



DS-100

Two Channel RS-232 Asynchronous
Serial Adapter

for ISA compatible machines

INTERFACE CARDS FOR IBM PC/AT AND PS/2

User's Manual

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Serial Number: _____

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Declaration of Conformity

Manufacturer's Name:	Quatech Inc.
Manufacturer's Address:	662 Wolf Ledges Parkway Akron, Ohio 44311 (USA)
Application of Council Directive:	89/336/EEC
Standards to which Conformity is Declared: EN61000-4-2, EN61000-4-3, EN61000-4-4	* EN50082-1 * CISPR 22 (EN55022)
Type of Equipment:	Information Technology Equipment
Equipment Class:	Commercial, Residential, & Light Industrial
Product Name:	ISA Communications Card
Model Number :	DS-100

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1. General Information

The Quatech, Inc. DS-100 provides two RS-232 asynchronous serial communication interfaces for IBM-compatible personal computer systems using the 16-bit ISA (Industry Standard Architecture) expansion bus.

The DS-100's serial ports are implemented using 16550 Universal Asynchronous Receiver/Transmitters (UARTs). The 16550 UARTs enable the DS-100 to transmit and receive data at a rate of up to 115.2 kbaud. The 16550 contains a 16-byte hardware buffer that reduces processing overhead. To use the 16550's buffering capabilities, the software must be aware of the UART's presence. Otherwise, it will act as a 16450 UART.

The DS-100 is highly flexible with respect to addressing and interrupt level use. The serial ports are individually addressed and can be placed anywhere within the range of 0000 hex to FFF8 hex at 0008 hex intervals. Available interrupt levels include IRQ2 to IRQ7, IRQ10 to IRQ12, IRQ14, or IRQ15.

Both ports on the DS-100 can share one interrupt level or an interrupt level can be shared with another Quatech adapter that supports interrupt sharing. The shared interrupt feature minimizes the system resources consumed by the adapter.

In order to support the use of the shared interrupt feature of the DS-100, Quatech has developed device drivers for several popular operating systems and environments. The sales department can be contacted for details on current offerings.

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2. Installation

If the default address and interrupt settings are sufficient, the DS-100 can be quickly installed and put to use. The factory defaults are listed in Figure 1.

PORT	ADDRESS	IRQ	ENABLED
Serial 0	3F8 hex	4	YES
Serial 1	2F8 hex	3	YES

Figure 1 --- Default address and IRQ settings for DS-100

The output of the DS-100 is two 9-pin D-connectors labeled CN1 (serial 0) and CN2 (serial 1).

1. If the default settings are correct, skip to step 2, otherwise refer to sections 4 and 5 of this document for detailed information on how to set the address and IRQ level.
2. Turn off the power of the computer system in which the DS-100 is to be installed.
3. Remove the system cover according to the instructions provided by the computer manufacturer.
4. Install the DS-100 in any vacant expansion slot. The board should be secured by installing the Option Retaining Bracket (ORB) screw.
5. Replace the system cover according to the instructions provided by the computer manufacturer.
6. Attach and secure the cable connectors to the desired equipment.

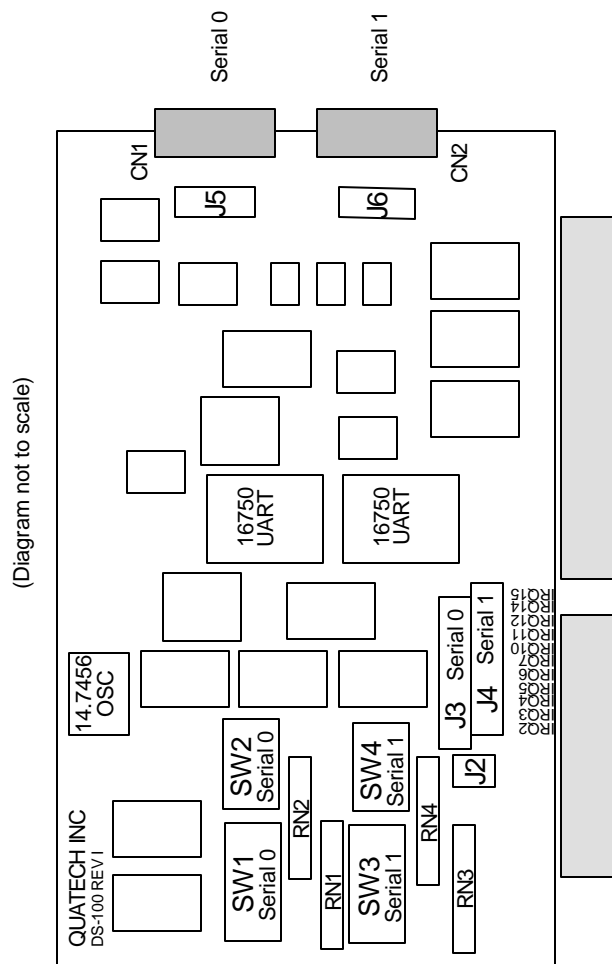


Figure 2 --- Diagram of DS-100

3. Windows 2000 Configuration

Windows 2000 maintains a registry of all known hardware installed in the computer. Inside the hardware registry Windows 2000 keeps track of all of the system resources, such as I/O locations, IRQ levels, and DMA channels. The “Add New Hardware Wizard” utility in Windows is designed to add new hardware and update this registry.

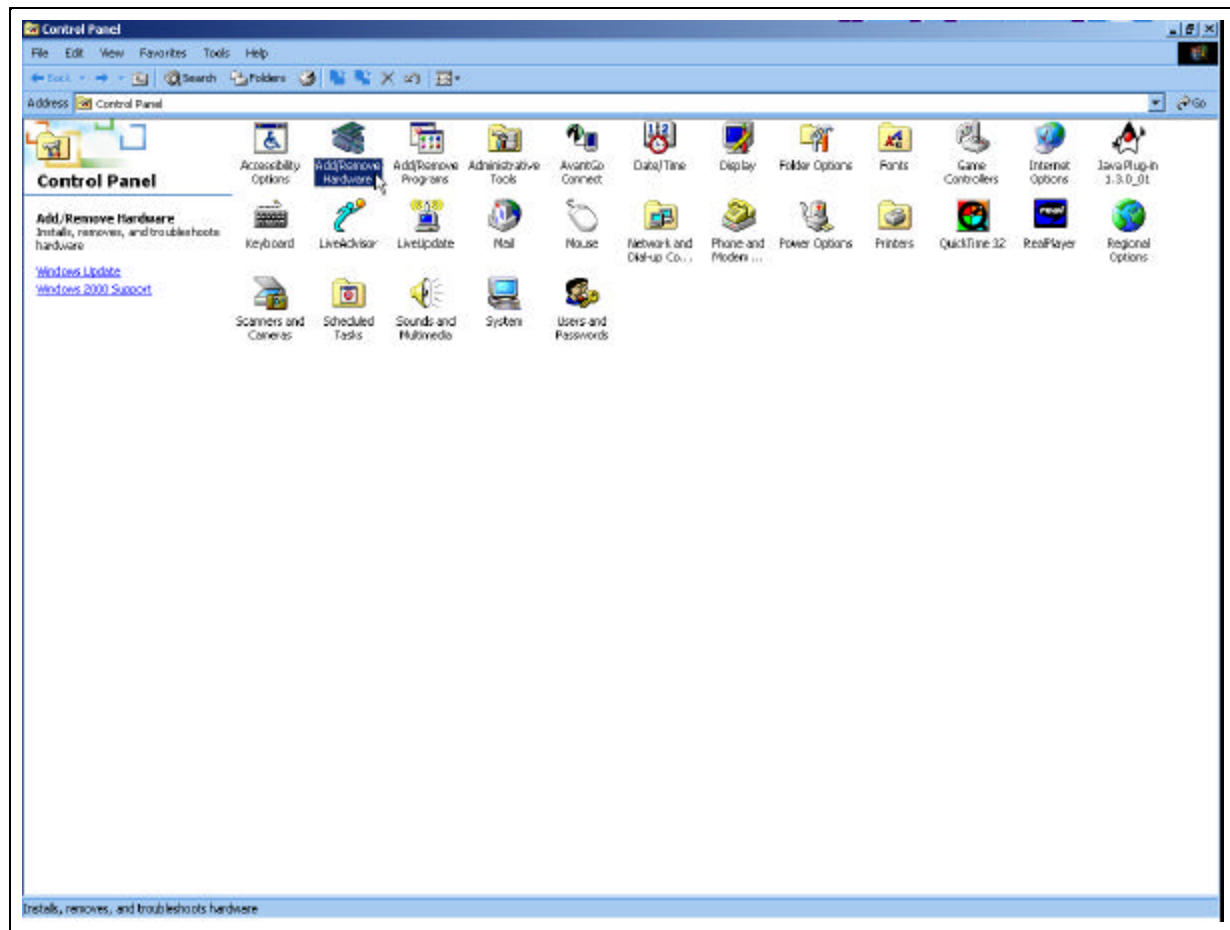
Windows 2000 will not automatically configure the DS-100. The user is required to manually configure Windows 2000 to match the resources set on the card.

3.1 Using the Add New Hardware Wizard

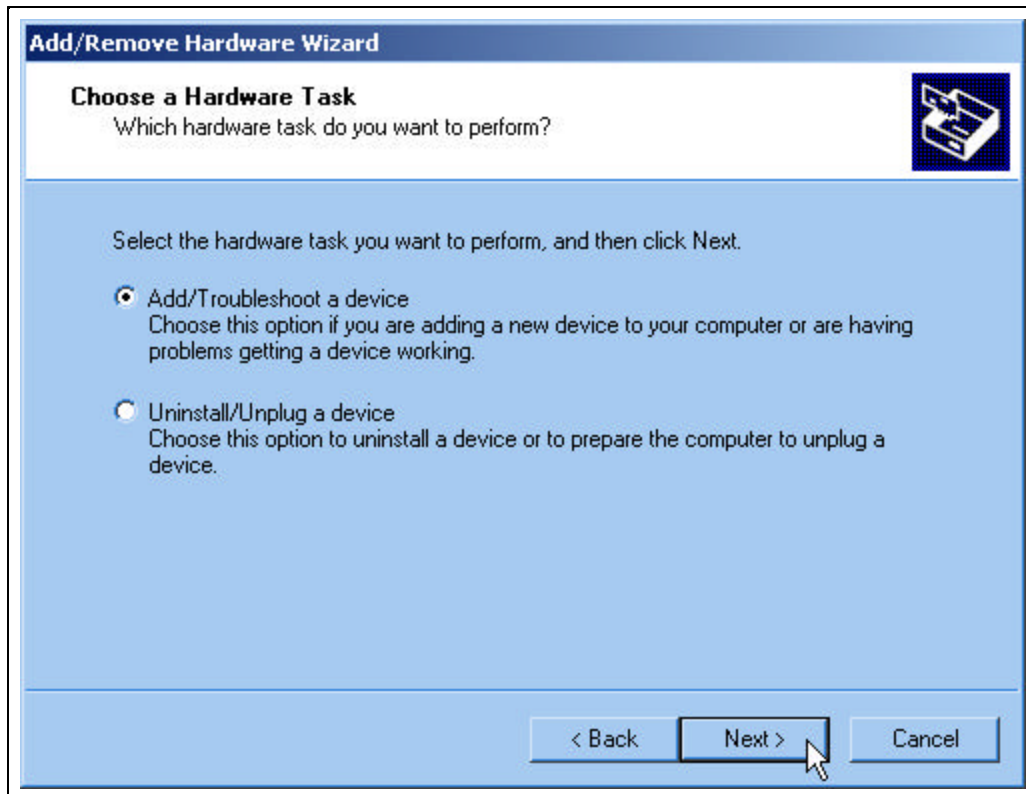
The following instructions provide a step-by-step instructions on installing the DS-100 Enhanced Serial Adapter in Windows 2000 using the “Add New Hardware” wizard.

1. Select Start>Settings>Control Panel.

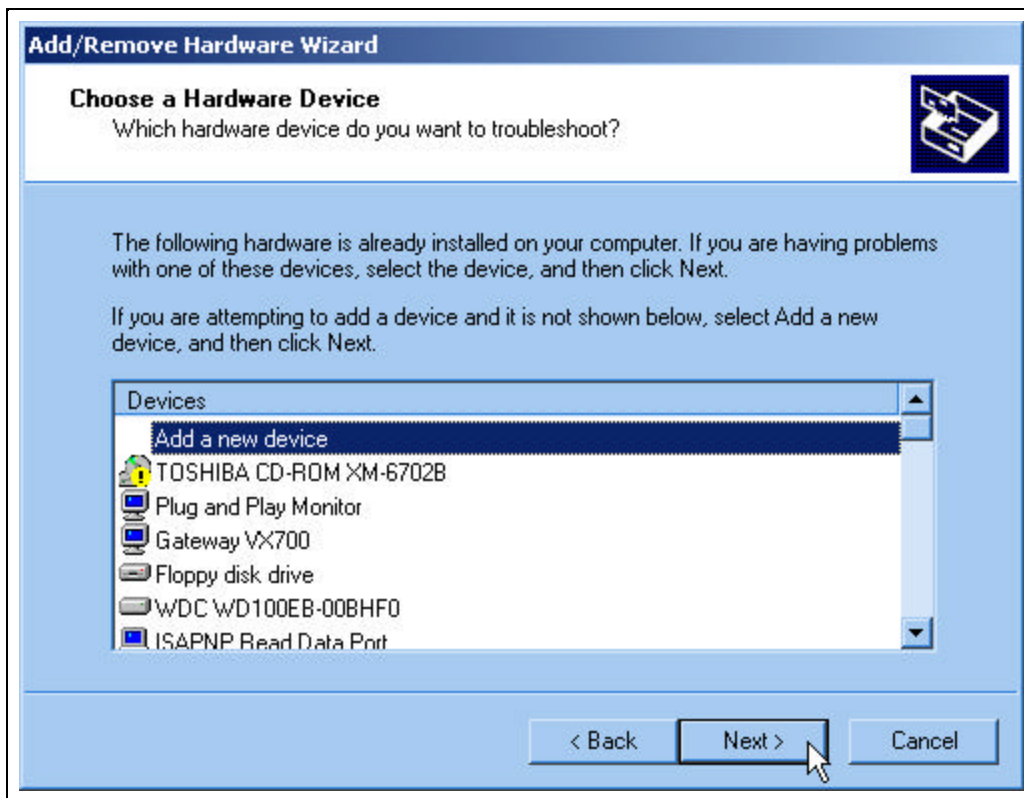
2. Double click on the “Add New Hardware” icon.



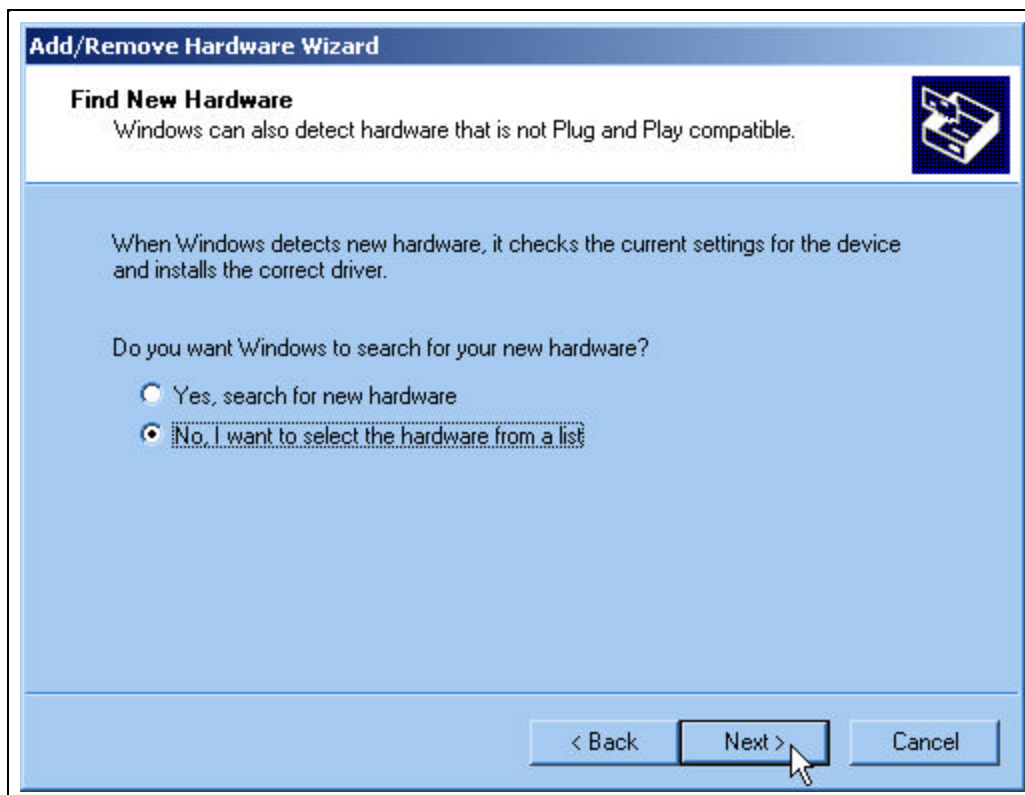
3. The next window will be the “Welcime to the Hardware Wizard”, click “Next”.
4. Next choose the “Add/Troublshood a device” radio button, click “Next”.



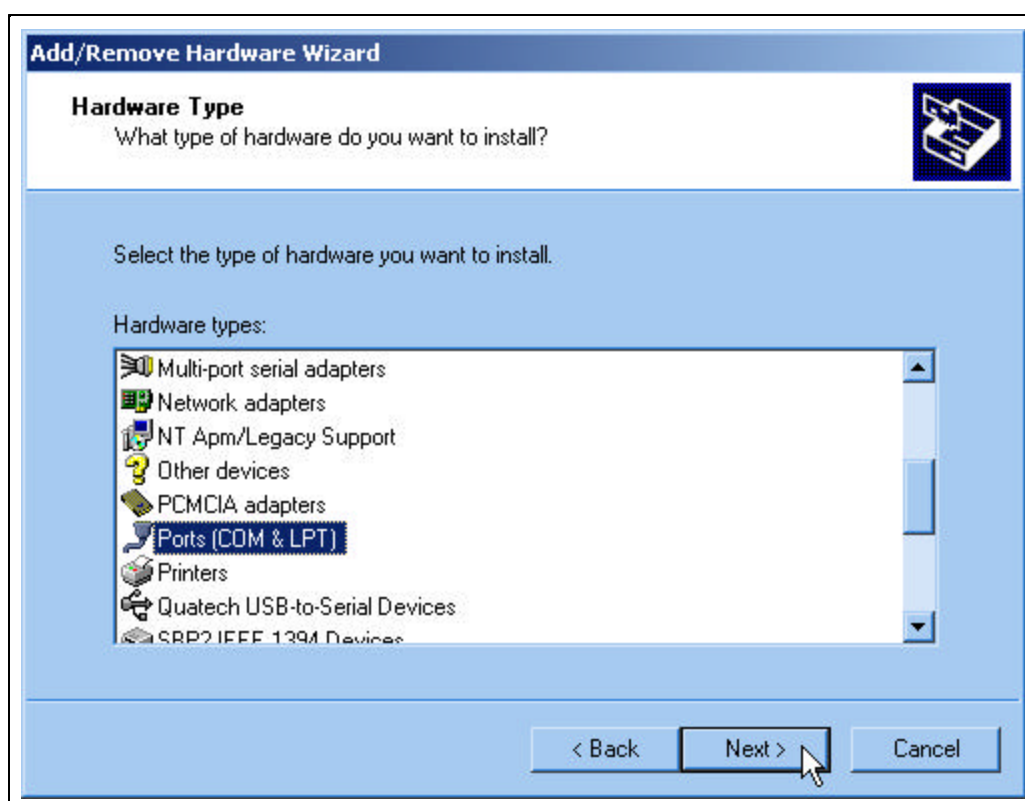
5. Once this process has finished Windows will list the available devices to add or troubleshoot. Select the “Add a new device” and click “Next”.



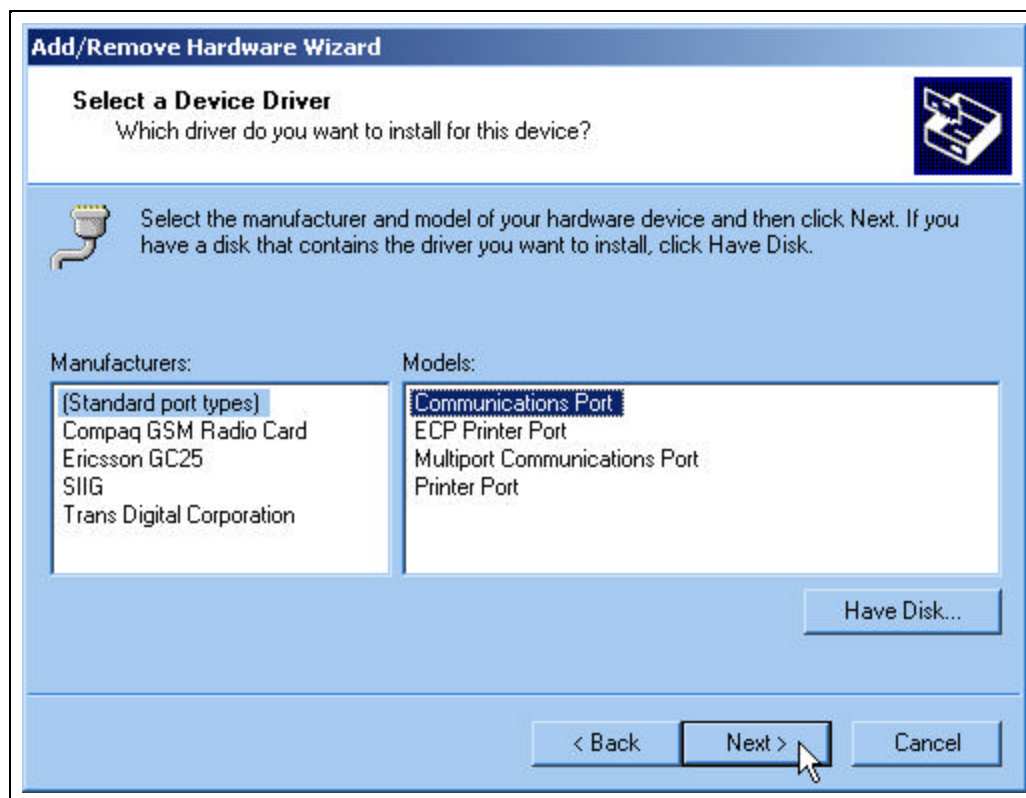
6. Next select “No, I want to select the hardware from a list” radio button.



7. Next select “Ports (COM & LPT)”, click “Next”.



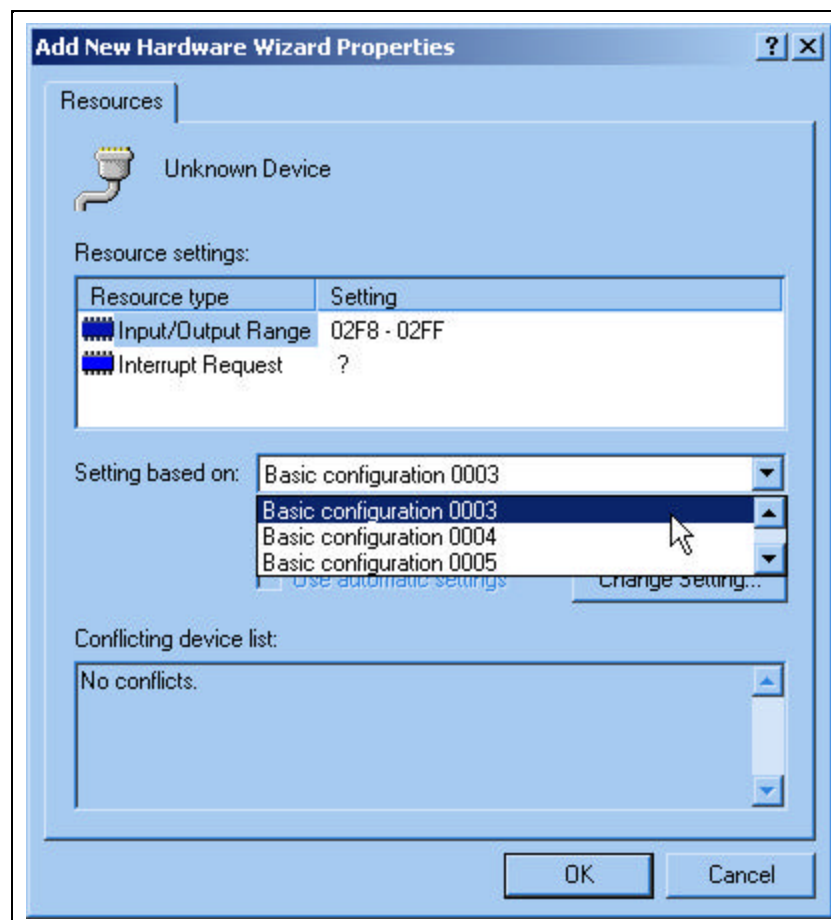
8. In the next window under manufacture select “(Standard port types), and under Models select “Communications Port.



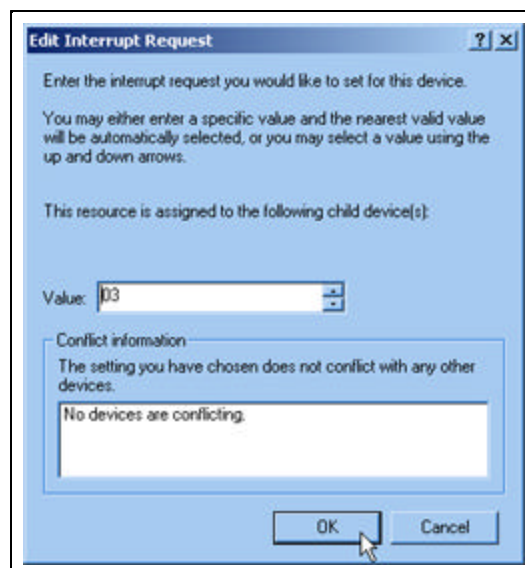
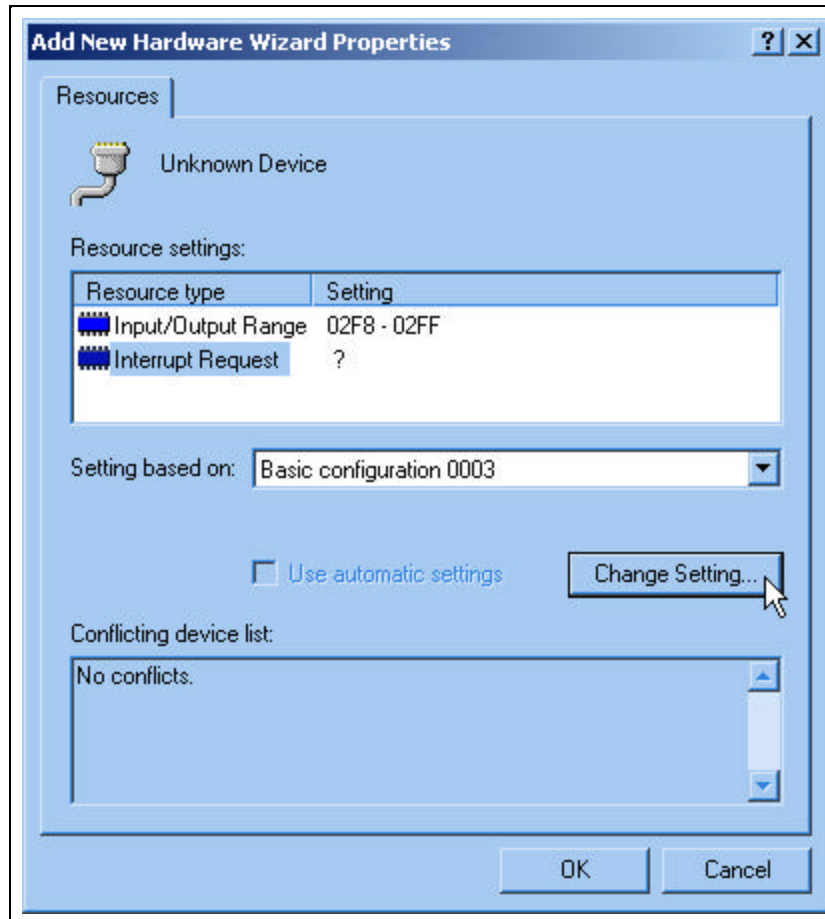
Because Windows will not detect plug and play you will have to manually enter the settings. Click “OK”.



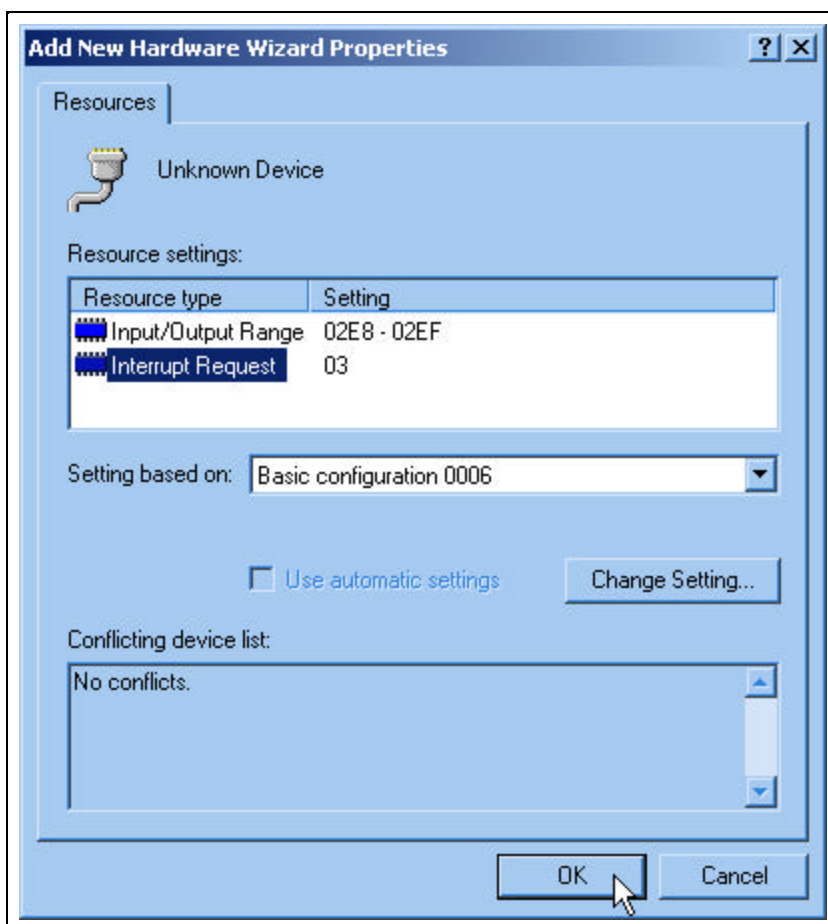
9. Next you will have to change the “Input/Output Range” to a setting that is not in use “No conflicts” by choosing a different “Basic Configuration”.



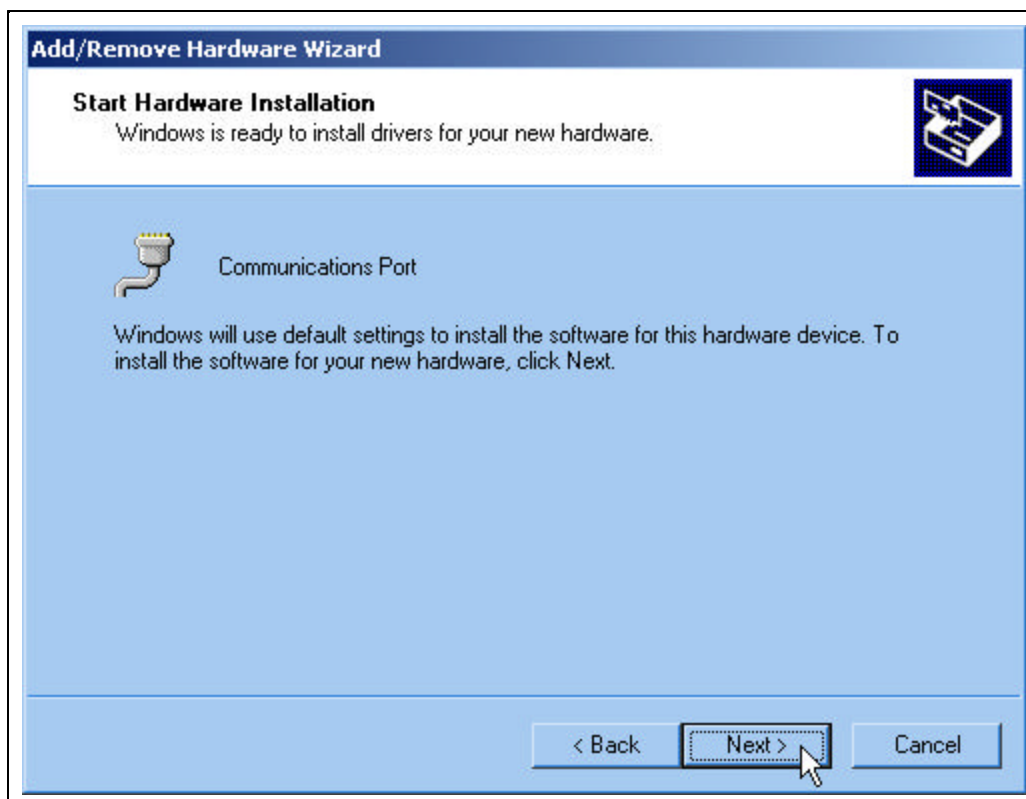
10. The “Input Request” (IRQ) must be set to corresponds with the jumpers setting on the DS-100 board.



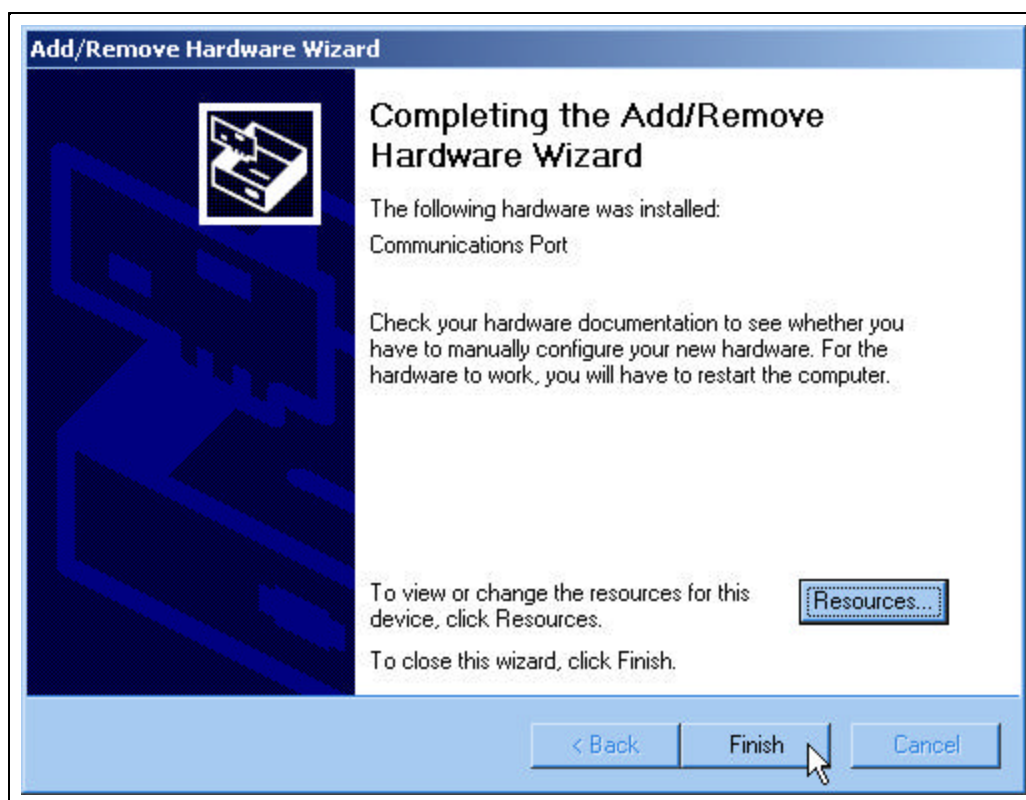
Once you have chosen the IRQ that corresponds with the setting on the Quatech DS-100 card the window will display “no conflicts” and the red circle with a slash of the “Input/Output Range” will not be present.



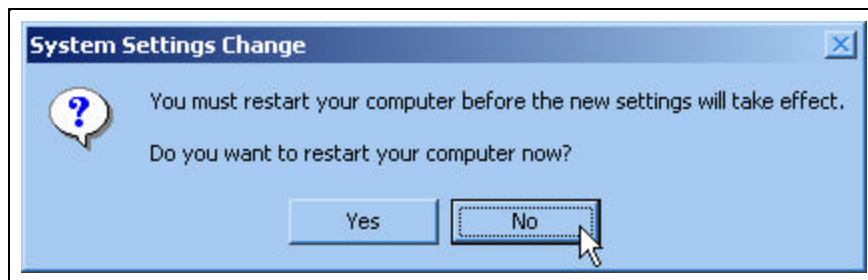
11. Next Windows will begin the install the hardware, click “Next”.



12. Next the “Completing the Add/Remove Hardware Wizard” will appear, click “Finish”.

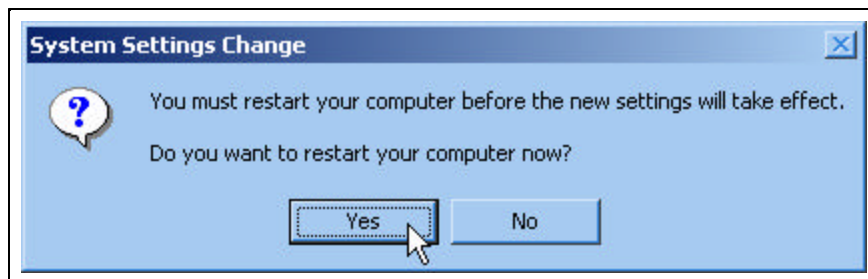


13. Next Windows will prompt you to restart the computer so the changes will take effect and show the new ports. Select “No” to install the second port.



Repeat the same process to install the second channel.

Finally, in order for the changes to take effect you will have to restart the computer.



4. Windows 95 Configuration

Windows 95 maintains a registry of all known hardware installed in your computer. Inside this hardware registry Windows 95 keeps track of all of your system resources, such as I/O locations, IRQ levels, and DMA channels. The "Add New Hardware Wizard" utility in Windows 95 was designed to add new hardware and update this registry.

An "INF" configuration file is included with the DS-100 to allow easy configuration in the Windows 95 environment. Also, a custom Windows 95 serial device driver is included with the DS-100 to support the use of the FIFOs on the 16550 UARTs. Windows 95 uses the "INF" file to determine the system resources required by the DS-100, searches for available resources to fill the requirements of the board, and then updates the hardware registry with an entry that allocates these resources.

Windows 95 will not automatically configure the DS-100. The user is required to manually configure the hardware to match the resources that Windows 95 allocates to the DS-100. Another option is to use the "Device Manager" in Windows 95 to change the system resources allocated to match the configuration of the hardware. See section 3.2 for information on changing resources within Windows 95.

4.1 Using the Add New Hardware Wizard

The following instructions provide step-by-step instructions on installing the DS-100 in Windows 95 using the "Add New Hardware" wizard. Select Start | Help from within Windows 95 for additional information on this utility.

1. Start the "Add New Hardware Wizard" utility. The icon for this utility is located in the Windows 95 control panel. Double-click the "My Computer" icon, double-click the "Control Panel" icon, and double-click the "Add New Hardware" icon.
2. A dialog box should appear explaining the "Add New Hardware Wizard" utility. Click the "Next" button to continue.
3. An option box appears providing the choice of having Windows 95 automatically detect your new hardware. Click the "No" option. The dialog in the box recommends selecting the "Yes" option, but unless the hardware is installed at some standard I/O and IRQ levels, this option will fail. Click the "Next" button to continue.

4. A hardware types list box should appear. Find the “Multi-function Adapters” type on the list and click it. Click the “Next” button to continue.
5. A list box opens with Manufacturers on the left and the associated board Models on the right. Click the “Have Disk” button.
6. An Install From Disk dialog box should pop up. Insert the diskette with the Quatech INF files on it, select the correct drive letter, and click the “OK” button. Windows 95 automatically browses the root directory for an INF file that defines configurations for Multi-function Adapters. If no INF files are found, click the “Browse” or “Other Location” button, double-click the Win95 sub directory on the installation diskette, and choose “OK”. The edit box should now read “A:\WIN95”. If it does, choose “OK”. You are not required to select the file name. After finding the directory containing the INF files, Windows 95 will choose the correct file.
7. Your computer should read the INF file on the diskette and display a list of Quatech Multi-function Adapter models supported by Windows 95. Select the DS-100 Model Name from the list and click the Next button to continue.
8. A dialog box will appear with an unused I/O range and IRQ resources that Windows 95 has found available in the registry. Windows 95 has assigned these resources to the DS-100. Review these settings carefully before proceeding. You should either take notes of these resources being allocated to your new hardware, or have Windows 95 print a copy. You are required to manually configure the DS-100 to match these resources. Windows 95 will not automatically configure a DS-100 board, it will only assign an available I/O range and IRQ.
9. The “Add New Hardware” utility now asks for your Windows 95 installation disks. Serial communication ports require two drivers supplied by Microsoft to function: SERIAL.VXD and SERIALUI.DLL. Insert the disk or CD and click “OK”.

NOTE:

You may be able to skip step 9 if you are certain that your system has the latest version of these files installed. If you do not have your Windows 95 install disks immediately available, click “OK” anyway. A dialog box appears with an option to Skip the files. Click the Skip button and the files will not be installed. This is all right if the latest version of these drivers are currently in the SYSTEM directory.

10. Another dialog box will open to tell you that the installation is complete. Click the “Finish” button to end the software part of the installation.

11. Windows 95 now instructs you to shut down your computer and install the hardware. Click “Yes” to shut down your computer. Wait until Windows 95 informs you that it is safe to turn your computer off. When this message appears, power down your computer.
12. You are required to manually configure the DS-100 to match the resources allocated by Windows 95. Another option is to use the “Device Manager” in Windows 95 to change the system resources allocated in Windows 95 to match your preferences. See chapter 2 for information on installing and configuring the DS-100.

4.2 Viewing and Changing Resources with Device Manager

The following instructions provide step-by-step instructions on viewing and changing resources of the DS-100 in Windows 95 using the “Device Manager” utility. Select Start | Help from within Windows 95 for additional information on this utility.

1. Double click the “System” icon inside the Control Panel folder. This opens up the System Properties box.
2. Click the “Device Manager” tab located along the top of the System Properties box. This lists all hardware devices registered inside the Windows 95 registry. Additional information is available on any of these devices by clicking on the device name and then selecting the “Properties” button.
3. Double click the device group “Multi-function Adapters”. The DS-100 model name should appear in the list of Multi-function adapters.

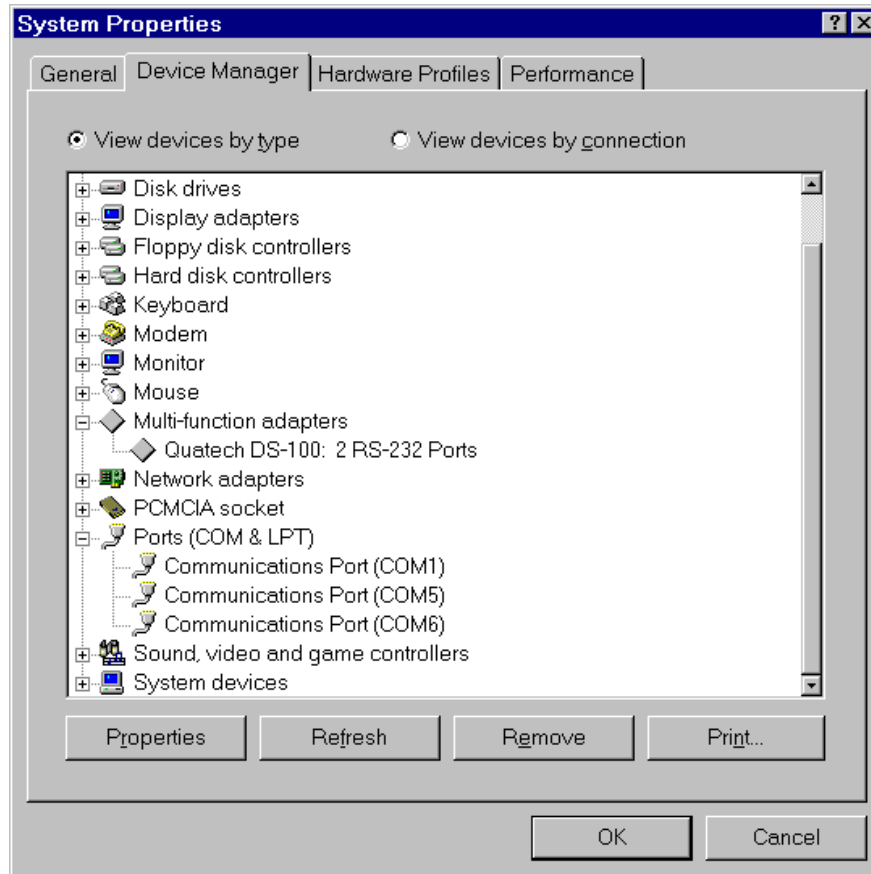


Figure 3--- Windows 95 Device Manager

4. Double click the DS-100 model name and a properties box should open for the hardware adapter.
5. Click the “Resources” tab located along the top of the properties box. Confirm that the resources Windows 95 has allocated for the DS-100 match the hardware configuration. To modify any of the resource settings click the resource name and click the “Change Setting” button. If the “Automatic Settings” option is selected, it will have to be unselected to access the “Change Settings” option. This is accomplished by pointing the mouse at the check next to “Automatic Settings” and clicking on it. Click “Cancel” to exit without making changes.
6. If the “Change Settings” button was selected an Edit Resource window will open up. Inside these Edit Resource windows click on the up/down arrows to the right of the resource value. This scrolls you through all of the allowable resources for your hardware. Pay attention to the Conflict Information at the bottom of the window. Do not select a resource that causes a conflict with any other installed hardware. Click “OK” to save your changes, or “Cancel” to abort.

7. The DS-100 serial ports are also listed under the group Ports (Com and LPT). Windows 95 does not assign COM1 - COM4 to ports addressed at nonstandard locations. The DS-100 ports will be enumerated starting with COM5 (or higher) even if lower logical numbers are available.
8. Select any of the Quatech Serial Ports listed under the group Port (Com and LPT) and click the “Properties” button. This action opens a properties dialog for the specific COM port on the DS-100.
9. Click the “Port Settings” tab and then click the “Advanced” button. The DS-100 driver will display a custom Advanced Port Settings control, which allows the ports UART compatibility mode and FIFO levels to be configured. Note that the FIFO option for each of the two ports of the DS-100 is configured independently.

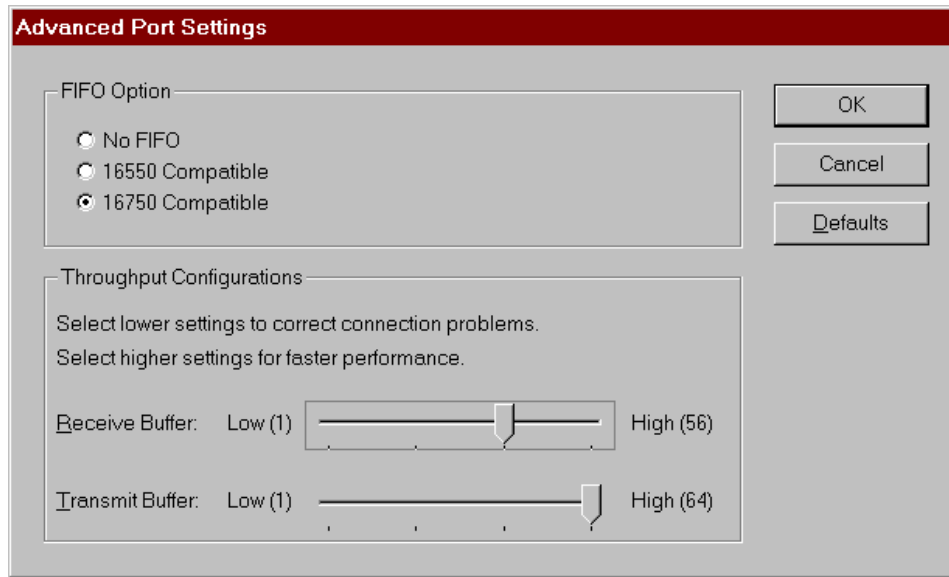


Figure 4 --- Windows 95 Device Manager

10. Use the Logical COM Ports numbers to access the serial ports on your DS-100 through your software applications. Note: The Logical COM Port name is assigned to your ports by Windows 95. This name is required by a Windows 95 application when accessing a particular port.

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5. Addressing Ports

5.1 Setting the address

The base address of each port of the DS-100 is set using two DIP switch packs. When setting the address selection switches, a switch in the "ON" position specifies that the corresponding address line must be a logic 0 for the port to be selected. Similarly, a switch in the "OFF" position forces the corresponding address line to be a logic 1 for the port to be selected.

A full sixteen bit address decode is implemented to reduce the chance of address conflicts with other adapters in the system. Each serial port on the DS-100 uses 8 consecutive I/O locations. The two ports reside in their own independent block of I/O space in eight byte increments. For example, if the base address for port 0 were set to 3F8, the registers associated with port 0 would occupy I/O spaces from 3F8 to 3FF.

Switches SW1 and SW2 select address lines A15 through A3 for Serial 0 and switches SW3 and SW4 select address lines A15 through A3 for Serial 1. The remaining address lines (A2, A1 and A0) are used by the UART to select the register being accessed. The sixth position on SW2 is used to enable or disable Serial 0 and the sixth position on SW4 is used to enable or disable Serial 1.

Figure 5 shows how the switches on the DS-100 represent the address values for serial ports. This figure can be used to explain the examples shown in Figure 6.

A serial port's address is a 16-bit quantity that is most often expressed in four hexadecimal (base 16) digits. A hex digit can hold a value from 0 to 15 (decimal), and is made up of four binary bits given weights of eight, four, two, and one, hence the maximum value of $8+4+2+1 = 15$.

A possible serial port address is 5220 hex. The example below shows how the hex digits are broken down into binary bits.

Binary bits	0 1 0 1	0 0 1 0	0 0 1 0	0 0 0 0
Bit weight	8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
Sum of bits	0+4+0+1	0+0+2+0	0+0+2+0	0+0+0+0
Hex digits	5	2	2	0

These address bits are set by the switches.
All other bits are considered to be zero.

↓

0 1 0 1 0 0 1 0 0 0 1 0 0 0 0 0

↓

Figure 5 --- Examination of a serial port base address

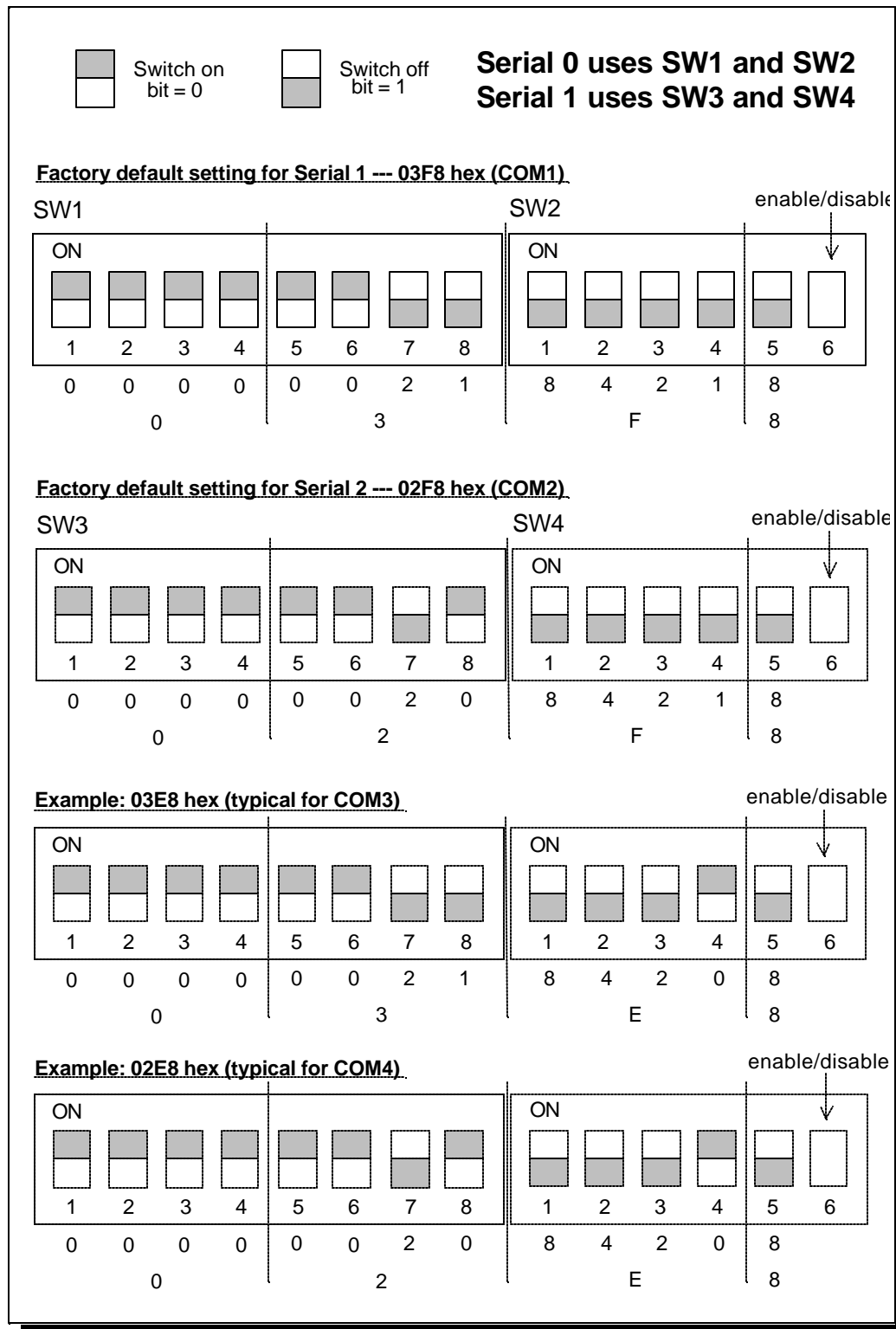


Figure 6 --- Serial Port base I/O address selection switches

The standard addresses for serial ports COM1 and COM2 are listed in Figure 7. Recommended addresses for serial ports COM3 and COM4 are also listed. The switch settings for these addresses are shown in Figure 6.

PORT	TYPICAL I/O ADDRESS	NOTES
COM1	03F8 hex	Factory default for Serial 0.
COM2	02F8 hex	Factory default for Serial 1.
COM3	03E8 hex	Recommendations only. No official standards exist for COM3 and COM4.
COM4	02E8 hex	

Figure 7 --- Recommended addresses for serial ports

5.2 Enabling or disabling ports

Each port of the DS-100 may be individually enabled or disabled. To enable a port, move the appropriate switch to the "ON" position. To disable a port, move the switch to the "OFF" position. This is illustrated in Figure 8 below.

The factory default configuration is both serial ports enabled.

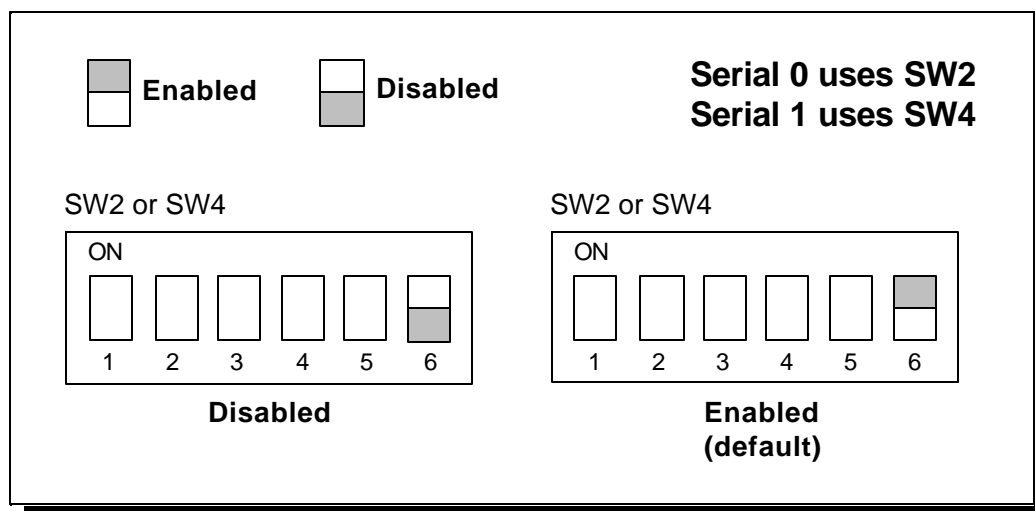


Figure 8 --- Enabling and disabling ports

6. Interrupt Level (IRQ)

The DS-100 allows the use of any interrupt level in the range IRQ2 to IRQ7, IRQ10 to IRQ12, IRQ14, or IRQ15, selected using jumper block J3 (for Serial 0) or J4 (for Serial 1). In Figure 9, the factory default settings for Serial 0 and Serial 1 are shown. To select a different IRQ, move the jumper to the appropriate position on J3 or J4.

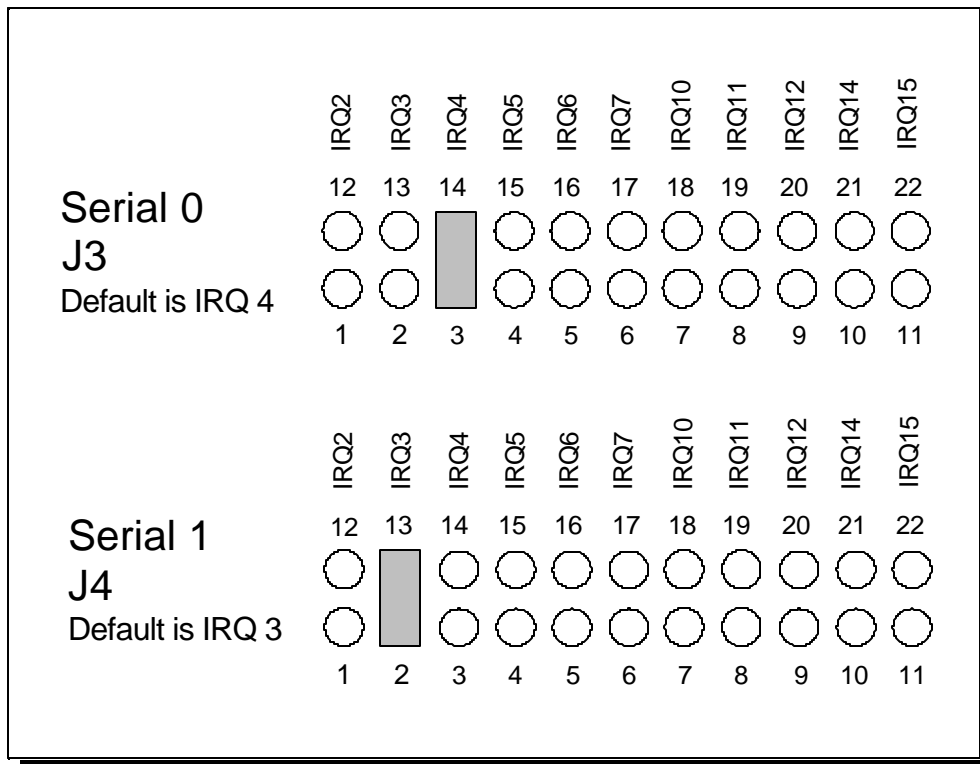


Figure 9 --- Interrupt level (IRQ) selection

6.1 Interrupt Sharing

Both ports on the DS-100 can share the same interrupt level or they can share their interrupt with another Quatech adapter supporting sharable interrupts. Jumper J2 can be used to connect the UART generated interrupt directly to the selected IRQ or to enable the interrupt sharing circuit. In either case, the software driving the serial ports must determine which port or ports are requesting service when an interrupt is generated. To maintain 100% ISA bus compatibility, J2 should be set in the non-sharable mode. If non-sharable mode is selected for both ports, the user must ensure that each port is using a unique IRQ.

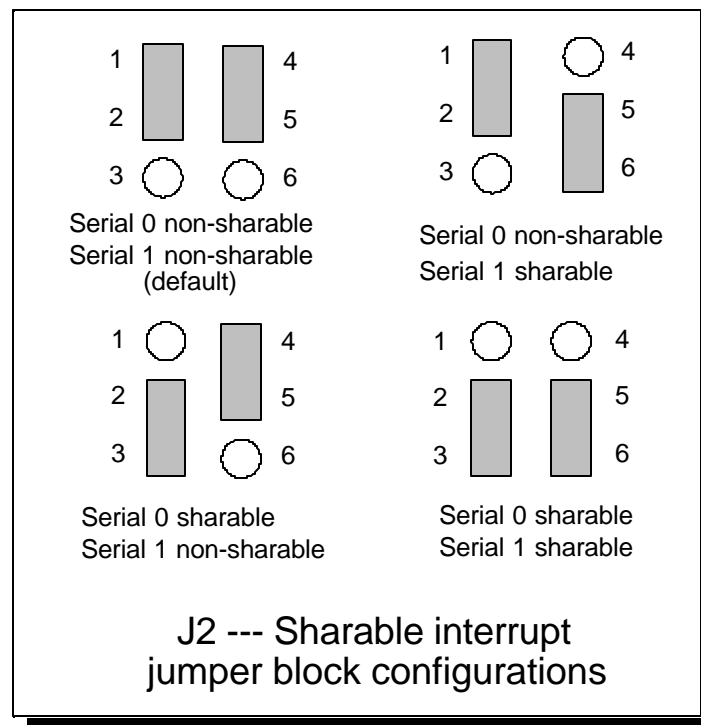


Figure 10--- Sharable interrupt selection

The DS-100 signals a hardware interrupt when any port requires service. The interrupt signal is maintained until no port requires service. Because the ISA bus is edge-sensitive, this behavior forces the interrupt service routine to ensure that all ports are checked before exiting. A way to do this is to poll each port until an interrupting port is found. After servicing the port, all ports should be checked again. If any interrupting port is left unserviced the DS-100 will be unable to signal any further interrupts.

7. External Connections

EIA/TIA-232-E devices are classified by their function as either Data Terminal Equipment (DTE) or Data Communication Equipment (DCE). Generally, data terminal equipment is defined as the communication source and data communication equipment is defined as the device that provides a communication channel between two DTE-type devices.

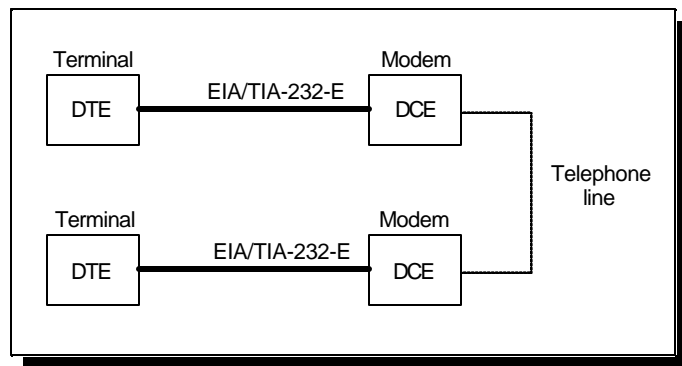


Figure 11 --- Use of DTEs and DCEs in a communications link

DTE- and DCE-type devices have complementary pinouts to allow terminals and modems to be connected directly using a one-to-one cable as shown in Figure 12. In many applications, DCEs are unnecessary, and in these cases a cable called a "null modem cable" or "modem eliminator cable" is used to directly connect two DTE-type devices. A typical null modem cable is also shown in Figure 12.

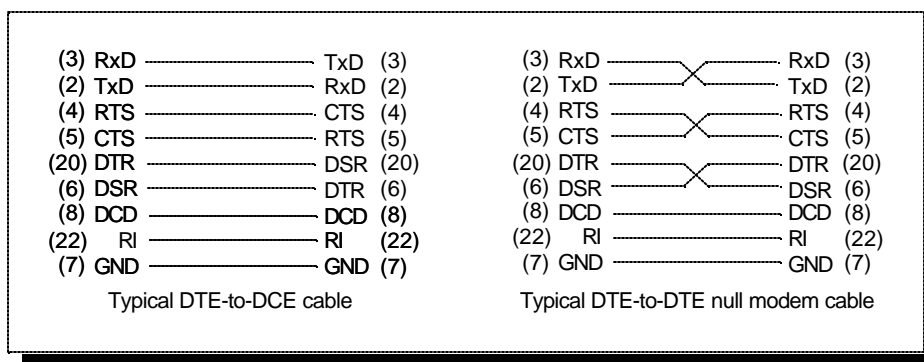


Figure 12 --- Cabling requirements for EIA/TIA-232-E devices (cables using 25-pin connectors shown)

To simplify connections to other devices, each port on the DS-100 is equipped with a jumper block that allows the port to be configured as either a DTE- or DCE-type device. This allows the DS-100 to communicate with either DTE- or DCE-type devices without using a null modem cable. J5 is used for Serial 0 and J6 is used for Serial 1. The DTE/DCE selection jumper blocks are illustrated in Figure 13.

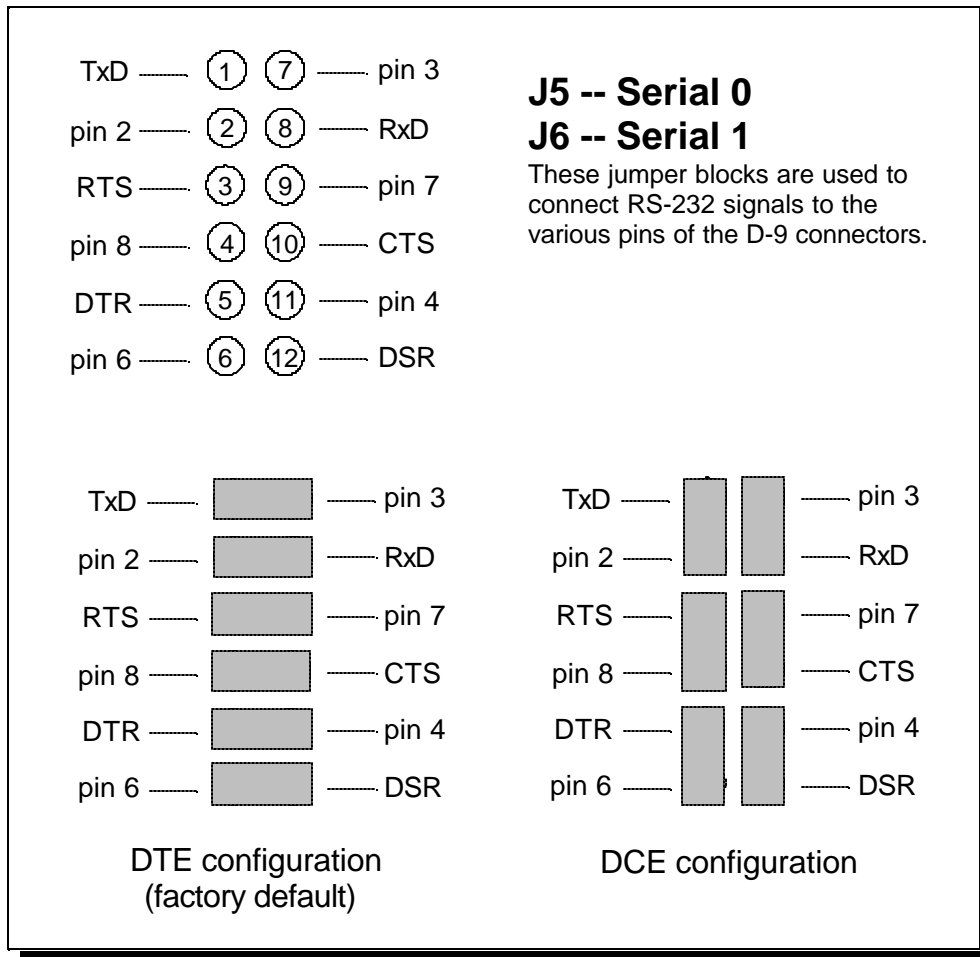


Figure 13 --- DTE or DCE output selection
(Jumpers J5 and J6)

The DS-100 connects to peripheral equipment through male D-9 connectors. Adapters are available to convert these connectors into standard D-25 male connectors. The standard serial port connections are listed in Figure 14.

RS-232 Signal Description	DTE Connection		DCE Connection	
	D-9	D-25	D-9	D-25
Data Carrier Detect (DCD)	1	8	1	8
Receive Data (RxD)	2	3	3	2
Transmit Data (TxD)	3	2	2	3
Data Terminal Ready (DTR)	4	20	6	6
Signal Ground	5	7	5	7
Data Set Ready (DSR)	6	6	4	20
Request To Send (RTS)	7	4	8	5
Clear To Send (CTS)	8	5	7	4
Ring Indicator (RI)	9	22	9	22

Figure 14 --- DS-100 connector definitions for EIA/TIA-232-E

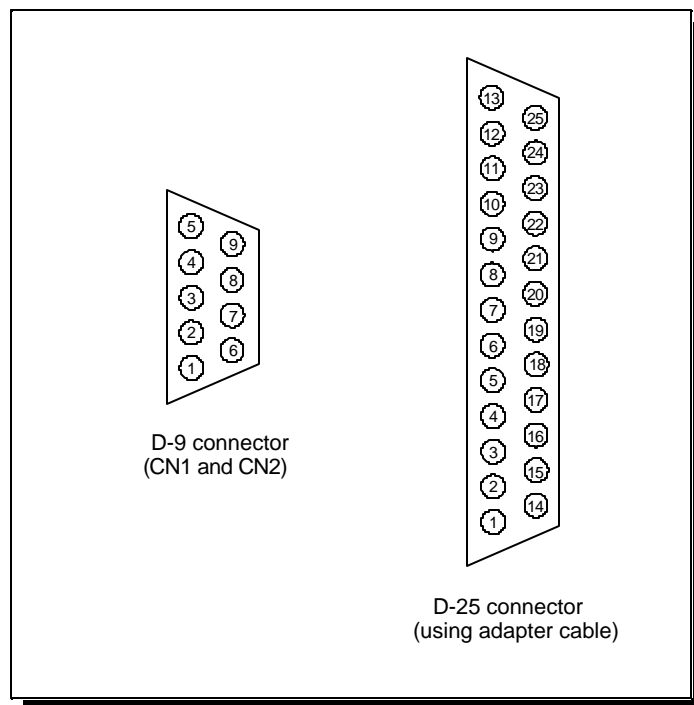


Figure 15 --- DS-100 Output connectors

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8. Specifications

BAUD RATES:

DATA RATE (kbaud)	MAXIMUM LOAD (pF)				
	4% TRAN	10% TRAN	15% TRAN	20% TRAN	25% TRAN
115.2	1000	2470	4300	5500	6600

NOTE 1: The signal transition time ratio is defined as the percentage of the unit interval or bit time (the inverse of the data rate) that is occupied by the signal transitioning from -3V to +3V. EIA/TIA-232-E defines a maximum signal transition time ratio of 4%; most RS-232 receivers will recognize signal transitions with much larger ratios. With a 4% signal transition time ratio, EIA/TIA-232-E is limited to a theoretical data rate of 200 kbaud. If maximum signal transition time ratio is extended to 10%, 15%, 20%, or even 25%, the maximum data rate achievable using EIA/TIA-232-E can be increased past 200 kbaud.

NOTE 2: A typical value for capacitance per foot of standard cable is 50 pF/ft.

UARTs: Two 16550 UARTs with 16-byte FIFOs

TRANSMIT DRIVERS: SN75150 or compatible

HIGH LEVEL OUTPUT: +5V min, +8V typical

LOW LEVEL OUTPUT: -5V max, -8V typical

SWITCHING SPEED, LOW-HIGH: 1.4 μ s with 2500 pF load
40 ns with 15 pF load

SWITCHING SPEED, HIGH-LOW: 1.5 μ s with 2500 pF load
20 ns with 15 pF load

RECEIVE BUFFERS: MC1489 or compatible

HIGH LEVEL OUTPUT: +3V to +13V

LOW LEVEL OUTPUT: -3V to -13V

SWITCHING SPEED: 120 ns typical, 175 ns max

BASE ADDRESS RANGE: 0000 hex to FFF8 hex

INTERRUPT OPTIONS: 2-7, 10-12, 14-15

CONNECTORS: Two DB-9 male connectors

SLOT REQUIREMENTS: One 16-bit ISA slot

DIMENSIONS: 7.050" x 3.900"

POWER REQUIREMENTS:

+5 volts	908 mA max
+12 volts	66 mA max
-12 volts	60 mA max

TEMPERATURE:

Operating	0° to 70°
Storage	-50° to 80°

HUMIDITY: 10% to 90%

APPROVALS AND CERTIFICATIONS: FCC, CE, Windows 95, Windows NT

OS SUPPORT: Windows 2000, Windows 95, Windows 3.1, Windows NT 4.0, OS/2 2.0, DOS 6.22, UNIX

9. Troubleshooting

Listed here are some common problems and frequent causes of those problems. Suggestions for corrective action are given. If the information here does not provide a solution, contact Quatech Customer Service for technical support.

Any unauthorized repairs or modifications will void the DS-100's warranty.

Computer will not boot up.

1. Is the DS-100 properly inserted? Remove the card and try again. Perhaps try a different expansion slot.
2. Is the base address correctly set? Check for address conflicts with other devices in the system. Remember that each port on the DS-100 requires 8 bytes of I/O space. Set a different address if necessary.
3. The DS-100 may be defective. Contact Quatech Customer Service for instructions.

Cannot communicate with other equipment.

1. Are the cable connections correct? Are the cables securely attached?
2. Are the base address and interrupt level (IRQ) correctly set? Check for address and IRQ conflicts with other devices in the system. Change the settings if necessary.
3. If you are trying to communicate with a DTE, a null-modem cable may be required.
4. If possible, use a loopback connector to test the port. This connector needs to connect the following sets of signals on a D-25 connector:

TxD and RxD (pins 2 and 3)

RTS and CTS (pins 4 and 5)

DCD, DTR, DSR, and RI (pins 8, 20, 6 and 22)

Sample Code and a detailed description of the DS-100's UARTs is available on Quatech's BBS (330)434-2481.

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