

Smartio C168H/HS User's Manual

Universal 8 Port Serial Board

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The content of this manual is also available in CD-ROM and at Moxa Web Site.



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Smartio C168H/HS User's Manual

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address: *ftp.moxa.com*

or

ftp.moxa.com.tw

user ID: *ftp*

password: *your_email_address*

World Wide Web (WWW) Site for product info

address: *www.moxa.com*

or

www.moxa.com.tw

About This Manual

This manual is composed of six Chapters and one Appendix. This manual is written for installer, system administrator and software programmer.

If you are a first-time installer and system administrator, we recommend you to go through the whole manual except Chapter 4.

If you are a software programmer, you may refer to Chapter 4 “Serial Programming Tools”.

If you need cable wiring information, please see Chapter “Connection Option (Opt8x) and Cable Wiring”.

If you encounter any problem during installation, please refer to Chapter “Troubleshooting”.

< In this manual, C168 Series refers to C168H and C168HS.

Chapter 1 Introduction

Overview and features of the Smartio C168 Series boards, list of items and overall installation guide.

Chapter 2 Hardware Installation

Hardware installation for the Smartio C168 Series boards and connection option (Opt8x) is detailed.

Chapter 3 Software Installation

This Chapter details the software installation, configuration, driver loading/unloading, driver upgrade and removal for various operating systems: Windows NT, Windows 95/98 , UNIX, DOS.

Chapter 4 Serial Programming Tools

This Chapter roughly describes the programming tools for various O.S. platforms, including *PComm* under Windows NT, Windows 95/98, API-232 under DOS and standard UNIX system calls. Also RS-485 programming issue is covered (for Opt8J).

Chapter 5 Connection Option (Opt8x) and Cable Wiring

This Chapter describes the RS-232/422/485 cable wiring for each connection option (Opt8x).

Chapter 6 Troubleshooting

This Chapter describes the problems and possible answers for Smartio C168 Series boards.

Appendix Technical Reference

Specification details, UART, I/O port address map, and DB62 pinouts are described.

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Introduction

Overview

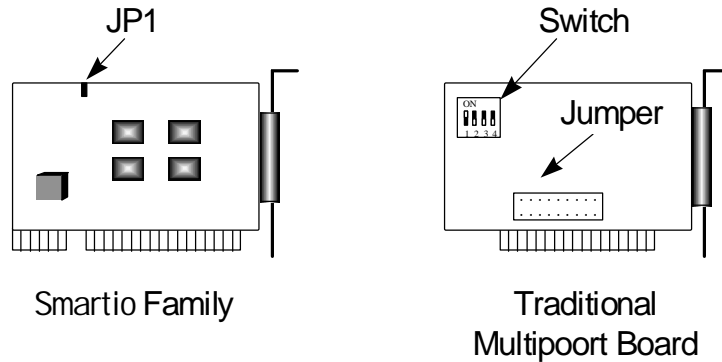
Smartio - The Smart Multiport Async Solutions

The term Smartio stands for smart multiport serial I/O solution. The **Smartio C168 Series** multiport boards offer 8 serial ports for connecting terminals, modems, printers, data acquisition equipment and any other serial devices to the PC/AT and its compatible systems. With the well-designed and fine-tuned device driver, the Smartio boards make full use of the 32 byte Tx/Rx FIFO and on-chip H/W flow control, so that they can transfer data without data loss even at high speed such as 921.6 Kbps, which offers a reliable and high performance solution for serial multiport communications.

The Smartio C168 Series is equipped with **custom-designed ASIC chip** which replaces lots of conventional ICs and reduces the board to half-size. The whole family supports 16 bit architecture. Full range of I/O addresses and IRQs are available. In addition, with **on-board EEPROM** for storing the configuration data, the family is designed without jumper or switch. These features make each port on the board truly independent to any other port and thus compatible with most existing multiport boards.

The Smartio C168 Series is also available in PCI bus. Please contact MOXA dealer/distributor or MOXA Web site for more details.

Hardware Configuration Method



New : set I/O address and IRQ via software Utility.

Traditional : set switch and jumper manually for I/O address and IRQ.

Instead of using traditional jumper or switch for IRQ and I/O address settings, hardware configuration of each port is easily set by DOS utility, **Io-irq.exe**, which read and write the on-board EEPROM for configuration information through the **CAP (Configuration Access Port) address**. The CAP address is the only channel via which the configuration utility Io-irq.exe can access the board, which is identical to **the first port's base I/O address**.

The only jumper, **JP1**, is designed in case that users forget the CAP address. Normally JP1 is left open. When JP1 is short, the CAP address is forced to a fixed I/O address, **0xA700**. However, to adopt quick installation (described later), it is a must to keep JP1 always short.

Quick Installation

To ease the hardware configuration, users who install **only one Smartio C168 Series board under Windows NT/95/98** are recommended to adopt **quick installation** described in Chapter 2.

Because the family is so flexible in hardware configuration that they are compatible virtually with all kinds of other manufacturer's multiport boards using 16450 or 16550 UART.

Surge Protection

To prevent the boards from damage caused by lightning or high potential voltage, **surge protection** technology is introduced in some model to protect the board.

Operating System Support

The family is operational under most popular operating systems such as Windows NT, Windows 95/98, SCO UNIX/XENIX/OpenServer, DOS, Linux, QNX, FreeBSD, UNIX SVR4.2. However, **MOXA device drivers** for Windows NT, Windows 95/98, Linux, SCO UNIX/OpenServer, UNIX SVR4.2 and DOS are provided for easier installation, configuration and better performance. In this manual, chapters for MOXA **Windows NT**, **Windows 95/98**, **UNIX** and **DOS** device drivers are included. For other compatible systems not mentioned, please refer to the respective operating system's manual for how to install and configure the standard driver.

MOXA Serial Comm Tools

For easy application development, MOXA provides an easy-use serial communication library under Windows NT/95/98 (**PCComm**) and DOS (**API-232**). Users can use this library to develop your own applications using Microsoft C, Turbo C, Assembly, QuickBASIC, Turbo Pascal, Clipper, Visual Basic, Visual C++, Borland Delphi, etc. **Utilities**, such as diagnostic and monitor, are included for diagnosing the board/port or monitoring the communication status.

Wide Applications

The Smartio C168 Series are suitable for many applications. Here are a few:

- } Internet/Intranet Connection
- } Remote Access Application
- } Multi-user Application
- } Industrial Automation
- } Office Automation
- } Telecommunication
- } PC-based (vending) Machine or Kiosk System
- } Point-of-Sale (POS) System

Features

The Smartio C168 Series consist of members as follows,

C168H 8 port RS-232 or RS-422, high speed 16550C or compatible UART
C168HS 8 port RS-232 or RS-422, surge protection, 16550C or compatible UART

- % Custom-designed ASIC, compact board size (half-size)
- % No switch no jumper, easily configured by software
- % Independent I/O address, IRQ setting for each of 8 serial ports
- % 16 bit AT bus architecture, more IRQs supported
- % Surge protection for RS-232 (C168HS)
- % Isolation protection for RS-422 (optional connection box Opt8F)
- % High speed 16550C Communication Controller with on-chip hardware flow control, no data loss
- % **PComm** serial communication tool
- % Support popular OS; Windows NT, Windows 95/98, SCO UNIX/OpenServer, UNIX SVR4.2, DOS, Linux
- % Compatible with many other OS; QNX, SCO XENIX, Free BSD

	<u>C168H/HS</u>
Windows NT	D
Windows 95/98	D
DOS	D
SCO UNIX/OpenServer	D
UNIX SVR4.2	D
Linux	R
QNX	C
SCO XENIX	C
FreeBSD	C

D: Driver supported by Moxa and shipped with product

R: Driver supported by Moxa but sent by request

C: Driver supported by OS

Note: MOXA FTP site is available for driver download

Check List

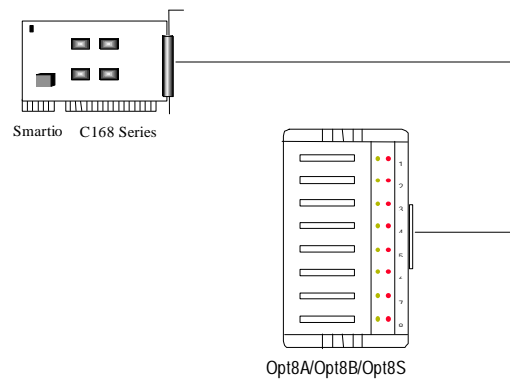
Upon unpacking the Smartio C168 Series package, you should find the following items in the package,

- % Smartio C168 Series 8-port high performance async board
- % Device driver diskettes:
 - } Windows NT and Windows 95/98; **Ñ**
 - } DOS; **Ñ**
 - } UNIX; **Ñ**
- % C168H/HS User's Manual (This Manual)
- % PComm Lite diskette; **Ñ**

You need also one of the following connection options:

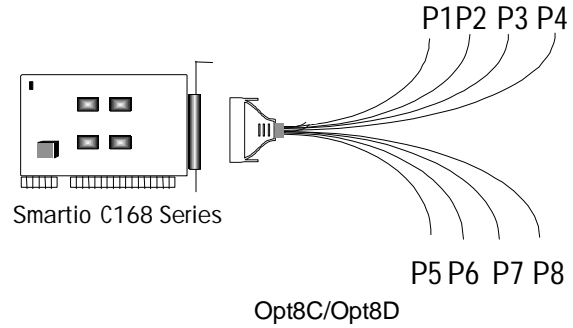
Opt8A/Opt8B/Opt8S

- % RS-232 connection box with 8 DB25 female/male/female ports, respectively (surge protection for Opt8S).
- % 1.5 meter DB62 to DB62 cable.



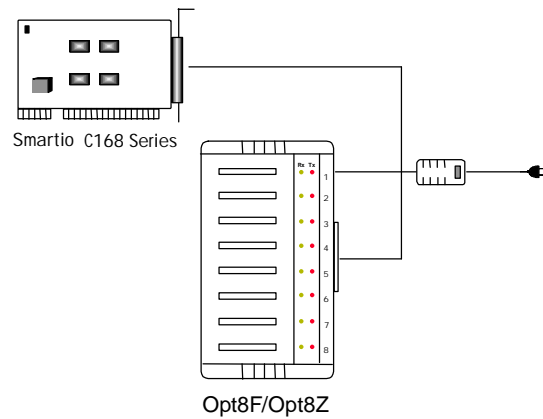
Opt8C/Opt8D

- ‰ RS-232 octopus cable with 8 port male connectors, DB25 for Opt8C and DB9 for Opt8D (1 meter long).



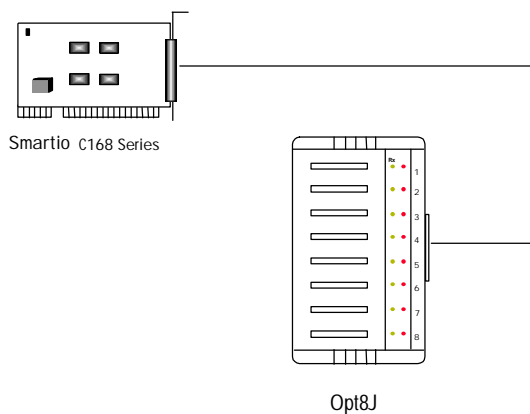
Opt8F/Opt8Z

- ‰ RS-422 connection box with 8 port female DB25 connectors (isolation protection for Opt8F).
- ‰ 1.5 meter DB62 to DB62 cable.
- ‰ 110V or 220V adapter.

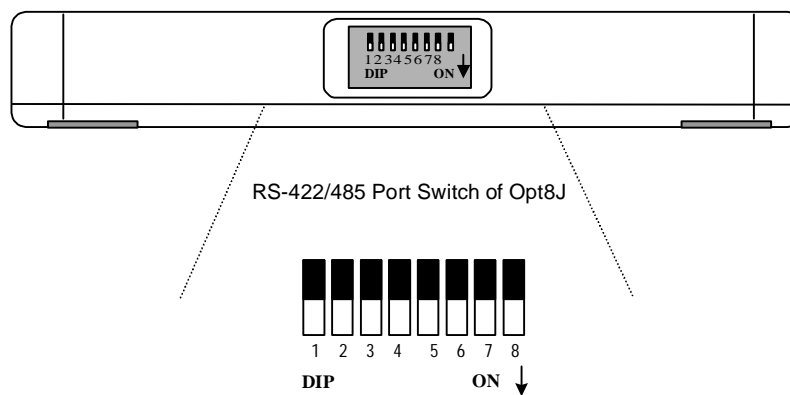


Opt8J

- % RS-422/485 connection box with 8 port female DB25 connectors.
- % 1.5 meter DB62 to DB62 cable.
- % 110V or 220V adapter.



Opt8J is the RS-422/485 connection box with 8 port female DB25 connectors for MOXA 8 port boards, including the Smartio C168 Series. There are 8-DIP switches on the side of the Opt8J. Each switch controls the communication mode (RS-422 or RS-485) of each port, respectively.



RS-422 Mode

Set the respective switch to **OFF** position to use RS-422 interface. This means the port is always ready to transmit and receive data simultaneously (full-duplex).

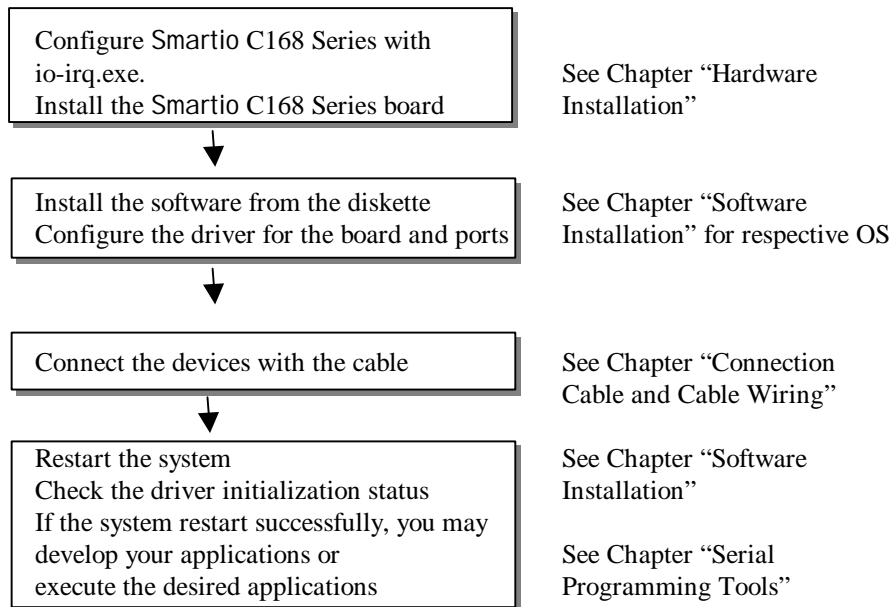
RS-485 Mode

The Opt8J supports only 2-wire RS-485 communication. Set the respective switch to **ON** position to use RS-485 interface. This means the port can transmit data only when RTS is asserted, and receive data only when RTS is not asserted (half-duplex).

Refer to Chapter “Connection Option (Opt8x) and Cable Wiring” for RS-422/RS-485 cable wiring. And also to Chapter “Serial Programming Tools” for Opt8J RS-485 programming details.

Installation Guide

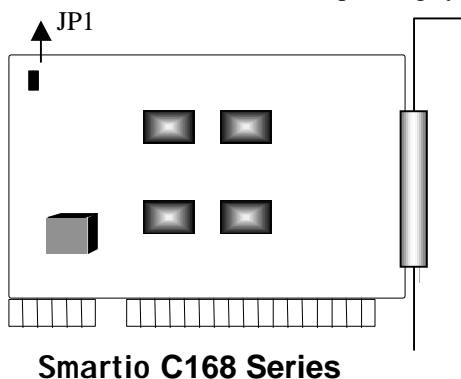
This section gives a brief summary of how to install the Smartio C168 Series under each supported operating system. The installation is simple and involves the following stages:



2

Hardware Installation

The installation of the Smartio C168 Series consists of hardware and software installation. The hardware installation is detailed in this chapter. The next chapter deals with the software installation for various operating systems.



Default Settings

The Smartio C168 Series has the following default (factory) settings:

I/O address: **0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port 4)
 0x1A0 (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
IRQ: **10**
INT Vector: **0x1C0**
CAP Jumper JP1: **Open**

Note! If the default settings above are what you desire and good for the system without conflicts, you may simply install the board in the system and go directly to the next chapter, "Software Installation". Otherwise, follow the instructions below.

Now you should do either **the normal hardware installation** (detailed in the later section, “Hardware Installation with IO-IRQ Utility”) or **the quick hardware installation** (detailed right in the next section, “Quick Hardware Installation”). The latter is provided to facilitate the hardware installation, only under the circumstances that:

- **Only one Smartio C168 Series board** is allowed to install in a system.
- **Windows NT and 95/98** are the only operating systems supported.
- I/O address **0xA700** must be free

Quick Hardware Installation

To fully utilize the superior feature of flexible hardware configuration design of the Smartio C168 Series, a quick and easy method of installation is designed for users, which absolutely free the users from hardware configuration effort, i.e., **installation without running configuration program: Io-irq.exe**. Simply always short the jumper JP1. The software and hardware configuration will be completed at the same time while doing the software configuration.

Besides, the speed range will be set to **from 50 to 921.6K bps by default**, which is called **High Speed Spectrum** and detailed in the section, “Hardware Installation with IO-IRQ Utility”.

How to Do Quick Hardware Installation

Users who install **only one Smartio C168 Series board under Windows NT/95/98** are strongly recommended to do the quick installation as follows:

1. **Short the jumper JP1** on the upper-left corner of the board.
2. Plug the board in PC with the desired system installed, which is powered off in advance.
3. Process software installation, detailed in the next chapter.

This is to specify the desired I/O address, IRQ and INT Vector in the software configuration panel, no matter what hardware settings are on the board. The

software configuration program will automatically update the hardware settings. After this, users already complete the whole installation.

4. Shutdown System (Windows NT/95/98).
5. DO power OFF and then ON (or Reset) the PC. (**Please cold start.**)
6. Restart System (Windows NT/95/98).

It is very important to keep the JP1 always short in this case. Without running the hardware configuration program, `Io-irq.exe` under DOS prompt, the software configuration program will automatically update the hardware settings of the board while updating the software settings. This saves the trouble doing hardware configuration. However, remember to **cold start the system every time the configuration changed.**

Hardware Installation with IO-IRQ Utility

This section is for those who can not use quick hardware installation:

- Install two or more Smartio C168 Series boards in a system.
- Fail to install, due to the I/O address 0xA700 is not available or has conflict in the system.
- Use operating systems other than Windows NT and 95/98.

Before proceeding the **software installation**, detailed in the next chapter, “Software Installation”, do **hardware configuration** to setup the I/O address and IRQ with “**Io-irq.exe**”, detailed in the next section.

Remember to keep the hardware settings in mind for the software installation.

The Smartio C168 Series has the following default (factory) settings:

I/O address : **0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port 4)
0x1A0 (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
IRQ : **10**
INT Vector : **0x1C0**

Because the ASIC-designed Smartio C168 Series has no switch and no jumper for configuring manually the I/O address, IRQ, INT vector, etc. of the boards, you **must** run the software utility, **Io-irq.exe**, in the driver diskette under **DOS** system to change the hardware configuration.

1. Choose a PC that has **DOS** system inside.
2. Power off the PC.
3. Make sure no hardware conflict and plug the board in a free 16-bit slot of the PC, **one board at a time with JP1 open**.

< If you are installing multiple boards, insert one board at a time and configure it using the Io-irq program before inserting the next board. This is to prevent conflict between two boards with same default hardware settings.
The Smartio C168 Series has the following default (factory) settings,
I/O address: **0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port4)
0x1A0 (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
IRQ: **10**
INT Vector: **0x1C0**
Configuration Access Port (CAP): **0x180**

4. Power on the PC and enter into **DOS** system.
5. Run the utility "**Io-irq.exe**" contained in the driver diskette to set up I/O address, IRQ and INT vector of the board. Please refer to the next section, "IO-IRQ Utility and Hardware Configuration" for more details. Or follow the on-line help to configure the Smartio C168 Series board.

After completing the hardware configuration, the board is ready for use under operating systems, such as Windows NT and 95/98, DOS, UNIX etc.

IO-IRQ Utility and Hardware Configuration

Note that the CAP address, e.g. 0x180, is identical to **the first port's I/O address** except in one case that the JP1 jumper is installed before powering on the PC. In this case, the CAP address will be forced to **0xA700**. The CAP address must be

typed correctly. With the correct CAP address, the utility can find the configuration stored in the **on-board EEPROM** and display it on the configuration panel. The CAP address is the only channel via which the configuration utility `Io-irq.exe` can access the board.

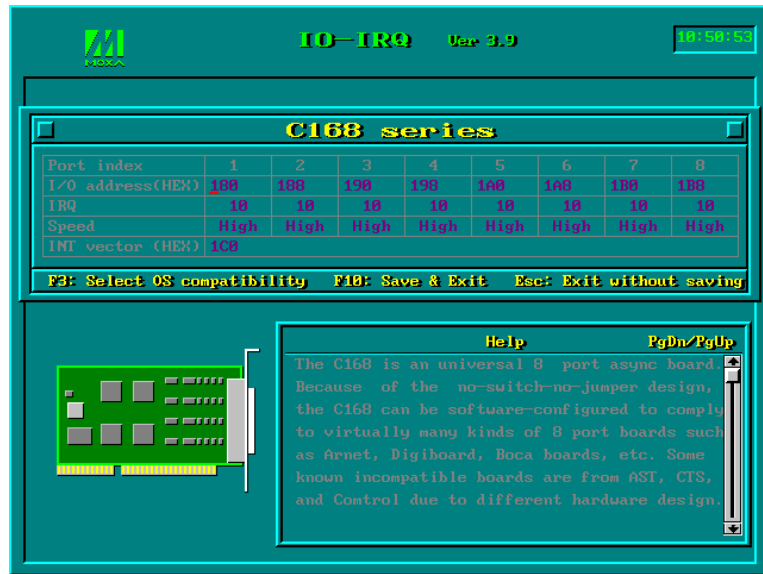
1. Run the utility "**Io-irq.exe**" contained in the driver diskette to set up I/O address, IRQ and INT vector of the board.



2. Select "Smartio/Industio ISA Family" and press ENTER key.

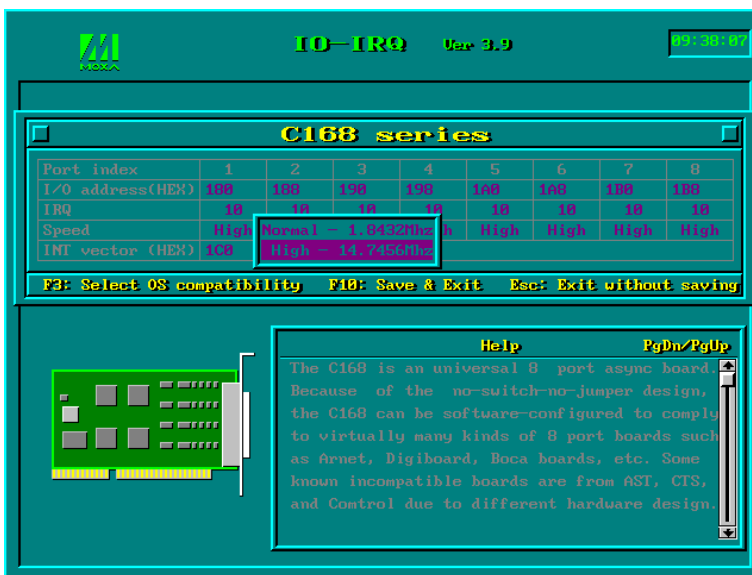


- Enter the CAP address of the Smartio C168 Series board to be configured.



- Configure the following parameters as necessary.

- Port Index** Indicate the port index for each port.
- I/O address** Enter the base I/O address for each port, either sequentially or not. Avoid to conflicting with any other devices.
- IRQ** Enter the IRQ, 2, 3, 4, 5, 7, 10, 11, 12 or 15, for each port, independently or not.
- Speed** This field specifies the use of **normal or high speed** capability. Normal speed ranges from 50 bps to 115.2 Kbps. High speed ranges from 50 bps to 921.6 Kbps. Smartio C168 Series support both normal and high speed spectra.



Note that, currently, port that uses **MOXA Windows NT and 95/98 driver** will run at the displayed speed. To be clear, when Smartio C168 Series board is configured as **High Speed Spectrum**, any port driven by the **Moxa-provided Windows NT and 95/98 driver** will display the exact working speed. For example, the displayed speed 38.4 Kbps is equal to the working speed 38.4 Kbps.

However, if the port is driven by **NON Moxa-provided driver**, such as **standard serial driver**, or Moxa drivers other than Windows NT and 95/98, such as **DOS**, the real working speed is equal to **8 times** of the displayed speed. For example, a port, if set to Normal Speed Spectrum with 38.4 Kbps, will work at 38.4 Kbps for sure; while a port, if set to High Speed Spectrum with displayed speed 38.4 Kbps, will actually work at 307.2 Kbps (38.4 Kbps \times 8).

The following is the **8 times speed mapping list** for quick reference purpose, **particularly for DOS driver**.

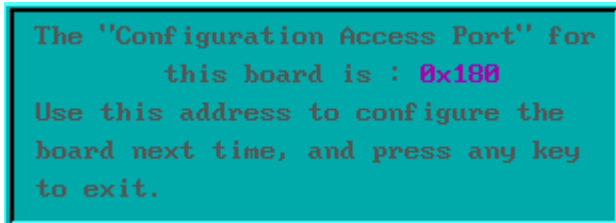
Normal Speed Spectrum	High Speed Spectrum
-----------------------	---------------------

50 (bps)	400 (bps)
75	600
110	880
134.5	1076
150	1200
300	2400
600	4800
1200	9600
1800	14.4K
2400	19.2K
4800	38.4K
7200	57.6K
9600	76.8K
19.2K	153.6K
38.4K	307.2K
57.6K	460.8K
115.2K	921.6K

INT Vector Enter the interrupt vector I/O address for all ports. I/O address for interrupt vector is from 00000H to 0FFFFH. Interrupt vector is one byte of I/O address, in which each bit is used to indicate the occurrence of interrupt for corresponding port. To use interrupt vector, type in the hardware Interrupt vector I/O address. If not using interrupt vector, type 0 or leave blank as the interrupt vector.

There are two modes for the Smartio C168 Series driver. One is using interrupt vector, the other is not using interrupt vector. Driver employing interrupt vector scheme is supposed to have better performance than employing polling scheme.

5. Press **F10** to save the configuration and exit the utility.



```
The "Configuration Access Port" for
this board is : 0x180
Use this address to configure the
board next time, and press any key
to exit.
```

3

Software Installation

In this chapter, the software driver installation, configuration and driver update/removal procedures are described for various operating systems, including Windows NT, Windows 95/98, UNIX and DOS. Before proceeding with the software installation, complete the hardware installation, detailed in previous chapter, “Hardware Installation”.

If it is necessary for you to develop your own applications, please also refer to the next chapter, “Serial Programming Tools”, for programming issues.

Windows NT

Windows NT supports up to **256** serial ports, from **COM1** to **COM256**. To fully integrate the advanced features of Windows NT, multi-process and multi-thread, pure 32-bit Windows NT device drivers are developed for the Smartio C168 Series multiport boards. The driver conforms to Win32 COMM API standard.

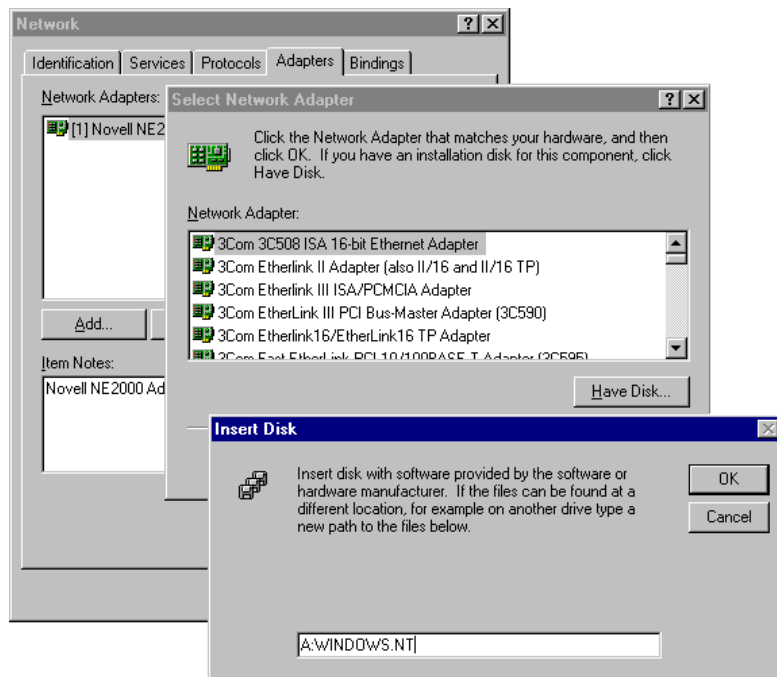
- } To install the driver for the first time, please go directly to the next section, “Installing Driver”.
- } If you already have installed the driver and want to re-configure the board and port, add more boards or delete boards, please refer to the section, “Configuring Board and Port”.
- } To update or remove the driver, please go to the section, “Updating Driver” or “Removing Driver”.

Installing Driver

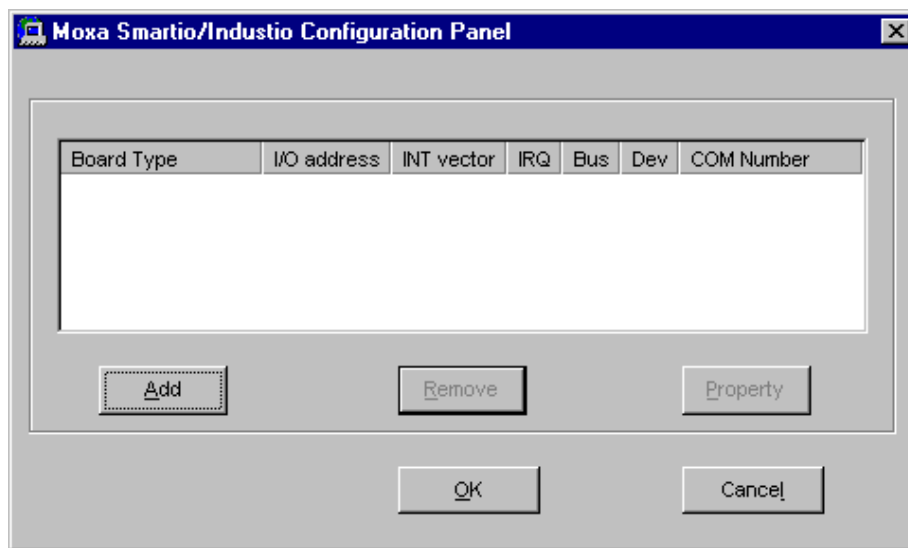
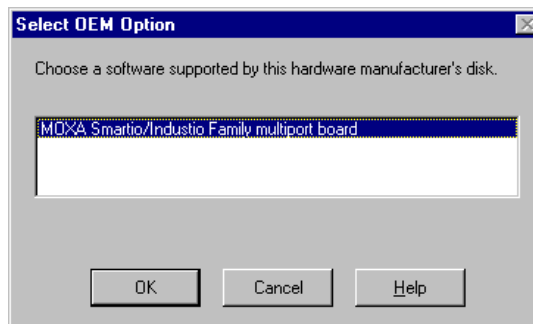
Following is the procedure for installing the Smartio C168 Series driver **for the first time** under Windows NT 4.0.

Note ! *Make sure the board(s) has(have) already been plugged in the system slot(s) if you are doing **quick** installation.*

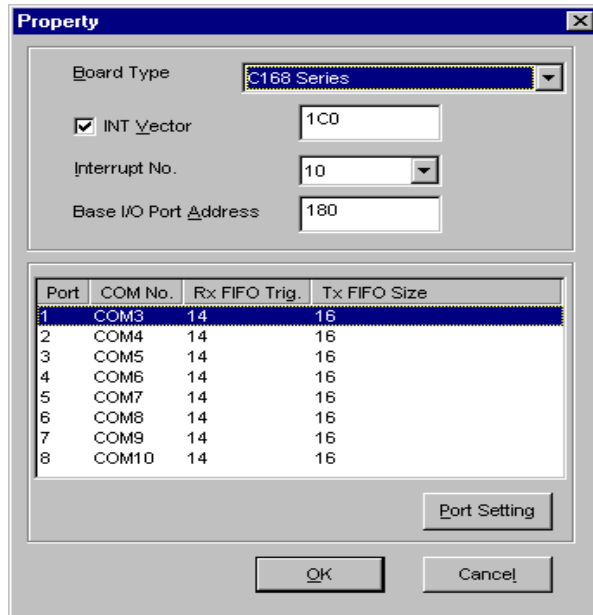
1. Please log in NT as **Administrator**.
2. Open the [**Control Panel**], click on the [**Network**] icon and select the [**Adapters**] tab.
3. Click on the [**Add**] button, then the [**Have Disk...**] button in “Select Network Adapter”.
4. Specify the exact path of the driver diskette, **A:\WINDOWS.NT**. Then click [**OK**].



5. Select **“MOXA Smartio/Industio Family multiport board”** in the **“Select OEM Option”** dialog box, and then click **[OK]** to enter the **“Moxa Smartio/Industio Configuration Panel”** dialog box to start the installation.

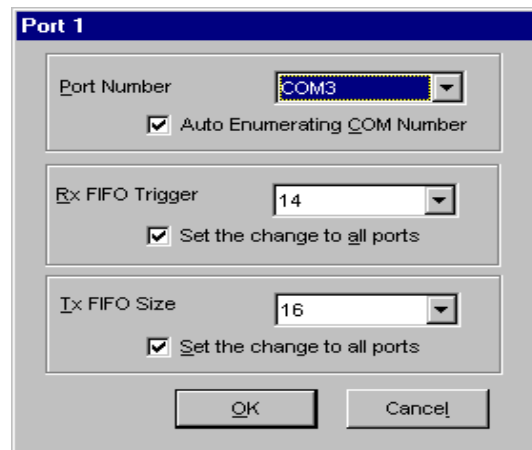


6. In the **“Moxa Smartio/Industio Configuration Panel”** dialog box, click **[Add]** to enter **“Property”** dialog box to add the Smartio C168 Series board. Select the **“C168 Series”** in the **“Board Type”** field. If necessary, type the desired interrupt vector address, in the **“INT Vector”** field. Select the desired interrupt number in the **“Interrupt No.”** field. Type the desired base I/O address, in the **“Base I/O Port Address”** field. All the settings should match settings that are physically set on the board and conflict with no other devices.



Note ! You may go directly to the **step 8** if you need not change any setting.

- In the “**Property**” dialog box, select the desired port in the port list and click [**Port Setting**] to enter the individual “**Port #**” setting dialog box to change the port COM number mappings or FIFO settings.



} **Port Number**

You have to set up all the ports of the board with the desired “**COM number**”, which should not conflict with other COM number in use. In this “Individual Port Setting” dialog box, you may have two ways to map the physical ports to COM numbers depending on the check box “**Auto Enumerating COM number**”.

If “Auto Enumerating COM Number” is checked and specify the COM number of the first port, subsequent ports are mapped to continuous COM numbers. For instance, if first port is mapped to COM3, then second port is mapped to COM4 sequentially.

If “Auto Enumerating COM Number” is not checked, specify the COM number for individual port. For instance, the second port can be out of sequence, say COM10, while the first port is mapped to COM3.

} **Rx FIFO Trigger**

Rx FIFO trigger levels, at 1, 4, 8 or 14 bytes, are available, and the default value is 14 bytes.

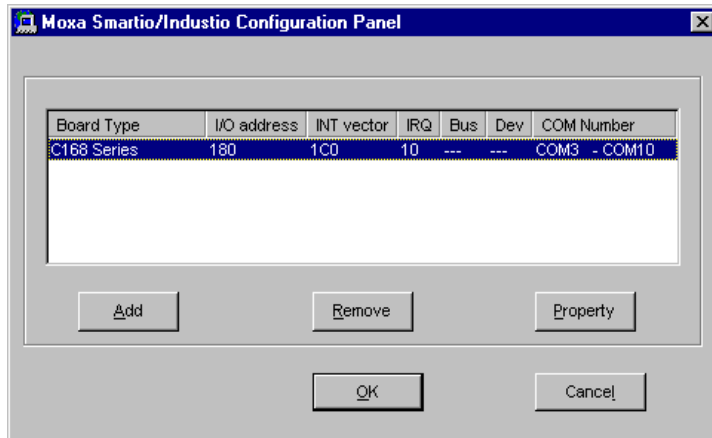
} **Tx FIFO Size**

Tx FIFO sizes from 1 to 16 bytes are available, and the default value is 16 bytes.

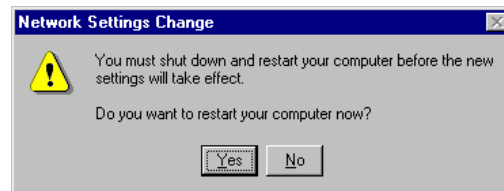
8. Click **[OK]** in the “Port #” and the “Property” dialog boxes to go back to the “Moxa Smartio/Industio Configuration Panel” dialog box.

<p>Note! If you need to install more than one board, click [Add] and repeat steps 6 to 8 to configure another board. Up to four Smartio C168 Series boards can be installed in a system.</p>
--

Click **[OK]** to finish the configuration.



9. When configuration is done, click on **[OK]** button in the “Network Settings” dialog box.
10. Restart Windows NT system. The latest configuration will not take effect unless the system restarts.



Note ! The latest configuration will not take effect unless the system restarts.

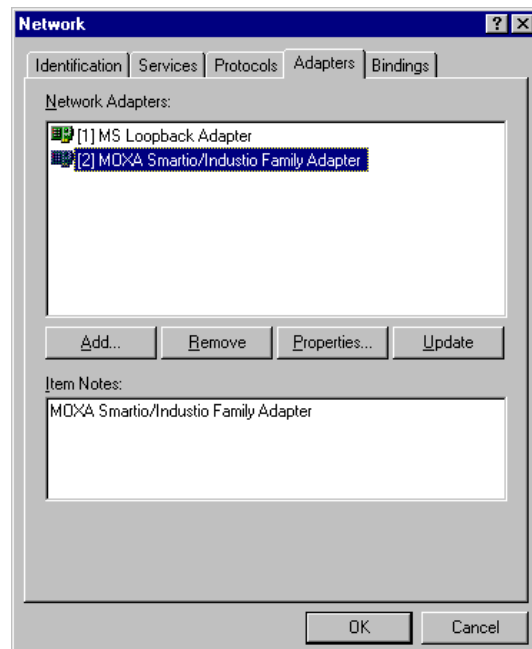
11. Once the system restarts, you may check the event log issued by the MOXA driver to see if the ports of the board are initialized successfully.
 - } Enter the **[Administrative]** group, click on the **[Event Viewer]** icon and select **[System Event Log]** to check a message similar to “**MOXA Smartio C168 Series, with first serial port COM3, has been enabled**” for each configured board.
 - } If an error message similar to “**Cannot find any configured MOXA Smartio C168 Series board!**” appears, refer to the “Troubleshooting” chapter for solutions.

Note ! Once the board and the driver are installed and the driver restarts successfully, you can start to develop applications with the *PComm* library (See “Serial Programming Tools” chapter) or the Microsoft Win32 API. You can also execute any ready-made applications, such as *PComm* utility Terminal emulator (See “Serial Programming Tools” chapter) or HyperTerminal to transmit/receive data, as well as Remote Access Service to provide dial-up networking capabilities.

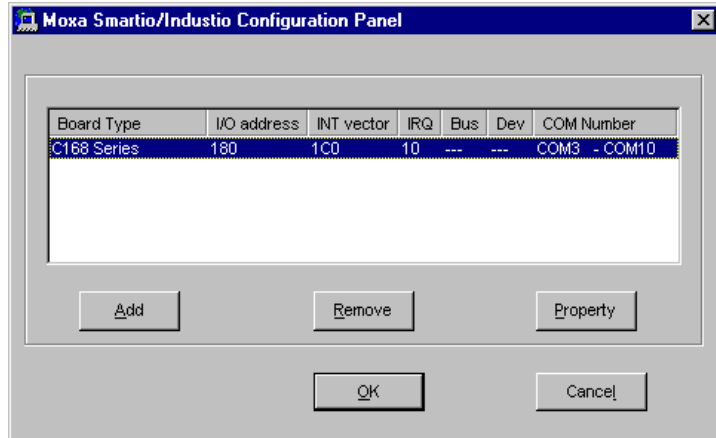
Configuring Board and Port

If you already have installed the driver and want to re-configure the ports, please follow this procedure.

1. In the [Control Panel], click on the [Network] icon and select the [Adapters] tab.
2. Select “MOXA Smartio/Industio Family Adapter” in “Network Adapters”.



-
3. Click on the **[Property]** button to open the “**Moxa Smartio/Industio Configuration Panel**” dialog box. Please see steps 6-10 in the previous section, “Installing Driver”, for more details.



In this configuration panel, you may:

- } Click **[Property]** to enter “Property” dialog box to configure the selected board with the correct “COM Number”, “INT Vector”, “Interrupt no” and “Base I/O Port Address”. Please see **steps 6 to 8** in the previous section, “Installing Driver”, for more details, except that the “Board Type” field is not supposed to be changed.
- } Click **[Add]** to add one more board that is not yet configured in the system. Please see **steps 6 to 8** in the previous section, “Installing Driver”, for more details.
- } Click **[Remove]** to remove the board currently selected from the configured board list.
- } Click **[OK]** to confirm the configuration changes you made.
- } Click **[Cancel]** to leave the dialog with the configuration unchanged.

Updating Driver

To update the driver for the Smartio C168 Series boards, simply remove the driver, as described in the next section, and reinstall it as detailed in section, “**Installing Driver**”.

Removing Driver

To remove the driver for the Smartio C168 Series boards,

1. Open the [**Control Panel**], click on the [**Network**] icon, and select the [**Adapters**] tab.
2. Select “**MOXA Smartio/Industio Family Adapter**” in the adapter list, then click on the [**Remove**] button and the [**OK**] button to remove the driver.
3. Restart the system to activate the new configuration.

Windows 95/98

Windows 95/98 supports up to **128** serial ports, from **COM1** to **COM128**. To fully integrate the advanced features of Windows 95/98, multi-process and multi-thread, pure 32-bit Windows 95/98 virtual device port drivers (VxD) compliant with communication drivers (VCOMM) are developed for the Smartio C168 Series and other MOXA multiport boards. The drivers conform to the Win32 COMM API standard.

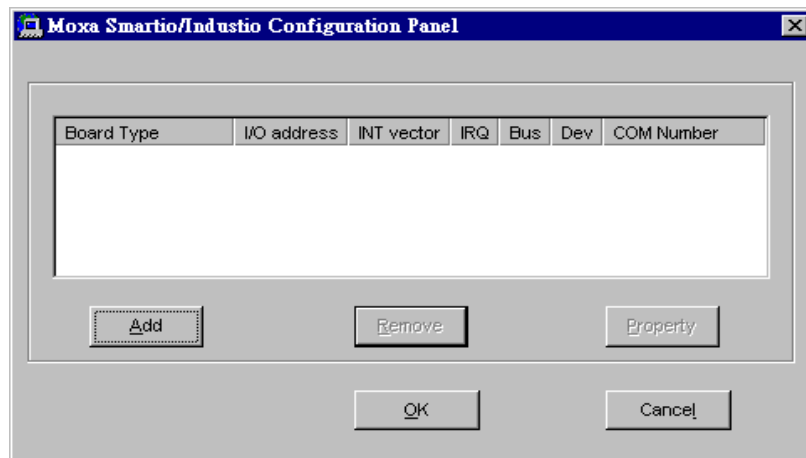
- } To install the driver for the first time driver, please go directly to the section, “Installing Driver”.
- } If you already have installed the driver and want to re-configure the board and port, add more boards or delete boards, please refer to the section, “Configuring Board and Port”.
- } To update or remove driver, please go to the sections, “Updating Driver” and “Removing Driver”.

Installing Driver

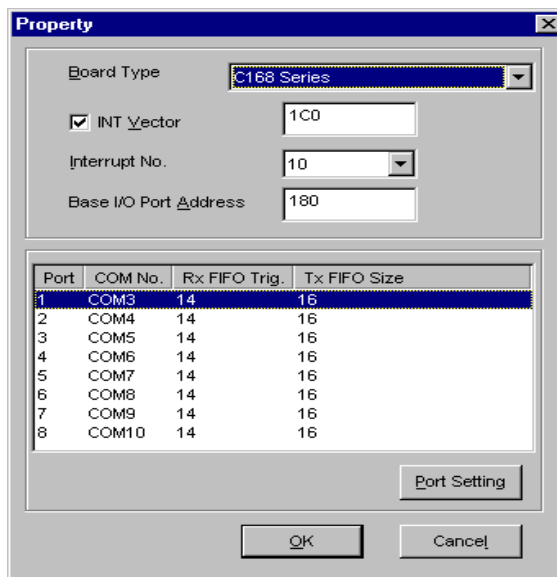
Up to four Smartio C168 Series boards can be installed together as long as the I/O addresses and IRQ number resources are sufficient and available in a system.

The following is the procedure for installing Smartio C168 Series **for the first time** under Windows 95/98:

1. Run **Setup95.exe** in the driver diskette.
2. Click on [Next>] button in the “Welcome ...” message dialog box. And then click on [Next>] button in the “Ready ...” message dialog.
3. Click on [Finish] button in the “Complete ...” message dialog to enter the configuration panel.
4. The “**Moxa Smartio/Industio Configuration Panel**” dialog will pop up for you to configure the boards and ports.

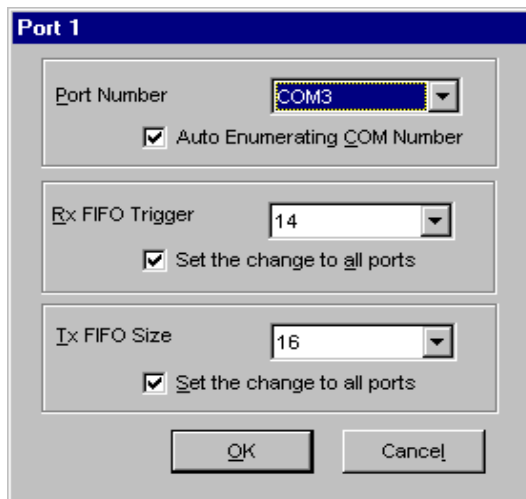


5. In the “**Moxa Smartio/Industio Configuration Panel**” dialog box, click [Add] to enter “**Property**” dialog box to add the Smartio C168 Series board. Select the “**C168 Series**” in the “Board Type” field. If necessary, type the desired interrupt vector address, in the “INT Vector” field. Select the desired interrupt number in the “Interrupt No.” field. Type the desired base I/O address, in the “Base I/O Port Address” field. All the settings should match settings that are physically set on the board and conflict with no other devices.



Note! Go directly to the **step 7** if you need not change any setting.

6. In the “**Property**” dialog box, select the desired port in the port list and click [**Port Setting**] to enter the individual “**Port #**” setting dialog box to change the port COM number mappings or FIFO settings.



} **Port Number**

You have to set up all the ports of the board with the desired “**COM number**”, which should not conflict with other COM number in use. In this “Individual Port Setting” dialog box, you may have two ways to map the physical ports to COM numbers depending on the check box “**Auto Enumerating COM number**”.

If “Auto Enumerating COM Number” is checked and specify the COM number of the first port, subsequent ports are mapped to continuous COM numbers. For instance, if first port is mapped to COM3, then second port is mapped to COM4 sequentially.

If “Auto Enumerating COM Number” is not checked, specify the COM number for individual port. For instance, the second port can be out of sequence, say COM10, while the first port is mapped to COM3.

} **Rx FIFO Trigger**

Rx FIFO trigger levels, at 1, 4, 8 or 14 bytes, are available, and the default value is 14 bytes.

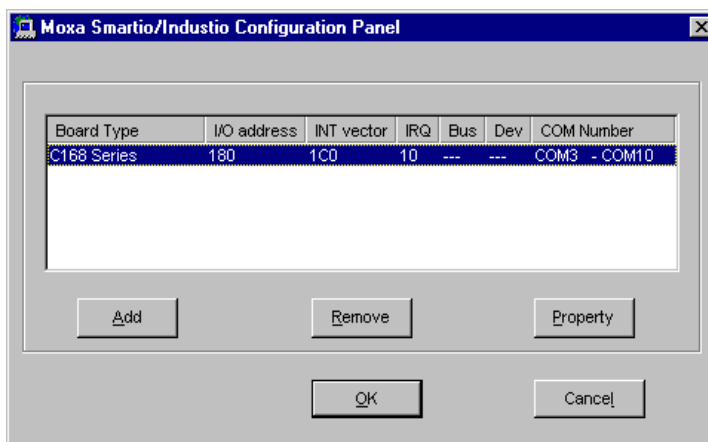
} **Tx FIFO Size**

Tx FIFO sizes from 1 to 16 bytes are available, and the default value is 16 bytes.

7. Click **[OK]** in the “Port #” and the “Property” dialog boxes to go back to the “Moxa Smartio/Industio Configuration Panel” dialog box.

<p>Note! If you need to install more than one board, click [Add] and repeat steps 5 to 7 to configure another board. Up to four Smartio C168 Series boards can be installed in a system.</p>
--

Click **[OK]** to finish the configuration.



8. Restart Windows 95/98 system.



Note! The latest configuration will not take effect unless the system restarts.

9. When system restarts, all the error conditions of the board will be popped up onto the screen if any. Otherwise, everything should be fine.

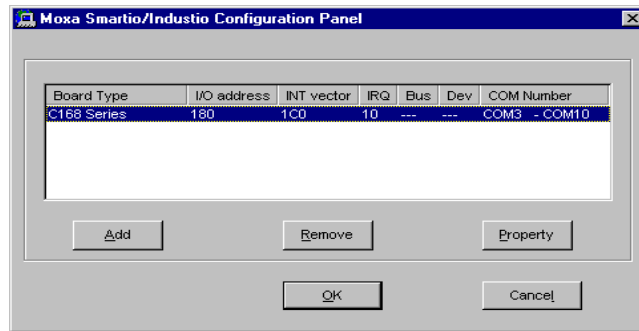
If error message like “**Smartio C168 Series (CAP=0x0180, port 1=COM3): Board is not found**” appears, refer to chapter, “Troubleshooting”, for solutions.

Note! Once the board and the driver are installed and the driver restarts successfully, you can start to develop applications with the *PComm* library (See “Serial Programming Tools” chapter) or the Microsoft Win32 API. You can also execute any ready-made applications, such as *PComm* utility Terminal emulator (See “Serial Programming Tools” chapter) or HyperTerminal to transmit/receive data, as well as Remote Access Service to provide dial-up networking capabilities.

Configuring Board and Port

If you already have installed the driver and want to re-configure the Smartio C168 Series board and ports, add more boards or delete boards under Windows 95/98, the following is the procedure for you.

1. Click on the Taskbar **[Start]** button, then select **[Programs]** menu, then **[MOXA Utilities]** menu and then **[Moxa Smartio/Industio Configuration Panel]** icon.
2. The Smartio/Industio configuration panel will be popped up. Please see steps 5-7 in the previous Section “Installing Driver” for more details.

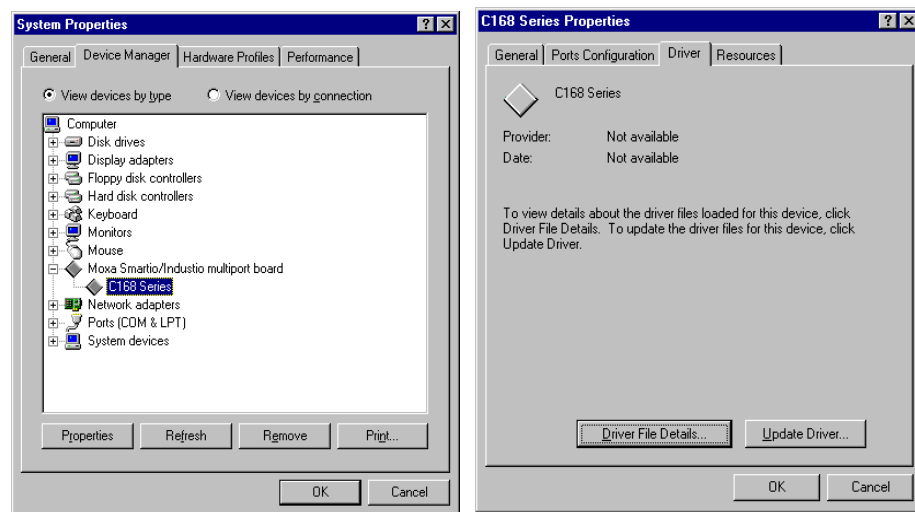


In this configuration panel, you may:

- } Click **[Property]** to enter “Property” dialog box to configure the selected board with the correct “COM Number”, “INT Vector”, “Interrupt no” and “Base I/O Port Address”. Please see **steps 5 to 7** in the previous section, “Installing Driver”, for more details, except that the “Board Type” field is not supposed to be changed.
- } Click **[Add]** to add one more board that is not yet configured in the system. Please see **steps 5 to 7** in the previous section, “Installing Driver”, for more details.
- } Click **[Remove]** to remove the board currently selected from the configured board list.
- } Click **[OK]** to confirm the configuration changes you made.
- } Click **[Cancel]** to leave the dialog with the configuration unchanged.

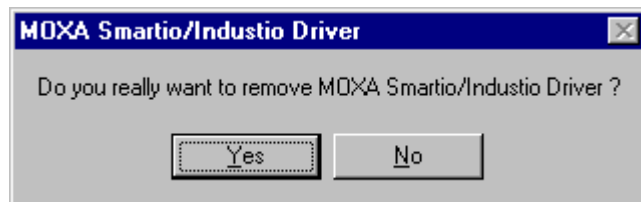
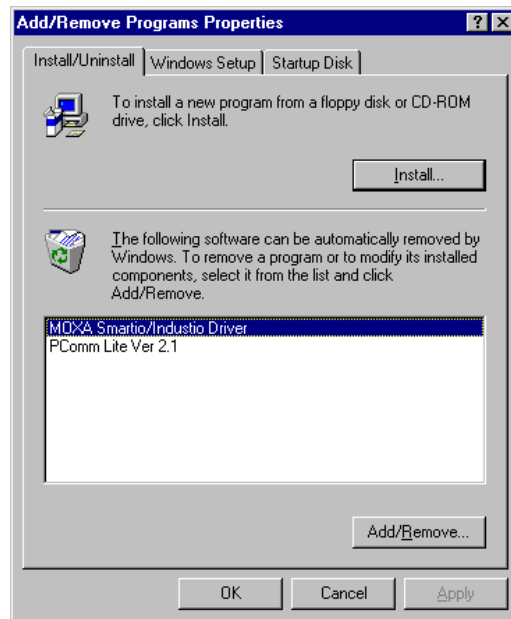
Updating Driver

Open [Control Panel] icon, and then [System] icon, and then select [Device Manager] tab. Then select and open the “MOXA Smartio/Industio Multiport Board” option and then select the “C168 Series”. Click on [Properties] button and then select [Driver] tab and then click on [Update Driver] button.



Removing Driver

Open [Control Panel] icon, and then [Add/Remove Programs] icon, and then select [Install/Uninstall] tab. Then select and open the “MOXA Smartio/Industio Driver” option and then enter [OK] to remove the driver.



DOS

MOXA DOS API-232 is a software package that assists users to develop and/or debug programs for serial communications. This section will show you how to install the package, how to setup up the driver, and how to load or unload driver.

For details of the serial programming (API-232 Library) and utilities, please refer to the next chapter, “Serial Programming Tools”.

Installing Driver

Run the installation program, **DOSINST.EXE**, in the DOS driver diskette. Specify the target API-232 directory (e.g. **C:\MOXA**) where software driver will be copied. Press **F2** to start the installation.



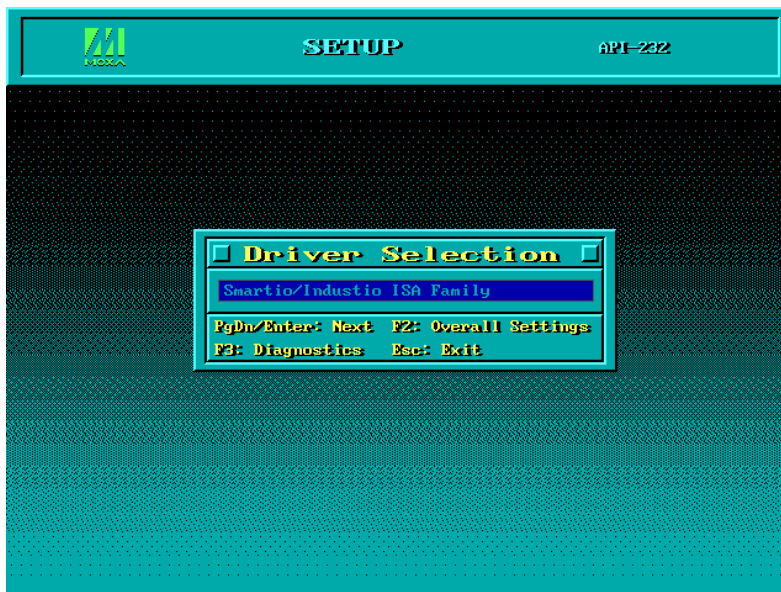
After installation is complete, you will be prompted to proceed running setup program. It is strongly recommended to do so.



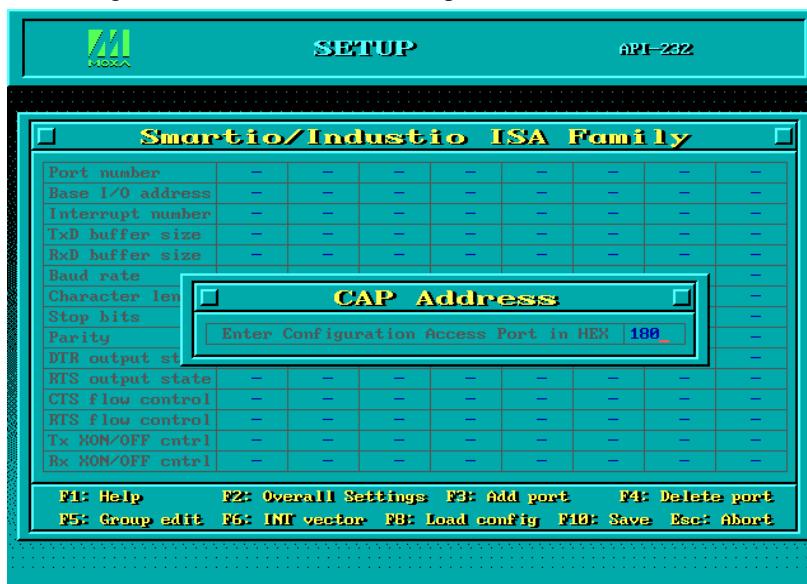
Driver Setup

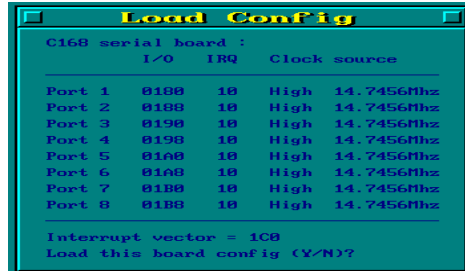
The following are steps for setting up the Smartio C168 Series driver. Note that it is not intended to illustrate all the convenient functions of the setup programs when configuring the boards. Please refer to the F1 on-line help instructions as running setup program.

1. Run the setup program, **BIN\SETUP.EXE**, in the API-232 directory. Select **"Smartio/Industio ISA Family"** in the "Driver Selection" dialog box.



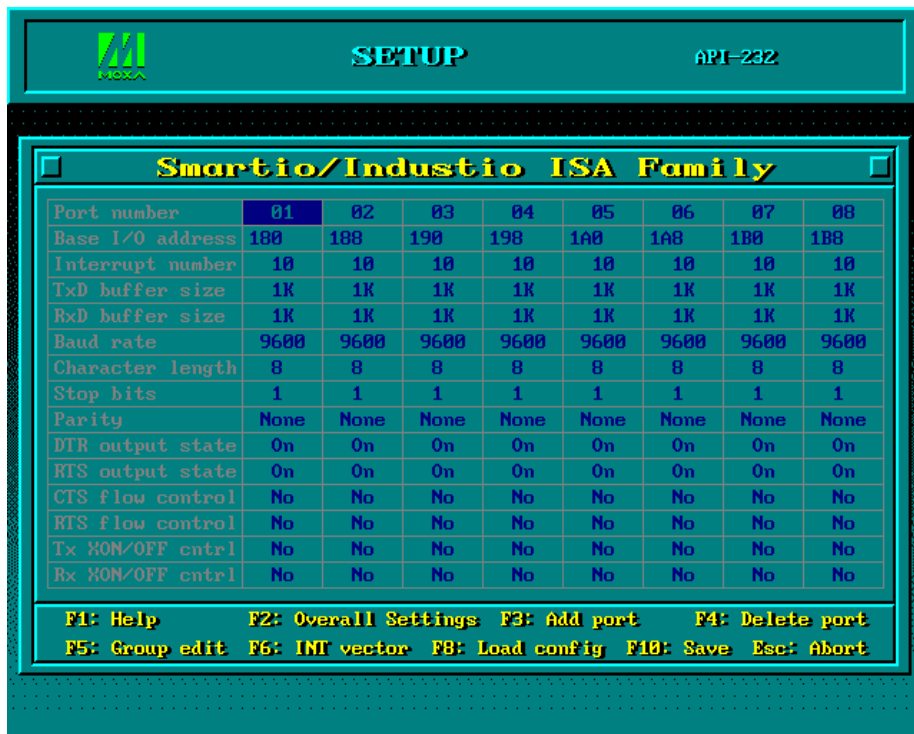
2. Press **Enter** to pop up the SETUP dialog box. In the SETUP dialog box, Press **F8** to specify the **CAP Address** and press **ENTER** and then type **Y (YES)** to load the configuration of the board to be setup.





- Now the configuration of the desired Smartio C168 Series board will be shown along with other default settings, such as port number, buffer size, etc.

Note! Up to now you have completed the setup for Smartio C168 Series board. You may skip this step and go directly to the next **step 5** if you need not change any setting or configure any board.



You may now enter/modify each port's configuration. These displayed values are the port initial values as driver is loaded.

Legend:

Port number: Some noticeable fields and functions are explained below. This is actually the port ID of each port. The application software will refer to the port by its port number (ID). Duplicated port number is not allowed. That is, each MOXA serial port is referred to as port number in terms of serial programming.

You may map the port number range to the one you prefer between 0 and 255 as long as no port number overlapping condition or port number undefined condition occurs. Generally, you should take the convenience of programming into consideration when specifying the port numbers for the board.

TxD buf size: The transmission (output) buffer allocated in the system for each port.

RxD buf size: The receiving (input) buffer allocated in the system for each port.

F5: Group Edit: This is a convenient function that helps you edit the configuration of several ports at one time as a group.



F6: INT vector: This is to set interrupt vector for each port. You can set this feature to “Yes” (default) and gain best performance for the board.



4. Press **F10** to save the latest configuration and exit the SETUP program.

Loading Driver

Having completed the setup, you can load the driver, “BIN\SER-DRV.EXE”, at the DOS prompt. The driver will detect the Smartio C168 Series board automatically. If the board(s) is(are) detected, a message similar to below will show:

```
API-232 Version 3.5
Universal 2/4/8 serial ports Communication Driver
Setup driver ...
Device driver setup O.K.
```

It means the Smartio C168 Series driver is installed properly. At this point, you are ready to execute application that supports API-232 functions, or start developing applications using API-232 library.

If something went wrong, for instance, the board does not match the configuration or the board is missing, the screen will show a message like:

```
API-232 Version 3.5
Universal 2/4/8 serial ports Communication Driver
Setup driver ...
None serial port found!!
```

It means the Smartio C168 Series driver is not installed properly. Please refer to chapter, “Troubleshooting”, for possible reasons and solutions.

Unloading Driver

To unload (release) the Smartio C168 Series driver from memory, type “**SER-DRV/Q**” at the DOS prompt

UNIX

There are various UNIX operating systems, such as SCO UNIX, UNIX SVR4.2, XENIX and Solaris, etc. Different types of UNIX drivers are required for different UNIX. Moxa supports device drivers currently for **SCO UNIX/OpenServer and UNIX SVR4.2**.

In this section, driver installation procedure is described. Administration utility, **moxaadm**, is explained, which is for configuration, monitor and terminal emulation. Related issues such as device naming, baud rate settings and terminal enable are stated.

If you are interested in UNIX serial programming, extended Ioctl() commands are provided in Chapter “Serial Programming Tools” for advanced programming. UNIX-specific troubleshooting is included in Chapter “Troubleshooting”.

Installing Driver

The following description is for Smartio C168 Series under SCO UNIX/OpenServer and UNIX SVR4.2.

Step 1. Login the UNIX system as a super user (root).

Step 2. Change to root directory.

```
# cd /
```

Step 3. Insert the UNIX driver diskette into the floppy drive A: (or B:).

If driver files are obtained from MOXA FTP service, put them under **/tmp/moxa** directory and skip the following '**tar**' command.

Step 4. Extract the files by,

```
# tar xvf /dev/fd0135ds18 /tmp/moxa/mxinstall (if A: floppy drive)
```

Step 5. Start the installation program,

```
# /tmp/moxa/mxinstall
```

Now follow the prompted instructions to finish the driver installation.

Choose the listed and desired operation system when asked. Currently, MOXA supports SCO UNIX (and SCO OpenServer, SCO Open Desktop) and UNIX SVR4.2 (and UnixWare). Ask your dealer for newly supported device drivers. If your system is none of the listed, choose the closest one to try.

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MOXA UNIX Device Driver Installation Ver. x.x

Please select one of the following OSs:

1. SCO UNIX
2. UNIX SVR4.2

Select :

Please select one of the devices where the driver diskette/files put:

1. /dev/fd0135ds18 (A: 1.44MB)
2. /dev/fd096ds15 (A: 1.2 MB)
3. /dev/fd1135ds18 (B: 1.44MB)
4. /dev/fd196ds15 (B: 1.2 MB)
5. Hard Disk /tmp/moxa

Select :

Then the **MOXA Multiport Board Installation Utility** will show for board installation.

Choose **C168 Series driver** and follow the instructions to install.

Step 6. Configure the board by,

moxaadm

The moxaadm utility is used to tell the UNIX driver how many Smartio C168 Series boards are installed, what their basic setting (I/O or IRQ), etc. It is also used to remove the Smartio C168 Series UNIX driver from the system. Whenever the setting is changed, run this utility again and tell the UNIX driver what is changed. Refer to section “**Administration Utility-moxaadm**” for more information.

This utility is not intended to change the Smartio C168 Series “hardware” I/O address nor IRQ setting. If you need to change the Smartio C168 Series hardware IRQ, for example, you need to execute IO-IRQ utility under DOS environment. The IO-IRQ utility is contained in the Dos/Windows3.x driver diskette.

Only up to two Smartio C168 Series boards are allowed to be installed under UNIX systems when MOXA UNIX driver is used.

Step 7. Now you may shutdown the system and reboot. If you have trouble in booting the new UNIX kernel, use the backup kernel (**/unix.moxa** or **/stand/unix.moxa**) to boot your system and the system will work as before. Refer to Chapter “Troubleshooting” for more information.

After the system starts up again, the following successful messages will show:

For SCO UNIX/OpenServer,

“C168 0x0180-0x01BF 11 Ver = x.x type=C168H (high speed)”

For UNIX SVR4.2,

“C168H board, base address 0x180, irq 5, Ver. x.x (high speed)”

where high speed indicates the port is in high speed status; otherwise, in normal speed status.

If the following error message appears:

For SCO UNIX/OpenServer,

“WARNING! C168 board IRQ at 11 mismatch (base address at 0x180)!”

For UNIX SVR4.2,

“WARNING! C168 board IRQ at 11 mismatch (base address at 0x180)!”

indicates the IRQ of the port is different between hardware and software configurations. However, only this port is disabled. Other ports should still work.

If the following common error message appears:

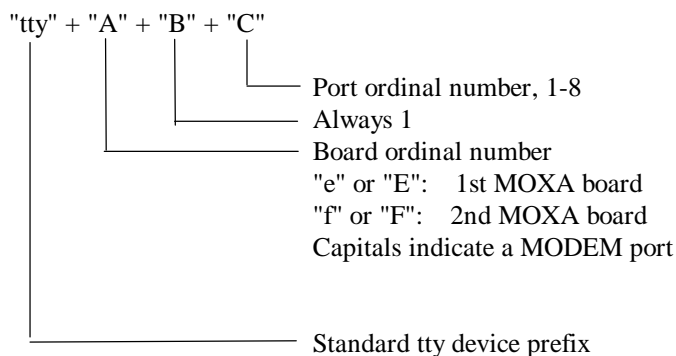
“WARNING! C168 board base address at 0x180 not found!” or “WARNING! C168 board interrupt vector disabled (Board base = 0x180)!”, indicates the base address of the board is not found or interrupt vector of the board is disabled. In these cases, all ports will not work.

Please see Chapter “Troubleshooting” for solutions.

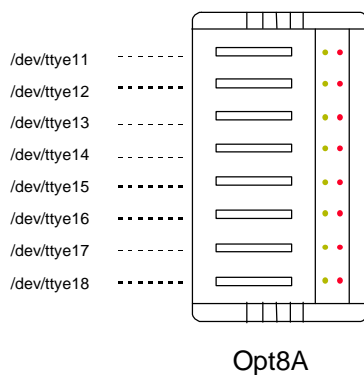
MOXA TTY Device Naming Convention

If the Smartio C168 Series is successfully configured, there will be two tty devices created for each port at `/dev` directory: one is **non-MODEM tty** (e.g. `ttYe11`), and the other is **MODEM tty** (e.g. `ttYE11`). The two devices are actually accessing the same physical port except that the MODEM tty has to check the ON status of DCD signal to be able to open device, and closing device automatically as DCD signal is OFF.

The convention of the MOXA tty device name is `/dev/tty{e-f}{1}{1-8}`, where:



For example:



Baud Rate Settings

For Smartio C168 Series set to **High Speed Spectrum**, the real working speed, is exactly **eight times** of the speed displayed by “**stty**” command. A port, if set to Normal Speed Spectrum with 38.4 Kbps, will work at 38.4 Kbps for sure; while a port, if set to High Speed Spectrum with displayed speed 38.4 Kbps, will actually work at 307.2 Kbps (38.4 Kbps; $\times 8$).

Note also that the 50 baud rate, **B50**, will no longer stand for 50 bps, instead, it means 57600 bps, and 75 baud rate, **B75**, for 115.2 Kbps. Furthermore, if the C168 Family H Series board is set to High Speed Spectrum, the real working speed is 8 times of the displayed speed. Hence, B50, 57.6 Kbps, is for 460.8 Kbps and B75, 115.2 Kbps, is for 921.6 Kbps.

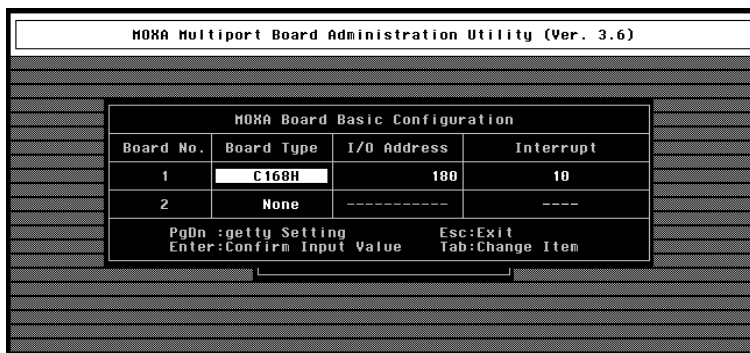
Administration Utility – moxaadm

Users can use the administration utility, **moxaadm**, to change the Smartio C168 basic and advanced configuration, to monitor the ports' activity, to use terminal emulation and to remove the installed MOXA driver from the system.

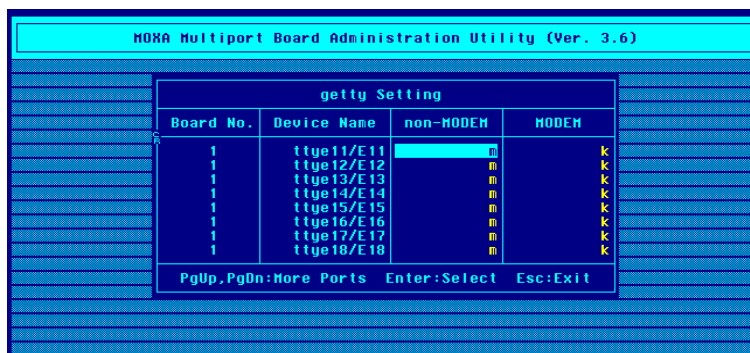


Basic Configuration

In the [Basic configuration] dialog, users can set base I/O address and interrupt, which should be the same as the hardware configuration of the boards. **Kernel rebuilding** is required if any setting is changed.



In [getty Setting] sub-dialog, there is one noticeable field:



Non-Modem and Modem Baud Rate

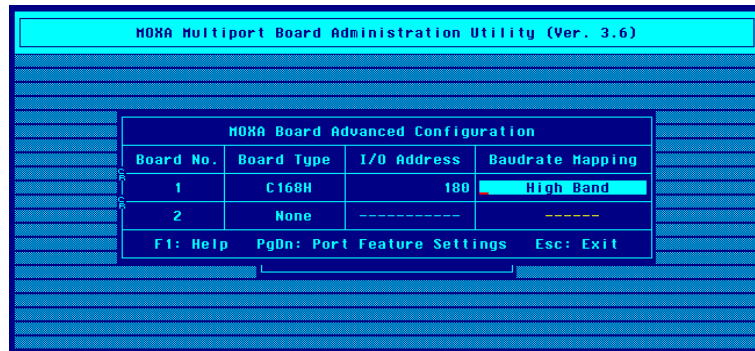
This field stands for the initial baud rate symbol and hunt sequence for Non-Modem /Modem tty. It is simply for setting parameters of getty entries in system file /etc/inittab which could also be manually modified by system administrator. Its value comes from the UNIX system “getty default” file, i.e., “/etc/gettydefs”. Modify this field to suit your need.

In some cases, you may need to modify the “getty default” file as well. For example, in some UNIX systems, the “9600” symbol indicated 8-data-bit no-parity while in

others it may stand for 7-data-bit, even-parity. So, please examine the “getty default” file carefully, and make sure the terminal settings is the same. Otherwise, garbled data will be inevitable.

Advanced Configuration

In the [Advanced configuration] dialog, users can set baud rate mapping, Rx FIFO trigger level, Tx FIFO trigger level and RTS/CTS hardware flow control.



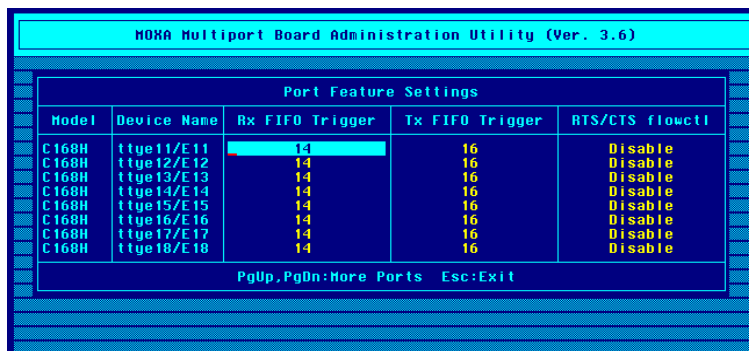
Baud Rate Mapping

There are two different baud rate tables can be selected: High Band and Low Band. The highest baud rate for High Band is 921.6K bps, while 38.4K bps for Low Band. Because of the limit of UNIX termio/termios definition, the highest baud rate label is B38400 (mapped to 38.4K bps). If users wish to use the baudrate higher than 38.4K bps for MOXA boards, this baud rate will be re-mapped to the lower as defined in the below baudrate-mapping table:

Label	High/Normal Speed	Normal Speed	High Speed
	Low Band	High Band	High Band
B50	50	57600	57600
B75	75	115200	115200
B110	110	110	230400
B134	134	134	460800
B150	150	150	921600
B200	200	200	200
B300	300	300	300
B600	600	600	600
B1200	1200	1200	1200
B1800	1800	1800	1800
B2400	2400	2400	2400
B4800	4800	4800	4800
B9600	9600	9600	9600
B19200	19200	19200	19200
B38400	38400	38400	38400

Note: You can press F1 on-line help to get more baud rate mapping information.

In [Port Feature Settings] sub-dialog, there are three noticeable fields:



Rx FIFO Trigger

Rx FIFO trigger levels, at 1, 4, 8 or 14 bytes, are available, and the default value is 14 bytes.

Tx FIFO Trigger

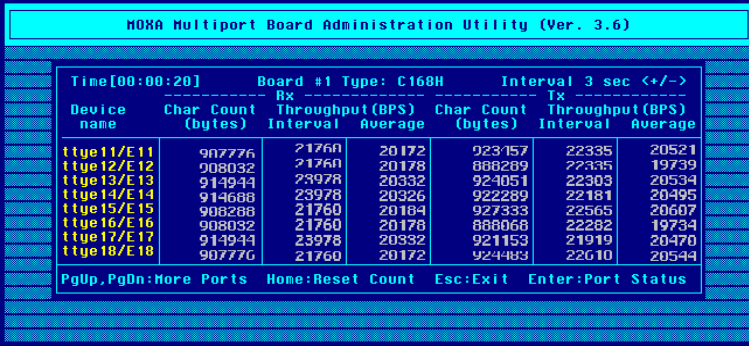
Tx FIFO sizes from 1 to 16 bytes are available, and the default value is 16 bytes.

RTS/CTS Hardware Flow Control

This feature is for more flexible driver behavior. If set to “**Disable**” (default), CTS signal is not needed for tty port to transfer data and RTS/CTS hardware flow control function in driver is disabled. On the contrary, if set to “**Enable**”, CTS signal is needed for tty port to transfer data and RTS/CTS hardware flow control function in driver is enabled.

Port Monitoring

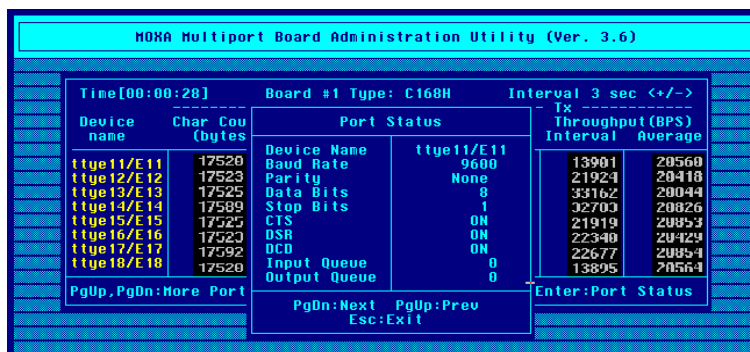
This utility gives you a quick view about all the MOXA ports' activities. You can easily learn each port's total received/transmitted (Rx/Tx) character count since the time when the monitoring is started. Rx/Tx throughputs per second are also reported in interval basis (e.g. the last 5 seconds) and in average basis (since the time the monitoring is started). You can reset all ports' count by <HOME> key. <+> <-> (plus/minus) keys to change the displaying time interval.



MOXA Multiport Board Administration Utility (Ver. 3.6)						
Time[00:00:20]		Board #1 Type: C168H		Interval 3 sec <+/->		
Device name	Char Count (bytes)	Rx		Tx		
		Throughput (BPS) Interval	Average	Char Count (bytes)	Throughput (BPS) Interval	Average
tttye11/E11	907776	21760	20172	923157	22335	20521
tttye12/E12	908032	21760	20178	888209	22335	19739
tttye13/E13	914944	23978	20332	924051	22303	20534
tttye14/E14	914688	23978	20326	922289	22181	20495
tttye15/E15	908288	21760	20184	927333	22565	20607
tttye16/E16	908032	21760	20178	888068	22282	19734
tttye17/E17	914944	23978	20332	921153	21919	20470
tttye18/E18	907776	21760	20172	924483	22610	20544

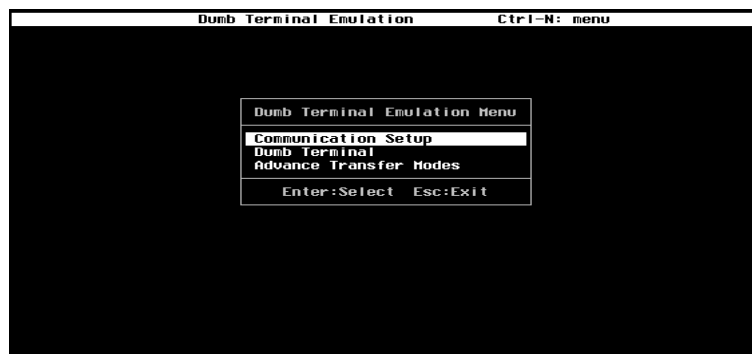
PgUp, PgDn: More Ports Home: Reset Count Esc: Exit Enter: Port Status

Press Enter on the port, that cursor stay, to view the port's communication parameters, signal status, and input/output queue.

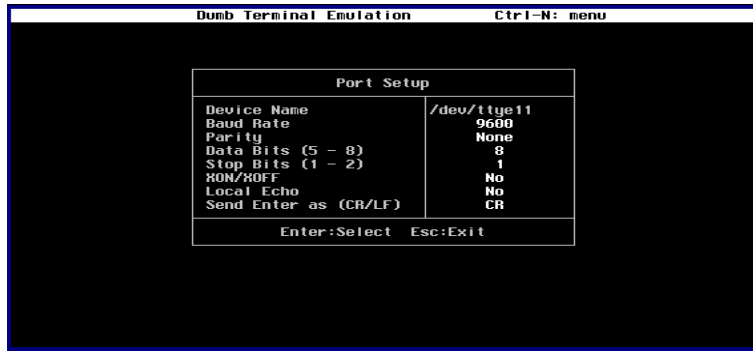


Terminal Emulation

This utility provides data sending and receiving ability of all tty ports, especially for MOXA ports. It is quite useful for testing simple application, for example, sending AT command to a modem connected to the port or used as a terminal for login purpose. Note that this is only a dumb terminal emulation without handling full screen operation. Besides, data scope function with pattern/file transfer is provided.



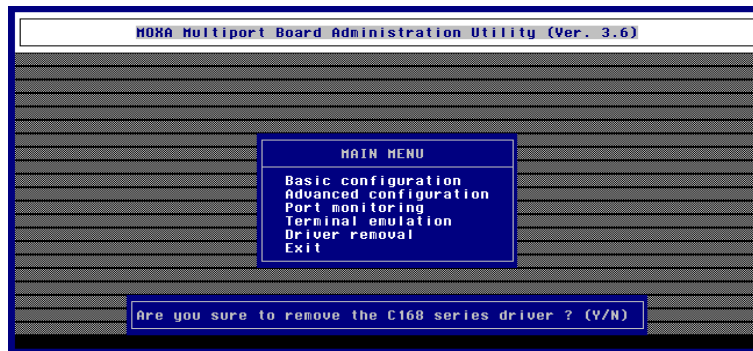
1. Select and Press Enter on item “**Communication Setup**” to setup up all the communication parameters for connection.



- 2 Select and enter **"Dumb Terminal"** to enter terminal emulation. Or select and enter **"Advance Transfer Modes"** to perform pattern or file transfer with protocols such as ZModem.

Driver Removal

If you want to remove the Smartio C168 Series device driver and return to your previous system configuration, simply press Enter in this function entry and answer **"Y"** to confirm. Then the system will be rebuild. This may take some time. If you answer **"N"**, no action will be taken.



Setting MOXA Ports to Terminal

Following procedure is how to set the MOXA port to the “Terminal” for login purpose, taking ttya11 as an example,

SCO UNIX/OpenServer
enable /dev/ttye11

UNIX SVR4.2

1. Edit (e.g. use vi editor) the file /etc/inittab.
2. Modify the tty entry from "ma11:23:off:/etc/getty ttye11 9600" to "ma11:23:respawn:/etc/getty ttye11 9600".
3. # init q

Or refer to your UNIX system manuals for how to activate a tty port.

4

Serial Programming Tools

Moxa supports easy but powerful serial programming library and communication troubleshooting utilities under Windows NT, Windows 95/98, UNIX and DOS. You will save greatly the developing time, using MOXA Serial Programming Tools.

The following sections will details the installation, the library and the utilities for various platforms.

Windows NT and Windows 95/98

PComm, the professional serial comm tool for PC, is a software package under **Windows NT and Windows 95/98**, which consists of powerful serial communication library for easy programming in most popular languages, useful utilities such as diagnostic, monitor and terminal emulator, illustrative example programs and comprehensive on-line documents.

The serial communication library is useful for developing a system for data communication, remote access, data acquisition or industrial control in the Windows NT and Windows 95/98 environment, which offers an easier solution compared with the more complex Windows Win32 COMM API.

Installation

To install *PComm*, please run `\Setup.exe` in the diskette. Note that *PComm* diagnostic and monitor utilities are for MOXA boards only. MOXA Windows NT or Windows 95/98 device driver as well as MOXA board are required. The driver are installed separately and detailed in Chapter “Software Installation”.

***PComm* Programming Library**

The serial communication library is to assist users to develop programs for serial communications **for any COM port** complying with Microsoft Win32 API. It can ease the implementation of multi-process and multi-thread serial communication programs and hence greatly reduce the developing time.

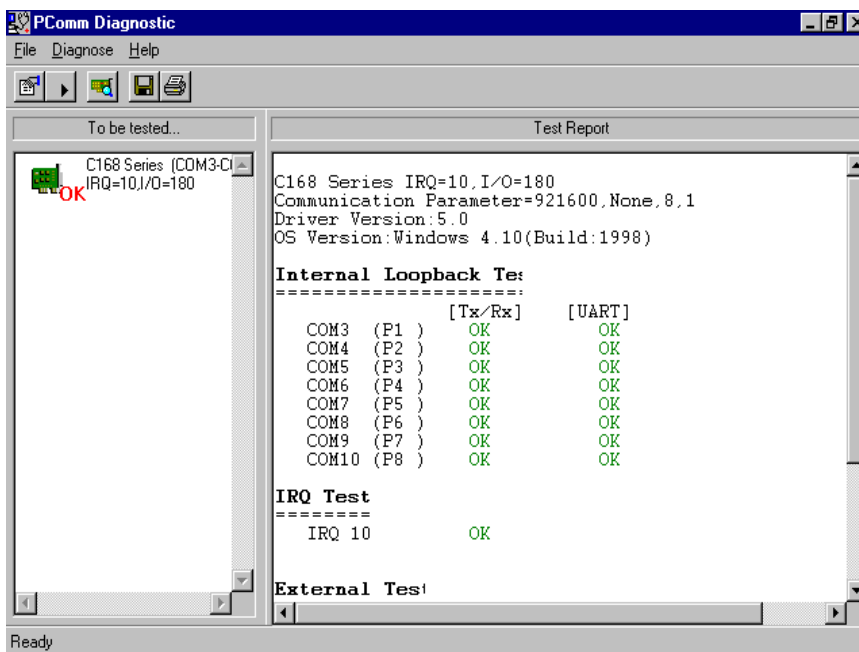
For complete library function description and example programs for Visual C++, Visual Basic and Delphi, please see help file and example programs in ***PComm*** directory for more details.

Utilities

The followings are short descriptions of each utility. For details, please see **on-line help** as running utilities.

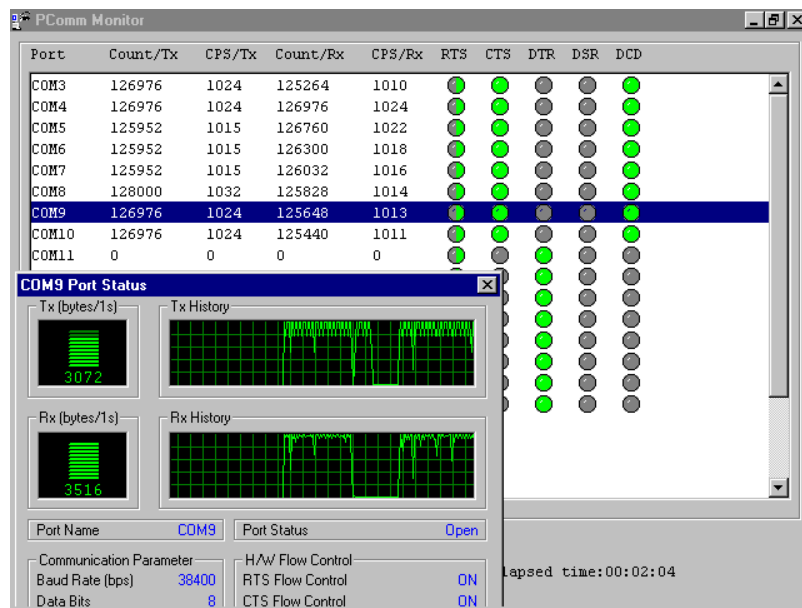
Diagnostic (for MOXA boards only)

A convenient diagnostic program provides internal and external testing, such as IRQ, TxD/RxD, UART, CTS/RTS, DTR/DSR, DTR/DCD testing, etc., for the MOXA boards and ports to verify correct operation of both the software and hardware.



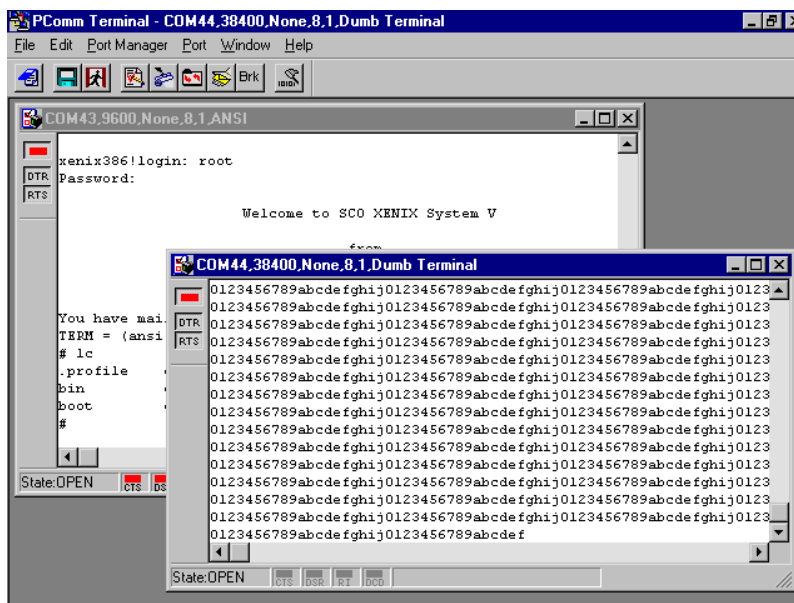
Monitor (for MOXA boards under Windows NT Only)

A useful port status monitoring program allows you to watch the selected MOXA COM ports' data transmitting/receiving throughput and communication line status which are updated and displayed on the screen at every time interval. In addition, you may click on one of the specific displayed port in order to see the current communication parameters and status of that port.



Terminal Emulator

The Terminal Emulator features multi-windows and supports terminal types of VT100 and ANSI. You can transfer data interactively, send pattern periodically or transfer file using ASCII, XMODEM, YMODEM, ZMODEM and KERMIT protocols.



UNIX

Programming the MOXA Ports

The system calls that apply to standard tty port can also be applied to MOXA port since MOXA port conforms to UNIX tty standard. System calls are like open(), ioctl(), read(), write(), close(), etc. Please refer to your UNIX Programmer's Reference manual.

However, these system services only provide limited functions and thus may not satisfy the sophisticated programmers' need. In order to meet the user's special purpose, MOXA supports extended services through ioctl() command, which are:

1. MIBUFED (= 0x401) To get byte count in input buffer.
2. MOBUFED (= 0x402) To get byte count in output buffer.
3. MTCRTS (= 0x403) To control RTS output signal.
4. MTCSTR (= 0x404) To control DTR output signal.
5. MLOWATER (= 0x405) To set output buffer low water level.
6. MSTATUS (= 0x407) To read modem line status (CTS/DSR/DCD).
7. MHWFLOW (= 0x40e) To enable/disable the hardware flow control.

The next Section details all the commands.

Extended UNIX ioctl() Commands

The following lists the syntax of MOXA extended functions for both non-SVR4.x and SVR4.x UNIX. The variable moxa_fd is the returned file descriptor by open() a specific MOXA port. For example,

```
int moxa_fd;  
moxa_fd = open("/dev/ttye11",O_RDWR);
```

1. MIBUFED

This function let you know how many bytes queued in input buffer when this function is issued.

Syntax for SCO UNIX/OpenServer

```
#define MIBUFED 0x401
int count; /* number of bytes queued in the buffer */
ioctl(moxa_fd, MIBUFED, &count);
```

Syntax for UNIX SVR4.2

```
#include <sys/stropts.h>
#include <sys/sysmacros.h>
#define MIBUFED 0x401
struct strioctl ioc;
int count; /* number of bytes queued in the buffer */

ioc.ic_cmd = MIBUFED;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&count;
ioctl(moxa_fd, I_STR, &ioc);
```

Note: Due to the characteristics of STREAMS driver, the returned count of bytes buffered only reflect the data buffered on MOXA board, not including the data buffered in STREAMS queue. In this case, the count is for reference only. For example, returned count may always be zero, but there still are data buffered in STREAMS queue.

2. MOBUFED

This function let you know the byte count queued in output buffer when this function is issued.

Syntax for SCO UNIX/OpenServer

```
#define MOBUFED 0x402
int count; /* number of bytes queued in the output buffer */

ioctl(moxa_fd, MOBUFED, &count);
```

Syntax for UNIX SVR4.2

```
#include <sys/stropts.h>
#include <sys/sysmacros.h>
#define MOBUFED 0x402
struct strioctl ioc;
int count; /* number of bytes queued in the output
buffer */

ioc.ic_cmd = MOBUFED;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&count;
ioctl(moxa_fd, I_STR, &ioc);
```

Note: See MIBUFED for influence of STREAMS driver.

3. MTCRTS

This function, only valid when hardware flow control is turned off (see MHWFLOW), is used to drive RTS signal on or off.

Syntax for SCO UNIX/OpenServer

```
#define MTCRTS 0x403
#define TurnON 1
#define TurnOFF 0

ioctl(moxa_fd, MTCRTS, TurnON);
ioctl(moxa_fd, MTCRTS, TurnOFF);
```

Syntax for UNIX SVR4.2

```
#include <sys/stropts.h>
#include <sys/sysmacros.h>
#define MTCRTS 0x403
#define TurnON 1
#define TurnOFF 0
struct strioctl ioc;
int setting;
```

```
setting = TurnON /* or TurnOFF */;
ioc.ic_cmd = MTCRTS;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&setting;
ioctl(moxa_fd, I_STR, &ioc);
```

4. MTCDTR

This function, only valid when hardware flow control is turned off (see MHWFLOW), is used to drive DTR signal on or off.

Syntax for SCO UNIX/OpenServer

```
#define MTCDTR      0x404
#define TurnON      1
#define TurnOFF     0
ioctl(moxa_fd, MTCDTR, TurnON);
ioctl(moxa_fd, MTCDTR, TurnOFF);
```

Syntax for UNIX SVR4.2

```
#include <sys/stropts.h>
#include <sys/sysmacros.h>
#define MTCDTR      0x404
#define TurnON      1
#define TurnOFF     0
struct strioctl
int                 ioc;
int                 setting;
```

```
setting = TurnON /* or TurnOFF */;
ioc.ic_cmd = MTCDTR;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&setting;
ioctl(moxa_fd, I_STR, &ioc);
```

5. MLOWATER

Sometimes the application software may not be able to write any further data to the output buffer because of the output buffer being full. The application has to wait

until the output buffer has 'enough space' again. The criteria to tell if the output buffer has 'enough space' is whether the output buffer reached its 'low water' level. That is the output buffer will accept further data only when the 'low water' level is reached. If the 'low water' value is relatively small, you may find that the output buffer become empty before you write another block of data (this is quite possible because UNIX is time-sharing multitasking environment). This will result in discontinuous data transmission. In a timeout-sensitive application, e.g. facsimile (FAX) transmission, discontinuous data may falter the operation.

The default 'low water' is 512 bytes. You can enlarge it but better not exceed one half of the output buffer. Each port's output buffer is 32K bytes.

Syntax for SCO UNIX/OpenServer

```
#define MLOWATER    0x405
int                lowater; /* low water value of output buffer
                           (default = 512 bytes) */

ioctl(moxa_fd, MLOWATER, lowater);
```

Syntax for UNIX SVR4.2

```
#include           <sys/stropts.h>
#include           <sys/sysmacros.h>
#define MLOWATER    0x405
struct strioc_t    ioc;
int lowater; /* low water value of output buffer (default = 512 bytes) */
ioc.ic_cmd = MLOWATER;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&lowater;
ioctl(moxa_fd, I_STR, &ioc);
```

6. MSTATUS

This function is used to know the RS-232 line status (CTS/DSR/DCD).

Syntax for SCO UNIX/OpenServer

```
#define MSTATUS 0x407
int      status; /* status = RS-232 line status */
           /* bit0i CTS (1:on, 0:off) */
           /* bit1i DSR (1:on, 0:off) */
           /* bit2i DCD (1:on, 0:off) */

ioctl(moxa_fd, MSTATUS, &status);
```

Syntax for UNIX SVR4.2

```
#define MSTATUS 0x407
#include <sys/stropts.h>
#include <sys/sysmacros.h>

struct strioctl      ioc;
int                  status; /* status = RS-232 line status */
           /* bit0i CTS (1:on, 0:off) */
           /* bit1i DSR (1:on, 0:off) */
           /* bit2i DCD (1:on, 0:off) */

ioc.ic_cmd = MSTATUS;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&status;
ioctl(moxa_fd, I_STR, &ioc);
```

7. MHWFLOW

This function is used to enable/disable hardware flow control. The first `open()` function of a port will set the hardware flow control bits on or off depending on the **[RTS/CTS Hardware Flow Control]** configuration in `mxadm`. However, users might want to control the DTR or RTS signal on their will, thus the RTS flow control bit should be turned off (`HWFlowControlOff`) in order to take over the control of DTR or RTS signal via function `MTCRTS` or `MTCDDTR`. `MTCRTS` and `MTCDDTR` can be effective only after the RTS flow control bit of `MHWFLOW` is turned off.

Syntax for SCO UNIX/OpenServer

```
#define MHWFLOW          0x40e
#define HWFlowControlOff 0x00
#define CTSFlowControlBitOn 0x01
#define RTSFlowControlBitOn 0x02
#define HWFlowControlOn  0x03
ioctl(moxa_fd, MHWFLOW, CTSFlowControlBitOn);
ioctl(moxa_fd, MHWFLOW, RTSFlowControlBitOn);
ioctl(moxa_fd, MHWFLOW, CTSFlowControlBitOn | RTSFlowControlBitOn);
```

Syntax for UNIX SVR4.2

```
#include <sys/stropts.h>
#include <sys/sysmacros.h>

#define MHWFLOW          0x40e
#define HWFlowControlOff 0x00
#define CTSFlowControlBitOn 0x01
#define RTSFlowControlBitOn 0x02
#define HWFlowControlOn  0x03
struct strioctl          ioc;
int                      setting;
setting = CTSFlowControlbitOn;
ioc.ic_cmd = MHWFLOW;
ioc.ic_timeout = 0;
ioc.ic_len = sizeof(int);
ioc.ic_dp = (char *)&setting;
ioctl(moxa_fd, I_STR, &ioc);
```

Utilities

You can use the administration utility, **moxaadm**, to **monitor port activity** and to **do terminal emulation**, which are details as follows.

Port Monitoring

This utility gives you a quick view about all the MOXA ports' activities. You can easily learn each port's total received/transmitted (Rx/Tx) character count since the time when the monitoring is started. Rx/Tx throughputs per second are also reported in interval basis (e.g. the last 5 seconds) and in average basis (since the time the monitoring is started). You can reset all ports' count by <HOME> key. <+> <-> (plus/minus) keys to change the displaying time interval.

MOXA Multiport Board Administration Utility (Ver. 3.6)						
Time[00:00:20]		Board #1 Type: C168H		Interval 3 sec <+/->		
Device name	Char Count (bytes)	Rx		Tx		
		Throughput (BPS) Interval	Average	Char Count (bytes) Interval	Throughput (BPS) Average	
tttye11/E11	907776	21760	20172	923157	22335	20521
tttye12/E12	908032	21760	20178	888289	22335	19739
tttye13/E13	914944	23978	20332	924051	22303	20534
tttye14/E14	914688	23978	20326	922289	22181	20495
tttye15/E15	908288	21760	20184	927333	22565	20607
tttye16/E16	908032	21760	20178	888068	22282	19734
tttye17/E17	914944	23978	20332	921153	21919	20470
tttye18/E18	907776	21760	20172	924483	22610	20544

PgUp, PgDn: More Ports Home: Reset Count Esc: Exit Enter: Port Status

Press Enter on the port, that cursor stay, to view the port's communication parameters, signal status, and input/output queue.

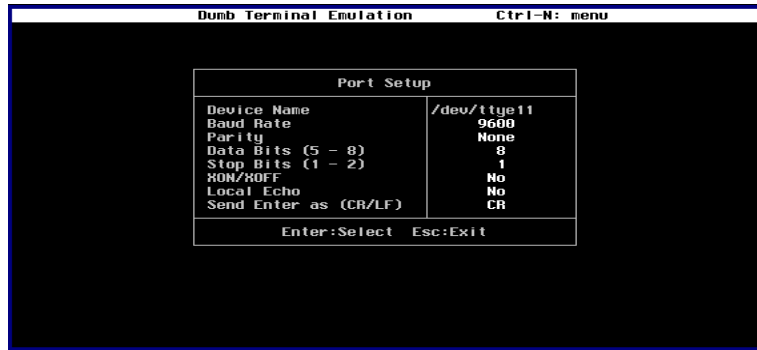
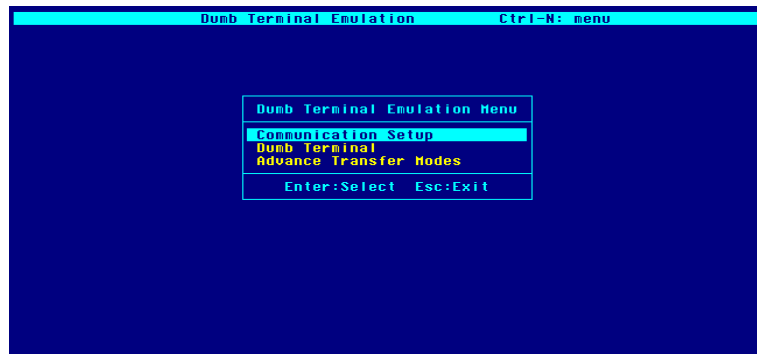
MOXA Multiport Board Administration Utility (Ver. 3.6)						
Time[00:00:28]		Board #1 Type: C168H		Interval 3 sec <+/->		
Device name	Char Cou (bytes)	Port Status		Tx		
		Device Name	tttye11/E11	Throughput (BPS) Interval	Average	
tttye11/E11	17520	Baud Rate	9600	13901	20560	
tttye12/E12	17520	Parity	None	21924	20410	
tttye13/E13	17525	Data Bits	8	33162	20044	
tttye14/E14	17599	Stop Bits	1	32703	20026	
tttye15/E15	17525	CIS	ON	21918	20053	
tttye16/E16	17520	DSR	ON	22340	20424	
tttye17/E17	17592	DCD	ON	22677	20054	
tttye18/E18	17520	Input Queue	0	13895	20564	
		Output Queue	0			

PgUp, PgDn: More Port PgDn: Next PgUp: Prev Esc: Exit Enter: Port Status

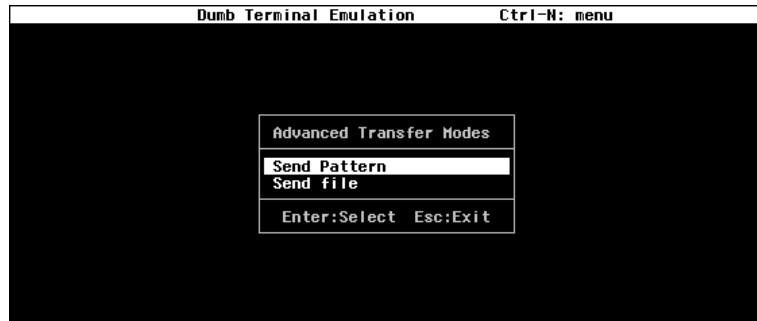
Terminal Emulator

This utility provides data sending and receiving ability of all tty ports, especially for MOXA ports. It is quite useful for testing simple application, for example, sending AT command to a modem connected to the port or used as a terminal for login purpose. Note that this is only a dumb terminal emulation without handling full screen operation. Besides, data scope function with pattern/file transfer is provided.

1. Select and Press Enter on item “**Communication Setup**” to setup up all the communication parameters for connection.



2. Select and enter “**Dumb Terminal**” to enter terminal emulation. Or select and enter “**Advance Transfer Modes**” to perform pattern or file transfer with protocols such as ZModem.



DOS

Installation

API-232 Library is the professional serial programming tool for DOS. It is installed automatically along with the MOXA DOS drivers. The installation is detailed in Chapter “Software Installation”.

DOS API-232 Library

DOS API-232 library supports languages like Microsoft C, Turbo C, Macro Assembly, QuickBasic, Turbo Pascal, Clipper, etc. Sample programs for each supported language are included, and placed in the sub-directory `..\EXAMPLE\%language` of the API-232 directory.

In addition, for DOS C language only, there are also Modem Control and File Transfer library available, supporting Hayes compatible modem control as well as ASCII, KERMIT, XMODEM, YMODEM and ZMODEM file transfer protocol functions.

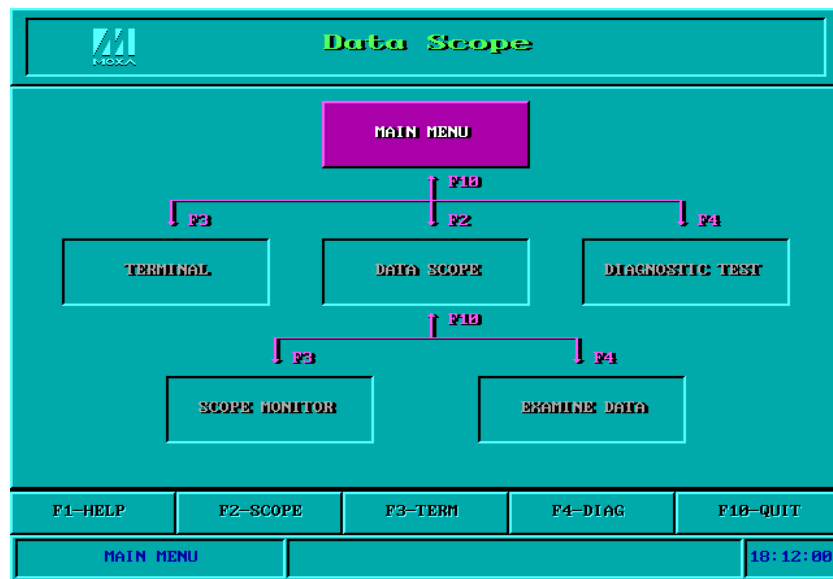
For complete API-232 function description, please see file `API-232.TXT` in the API-232 directory for more details.

Utilities

There are two utilities available for DOS: Data Scope and Diagnose, which are detailed below.

Data Scope

The Data Scope, `BIN\SCOPE.EXE`, is a suite of utility programs that can help users with system troubleshooting and serial communication debugging.



There are three major functions in Data Scope utility:

1. The **Data Scope utility** offers transparent monitoring of serial communication lines and allows data to be streamed to disk storage for later analysis.
2. The **TTY terminal emulation utility** allows user to view the signal status and transfer data interactively or files using ASCII, XMODEM, YMODEM, ZMODEM and KERMIT protocols.
3. The **Diagnostic test utility** provides port connection test with two MOXA ports connected via a properly wired cable.

Please see **on-line help** as running BIN\SCOPE.EXE for more usage and capability information.

Diagnose

The Diagnose, BIN\DIAGNOSE.EXE, is a utility that can help users to diagnose the hardware condition of each port of the selected board. See on-line help for more details.

Before executing it, please remove the Moxa driver in advance via executing “Mx-drv/Q” if the Moxa driver is running in the background.



RS-485 Programming for Opt8J

If you intend to do RS-485 communication with Opt8J, please follow the RS-485 programming guide below and also refer to Chapter “**Connection Option (Opt8x) and Cable Wiring**” for more Opt8J RS-485 operation details.

The Opt8J supports **only 2-wire half-duplex RS-485 communication**. Data+/- pins are served for both data transmitting and receiving, depending on the RTS signal.

The port switch of each port should be set to **On** position. The port is for transmitting data if **RTS is asserted** and for receiving data if **RTS is not asserted**.

RTS scheme is suitable for any system, including Windows NT and Windows 95/98, DOS, or UNIX, that permits RTS control from application programs.

There are 2 solutions to control RS-485 2-wire transmission.

Solution 1

The following model is common in RS-485 2-wire transmission.

```
sio_SetWriteTimeouts(port, 0); /* Set sio_write() into block mode if
                                for Windows NT and Windows 95/98 */
sio_RTS(port, 1);              /* Turn on RTS signal. The RS-485
                                port is ready for transmitting data. */
sio_write(port, buff, 10);     /* Write 10 byte characters in "buff".
                                The function blocks until last
                                character transmitted */
sio_RTS(port, 0);             /* Turn off RTS signal. The RS-485
                                port is ready for receiving data. */
sio_read(port, buff, 10);     /* Read 10 bytes */
```

Solution 2

There is a dedicated RS-485 function in *PComm* or *API-232* library. It integrates the above functions of solution 1 regarding sending data as one.

```
sio_putb_x(port, buff, tick ); /* 1. Turn on RTS and ready for
                                transmitting data.
                                2. Send data.
                                3. Wait for tick time.
                                4. Turn off RTS and ready for
                                receiving data. */
```

For more information on these functions, please refer to *PComm* library on-line Help file for Windows NT and Windows 95/98 or *API-232.txt* file for DOS, respectively

Connection Option (Opt8x) and Cable Wiring

In serial data communications, the term **DTE** is for Data Terminal Equipment like PC COM1/2, serial printer and terminal. The term **DCE** is for Data Communication Equipment like modem.

RS-232 Cable Wiring for Opt8A/B/C/D/S

RS-232 8-port connection boxes/octopus cable designed for Smatio C168 Series are:

Opt8A: 8-port RS-232 DB25 female connection box

Opt8B: 8-port RS-232 DB25 male connection box

Opt8C: Octopus cable with 8 male RS-232 DB25 ports

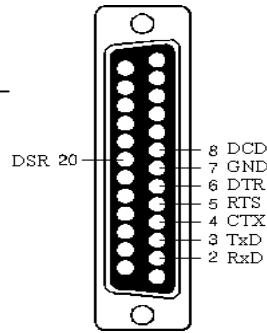
Opt8D: Octopus cable with 8 male RS-232 DB9 ports

Opt8S: 8-port RS-232 DB25 surge protected female connection box

The followings are pin assignments for various connection options:

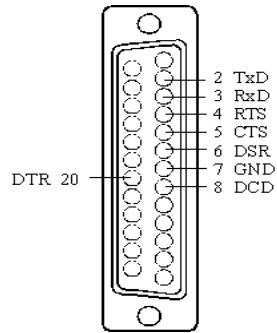
**Opt8A/S
(DCE, DB25 Female)**

- 2 RxD
- 3 TxD
- 4 CTS
- 5 RTS
- 6 DTR
- 7 GND
- 8 DCD
- 20 DSR



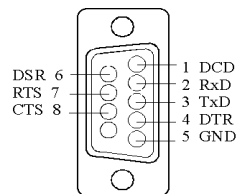
**Opt8B/C
(DTE, DB25 Male)**

- 2 TxD
- 3 RxD
- 4 RTS
- 5 CTS
- 6 DSR
- 7 GND
- 8 DCD
- 20 DTR



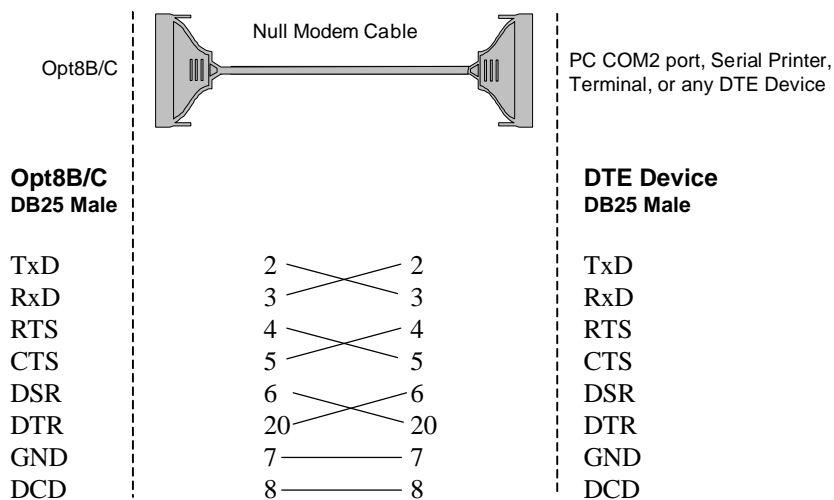
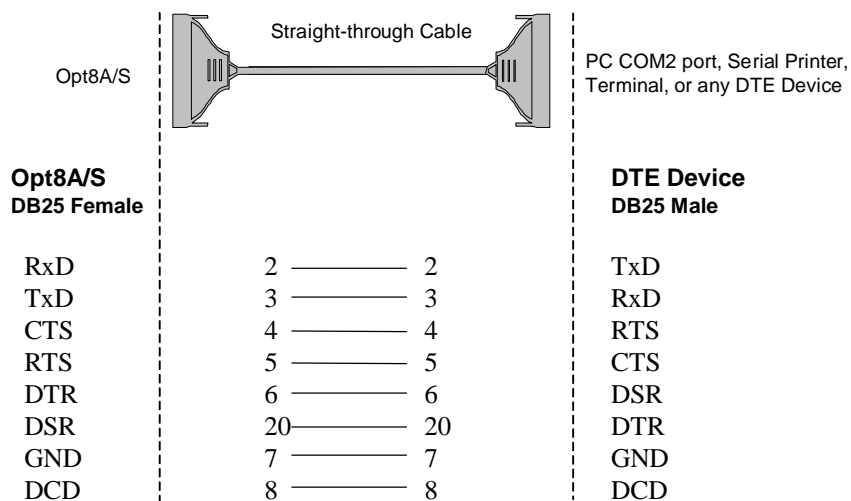
Opt8D (DB9 Male)

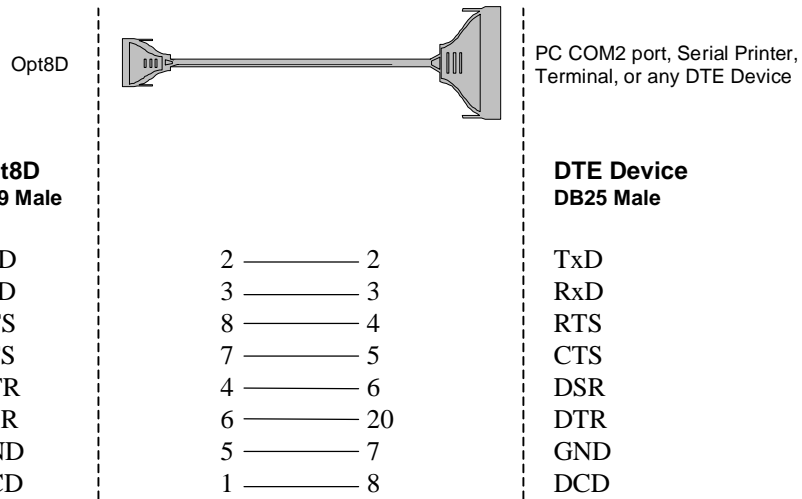
- 1 DCD
- 2 RxD
- 3 TxD
- 4 DTR
- 5 GND
- 6 DSR
- 7 RTS
- 8 CTS



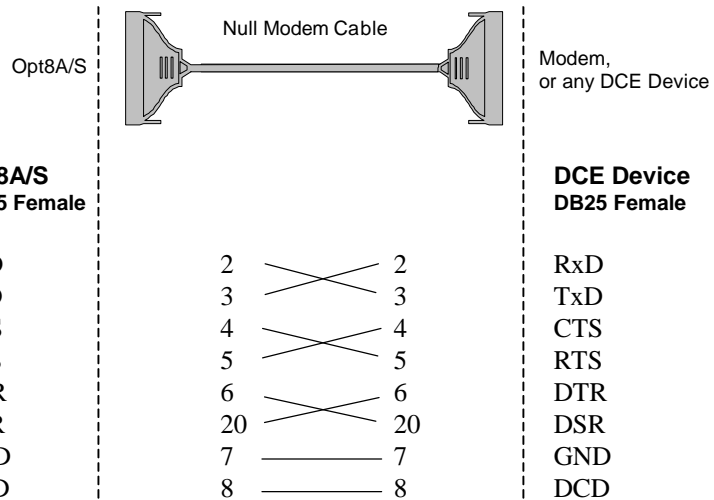
Connection Option (Opt8x) and Cable Wiring

Type 1: To connect Smartio C168 Series to a DTE device.

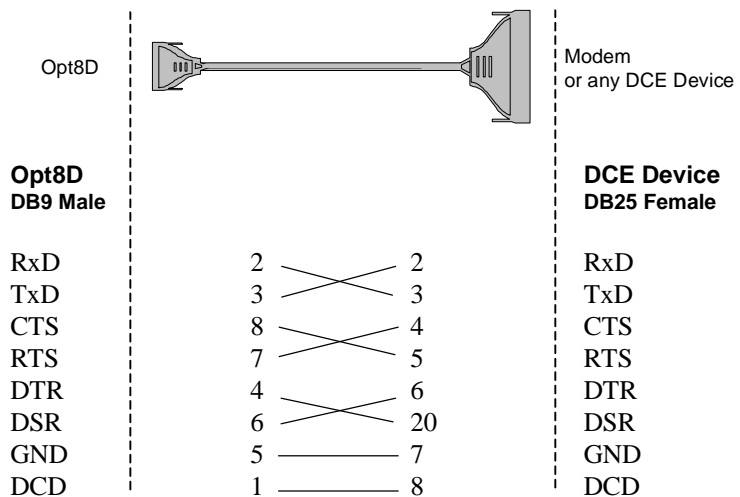
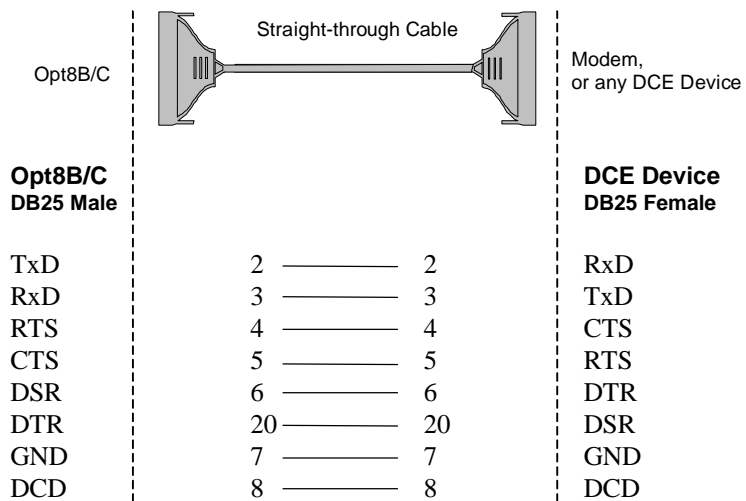




Type 2: To connect Smartio C168 Series to a DCE device.

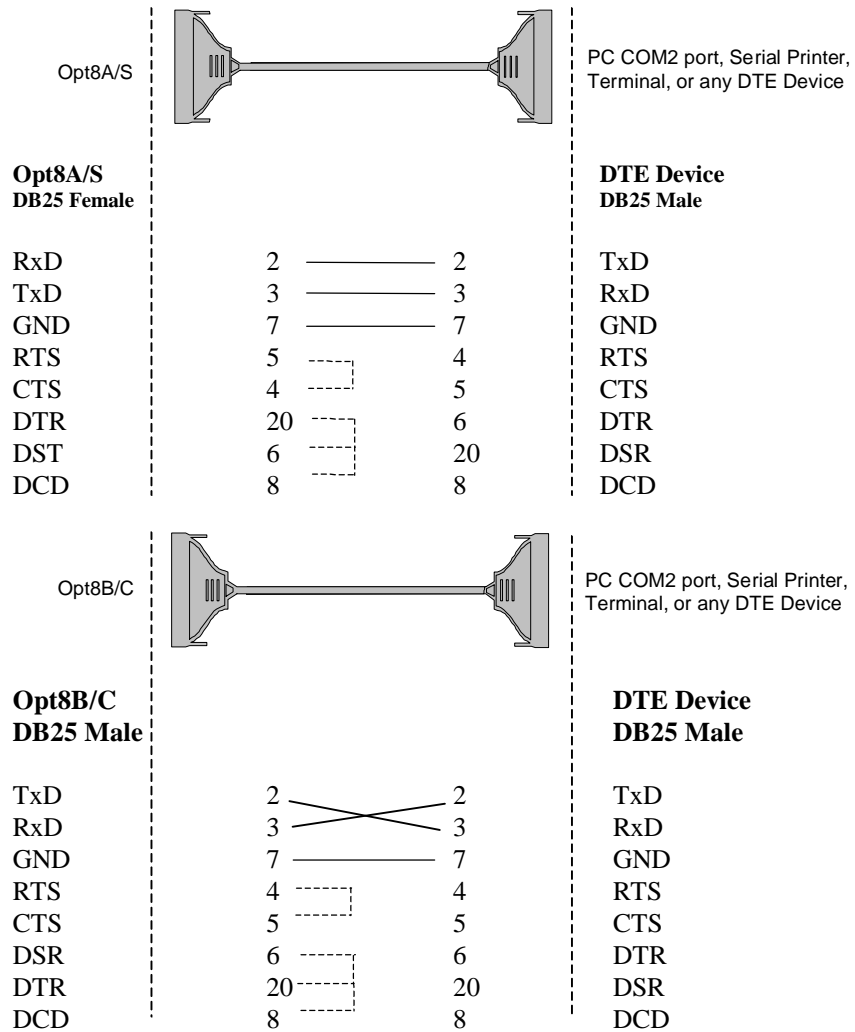


Connection Option (Opt8x) and Cable Wiring

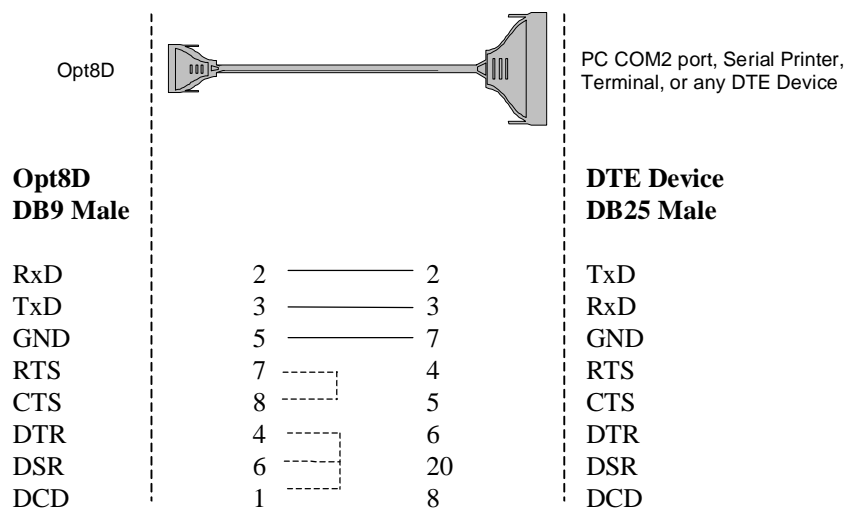


Type 3: To connect Smartio C168 Series to a DTE with 3-pin wiring.

If the “**Hardware flow control**” feature is set to “**ON**”, you must loop back (or short) the RTS with CTS and DSR with DTR, DCD on MOXA site, indicated in dash-lines of the following diagrams. If the “**Hardware flow control**” feature is set to “**OFF**”, you could just leave RTS, CTS, DSR, DTR, DCD open, ignoring the connection indicated in dash-lines.



Connection Option (Opt8x) and Cable Wiring



RS-422 Cable Wiring for Opt8J/F/Z

RS-422 connection boxes designed for Smartio C168 Series are:

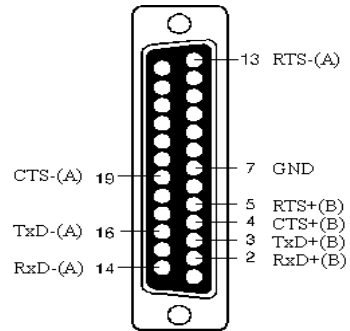
- Opt8J:** Connection box with 8 female RS-422/485 DB25 ports. Set the port switch to **OFF** position (RS-422) for the desired port(s).
- Opt8F:** Connection box with 8 female RS-422 DB25 ports and Max. 500V DC isolation protection which prevents damage caused by high potential voltage.
- Opt8Z:** Connection box with 8 female RS-422 DB25 ports but without isolation protection.

RS-422 Pinouts for Opt8J/F/Z:

Opt8J/F/Z

2	RxD+(B)
3	TxD+(B)
14	RxD-(A)
16	TxD-(A)
7	GND
4	CTS+(B)
5	RTS+(B)
13	RTS-(A)
19	CTS-(A)

} Opt8J only



The RS-422 transmission distance can reach as long as 4000ft. The connection box needs an external power adapter to supply 5V DC power. Either 110V or 220V AC power adapter is selectable.

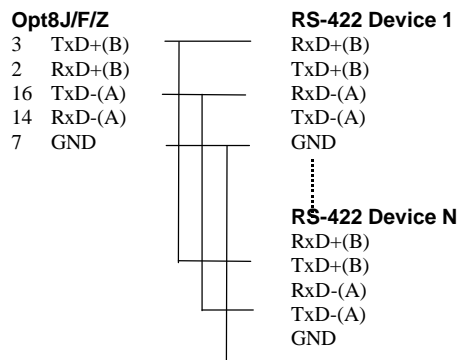
Connection Option (Opt8x) and Cable Wiring

The followings are operation modes for RS-422:

RS-422 Point-to-point

Opt8J/F/Z		RS-422 Device
3	TxD+(B) ———	RxD+(B)
16	TxD-(A) ———	RxD-(A)
2	RxD+(B) ———	TxD+(B)
14	RxD-(A) ———	TxD-(A)
7	GND ———	GND

RS-422 Broadcasting



Opt8J RS-422 with Handshaking

Opt8J		RS-422 Device
3	TxD+(B) ———	RxD+(B)
16	TxD-(A) ———	RxD-(A)
2	RxD+(B) ———	TxD+(B)
14	RxD-(A) ———	TxD-(A)
7	GND ———	GND
5	RTS+(B) ———	CTS+(B)
13	RTS-(A) ———	CTS-(A)
4	CTS+(B) ———	RTS+(B)
19	CTS-(A) ———	RTS-(A)

RS-485 Cable Wiring for Opt8J

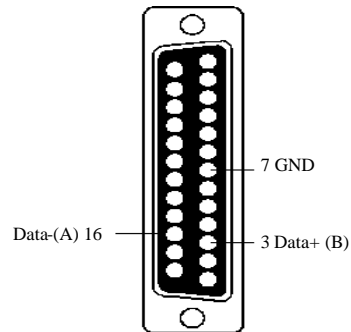
One RS-485 connection box designed for Smartio C168 Series is:

Opt8J: Connection box with 8 female RS-422/485 DB25 ports. Set the port switch to **ON** position (RS-485) for the desired port(s).

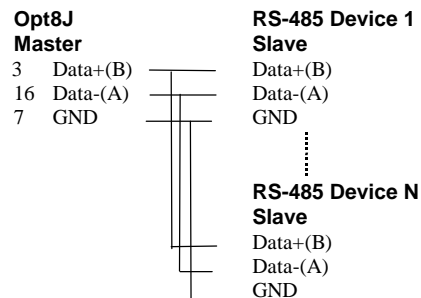
The Opt8J supports **only 2-wire half-duplex RS-485 communication**. **Data+/-** pins are served for both data transmitting and receiving, depending on the RTS signal.

RS-485 Pinouts for Opt8J:

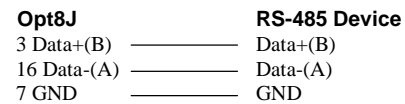
Opt8J	
3	Data+(B)
7	GND
16	Data-(A)



Multidrop RS-485 Half-duplex



Point-to-Point RS-485 Half-duplex




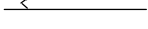
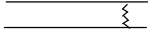
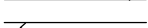




See Section “**RS-485 Programming**” of Chapter “**Serial Programming Tools**” for more Opt8J RS-485 programming details.

RS-422/485 Impedance Matching

For RS-422/485 serial communications, when an electrical signal travels through two different resistance junctions in a transmission line, the impedance mismatch will sometimes cause signal reflection. Signal reflection causes signal distortion, which in turn will contribute communication errors. The solution to this problem is to establish the same impedance at the line ends as in the line itself by terminating them with resistors.

The value of the termination resistor should equal the characteristic impedance of the transmission line. The resistors should be added **near the receiving side**.

	Opt8J/F/Z		RS-422/485 Device
	3 TxD+(B)		RxD+(B)
	16 TxD-(A)		RxD-(A)
	2 RxD+(B)		TxD+(B)
	14 RxD-(A)		TxD-(A)
Opt8J only	5 RTS+(B)		CTS+(B)
	13 RTS-(A)		CTS-(A)
	4 CTS+(B)		RTS+(B)
	19 CTS-(A)		RTS-(A)

Note:

1. ξ Stands for termination resistor near the receiving side
2. The suggested termination resistor for AWG #26 cable is 100 ohm.
3. The suggested termination resistor for phone cable is 600 ohm.

6

Troubleshooting

Common Smartio C168 Series problems and possible solutions are listed below. If you still have problems, contact your dealer or Moxa for help. Or use the “**Problem Report Form**” at the end of this manual to report problems to your dealer at once for faster technical support.

General Troubleshooting

1. **The MOXA driver, while installing the driver, cannot detect the MOXA board.**

Hardware causes and solutions:

- a. The board is not installed or missing (absent). Please install it.
- b. The board is not properly plugged in the system. If that is the case, re-install the board and make sure that it fits well in a 16-bit slot this time. Sometimes the slot for plugging the board is bad. In this case, try other slots until you find a good one.

2. **The MOXA board and driver are activated but cannot transfer (transmit/receive) data.**

Hardware Causes and Solutions:

- a. Check for wrong cable wiring. Refer to the “Connection Cable and Cable Wiring” chapter for precise pin outs of the connector type you are using.
- b. The cable or the board is defective. You may use other ports, cables or boards to verify. In addition, the *PComm* “Diagnostic” utility for Windows NT and Windows 95/98 is good for testing MOXA boards and port conditions. If Diagnostic reports error, replace the faulty components.

Software Causes and Solutions:

- a. Smartio C168 Series checks the line status (CTS) before it sends data out if the RTS/CTS flow control feature is set to “Enable” in the configuration or application program. Please refer to the “Connection Cable and Cable Wiring” chapter for proper wiring. Check the line status of the suspected port using the diagnostic LED indicators on the mini tester.
- b. Perhaps the application controlling the board is not correctly written according to the corresponding API of the operating system. To verify, please run an existing and known good application or the provided utilities by Moxa. For example, under Windows NT and Windows 95/98, *Pcomm* “Terminal emulator” or “HyperTerminal” utilities are good for testing the COM ports.

3. Why the DOS utility IQ-IRQ can not access Smartio C168 Series to configure?

There are several reasons that may lead to this trouble:

- a. The user forgets or does not know the Configuration Access Port (CAP) of the board. See next problem 4 for how to solve this problem.
- b. The CAP of the board conflicts with other add-on boards’ I/O address. Please change other add-on boards’ I/O address to avoid the conflict.
- c. The Smartio C168 Series board is not plugged in a right or good slot. Please plug the board in a good 16-bit ISA slot.
- d. The Smartio C168 Series board may malfunction. Please return for repair.

If any existing board has the same I/O address as 0x180, the **default** CAP address, or the 1st port's I/O address, you must try to avoid the conflict by doing either one the following.

- a. Install a jumper (short) at position JP1 on the upper-left corner of the board. This will force the CAP address to 0xA700.
- b. Change or disable the existing board's I/O address.

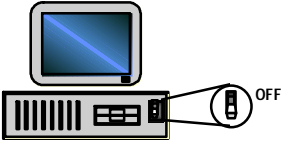
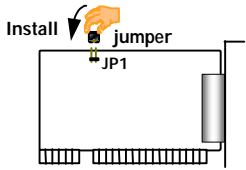
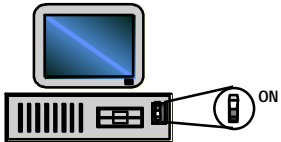
4. What to do if user forgets or does not know the Configuration Access Port (CAP) address of Smartio C168 Series?

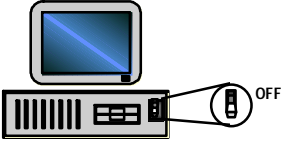
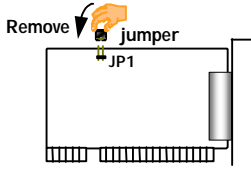
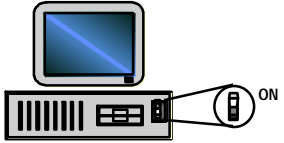
The Smartio C168 Series multiport boards are designed without jumper or switch, so the configuration is completed only by DOS utility Io-irq.exe.

Troubleshooting

To configure the board, you need to know the board's Configuration Access Port (CAP) address. Because the CAP address is the only channel, via which the Io-irq.exe can access to the board.

The following procedure instructs user to recover once the CAP is unknown.

Step 1.	Power off the PC.	
Step 2.	Install jumper onto the JP1 of the board.	
Step 3.	Power on the PC. Now the CAP address of the board will be 0xA700.	
Step 4.	Execute Io-irq under DOS environment. A:> Io-irq	
Step 5.	Enter CAP address 0xA700 to access the board. <i>Enter the "Configuration Access Port" in HEX: A700</i>	
Step 6.	The previous hardware configuration will be shown. <i>Modify them if necessary. Remember the CAP address this time.</i>	
Step 7.	Exit the IO-IRQ.	

Step 8.	Power off the PC.	
Step 9.	Remove the jumper on position JP1.	
Step 10.	Power on the PC.	

Windows NT

This section is specific for troubleshooting under Windows NT. For general problems and solutions, please see the previous section, “General Troubleshooting”.

1. **After the system reboots, the error message “Another driver in the system, which did not report its resources, has already claimed the interrupt used by xxx.” appears in the Event Log.**

This indicates that the MOXA board is found, but the IRQ is conflicting with another adapter. Please make sure there is no conflict with other adapter’s IRQ. Check the BIOS IRQ settings first. Make sure that an IRQ is available.

2. **After the system reboots, the error message “Cannot find any configured MOXA Smartio/Industio Series board!” appears in the Event Log.**

- a. Some partial decoded network board may interfere with our board. Please avoid from using 0x300 as I/O address for those network boards.
- b. Check hardware configuration of Smartio C168 Series board by IO-IRQ.EXE. Then make sure the hardware configuration, including I/O addresses for each port, Interrupt Vector, IRQ, is identical to that of the driver.
- c. The I/O addresses may conflict with other devices, please change another set of I/O address such as I/O:0x280, Interrupt Vector:0x2C0.
- d. The board(s) is not plugged properly. Please make sure the board is seated firmly in the expansion slot.
- e. The slot for plugging the board is defective.
In this case, please try other slots until you find a good one.
- f. The board might be defective.

3. The COM number of the Smartio C168 Series conflicts with others.

The COM numbers of different boards happen to be the same. Try to change the COM number mappings.

4. Windows NT system panic (blue screen).

The possible reason is an IRQ or memory conflict with other ISA Bus adapters, like LAN and SCSI boards, or the system BIOS. Please refer to the corresponding problem in the previous section, “General Troubleshooting”, for solutions.

Windows 95/98

This section is specific for troubleshooting under Windows 95/98. For general problems and solutions, please see the previous section, “General Troubleshooting”.

- 1. The system fails to find the Smartio C168 Series board! After system reboots, error message “Smartio C168 Series (CAP=0x0180, port 1=COM3): Board is not found” appears.**
 - a. Some partial decoded network board may interfere with our board. Please avoid from using 0x300 as I/O address for those network boards.
 - b. Check hardware configuration of Smartio C168 Series board by IO-IRQ.EXE. Then make sure the hardware configuration, including I/O

-
- addresses for each port, Interrupt Vector, IRQ, is identical to that of the driver.
- c. The I/O addresses may conflict with other devices, please change another set of I/O address such as I/O:0x280, Interrupt Vector:0x2C0.
 - d. The board(s) is not plugged properly. Please make sure the board is seated firmly in the expansion slot.
 - e. The slot for plugging the board is defective.
In this case, please try other slots until you find a good one.
 - f. The board might be defective.

DOS

This section is specific for troubleshooting under DOS. For general problems and solutions, please see the previous section, “General Troubleshooting”.

1. **After executing SER-DRV.EXE, error message “None serial port found!” appears.**
 - a. Make sure you’re using the right driver.
 - b. Check if the board is properly plugged into ISA/EISA bus slot.
 - c. Check if the I/O address and IRQ settings in SETUP program are same as the settings on board.

UNIX

This section is specific for troubleshooting under UNIX. For general problems and solutions, please see the previous section, “General Troubleshooting”.

1. **Under UNIX, when respawning quite a few number of tty ports, the following error messages appear: “Time out table overflow”, “File table overflow”, “Region table overflow”.**

Software Cause and Solution:

The above error messages imply that the system resources are exhausted. You should tune the kernel parameters to a larger value and rebuild the kernel to be able to accommodate the new configuration. Refer to UNIX system manual about how to tune the parameters and rebuild kernel.

“Time out table overflow”: NCALL parameter too small.
“File table overflow”: NFILE or NINODE parameter too small.
“Region table overflow” : NREGION or NPROC parameter too small.

2. Under UNIXs, the newly rebuilt kernel could not boot.

Software Causes and Solutions:

The C168 driver might not be built into the new kernel correctly.

- a. Please use the last good kernel backup to boot again. The kernel backup in SCO UNIX is /unix.moxa while in UNIX SVR4.2 /stand/unix.moxa.
- b. Then remove the C168 driver. Refer.
- c. Re-install the C168 driver once more.

Appendix

Technical Reference

Specifications

%o	Bus interface:	ISA (EISA compatible)
%o	Number of ports:	8
%o	I/O address:	0x0000 ~ 0xFFFF
%o	IRQ:	2, 3, 4, 5, 7, 10, 11, 12, 15
%o	Data bits:	5, 6, 7, 8
%o	Stop bits:	1, 1.5, 2
%o	Parity:	none, even, odd, space, mark
%o	UART:	8j \tilde{N} 550C or compatible
%o	Speed (bps):	50 ~ 921.6K
%o	Connectors:	8j \tilde{D} B25 male or female
%o	Data signals:	RS-232j \tilde{T} xD, RxD, RTS, CTS, DTR, DSR, DCD, GND RS-422j \tilde{T} xD+(B), TxD-(A), RxD+(B), RxD-(A), GND (Opt8J: RTS+(B), RTS-(A), CTS+(B), CTS-(A)) RS-485j \tilde{D} ata+(B), Data-(A), GND
%o	Surge protection:	max. 2000V (C168HS)
%o	Operating temp:	0 ~ 55 \tilde{C} J
%o	Power requirement:	180mA max. (+5V), 110mA max. (+12V), 160mA, max. (-12V)
%o	Dimensions:	157mmj $\tilde{9}$ 3mm
%o	Operating Systems:	See the driver support list below.

Smartio C168 Series

Windows NT	D
Windows 95/98	D
DOS	D
SCO UNIX/OpenServer	D
UNIX SVR4.2	D
Linux	R
SCO XENIX	C
QNX	C
FreeBSD	C

D: Driver supported by Moxa and shipped with product

C: Driver supported by OS

R: Available by request

Note: Download the newest drivers from the MOXA FTP service

UART 16C550C

The UART chip, **16C550C**, is an intelligent asynchronous controller capable of supporting one full duplex channel that simultaneously transfers data at **921.6 Kbps**. To increase the overall data throughput, special features such as on-chip FIFO and on-chip hardware flow control are used to reduce the number of interrupts to the onboard CPU and to prevent any loss of valuable data.

PC I/O Port Address Map

The following is the list of the I/O port addresses commonly used, which is good for preventing I/O address conflict when configuring Smartio C168 Series.

IO/ Address	Device
000-01F	DMA controller 1
020-03F	interrupt controller
040-05F	Timer
060-06F	Keyboard
070-07F	Real-time clock
080-09F	DMA page register
0A0-0BF	Interrupt controller 2
0C0-0DF	DMA controller
0F0-0FF	Math coprocessor
100-1EF	not usable
1F0-1F8	Fixed disk
200-207	Game I/O
278-27F	Parallel printer port 2 (LP2:)
2F8-2FF	Serial Port 2 (COM2:)
300-31F	Prototype card
360-36F	Reserved
378-37F	Parallel printer port 1 (LP1:)
3B0-3BF	Monochrome display
3C0-3CF	Reserved
3D0-3DF	Color graphics display
3F0-3F7	Diskette controller
3F8-3FF	Serial port 1 (COM 1:)

DB62 Connector Pinouts

The following lists the pin assignments of the **DB62** connector on the bracket.

Pin no.	Signal	Pin no.	Signal	Pin no.	Signal
1	TxD1	22	RxD1	43	CTS1
2	DTR1	23	DSR1	44	RTS1
		24	DCD1	45	GND
3	RxD2	25	TxD2	46	CTS2
4	DSR2	26	DTR2	47	RTS2
5	DCD2				
6	TxD3	27	RxD3	48	CTS3
7	DTR3	28	DSR3	49	RTS3
		29	DCD3	50	GND
8	RxD4	30	TxD4	51	CTS4
9	DSR4	31	DTR4	52	RTS4
10	DCD4	32	GND		
11	RxD5	33	TxD5	53	CTS5
12	DSR5	34	DTR5	54	RTS5
13	DCD5			55	GND
14	TxD6	35	RxD6	56	CTS6
15	DTR6	36	DSR6	57	RTS6
		37	DCD6	58	GND
16	RxD7	38	TxD7	59	CTS7
17	DSR7	39	DTR7	60	RTS7
18	DCD7	40	GND		
19	RxD8	41	TxD8	61	CTS8
20	DSR8	42	DTR8	62	RTS8
21	DCD8				

Problem Report Form

Smartio C168 Series

Customer name:	
Company:	
Tel:	Fax:
Email:	Date:

1. **Moxa Product:** Smartio C168 Series **Model :** , C168H , C168HS **Serial Number:** _____

2. **Moxa Driver Version:** _____

3. **Moxa hardware settings:**

3.1 Please check the hardware configuration by IO-IRQ.EXE from DOS or Windows 95/98 DOS Prompt.

PORT	1	2	3	4	5	6	7	8
I/O								
IRQ								

Interrupt Vector: _____

Speed: _____(High/Normal)

3.2 Jumper JP1 on the board: , open , short

4. **Operating System:** , Windows 95 , Windows 98
 , Windows NT 3.51 , Windows NT 4.0
 , DOS , UNIX , Others

5. **PC Host:** Make _____ Model _____

6. **CPU:** Speed _____MHz Make _____ Model _____

7. **BIOS:** Make _____ Version _____

8. **Problem Description:** Please describes the problem as clearly as possible, including the error message you see. We may have to follow your description to reproduce the problem.

- , Board not found. , Board found, but can't transfer data.
- , Can transfer data, but lose data. , Can transfer data, but with garbled data.
- , Others. Detailed error message description is recommended:

Return Procedure

For product repair, exchange or refund, you must:

- % Provide evidence of original purchase
- % Fill out the Problem Report Form (PRF) as detailed as possible for shorter product repair time.
- % Obtain a Return Merchandise Authorization (RMA) number from the sales representative or dealer
- % Carefully pack the product in anti-static package, and send it, pre-paid, to the dealer. The RMA number should show on the outside of the package, and include a description of the problem along with the return address and telephone number of a technical contact.