COM-2(PC)F

RS-232C (2ch) Serial I/O Board

User's Guide

CONTEC

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Product Configuration

- COM-2(PC)F Board…1
- Sample Program Diskette (3.5inch/1.44MB)…1
- User's Guide (This Booklet)…1

Unpacking:

This board is specially packed in an anti-static bag to prevent damage in shipping.

Check the contents to make sure that you have everything listed above. If you do not have all the items, contact your distributor or CONTEC group office where you purchased.

Note!

Do not remove the board from its protective packaging until the computer case is open and ready for installation. Electrical static can cause damage to electrical components.

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1. Introduction

About the COM-2(PC)F Board

The COM-2(PC)F is an IBM PC/AT ISA-Bus add-on interface board for multi-channel RS-232C asynchronous communications. It features two serial communication ports and a programmable communication rate ranging from 50 to 115,200 bps for communication or modem control.

Support Software of Option

- For Windows API-PAC(W32)
- For Windows 3.1 API-SIO(PC)WIN
- For MS-DOS SUPPORT-PAC(PC)103

Features

- 2-channel asynchronous communication
- Supports RS-232C protocol
- Programmable communication rate from 50 to 115,200 bits per second
- Two operational modes : Enhanced and Compatible (COM1, COM2, COM3, and COM4)

For more information, see System Reference.

Limited Three-Year Warranty

CONTEC Interface boards are warranted by CONTEC Co., LTD to be free from defects in material and workmanship for up to three years from the date of purchase by the original purchaser.

Repair will be free of charge only when this device is returned freight prepaid with a copy of the original invoice and a Return Merchandise Authorization to the distributor or the CONTEC group office, from which it was purchased.

This warranty is not applicable for scratches or normal wear, but only for the electronic circuitry and original boards. The warranty is not applicable if the device has been tampered with or damaged through abuse, mistreatment, neglect, or unreasonable use, or if the original invoice is not included, in which case repairs will be considered beyond the warranty policy.

How to Obtain Service

For replacement or repair, return the device freight prepaid, with a copy of the original invoice. Please obtain a Return Merchandise Authorization Number (RMA) from the CONTEC group office where you purchased before returning any product.

No product will be accepted by CONTEC group without the RMA number.

Liability

The obligation of the warrantor is solely to repair or replace the product. In no event will the warrantor be liable for any incidental or consequential damages due to such defect or consequences that arise from inexperienced usage, misuse, or malfunction of this device.

About the Manual

This manual consists of the following chapters :

Chapter 1 Introduction

Chapter 2 How to Use the Board

Chapter 3 Hardware Setup

Chapter 4 I/O Ports and Registers

Chapter 5 System Reference

Chapter 6 Troubleshooting

Chapter 7 Index

2. How to Use the Board

Compatible Mode and Enhanced Mode

The COM-2(PC)F supports Compatible mode and Enhanced mode. In Compatible mode, the board channels operate as standard PC serial ports. In Enhanced mode, the board operates under CONTEC's proprietary control procedures. Give full consideration to the features of each mode when selecting which mode to use in your system.

Compatible Mode

The two channels of the COM-2(PC)F can be used as standard PC serial ports. Channel CN1 of the COM-2(PC)F can be assigned as COM1 or COM3, and channel CN2 can be assigned as COM2 or COM4.

In Compatible mode, each channel uses one interrupt level. Therefore, your PC must have at least two interrupt levels available. The COM-2(PC)F uses the I/O addresses assigned to the standard serial ports.

As the COM-2(PC)F channels operate as standard serial ports, the board can be accessed using either the CONTEC driver software (purchased separately) or some other driver software that supports standard serial ports.

Enhanced Mode

The COM-2(PC)F operates under CONTEC's proprietary control procedures.

In Enhanced mode, a single interrupt level is used to control both channels. Therefore, the board can be used even if your PC has only one free interrupt level available. The I/O address used is specified by CONTEC.

As the board operates under CONTEC's proprietary control procedures, you must use the CONTEC driver software (purchased separately) or develop your own driver software. Programming for Enhanced mode is different to programming for Compatible mode.

Operating under Windows Me/98

This section describes the procedure for using the board under Windows Me/98 and lists a number of points to note.

Procedure

When using the board under Windows Me/98, the OS must be set to recognize the I/O address and interrupt level used by the COM-2(PC)F. In Windows Me/98, this is called hardware installation. Use the following installation procedure.

Check the Current Settings

First, check the current settings. Check which interrupt levels are available. If using in Compatible mode, also check which COM ports (COM1 to COM4) are already set. The COM-2(PC)F cannot be assigned to a COM port that is already set. The procedure for checking is as follows.

- Check the interrupt level

1. Select [System] from [Control Panel] and open [Device Manager].
2. Select the [Computer] folder and click [Properties].
3. Display the [Interrupt request(IRQ)] list and check which interrupt levels are available.

- Check the ports

1. Select [System] from [Control Panel] and open [Device Manager].
2. Double click on the [Ports (COM & LPT)], [Infrared], [Modem] folder and check which ports are already set.

Compatible Mode Installation Procedure 1

1. Set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup. Set an interrupt level that is not currently used by the computer.

2. Insert the COM-2(PC)F in an expansion slot and turn on the power to the PC.

3. After Windows Me/98 starts, select [Control Panel] from [My Computer] and start the [Add New Hardware].

4. Click [Next >] in response to [To begin installing your new hardware, click Next] in the Add New Hardware Wizard.

5. Select [Yes (Recommended)] in response to [Do you want Windows to search for your new hardware ?].

6. After following the instructions and completing detection, use [Details...] to check that the standard serial ports have been detected.

7. Next, click [Finish] and restart your computer.
(When Windows Me is used, it doesn't need to restart.)

8. After rebooting, use the procedure described in the "Check Resources" section below to check the interrupt level assigned to the COM-2(PC)F. If the value is different to the level set on the jumper, correct the setting in the OS.

9. When installing by this method, the COM-2(PC)F channels are installed as standard serial ports (COM*).

Compatible Mode Installation Procedure 2

1. Turn on the power to the PC without inserting the COM-2(PC)F in an expansion slot.
2. After Windows Me/98 starts, select [Control Panel] from [My Computer] and start the [Add New Hardware].
3. Click [Next >] in response to [To begin installing your new hardware, click Next] in the Add New Hardware Wizard.
4. Select [No] in response to [Do you want Windows to search for your new hardware ?].
5. Select the [Ports (COM & LPT)] folder from the [Hardware types:] screen.
6. Select [Communication Port] from [Models:] and click on [Have Disk...] in the screen.
7. When the [Install From Disk] screen appears, place the floppy disk in the drive, enter the drive name in [Copy manufacturer's file from:], then click [OK].
8. The next screen displays the board type. Select [CONTEC Co., Ltd. - COM-2(PC)F, V, H Compatible] from [Models:].
9. Next, the resource items and settings are displayed. Take a note of the displayed I/O address and interrupt level.
10. End the operation as instructed. This completes the installation of one port. When using both ports in Compatible mode, repeat the procedure from step 2. If the interrupt level used by a COM-2(PC)F port is already used on the PC, change the interrupt level to an available level.
11. Turn off the power, then set the operation mode (I/O address) and interrupt level on the COM-2(PC)F to the values set in steps 9 and 10 above. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

Enhanced Mode Installation Procedure

When it is used with Enhanced Mode, API-PAC(W32) of the option is necessary. Refer to Help "HWINSTE.HLP" of the way of registering the hardware being attached to API-PAC(W32) for the way of installing it.

Check Resources

Always check the PC resources (I/O address and interrupt level) assigned to the COM-2(PC)F before actually using the board. Use the following procedure to check the resources managed by the OS.

1. Select [System] from [Control Panel] and click [Hardware] property sheet, then open [Device Manager].
2. For Compatible mode, double click on the [Ports (COM & LPT)] folder. For Enhanced mode, double click on the [Multi-function adapters] folder.
3. Double click on the [CONTEC Co., Ltd. - COM-2(PC)F] or [COM*] folder to display the properties screen.
4. Select [Resources]. Check the resource items and settings, and look for any conflicts.
5. Disable [Use automatic settings] first if changing the settings. If changing an I/O address, change the Basic configuration from the [Setting based on:]. To change an interrupt level, click on [Change setting...]. After checking the resources, check again that the interrupt level value on the COM-2(PC)F board match the settings in the OS.

Operating under Windows 95

This section describes the procedure for using the board under Windows 95 and lists a number of points to note.

Procedure

When using the board under Windows 95, the OS must be set to recognize the I/O address and interrupt level used by the COM-2(PC)F. In Windows 95, this is called hardware installation. Use the following installation procedure.

Check the Current Settings

First, check the current settings. Check which interrupt levels are available. If using in Compatible mode, also check which COM ports (COM1 to COM4) are already set. The COM-2(PC)F cannot be assigned to a COM port that is already set. The procedure for checking is as follows.

- Check the interrupt level

1. Select [System] from [Control Panel] and open [Device Manager].
2. Select the [Computer] folder and click [Properties].
3. Display the [Interrupt request(IRQ)] list and check which interrupt levels are available.

- Check the ports

1. Select [System] from [Control Panel] and open [Device Manager].
2. Double click on the [Ports (COM & LPT)] folder and check which ports are already set.

Compatible Mode Installation Procedure 1

1. Set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup. Set an interrupt level that is not currently used by the computer.

2. Insert the COM-2(PC)F in an expansion slot and turn on the power to the PC.

3. After Windows 95 starts, select [Control Panel] from [My Computer] and start the [Add New Hardware].

4. Click [Next >] in response to [To begin installing your new hardware, click Next] in the Add New Hardware Wizard.

5. Select [Yes (Recommended)] in response to [Do you want Windows to search for your new hardware ?].

6. After following the instructions and completing detection, use [Details...] to check that the standard serial ports have been detected.

7. Next, click [Finish] and restart your computer.

8. After rebooting, use the procedure described in the "Check Resources" section below to check the interrupt level assigned to the COM-2(PC)F. If the value is different to the level set on the jumper, correct the setting in the OS.

9. When installing by this method, the COM-2(PC)F channels are installed as standard serial ports (COM*).

Compatible Mode Installation Procedure 2

1. Turn on the power to the PC without inserting the COM-2(PC)F in an expansion slot.
2. After Windows 95 starts, select [Control Panel] from [My Computer] and start the [Add New Hardware].
3. Click [Next >] in response to [To begin installing your new hardware, click Next] in the Add New Hardware Wizard.
4. Select [No] in response to [Do you want Windows to search for your new hardware ?].
5. Select the [Ports (COM & LPT)] folder from the [Hardware types:] screen.
6. Select [Communication Port] from [Models:] and click on [Have Disk...] in the screen.
7. When the [Install From Disk] screen appears, place the floppy disk in the drive, enter the drive name in [Copy manufacturer's file from:], then click [OK].
8. The next screen displays the board type. Select [CONTEC Co., Ltd. - COM-2(PC)F, V, H Compatible] from [Models:].
9. Next, the resource items and settings are displayed. Take a note of the displayed I/O address and interrupt level.
10. End the operation as instructed. This completes the installation of one port. When using both ports in Compatible mode, repeat the procedure from step 2. If the interrupt level used by a COM-2(PC)F port is already used on the PC, change the interrupt level to an available level.
11. Turn off the power, then set the operation mode (I/O address) and interrupt level on the COM-2(PC)F to the values set in steps 9 and 10 above. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

Enhanced Mode Installation Procedure

When it is used with Enhanced Mode, API-PAC(W32) of the option is necessary. Refer to Help "HWINSTE.HLP" of the way of registering the hardware being attached to API-PAC(W32) for the way of installing it.

Check Resources

Always check the PC resources (I/O address and interrupt level) assigned to the COM-2(PC)F before actually using the board. Use the following procedure to check the resources managed by the OS.

1. Select [System] from [Control Panel] and open [Device Manager].
2. For Compatible mode, double click on the [Ports (COM & LPT)] folder. For Enhanced mode, double click on the [Multi-function adapters] folder.
3. Double click on the [CONTEC Co., Ltd. - COM-2(PC)F] or [COM*] folder to display the properties screen.
4. Select [Resources]. Check the resource items and settings, and look for any conflicts.
5. Disable [Use automatic settings] first if changing the settings. If changing an I/O address, change the Basic configuration from the [Setting based on:]. To change an interrupt level, click on [Change setting...]. After checking the resources, check again that the interrupt level value on the COM-2(PC)F board match the settings in the OS.

Operating under Windows 2000

This section describes the procedure for using the board under Windows 2000 and lists a number of points to note.

Procedure

When using the board under Windows 2000, the OS must be set to recognize the I/O address and interrupt level used by the COM-2(PC)F. In Windows 2000, this is called hardware installation. Use the following installation procedure.

Check the Current Settings

First, check the current settings. Check which interrupt levels are available. If using in Compatible mode, also check which COM ports (COM1 to COM4) are already set. The COM-2(PC)F cannot be assigned to a COM port that is already set. The procedure for checking is as follows.

- Check the interrupt level

1. Select [System] from [Control Panel] and click [Hardware] property sheet, then open [Device Manager].
2. Select the [View] and click [Resource by type].
3. Display the [Interrupt request(IRQ)] list and check which interrupt levels are available.

- Check the ports

1. Select [System] from [Control Panel] and click [Hardware] property sheet, then open [Device Manager].
2. Double click on the [Ports (COM & LPT)] [Infrared], [Modem] folder and check which ports are already set.

Compatible Mode Installation Procedure 1

It can't be used with Compatible Mode when API-SIO(98/PC)NT of packing together is used for API-PAC(W32).

1. Set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup. Set an interrupt level that is not currently used by the computer.
2. Insert the COM-2(PC)F in an expansion slot and turn on the power to the PC.
3. After Windows 2000 starts, select [Control Panel] from [My Computer] and start the [Add/Remove Hardware].
4. Click [Next >] in response to [Welcome to the Add/Remove Hardware Wizard] in the Add/Remove Hardware Wizard.
5. Select [Add/Troubleshoot a device] in response to [Choose a Hardware Task].
6. The next, select [Add a New Device] and click [Next].
7. Select [Yes] in response to [Do you want Windows to search for your new hardware ?], and click [Next].
8. It confirms that two [Install Communications Port] sentences are indicated on the [Detected Hardware], and click [Next].
9. After rebooting, use the procedure described in the "Check Resources" section below to check the interrupt level assigned to the COM-2(PC)F. If the value is different to the level set on the jumper, correct the setting in the OS.
10. When installing by this method, the COM-2(PC)F channels are installed as standard serial ports (COM*).

Compatible Mode Installation Procedure 2

It can't be used with Compatible Mode when API-SIO(98/PC)NT of packing together is used for API-PAC(W32).

1. Turn on the power to the PC without inserting the COM-2(PC)F in an expansion slot.
2. After Windows 2000 starts, select [Control Panel] from [My Computer] and start the [Add/Remove Hardware].
3. Click [Next >] in response to [Welcome to the Add/Remove Hardware Wizard] in the Add/Remove Hardware Wizard.
4. Select [Add/Troubleshoot a device] in response to [Choose a Hardware Task].
5. The next, select [Add a New Device] and click [Next].
6. Select [No] in response to [Do you want Windows to search for your new hardware ?], and click [Next].
7. Select the [Ports (COM & LPT)] folder from the [Hardware types:] screen.
8. Click [Hard Disk], and the [Install From Disk] screen appears, place the floppy disk in the drive, enter the drive name in [Copy manufacturer's file from:], then click [OK].
9. The next screen displays the board type. Select [CONTEC Co., Ltd. - COM-2(PC)F, V, H Compatible] from [Models:].
10. Next, the resource items and settings are displayed. Take a note of the displayed I/O address and interrupt level.
11. End the operation as instructed. This completes the installation of one port. When using both ports in Compatible mode, repeat the procedure from step 2. If the interrupt level used by a COM-2(PC)F port is already used on the PC, change the interrupt level to an available level.
12. Turn off the power, then set the operation mode (I/O address) and interrupt level on the COM-2(PC)F to the values set in steps 10 and 11 above. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

Enhanced Mode Installation Procedure

When it is used with Enhanced Mode, API-PAC(W32) of the option is necessary. Refer to Help "HWINSTE.HLP" of the way of registering the hardware being attached to API-PAC(W32) for the way of installing it.

Check Resources

Always check the PC resources (I/O address and interrupt level) assigned to the COM-2(PC)F before actually using the board. Use the following procedure to check the resources managed by the OS.

1. Select [System] from [Control Panel] and click [Hardware] property sheet, then open [Device Manager].
2. For Compatible mode, double click on the [Ports (COM & LPT)] folder. For Enhanced mode, double click on the [Multi-function adapters] folder.
3. Double click on the [CONTEC Co., Ltd. - COM-2(PC)F] or [COM*] folder to display the properties screen.
4. Select [Resources]. Check the resource items and settings, and look for any conflicts.
5. Disable [Use automatic settings] first if changing the settings. If changing an I/O address, change the Basic configuration from the [Setting based on:]. To change an interrupt level, click on [Change setting...]. After checking the resources, check again that the interrupt level value on the COM-2(PC)F board match the settings in the OS.

Operating under Windows NT

This section describes the procedure for using the board under Windows NT and lists a number of points to note.

Procedure

First, set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

When using the board in compatible mode, the OS must be set to recognize the I/O address and interrupt level used by the COM-2(PC)F. Use the Ports icon in Control Panel to set the I/O address and interrupt level.

The I/O address and interrupt level used by the COM-2(PC)F do not need to be set for the OS when using the board in enhanced mode.

Operating under Windows 3.1

This section describes the procedure for using the board under Windows 3.1 and lists a number of points to note.

Procedure

First, set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

When using the board in Compatible mode, the OS must be set to recognize the I/O address and interrupt level used by the COM-2(PC)F. Use the Ports icon in Control Panel to set the I/O address and interrupt level.

The I/O address and interrupt level used by the COM-2(PC)F do not need to be set for the OS when using the board in Enhanced mode.

Operating under MS-DOS

This section describes the procedure for using the board under MS-DOS and lists a number of points to note.

Procedure

First, set the operation mode (I/O address) and interrupt level for the COM-2(PC)F. Set the COM-2(PC)F switch and jumpers as described in Hardware Setup.

When using the board in Compatible mode, the system area of the PC must be set to recognize the I/O address used by the COM-2(PC)F. If a system configuration program or the MODE.COM command is available on the PC, use the program to set the I/O addresses for the standard serial ports. If neither a system configuration program nor the MODE.COM command is available, use the SETCOM.EXE program provided on the floppy disk to set the I/O addresses for the standard serial ports as shown below. Set the I/O address to "NONE" for unused serial ports.

```
C>SETCOM     [COM1 I/O address] [COM2 I/O address]
             [COM3 I/O address] [COM4 I/O address]
```

Example:

```
C>SETCOM 3F8 2F8 NONE NONE
COM-2(PC) series compatible mode setting software  by CONTEC

I/O address data: COM1:[3F8] COM2:[2F8] COM3:[NONE] COM4:[NONE]

C>
```

The I/O addresses used by the COM-2(PC)F do not need to be set for the system area of the PC when using the board in Enhanced mode.

Note!

When used in Compatible mode, COM3 and COM4 are not supported by some programming languages. Check the specifications of the language you are using. Table 2.1. lists the COM ports supported by a number of common programming languages.

Table 2.1. COM Port Support for Various Programming Languages

Language	COM1	COM2	COM3	COM4
Microsoft C	O	O	O	O
Quick BASIC	O	O	×	×
GW-BASIC	O	O	×	×
Turbo Pascal	O	O	O	O

If writing your own driver software, see "Appendix B : Notes on Developing Driver Software".

3. Hardware Setup

Names of Board Components

Figure 3.1. shows the names of various board components.
The switch and jumper settings shown in the figure are the default factory settings.

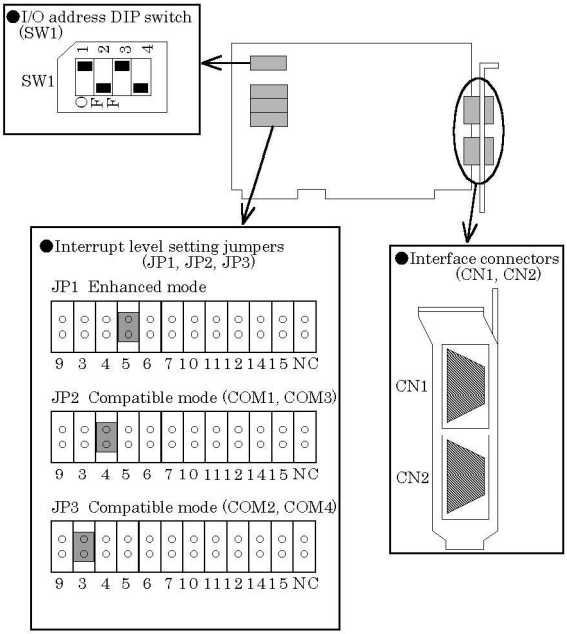


Figure 3.1. Names of Board Components and Default Factory Settings

I/O Address Setting

The board is an I/O device controlled by I/O instructions from the PC. I/O devices include expansion boards and devices inside the PC. The various devices are identified by their I/O addresses. I/O addresses are represented as four digit hexadecimal values (e.g. 02A0H) and act as the ID number for each I/O device.

Most expansion boards are controlled via a range of consecutive I/O addresses. The address of the first I/O address in the range is called the base I/O address.

When using Enhanced mode, either 1A0H or 2A0H is selected as the base I/O address. In Compatible mode, the fixed address for the PC system is used.

Notes!

1. *When using more than one expansion board, set each board so that their I/O addresses do not overlap.*
2. *If the PC already has COM1 to COM4 ports, those ports cannot be set for the board.*

Setting Procedure

The I/O address is set using a DIP switch (SW1) on the board.

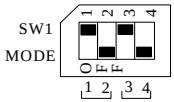


Figure 3.2. I/O Address DIP Switch

Table 3.1. I/O Address Settings

	SW1		Function	I/O Address	Interrupt Vector Register Address
	Bit 1	Bit 2			
CN1	ON	ON	Enhanced	1A0~1A7	1BF
		OFF	Enhanced	2A0~2A7	2BF
	OFF	ON	COM3	3E8~3EF	---
		OFF	COM1	3F8~3FF	---

	SW1		Function	I/O Address	Interrupt Vector Register Address
	Bit 3	Bit 4			
CN2	ON	ON	Enhanced	1A8~1AF	1BF
		OFF	Enhanced	2A8~2AF	2BF
	OFF	ON	COM4	2E8~2EF	---
		OFF	COM2	2F8~2FF	---

Figure 3.2 shows the CN1 bace I/O address set to 2A0H and the CN2 bace I/O address set to 2A8H.

Interrupt Level Setting

The signal from the LSI (NS16550 equivalent) on the board can be used as an interrupt request signal based on the JP1, JP2, and JP3 settings.

Note!

When using interrupts, set an interrupt level that is not used by any other device.

Setting Procedure

When not Using Interrupts

Place a short connector on the NC pin of each jumper (JP1, JP2, and JP3).

When Using Interrupts

Connect the interrupt level using the short connector on each jumper (JP1, JP2, and JP3). Available interrupt levels are IRQ3 to 7, 9 to 12, 14, and 15.

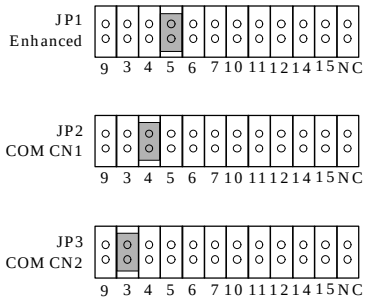


Figure 3.3. Interrupt Level Settings

If SW1 selects Enhanced mode, the settings in Figure 3.3. specify that CN1 and CN2 both use IRQ5. If Compatible mode is set, the settings specify that CN1 uses IRQ4 and CN2 uses IRQ3.

Note!

Jumper of the mode which isn't used is to connect a short connector to the NC pin.

Table 3.2. lists the I/O address and standard interrupt level settings for COM1 to COM4 (Compatible mode).

Table 3.2. Example Compatible Mode Settings

Port	I/O Address	Interrupt Level	
COM1	3F8~3FF	IRQ4	
COM2	2F8~2FF	IRQ3	
COM3	3E8~3EF	IRQ4	*1
COM4	2E8~2EF	IRQ3	

*1 On the IBM PS/55Z and similar, COM3 uses IRQ3.

Note!

If using the PC's RS-232C ports as COM 1 and COM 2 at the same time as using the CONTEC board as COM3 and COM4, COM3 and COM4 must be set to interrupt levels other than IRQ3 and IRQ4 because COM1 uses IRQ4 and COM2 uses IRQ3.

Mounting Method

There are many kinds of boards that can be mounted in a computer's extension slots, however the mounting method is identical for any slot.

Before starting

(1) Set the Power switch to OFF.

(2) Unplug the power cable from the AC outlet.

Mounting the board

(1) Remove the screws from the rear of the computer. When removing screws, use a screwdriver that matches the screw heads.

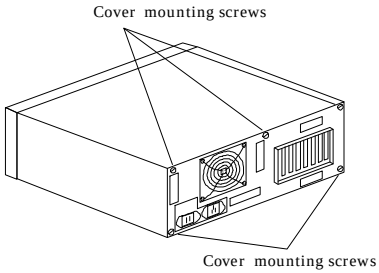


Figure 3.4. Rear Panel of IBM-PC/AT

(2) Hold the left and right sides of the front cover and remove it from the computer's chassis by sliding it to the front.

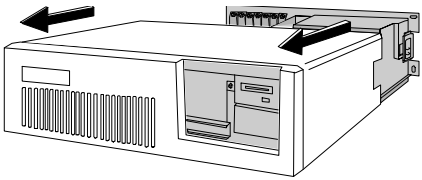


Figure 3.5. Removing the Cover

(3) Remove the screw retaining the cover of the slot where the board is to be mounted, and remove the cover from the rear panel.

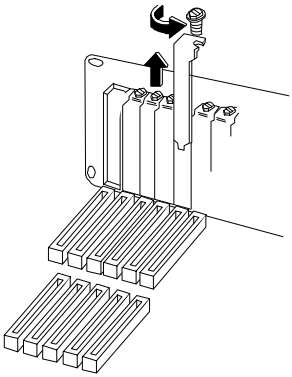


Figure 3.6. Expansion Slot Cover

Caution!

To prevent a discharge of static electricity from damaging the board, it is important to ground yourself. Hold the packaged board in one hand and touch an unpainted, grounded metal surface with the other hand. Then, hold the non-conductive part of the board and remove it from the bag. Don't touch the underside side of the board with the exposed pins and solder. Place the board on a clean, non-conductive surface.

(4) Remove the board from the anti-static packaging.

(5) Inspect the board. Check the board for any visible damage or loose parts. If you notice any problems with the board, contact CONTEC. Don't attempt to fix the board yourself. CONTEC does not warranty boards damaged or worked-on by the customers.

(6) Insert the board into the expansion slot and press in firmly. Make sure the board is fully seated in the support bracket.

(7) Anchor the board with the screw. Use the screw set aside in step 3. Tighten so that the board is held in place.

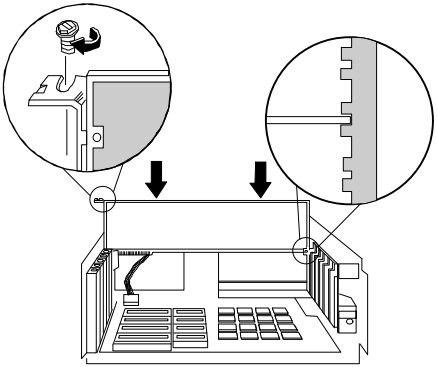


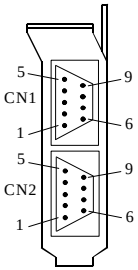
Figure 3.7. Anchoring the COM-2(PC)F

(8) Replace the computer cover.

(9) Connect the power cord.

Connecting the External Devices

Connecting the COM-2(PC)F board to external devices is via two 9-pin D-SUB connector (male) on the board.



On-board Connector : DELC-J9PAF-20L9 (Male) [mfd. by JAE]

Application Connector : 17JE-13090-02 (D8C) (Female) [mfd. by DDK]

Figure 3.8. Interface Connectors (CN1 and CN2)

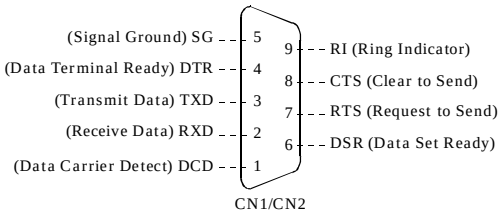


Figure 3.9. CN1 and CN2 Pin Assignments

Connecting the Cable

The RS-232C interface requires that you use a different type of cable depending on the type of device being connected. For example, modem connections and computer (PC) connections require different cables. Accordingly, check the specifications of the external device to which you are connecting and select the appropriate type of cable. The two types of cable are "straight-through" and "crossed". Also, if the signal lines require conditioning in the connector, provide conditioning in accordance with the specifications.

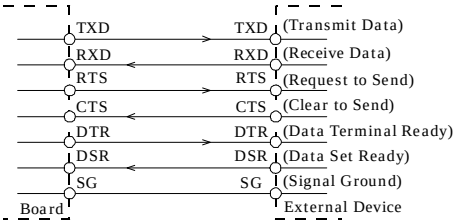


Figure 3.10. Example Connection to a Modem

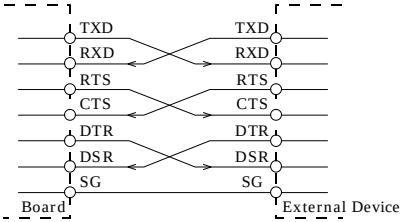


Figure 3.11. Example Connection to a PC

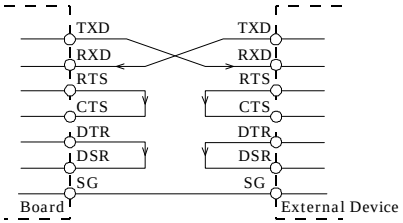


Figure 3.12. Example Connection to a Device

4. System Reference

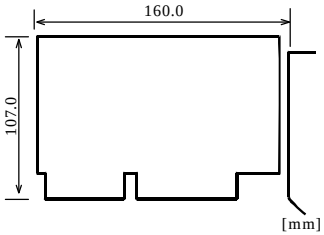
Specifications

Table 4.1. Specifications

Item	Specification
Number of Channels	2
Input Type	RS-232C
External connectors	Two 9-pin D-SUB connector (Male)
Transfer Method	Asychronous serial transfer
Baud Rate	50~115,200bps *1
Data Length	5, 6, 7, 8 bits 1, 1.5, 2 stop bits *1
Parity heck	Even, Odd, Non-parity *1
Controller Chip	NS16550 or equivalent
Distance	15m Max.
Interrupt Requests	Enhanced mode : 1 level Compatible mode : 2 levels
I/O Address	8 bits x 16 ports
Power Consumption	+5VDC, 420mA Max.
	+12VDC, 60mA Max.
	-12VDC, 50mA Max.
Operating Temperature	0~50°C
Storage Temperature	-20~60°C
Relative Humidity	20~90% non-condensing
Dimensions	160.0 x 107.0 x 18.5mm (6.3inch x 4.2inch x 0.7inch)
Weight	130g

*1 : Software programmable.
For details, see "Appendix B Notes on Developing Driver Software" or refer to the data sheet of the NS16550 or the equivalent chip.

Board Dimensions



Circuitry Diagrams

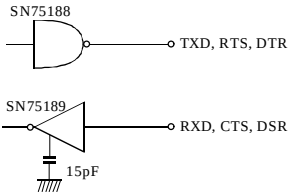


Figure 4.1. Circuitry Diagrams

Block Diagram

The following is a block diagram of the COM-2(PC)F interface board.

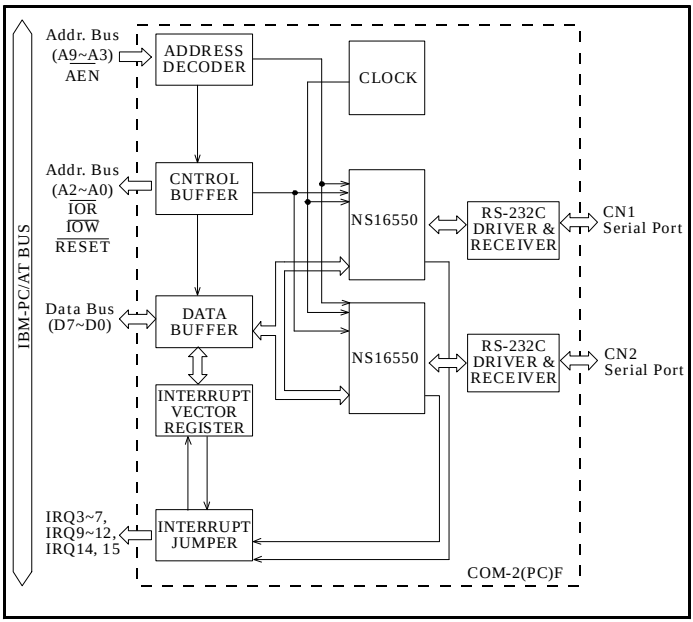


Figure 4.2. COM-2(PC)F Block Diagram

5. Troubleshooting

If you are having trouble with your board or program, answer the following questions to see if you can find the problem.

QUESTIONS:

STEPS TO TAKE

Is the pilot light on?

The system must be turned on and the power supply must be working. Check the main power switch and the power supply.

Did the system boot up?

If the board has been installed and the system did not boot, check the following:

- Make sure the board has been inserted firmly. Pull it out and try to reboot. If your system reboots, then re-insert the board and try to boot again.
- Check that cables attached to your other boards fit tightly.

Does your program work?

If the system booted and your program does not work, check the following:

- DIP switches have been set correctly for the desired base address.
- Selected base address doesn't conflict with another peripheral device or card installed in the computer.
- Selected interrupt levels don't conflict with interrupts required by other devices or cards.
- Try one of the sample programs provided on the disk and see if it works.

Does the sample program work?

Check the following:

- Signals are connected to the correct pins.
- Pin connections on the I/O cables are secure.
- Signals are present at the external connectors.
- Try using the COM-2(PC)F board with other non-essential boards removed. Remove other boards one by one, checking the COM-2(PC)F for successful operation after each board is removed.

Is the input data accurate?

If you believe something is wrong with either the input data or the output data, check the following:

- Environmental noise. Move the equipment and cables away from sources of electrical noise. Try an isolated power source.
- Dirty connector edge. Clean the edge.
- External connectors fit tightly. Separate and reattach external cables.

Still have a probrem?

Contact CONTEC group office where you purchased as shown in the last page of this manual.

Note!

Before you call, make a list of the following information. Our technical representatives will need the following information to help you.

1. Your name, company, and phone number.

2. The brand and type of computer you are using (e.g. IBM-AT, Compaq 386).

3. DOS Version.

4. Name of the CONTEC board that you are using.

5. Names of other boards in the computer.

6. I/O addresses for the CONTEC board and all other boards.

7. Interrupt levels for the CONTEC board and all other boards.

8. DMA channels for the CONTEC board and all other boards (if applicable).

9. The programming language that you are using (and the version number).

10. Different I/O addresses you have tried.

11. Are you using your own program or a CONTEC sample program.

12. List AUTOEXEC.BAT.

13. List CONFIG.SYS.

6. Appendix

A. Sample Programs (for MS-DOS)

This section covers the sample programs that are supplied on the floppy disk included with this board.

COM-2(PC)F Diskette

CONTEC supplies a sample program diskette with each COM-2(PC)F board. This diskette contains sample programs to help you get started.

Use the DOS DIR command to see a list of files on the COM-2(PC)F diskette.

```
A> dir
```

Backup Copy

Make a backup of the COM-2(PC)F diskette before use. This will protect you if the original copy becomes damaged or destroyed. Use the DOS DISKCOPY command.

```
A> diskcopy a: b:
```

Keep the original in a safe place and use the backup copy for the following procedures.

Copy Files to Hard Disk

If a hard disk drive is available on your PC, then installing and executing the sample programs from the hard disk drive will be faster than using a floppy drive. To run sample programs from the hard drive, create a subdirectory named COM2F on your C drive and copy the files from A: to C: with the following commands.

```
A:> c:
C:> md com2f
C:> xcopy A:¥*.* c:¥com2f /s
```

Sample Programs

The programs are written in GW-BASIC and Microsoft C.
The sample programs transmit data entered from the keyboard and display received data on the screen. Table 6.1. lists the communications data format.

The sample programs listed in Figure 6.1. are included on the floppy disk.

Table 6.1. Data Format

Parameter	Data Format
Data bits	8 bits
Stop bits	2 bits
Parity	None

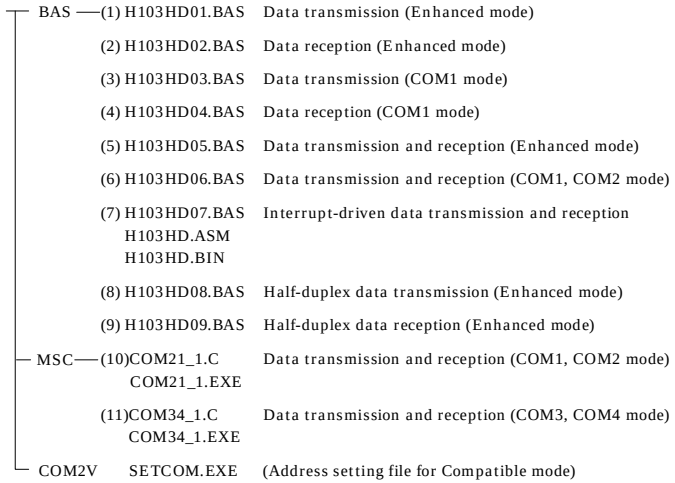


Figure 6.1. Floppy Disk Files

Notes!

- *All the sample programs must be run on a PC operating under MS-DOS.*
- *Sample programs 3, 4, 6, and 10 cannot be used on a PC that already has COM1 and COM2 ports. Similarly, sample programs 11 cannot be used on a PC that already has COM3 and COM4 ports.*
- *As sample programs 8 and 9 use half-duplex mode, they can only be used with the COM-2PD(PC) board.*

Switch and Jumper Settings

Table 6.2. Switch and Jumper Settings of Sample Program 1, 2, and 5

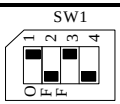
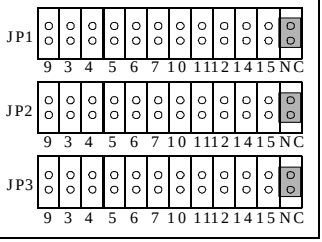
Item	Settings
I/O Address (SW1)	
Interrupt Level (JP1, JP2, JP3)	

Table 6.3. Switch and Jumper Settings of Sample Program 3, 4, 6, and 10

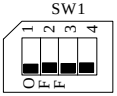
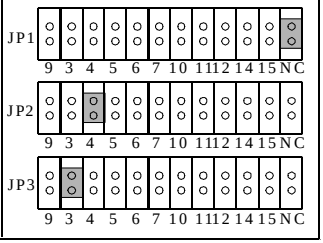
Item	Settings
I/O Address (SW1)	
Interrupt Level (JP1, JP2, JP3)	

Table 6.4. Switch and Jumper Settings of Sample Program 7

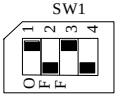
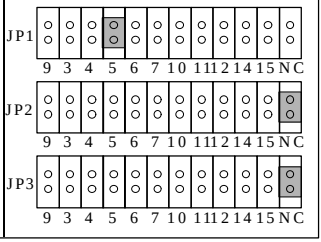
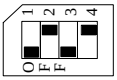
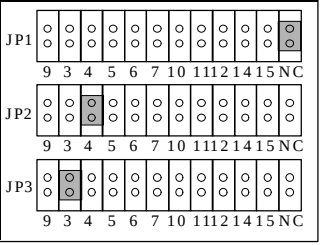
Item	Settings
I/O Address (SW1)	
Interrupt Level (JP1, JP2, JP3)	

Table 6.5. Switch and Jumper Settings of Sample Program 11

Item	Settings
I/O Address (SW1)	
Interrupt Level (JP1, JP2, JP3)	

Cable Connection

When running the sample programs 1 to 11 (except 8 and 9), use the interconnection cable as shown in Figure 6.2. for connection with the mating device in the Compatible mode. For use in the Enhanced mode, on the other hand, use the cross cable or the interconnection configuration diagram in Figure 6.2.

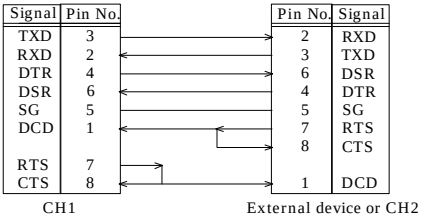


Figure 6.2. 9-pin Connector Diagram

Sample Program 1

This GW-BASIC sample program demonstrates the transmit-data capability of COM-2(PC)F in Enhanced mode. First, it initializes the Asynchronous Communication Element (ACE), then it transmits the data input from the keyboard to the external device through channel 1 (CN1).

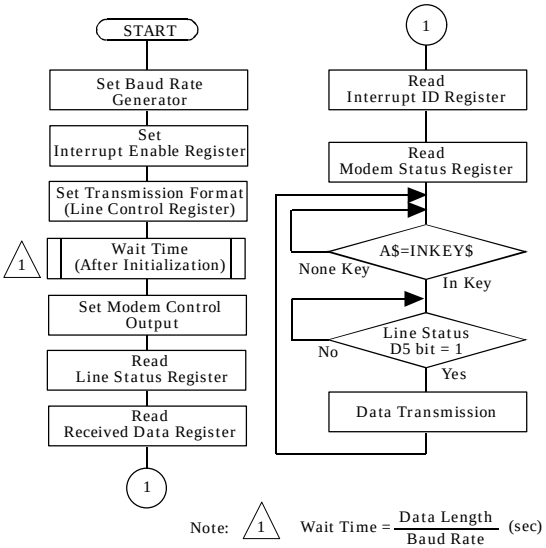


Figure 6.3. Flowchart of Sample Program 1

Sample Program 2

This GW-BASIC sample program demonstrates the receive-data capability of COM-2(PC)F in Enhanced mode. First, it initializes the ACE, then it transmits the data input from the external device to CRT through CN1.

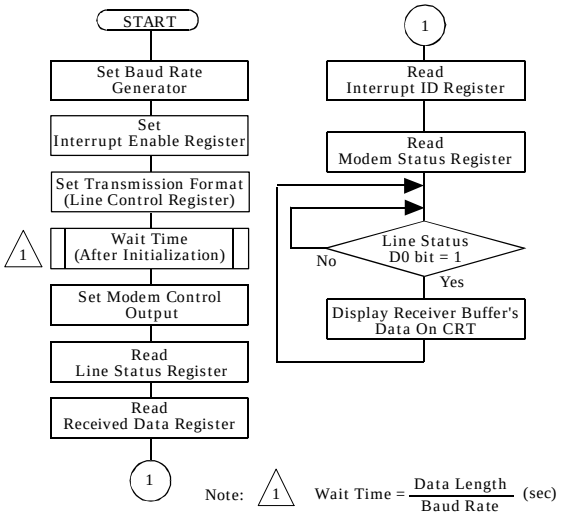


Figure 6.4. Flowchart of Sample Program 2

Sample Program 3

This GW-BASIC sample program demonstrates the transmit-data capability of COM-2(PC)F in Compatible mode. Using this [OPEN "COM1 : 9600, N, 8, 2, DS" AS #1] command opens the RS-232C communication file (COM1). It then writes the data input from the keyboard to COM1 through CN1.

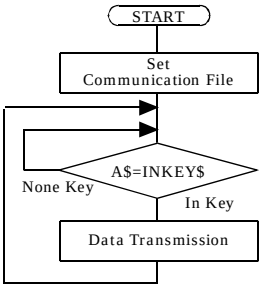


Figure 6.5. Flowchart of Sample Program 3

Sample Program 4

This GW-BASIC sample program demonstrates the receive-data capability of COM-2(PC)F in Compatible mode. Using this [OPEN "COM1 : 9600, N, 8, 2, DS" AS #1] command opens the RS-232C communication file (COM1). It then reads the data from COM1 and outputs to CRT through CN1.

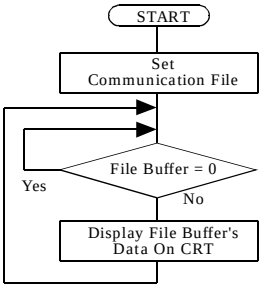


Figure 6.6. Flowchart of Sample Program 4

Sample Program 5

This GW-BASIC sample program demonstrates the receive/transmit-data capability of COM-2(PC)F in Enhanced mode. First, it initializes the ACE, it then receives the data input from the keyboard through CN1. Finally it outputs the data to CRT through CN2.

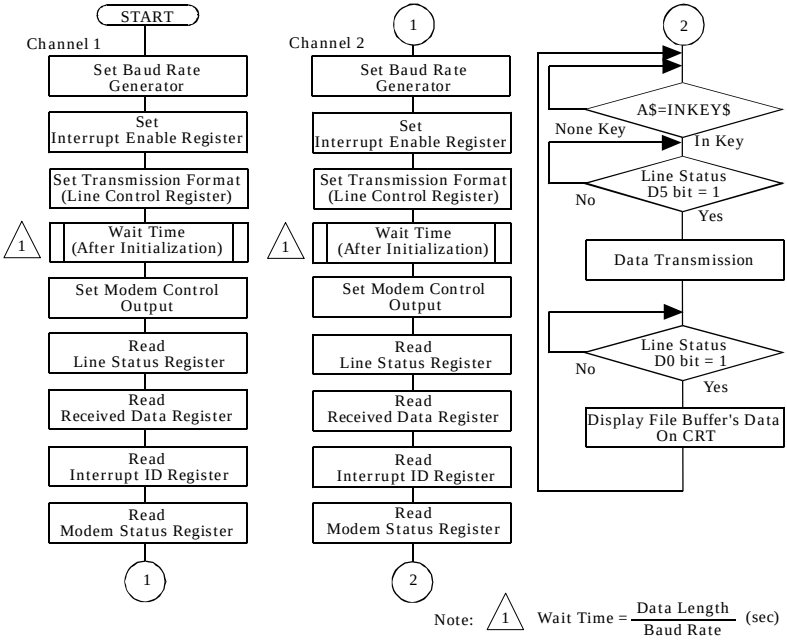


Figure 6.7. Flowchart of Sample Program 5

Sample Program 6

This GW-BASIC sample program demonstrates the receive/transmit-data capability of COM-2(PC)F in Compatible mode. Using the [OPEN "COM1 : 9600, N, 8, 2, DS" AS #1] command and the [OPEN "COM2 : 9600, N, 8, 2, DS" AS #2] command opens two RS-232C communication files (COM1 and COM2). The program sends the keyboard input data from COM1 to COM2 and displays the data received from COM2 to CRT.

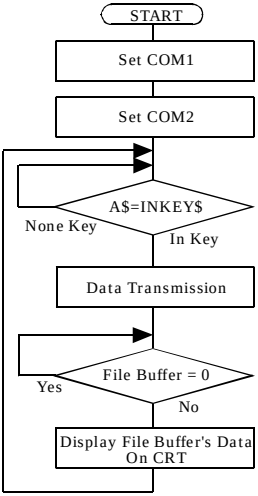


Figure 6.8. Flowchart of Sample Program 6

Sample Program 7

This GW-BASIC sample program demonstrates the receive/transmit-data capability of COM-2(PC)F in Enhanced mode with interrupt input. It calls a machine language program to register and handle interrupt input. One channel's receive/transit-data routine is processed in the interrupt handler. The received data is stored in the data buffer. Data to be transmitted is read from the data buffer.

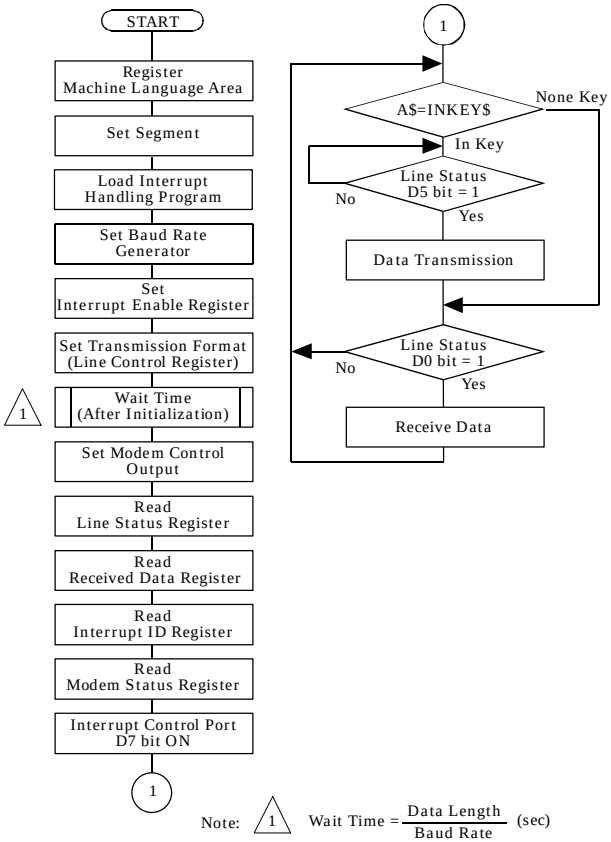


Figure 6.9. Flowchart of Sample Program 7

Sample Program 8
[Half-duplex data transmission (Enhanced mode)]

The sample program 8 enables initialization on ACE, data transmission in the transmission mode, and waits for the receive data in the receive mode.

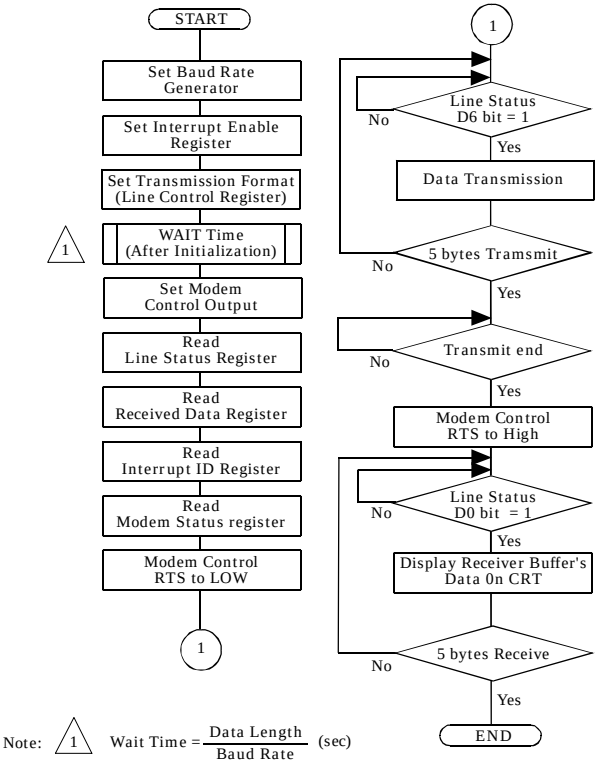


Figure 6.10. Flowchart of Sample Program 8

Sample Program 9
[Half-duplex data reception (Enhanced mode)]

The sample program 9 enables initialization on ACE, receives 5-byte data; after transmission, the program enters the transmission mode for data transmission.

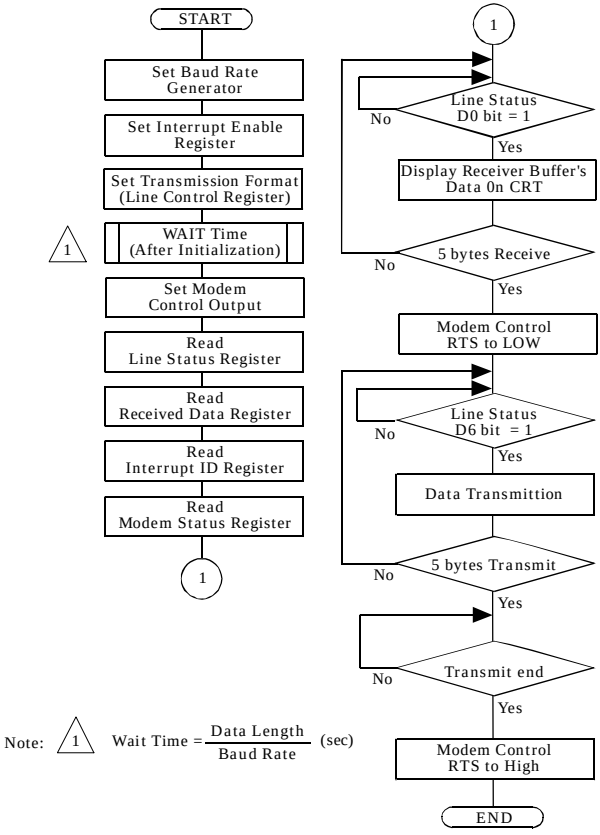


Figure 6.11. Flowchart of Sample Program 9

Sample Program 10
[Data transmission and reception (COM1, COM2 mode)]

Sample program 10 uses the bios_serialcom( ) function for MS-C. It first receives the data transmitted from COM1, and then receives the data at COM1 transmitted from COM2. Received data is displayed on the CRT.

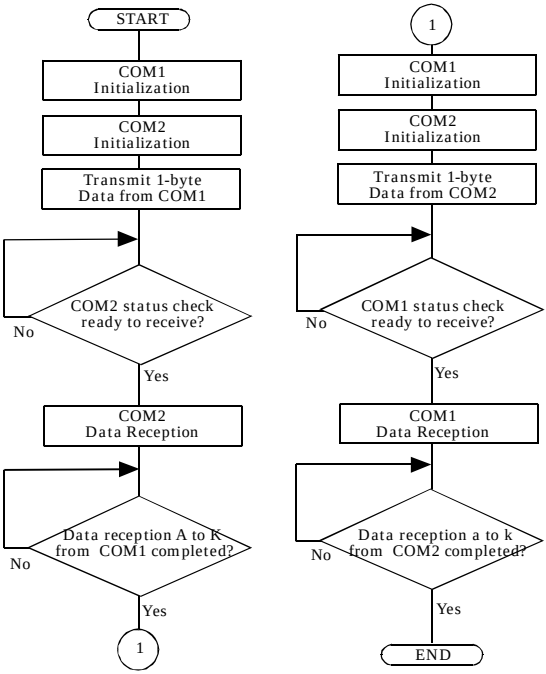


Figure 6.12. Flowchart of Sample Program10

Sample Program 11
[Data transmission and reception (COM3, COM4 mode)]

Sample program 11 uses the bios_serialcom( ) function for MS-C. It first receives the data transmitted from COM3, and then receives the data at COM3 transmitted from COM4. Received data is displayed on the CRT.

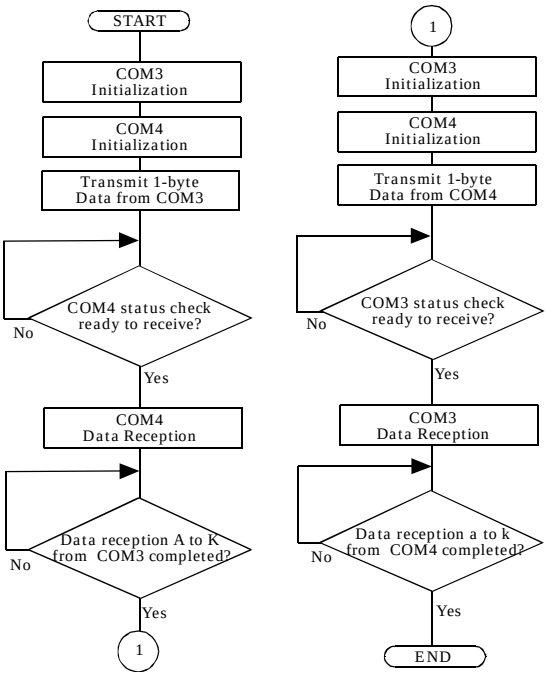


Figure 6.13. Flowchart of Sample Program 11

B. Notes on Developing Driver Software

Internal Registers

COM-2(PC)F uses the NS16550 (National Semiconductor) as the Asynchronous Communication Element (ACE). Within the address range of each channel, the offset addresses 0 through 7 furnish access to the internal registers of each of the two ACE's. Table 6.6. shows how functions relate to the internal registers. To access the baud rate generator (defined on the next page), the DLAB signal must be set high. For more details on NS16550, refer to the National Semiconductor Data Book.

Table 6.6. Function Selection through Internal Registers

I/O Port Address	DLAB *1	ACE Register (NS16550)	Note *2
"Base Address" +0H	0	Receiver (Buffer register)	R
"Base Address" +0H	0	Transmitter (Holding register)	W
"Base Address" +1H	0	Interrupt Enable Register	
"Base Address" +2H	x	Interrupt ID	R
"Base Address" +2H	x	FIFO Control	W
"Base Address" +3H	x	Line Control	
"Base Address" +4H	x	Modem Control	
"Base Address" +5H	x	Line Status	
"Base Address" +6H	x	Modem Status	
"Base Address" +7H	x	Scratchpad Register	
"Base Address" +0H	1	Baud Rate Divider Register LSB	
"Base Address" +1H	1	Baud Rate Divider Register MSB	

*1 DLAB: Divisor Latch Access Bit in the Modem Status Register.

*2 R=Read only; W=Write only.

Baud Rate Selection

The COM-2(PC)F board has one programmable baud rate generator for each of the two ACEs. The ACEs use a 1.8432MHz crystal oscillator as clock input. The baud rate generator takes the 1.8432MHz clock and divides it by a divisor from 1 to (2^{16} - 1). The output frequency of the baud rate generator equals 16 times the baud rate.

Based on the originating clock frequency, the baud rate is derived as:

```
Divisor = clock frequency/(baud rate x 16)
```

Two eight-bit divisor registers on the ACEs store the divisor in a 16-bit binary format. These divisors must be loaded during initialization into Divider registers (see Table 6.6.). Table 6.7. provides frequently used baud rates and their divisors. The percent error is the difference between actual and desired value.

Table 6.7. Baud Rate and Divisors

Desired Baud Rate	Divisor	Percent Error
50	2304	---
75	1536	---
110	1047	0.026
134.5	857	0.058
150	768	---
300	384	---
600	192	---
1200	96	---
1800	64	---
2000	58	0.680
2400	48	---
3600	32	---
4800	24	---
7200	16	---
9600	12	---
19200	6	---
38400	3	---
57600	2	---
115200	1	---

LSI Recovery Time

Due to the ever higher CPU clock rates used in PCs, restrictions apply when controlling a peripheral LSI device by software. Table 6.8. lists the LSIs used on CONTEC boards which require special consideration when accessing. Take note of the following point when accessing these LSIs.

In PCs using i386 or earlier CPUs, software waits (JMP $+2) can be used to provide a recovery time when accessing the LSI. However, software waits cannot be used to provide a recovery time in PCs with a i486 or later CPU because of the CPU cache memory function.

The following describes one method of providing the recovery time when using an i486 or later CPU.

In the PC/AT and compatible computers, executing an IN instruction for the port at I/O address 2EFh (COM4 scratch register) takes a minimum of 0.5µs. As this time does not depend on the CPU type or clock rate, the time can be used to provide the recovery time. After accessing any of the devices listed in Table 6.8., execute the IN instruction for the 2EFh port the required number of times to provide the recovery time.

Table 6.8. Number of Times the IN Instruction Must be Executed for the 2EFh Port after Accessing the LSI

LSI Device	Output	Input
i8237 or equivalent	None	None
i8254 or equivalent	Once	Once
i8255 or equivalent	Once	Once
i8259 or equivalent	Once	Once
NS16550 or equivalent	Once	Once
µPD7210C	Once	None

Example program (for accessing an i8254 or equivalent)

- Microsoft Macro Assembler

```
OUT DX, AL          ;  Access to the i8254
IN  AL, 2EFH        ;  Execute IN AL, 2EFH once to provide
                       the recovery time
```

- Microsoft C/C++

```
outp(port, byte);    /* Access to the i8254 */
rt=inp(0x2ef);       /* Execute rt=inp(0x2ef); once to
                        provide the recovery time */
```

Various Aspects of Interrupt Handling in Enhanced Mode and Compatible Mode

Enhanced Mode

When in Enhanced mode, two channels of the COM-2(PC)F share the same interrupt request line. The interrupt levels can be set from IRQ3~IRQ7, IRQ9~IRQ12, IRQ14, and IRQ15 by setting JP1 before installing this board. Each channel's interrupt signal will be latched in the Interrupt Vector Register (IVR).

Therefore, when the CPU receives an interrupt requirement, the interrupt service routine can check the IVR to determine which channel is requesting interrupt service. After finishing the interrupt service process, the interrupt service routine has to check IVR again to see if a Pending interrupt request has occurred.

ACE (Asynchronous Communication Element) has its own internal register for enabling interrupts and identifying the interrupt service requesting channel. Refer to National Semiconductor's data book for additional details on NS16550 and its operation.

When turning on the PC's main power, the ACE's master reset function sets OUT1 to "High". This status automatically enables the interrupt. If one of the two channels is not allowed to generate the interrupt, set the OUT1 bit to "Low".

In addition to being able to enable/disable interrupt by channel, the board also has a global interrupt enable function. This global interrupt enable function determines whether the IRQ line is active or not. When turning on the power, this function sets to the disable status. To enable the PC bus to accept an interrupt, this function has to be programmed to enable status. To enable this function, write "1" to IVR's D7 bit; to disable this function, write "0" to IVR's D7 bit.

Figure 6.14. describes the bit function of IVR in Enhanced mode. The I/O address of IVR is either 2BF or 1BF.

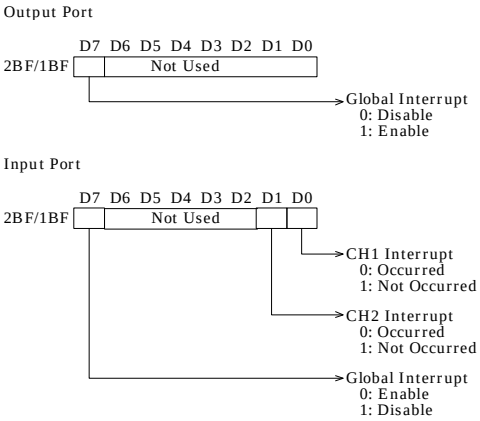


Figure 6.14. IVR Bit Function in Enhanced Mode

Compatible Mode

When in the Compatible mode, CN1 of the interface board is compatible with COM1 or COM3 and CN2 is compatible with COM2 or COM4. By using JP2 and JP3, interrupt levels can be selected from IRQ3~IRQ7, IRQ9~IRQ12, IRQ14, and IRQ15 for CN1 and CN2. Normally, COM1/COM3 uses IRQ4 and COM2/COM4 uses IRQ3.

C. The Details on NS16550

Table 6.9. NS16550's Register
(Short from National Semiconductor's data book)
< 1 / 2 >

	Register					
	0 DLAB = 0	0 DLAB = 0	1 DLAB = 0	2	2	3
Bit No.	Receiver Buffer Register (Read Only)	Transmitter Holding Register (Write Only)	Interrupt Enable Register	Interrupt Ident. Register (Read Only)	FIFO Control Register (Write Only)	Line Control Register
	RBR	THR	IER	IIR	FCR	LCR
0	Data Bit 0	Data Bit 0	Enable Received Data Available Interrupt (ERBFI)	"0" if Interrupt Pending	FIFO Enable	Word Length Select Bit 0 (WLS0)
1	Data Bit 1	Data Bit 1	Enable Transmitter Holding Register Empty Interrupt (ETBEI)	Interrupt ID Bit (0)	RCVR FIFO Reset	Word Length Select Bit 1 (WLS1)
2	Data Bit 2	Data Bit 2	Enable Receiver Line Status Interrupt (ELSI)	Interrupt ID Bit (1)	XMIT FIFO Reset	Number of Stop Bits (STB)
3	Data Bit 3	Data Bit 3	Enable MODEM Status Interrupt (EDSSI)	Interrupt ID Bit (2)	DMA Mode Select	Parity Enable (PEN)
4	Data Bit 4	Data Bit 4	0	0	Reserved	Even Parity Select (EPS)
5	Data Bit 5	Data Bit 5	0	0	Reserved	Stick Parity
6	Data Bit 6	Data Bit 6	0	FIFOs Enabled	RCVR Trigger (LSB)	Set Break
7	Data Bit 7	Data Bit 7	0	FIFOs Enabled	RCVR Trigger (MSB)	Divisor Latch Access Bit (DLAB)

Table 6.9. NS16550's Register
(Short from National Semiconductor's data book)
< 2 / 2 >

Bit No.	Register					
	4	5	6	7	0 DLAB = 1	1 DLAB =1
	MODEM Control Register	Line Status Register	MODEM Status Register	Scratch Register	Divisor Latch (LS)	Divisor Latch (MS)
	MCR	LSR	MSR	SCR	DLL	DLM
0	Data Terminal Ready (DTR)	Data Ready (DR)	Delta Clear to Send (DCTS)	Bit 0	Bit 0	Bit 8
1	Request to Send (RTS)	Overrun Error (OE)	Delta Data Set Ready (DDSR)	Bit 1	Bit 1	Bit 9
2	Out 1	Parity Error (PE)	Trailing Edge Ring Indicator (TERI)	Bit 2	Bit 2	Bit 10
3	Out 2	Framing Error (FE)	Delta Data Carrier Detect (DDCD)	Bit 3	Bit 3	Bit 11
4	Loop	Break Interrupt (BI)	Clear to Send (CTS)	Bit 4	Bit 4	Bit 12
5	0	Transmitter Holding Register (THRE)	Data Set Ready (DSR)	Bit 5	Bit 5	Bit 13
6	0	Transmitter Empty (TEMT)	Ring Indicator (RI)	Bit 6	Bit 6	Bit 14
7	0	Error in RCVR FIFO	Data Carrier Detect (DCD)	Bit 7	Bit 7	Bit 15

D. Difference Between the COM-2(PC)F and COM-2(PC)V

The COM-2(PC)F is an upgrade of the previous COM-2(PC)V board and is upwardly compatible. Therefore, the board can generally be used in the same way as the COM-2(PC)V.

However, as the bus specification has changed from the XT bus to the AT bus and the board sizes are different, the COM-2(PC)F may not fit in some PCs. Check the size of board that can be mounted in your PC before selecting the COM-2(PC)F. The two boards also differ in their specifications and hardware setup. The differences are described below.

Table 6.10. Specifications Differences

	COM-2(PC)V	COM-2(PC)F
Bus	XT Bus	AT Bus
Baud Rate	50~38,400bps	50~115,200bps
Interrupt Level	IRQ3~7, 9 (Jumper Selectable)	IRQ3~7, 9~12, 14, 15 (Jumper Selectable)
Dimensions	120.0 x 107.0 x 18.5mm	160.0 x 107.0 x 18.5mm

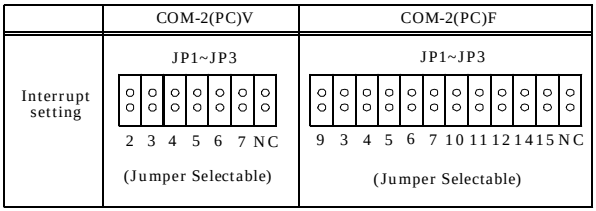


Figure 6.15. Difference in Jumpers (JP1~JP3)

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