



QS-100D

Four Channel RS-232 Asynchronous  
Communications Adapter

for ISA compatible machines

*INTERFACE CARDS FOR IBM PC/AT AND PS/2*

User's Manual

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Model Number:     **QS-100D**    

Product Description:     Four Channel Asynchronous RS-232         Communications ISA      
    Adapter    

Serial Number: \_\_\_\_\_

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<b>Manufacturer's Name:</b>	Quatech Inc.
<b>Manufacturer's Address:</b>	5675 Hudson Industrial Parkway Hudson, Ohio 44236 (USA)
<b>Application of Council Directive:</b>	89/336/EEC
<b>Standards to which Conformity is Declared:</b>	* EN50081-1 (EN55022, EN60555-2, EN60555-3) * EN50082-1 (IEC 801-2, IEC 801-3, & IEC 801-4)
<b>Type of Equipment:</b>	Information Technology Equipment
<b>Equipment Class:</b>	Commercial, Residential, & Light Industrial
<b>Product Name:</b>	ISA Communications Card
<b>Model Number :</b>	QS-100D/S/750/IND

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# 1. General Information

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

The QS-100D is highly flexible with respect to addressing and interrupt level use. The serial ports are addressed in a contiguous block that can be placed anywhere within the range of 0000 hex to FFFF hex, and available interrupt levels include IRQ2 to IRQ7, IRQ10 to IRQ12, IRQ14, or IRQ15. (Early versions of the QS-100D are limited to IRQ2-7.)

All four ports on the QS-100D can share one interrupt level. A special interrupt status register is provided to allow controlling software to manage the shared interrupt level. 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 QS-100D, Quatech has developed device drivers for several popular operating systems and environments. The sales department can be contacted for details on current offerings.

**Note:** References to the QS-100D throughout this manual apply to the following products.

PRODUCT	IND PACKAGE	UART UPGRADE
QS-100DS	no	no
QS-100IND	yes	no
QS-100D750	no	yes
QS-100IND750	yes	yes

Figure 1 --- QS-100D Product Series Summary

## 1.1 Explanation of Packages

The base four port RS-232 asynchronous communications adapter is the QS-100DS. This product implements each of its four communication channels with a 16550 UART. Signal Transmission and Reception is accomplished using standard line driver and receiver components.

For improved performance and reliability, Quatech offers the following board upgrades:

### **1.1.1 IND Package**

The IND upgrade on the QS-100IND and QS-100IND750 boards provides the protection essential for reliable use in an industrial environment. Special line drivers and receivers are used which have 15kV ESD (Electro Static Discharge) protection, and each communication line has a surge suppressor capable of sustaining up to 40A transient surges (at 14V).

### **1.1.2 UART Upgrade**

The UART upgrade on the QS-100D750 and QS-100IND750 boards provides a 16750 UART in place of the 16550 UART found on the standard QS-100D. The UART (Universal Asynchronous Transmitter and Receiver) takes byte size data from the bus side of board and breaks it into the bit size data required for serial communication. Benefits of the 16750 UART include extended 64 byte FIFOs on transmit and receive and the ability to sustain transfer rates as high as 1Mbaud ( achieving this rate is dependent upon the user's system and the board's oscillator frequency). The increased FIFO size allows the 16750 UART to store larger amounts data; which means that each read or write access to the UART can move more data per operation, resulting in less processor time being spent servicing the UART.

The Quatech serial device driver for Windows 95, which is included with the QS-100D, provides support for the UART's 16750 mode. Other applications and/or operating systems may not support a UART operating in 16750 mode, in which case the default operation will be 16550 compatible mode.

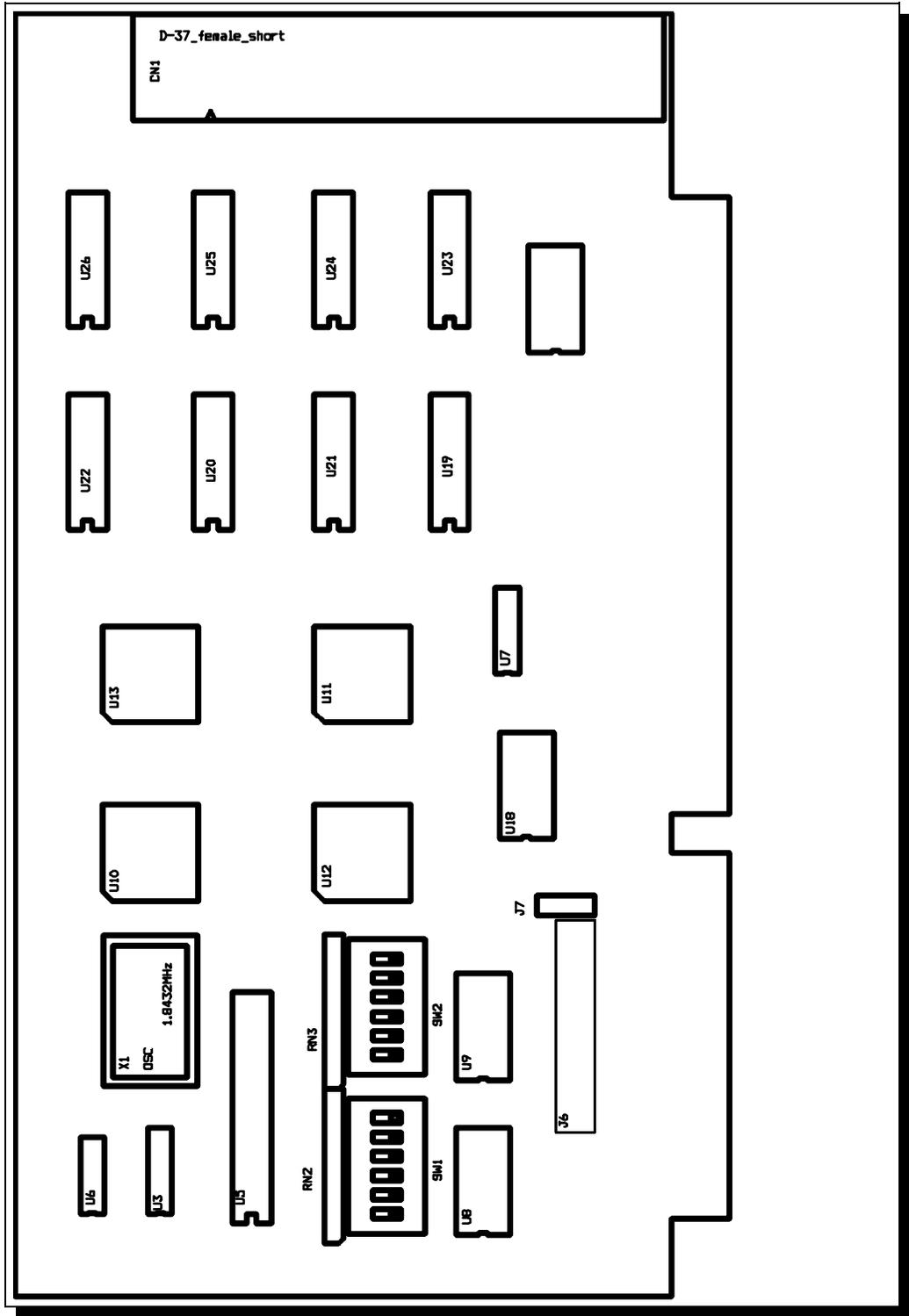


Figure 2 --- Diagram of QS-100D

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## 2. Hardware Installation

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If the default address and interrupt settings are sufficient, the QS-100D can be quickly installed and put to use. The factory defaults are listed in Figure 3.

PORT	ADDRESS	IRQ
Serial 1	300 hex	3
Serial 2	308 hex	3
Serial 3	310 hex	3
Serial 4	318 hex	3

Figure 3 --- Default address and IRQ settings for QS-100D

The output of the QS-100D is a 37-pin D-connector labeled CN1. A cable is provided to convert the D-37 into four standard male D-25 connectors with all control signals provided to each port (RTS, DTR, CTS, DSR, DCD, and RI).

1. If the default settings are correct, skip to step 2, otherwise refer to sections 2.1 and 2.2 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 QS-100D is to be installed.
3. Remove the system cover according to the instructions provided by the computer manufacturer.
4. Install the QS-100D 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.

## 2.1 Setting the Base Address

The base address of the QS-100D is set using the 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 QS-100D uses 8 consecutive I/O locations. The four ports reside in a contiguous block of I/O space in eight byte increments, for a total of 32 contiguous bytes, as shown in Figure 4.

PORT	ADDRESS RANGE
Serial 1	Base Address + 0 to Base Address + 7
Serial 2	Base Address + 8 to Base Address + 15
Serial 3	Base Address + 16 to Base Address + 23
Serial 4	Base Address + 24 to Base Address + 31

Figure 4 --- Port Address Map

Switches SW1 and SW2 select address lines A15 through A5. The remaining address lines (A4, A3, 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 the interrupt status register( See Figure 8).

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

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.

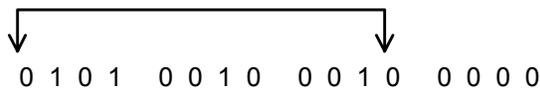


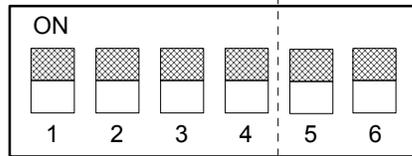
Figure 5 --- Examination of a serial port base address

Switch on bit = 0      Switch off bit = 1

A4 - A0 are zero for the base address.  
Position 6 of SW2 is used to enable or disable the interrupt status register.

**Factory default setting --- 0300 hex**

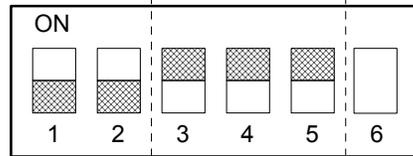
SW1



0 0 0 0 | 0 0

0 3

SW2

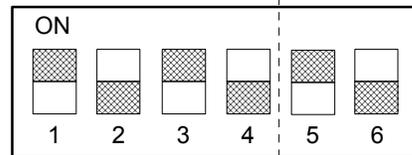


2 1 | 0 0 0 (no digits)

0 0

**Another Example --- 54A0 hex**

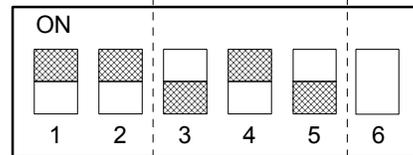
SW1



0 4 0 1 | 0 4

5 4

SW2



0 0 | 8 0 2 (no digits)

A 0

Figure 5 --- Serial Port base I/O address selection switches

## 2.2 Setting the Interrupt Level (IRQ)

The QS-100D allows the use of any interrupt level in the range IRQ2 to IRQ7, IRQ10 to IRQ12, IRQ14, or IRQ15, selected using jumper pack J6. (Early versions of the QS-100D are limited to IRQ2-7.) In Figure 6, the factory default setting of IRQ3 is shown. To select a different IRQ, move the jumper to the appropriate position on J6.

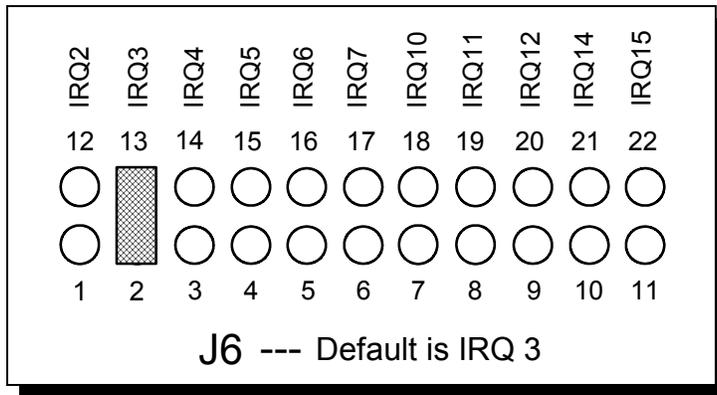


Figure 6 --- Interrupt level (IRQ) selection

## 2.3 Configuring Interrupt Sharing

All ports on the QS-100D share the same interrupt level. Jumper J7 can be used to connect the UART generated interrupt directly to the selected IRQ. J7 can also be used to enable an interrupt sharing circuit, allowing the QS-100D to share its interrupt with another Quatech adapter supporting sharable interrupts. 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, J7 should be set in the non-sharable mode.

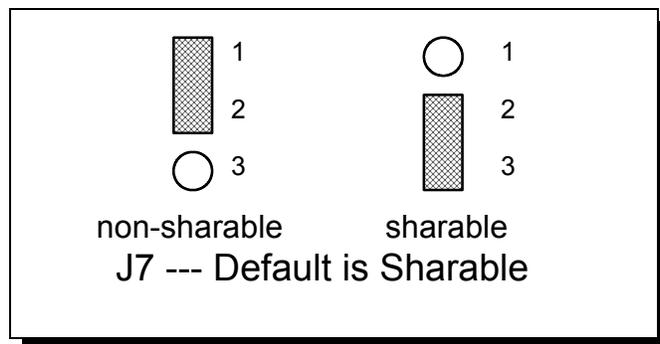


Figure 7--- Sharable interrupt selection

The QS-100D 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 QS-100D will be unable to signal any further interrupts.

### 2.4 Interrupt Status Register

The QS-100D is equipped with an interrupt status register which can be used to simplify the servicing of shared interrupts. If this feature is enabled, the interrupt status register is accessed in place of the scratchpad of any given UART at base address + 7. Virtually no commercially available software makes use of the scratchpad register. The interrupt status register is read-only. The choice of using the interrupt status register or the UART scratchpads (factory default) is made using position 6 of switch SW2 as shown in Figure 8.

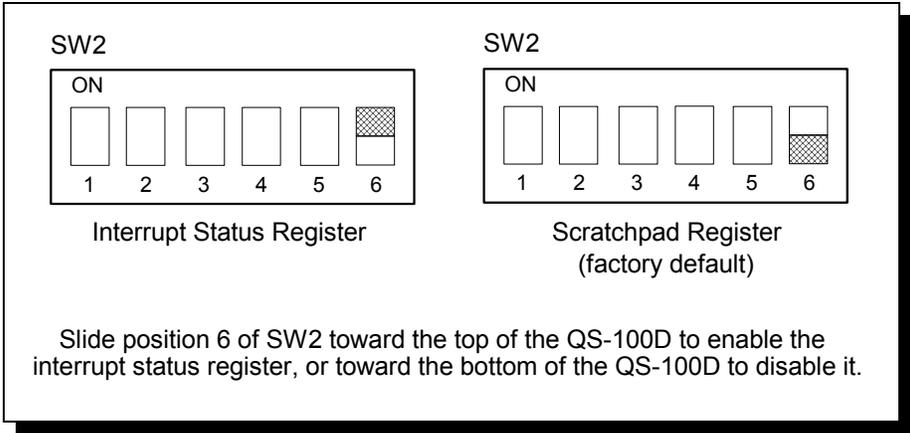


Figure 8--- Enabling the Interrupt Status Register

When a hardware interrupt occurs, reading the interrupt status register will return the interrupt status of the entire QS-100D, as shown in Figure 9. Individual bits are cleared as the interrupting ports are serviced. The interrupt service routine must ensure that the interrupt status register reads zero before exiting, or the QS-100D will be unable to signal subsequent interrupts.

If the QS-100D is of revision level 'C' or higher, an I/O write to the interrupt status register will cause another hardware interrupt to be generated if the interrupt status register is non-zero. The value written is ignored and has no effect on the contents of the interrupt status register. Software written to take advantage of this retriggering will be transparent to an older revision of the QS-100D.

BIT	DESCRIPTION
-----	-------------

7 (MSB)	0 (not used)
6	0 (not used)
5	0 (not used)
4	0 (not used)
3	Serial 4 --- 1 if interrupt pending
2	Serial 3 --- 1 if interrupt pending
1	Serial 2 --- 1 if interrupt pending
0	Serial 1 --- 1 if interrupt pending

Figure 9 --- Interrupt Status Register contents

## 3. Windows 95 Configuration

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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 QS-100D to allow easy configuration in the Windows 95 environment . Also a custom Windows 95 serial device driver is included with the QS-100D to support the use of the 16750 UART's 64 byte fifo. Windows 95 uses the "INF" file to determine the system resources required by the QS-100D, searches for available resources to fill the boards requirements, and then updates the hardware registry with an entry that allocates these resources.

Windows 95 will not automatically configure the QS-100D. The user is required to manually configure the hardware to match the resources that Windows 95 allocates to the QS-100D. 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.

### 3.1 Using the Add New Hardware Wizard

The following instructions provide step-by-step instructions on installing the QS-100D 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.
2. A dialog box should appear explaining about "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” button and search the Win95 sub directory on the installation diskette. 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 QS-100D 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 QS-100D. 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 QS-100D to match these resources. Windows 95 will not automatically configure a QS-100D board.
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 this step 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 QS-100D 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 QS-100D.

### **3.2 Viewing and Changing Resources with Device Manager**

The following instructions provide step-by-step instructions on viewing and changing resources of the QS-100D 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 click on the device name and then selecting the “Properties” button.
3. Double click the device group “Multi-function Adapters”. The QS-100D model name should appear in the list of Multi-function adapters.
4. Double click the QS-100D 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 QS-100D match the hardware configuration. To modify any of the resource settings click the resource name and click the “Change Setting” button. Click “Cancel” to exit without making changes.

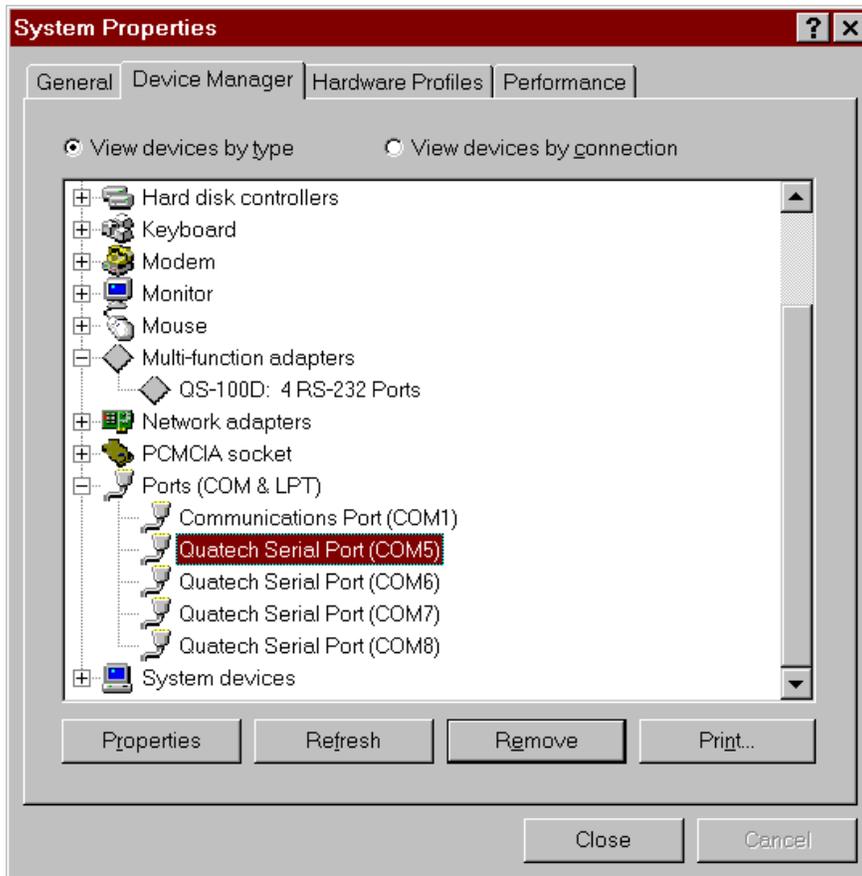


Figure 10--- Windows 95 Device Manager

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 QS-100D 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 QS-100D 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 QS-100D.
9. Click the “Port Settings” tab and then click the “Advanced” button. The QS-100D driver will display a custom Advanced Port Settings control,

which allows the ports UART compatibility mode and FIFO levels to be configured. Note that FIFO option for each of the four ports QS-100D ports is configured independently.

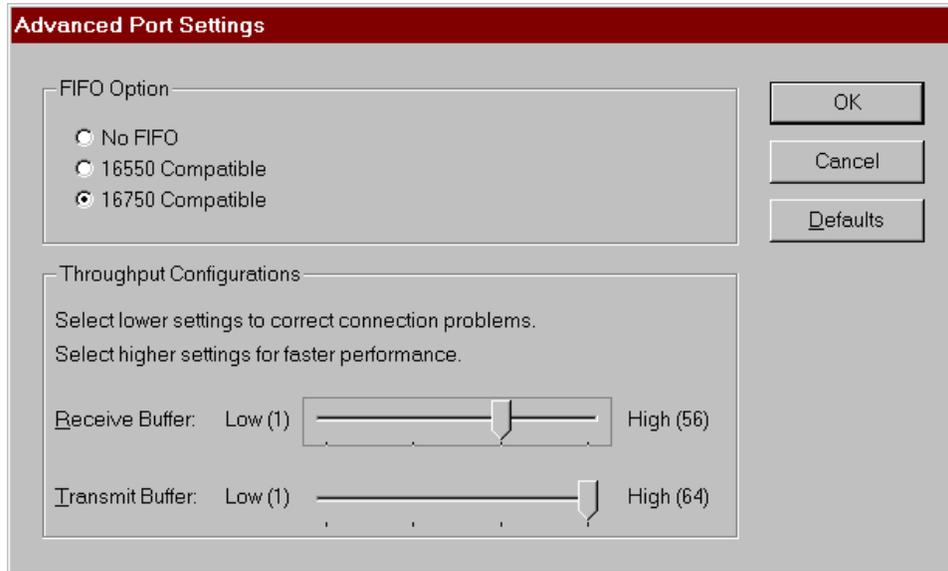


Figure 11 --- Windows 95 Device Manager

10. Use the Logical COM Ports numbers to access the serial ports on your QS-100D 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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## 4. External Connections

RS-232-C 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.

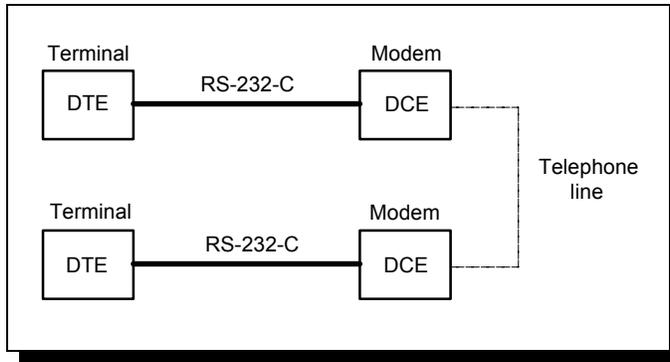


Figure 12 --- Use of DTEs and DCEs in a communications link

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 13. 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 13.

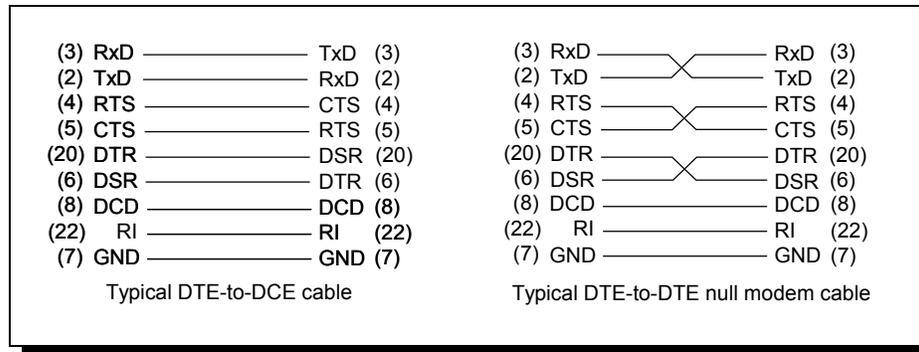


Figure 13 --- Cabling requirements for RS-232-C devices  
(cables using 25-pin connectors shown)

The QS-100D connects to peripheral equipment through a single female D-37 connector, or using the adapter cable, four male D-25 connectors. The standard serial port connections are listed in Figure 14.

RS-232 Signal Description	Serial 1		Serial 2		serial 3		serial 4	
	D-37	D-25	D-37	D-25	D-37	D-25	D-37	D-25
TxD	24	2	10	2	33	2	19	2
RxD	5	3	28	3	14	3	37	3
RTS	23	4	9	4	32	4	18	4
CTS	4	5	27	5	13	5	36	5
DTR	21	20	7	20	30	20	16	20
DSR	22	6	8	6	31	6	17	6
DCD	2	8	25	8	11	8	34	8
RI	20	22	6	22	29	22	15	22
GND	3	7	26	7	12	7	35	7

Figure 14 --- QS-100D connector definitions

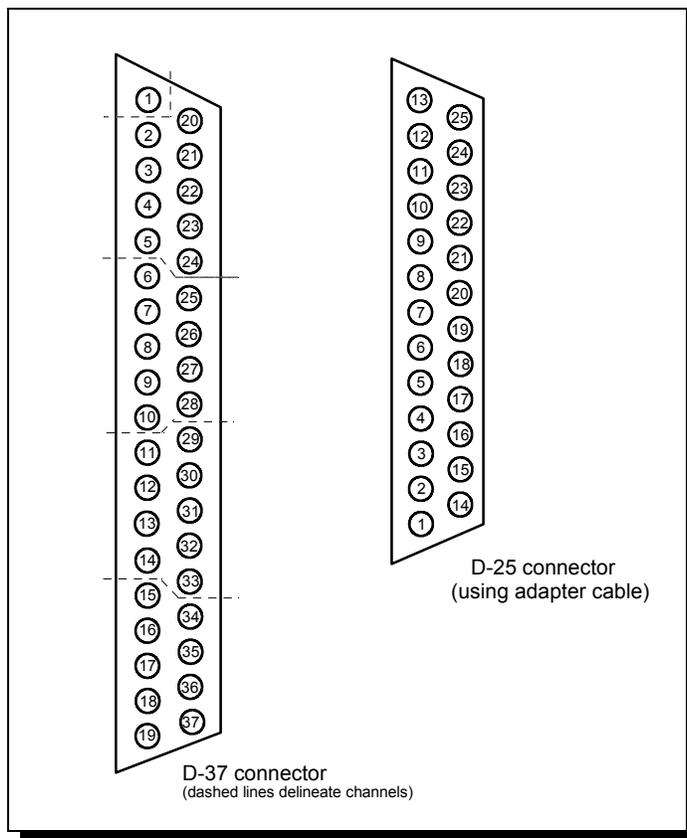


Figure 15 --- QS-100D output connectors

## 5. Specifications

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Bus interface: Industry Standard Architecture (ISA)  
16-bit bus  
IBM PC-AT™ compatible

Dimensions: 6.65" x 3.7"

### Serial ports

Controller: 16550 (**16750 optional**)  
Interface: One female D-37 connector  
Four male D-25 connectors  
using adapter cable

Transmit drivers: MC1488 or compatible  
High level output: +9V min, +10.5V max  
Low level output: -9V min, -10.5V max  
Switching speed: 55ns typ, 100ns max

Receive buffers: MC1489 or compatible  
High level input: +3V to +13V  
Low level input: -3V to -13V  
Switching speed: 120ns typ, 175ns max

I/O Address range: 0000H - FFFFH  
Interrupt levels: IRQ2 to IRQ7  
IRQ10 to IRQ12,  
IRQ14, IRQ15

### Power requirements

+5 volts: 382 mA typ, 438 mA max  
+12 volts: 57 mA typ, 67 mA max  
-12 volts: 54 mA typ, 63 mA max

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## 6. Troubleshooting

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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 QS-100D's warranty.

### **Computer will not boot up.**

1. Is the QS-100D 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 the QS-100D requires 32 bytes of I/O space. Set a different address if necessary.
3. The QS-100D 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 QS-100D's UARTs is available on Quatech's BBS (330)434-2481.**

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QS-100D  
User's Manual  
Revision 3.11  
March 2004  
P/N: 940-0022-311