')
   {
      i=0;
      cmd[strlen(cmd)] = 0x0d;
      flag=1;
      while (flag)
      {
         outportb(base0, cmd[i]);   /* Send data */
         if (cmd[i] == 0x0d)
            flag=0;
         i++;
      }

      i=0;
      flag=1;
      timeout=TIME_OUT;
      while (flag)
      {
         /* Check if receiver data is ready */
         if ((inportb(base1+5) & 1) !=0)
         {
            rec[i]=inportb(base1);  /* Receive data */
            if (rec[i] == 0x0d)
            {
               rec[i+1]='\0';
               flag=0;
               printf(“\nReceived data: %s\n”, rec);
            }
            i++;
         }
         else
         {   /* Check timeout */
            timeout--;
            if (timeout == 0)
            {
               flag = 0;
               printf(“\nTimeout error\n”);
            }
         }
      }
      printf("\nEnter a string to be transmitted "
           "(15 characters or less) or Q to quit:");
      gets(cmd);
      }
   }
```

Register structure and format

This section gives short description of each of the module's registers. For more information please refer to the data book for the STARTECH 16C550 UART chip.

All registers are one byte. Bit 0 is the least significant bit, and bit 7 is the most significant bit. The address of each register is specified as an offset from the port base address (BASE), selected with DIP switch SW1.

DLAB is the "Divisor Latch Access Bit", bit 7 of BASE+3.

BASE+0 Receiver buffer register when DLAB=0 and the operation is a read.

BASE+0 Transmitter holding register when DLAB=0 and the operation is a write.

BASE+0 Divisor latch bits 0 - 7 when DLAB=1.

BASE+1 Divisor latch bits 8 - 15 when DLAB=1.

The two bytes BASE+0 and BASE+1 together form a 16-bit number, the divisor, which determines the baud rate. Set the divisor as follows:

Baud rate	Divisor
50	2304
75	1536
110	1047
133.5	857
150	768
300	384
600	192
1200	96
1800	64
2000	58
2400	48
3600	32
4800	24
7200	16
9600	12
19200	6
38400	3
56000	2
115200	1

BASE+1 Interrupt Status Register (ISR) when DLAB=0

- bit 0 Enable received-data-available interrupt
- bit 1 Enable transmitter-holding-register-empty interrupt
- bit 2 Enable receiver-line-status interrupt
- bit 3 Enable modem-status interrupt

BASE+2 FIFO Control Register (FCR)

- bit 0 Enable transmit and receive FIFOs
- bit 1 Clear contents of receive FIFO
- bit 2 Clear contents of transmit FIFO
- bit 3 Change RXRDY and TXRDY from mode 0 to mode 1.
- bits 6-7 Set trigger level for receiver FIFO interrupt.

Bit 7	Bit 6	FIFO trigger level
0	0	01
0	1	04
1	0	08
1	1	14

BASE+3 Line Control Register (LCR)

- bit 0 Word length select bit 0
- bit 1 Word length select bit 1

Bit 1	Bit 0	Word length (bits)
0	0	5
0	1	6
1	0	7
1	1	8

- bit 2 Number of stop bits
- bit 3 Parity enable
- bit 4 Even parity select
- bit 5 Stick parity
- bit 6 Set break
- bit 7 Divisor Latch Access Bit (DLAB)

BASE+4 Modem Control Register (MCR)

- bit 0 DTR
- bit 1 RTS

BASE+5 Line Status Register (LSR)

- bit 0 Receiver data ready
- bit 1 Overrun error
- bit 2 Parity error
- bit 3 Framing error
- bit 4 Break interrupt
- bit 5 Transmitter holding register empty
- bit 6 Transmitter shift register empty
- bit 7 At least one parity error, framing error or break indication in the FIFO

BASE+6 Modem Status Register (MSR)

- bit 0 Delta CTS
- bit 1 Delta DSR
- bit 2 Trailing edge ring indicator
- bit 3 Delta received line signal detect
- bit 4 CTS
- bit 5 DSR
- bit 6 RI
- bit 7 Received line signal detect

BASE+7 Temporary data register

PC/104 Bus signal assignments

Pin	J1/P1 Row A	J1/P1 Row B	J2/P2 Row C	J2/P2 Row D
0	-	-	0V	0V
1	IOCHCHK*	0V	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-5V	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	-12V	LA18	IRQ14
8	SD1	ENDXFR*	LA17*	DACK0*
9	SD0	+12V	MEMR*	DRQ0*
10	IOCHRDY	(KEY)[2]	MEMW*	DACK5*
11	AEN	SMEMW*	SD8	DRQ5
12	SA19	SMEMR*	SD9	DACK6*
13	SA18	IOW*	SD10	DRQ6
14	SA17	IOR*	SD11	DACK7*
15	SA16	DACK3*	SD12	DRQ7
16	SA15	DRQ3	SD13	+5V
17	SA14	DACK1*	SD14	MASTER*
18	SA13	DRQ1	SD15	0V
19	SA12	REFRESH*	(KEY)[2]	0V
20	SA11	SYSCLK	-	-
21	SA10	IRQ7	-	-
22	SA9	IRQ6	-	-
23	SA8	IRQ5	-	-
24	SA7	IRQ4	-	-
25	SA6	IRQ3	-	-
26	SA5	DACK2*	-	-
27	SA4	TC	-	-
28	SA3	BALE	-	-
29	SA2	+5V	-	-
30	SA1	OSC	-	-
31	SA0	0V	-	-
32	0V	0V	-	-

Standard PC I/O port assignments

The following chart shows the I/O addresses used by standard PC peripheral devices.

I/O address (hex)	Assignment
000-1FF	used by base system board
200	not used
201	game control
202-277	not used
278-27F	second printer port
280-2F7	not used
2F8-2FF	COM2
300-377	not used
378-37F	printer port
380-3AF	not used
3B0-3BF	monochrome adapter and printer
3C0-3CF	not used
3D0-3DF	color and graphics adapters
3E0-3EF	not used
3F0-3F7	floppy diskette drive
3F8-3FF	COM1: