Application Note AN-0007

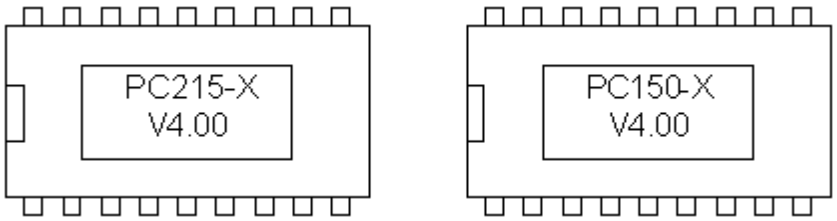
Serial Control Speed and Deterministic Switching

Most modern routing systems consist of many separate units (routers, panels, interfaces) connected together on a serial communications link. The serial links are controlled by microprocessors. When a new route is made the information takes time to get to all parts of the system, due to delays in the microprocessors and serial links, and this can introduce an uncertainty as to when the actual video will change. Typical timing uncertainty will be 1 or 2 video fields.

A Quartz routing system has the above architecture; consisting of at least one router frame and usually at least one control panel and these are connected together using the Q-Link. The Q-link is a serial link by which the various units in a routing system communicate with each other and uses standard video cable to achieve this.

One of the routers is set as a master, which means it holds the setup or configuration of the system and controls the Q-link communications.

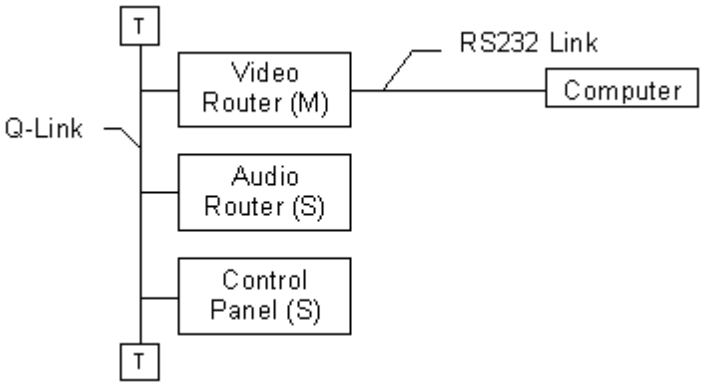
Quartz routing systems can be controlled from computers and automation systems etc. via an RS232/422 port on the rear of each router. Quartz supports a wide range of remote control protocols but each router supports only one remote control protocol at a time. Protocols are changed by downloading new firmware or by fitting a different system EPROM in the router. EPROM's fitted will typically be labelled as:



Where SYS or PC150 indicates the System or operating software and the -X indicates the protocol built into the software. For the standard Quartz Remote Control Protocol Type 1 X=1. The version number e.g. V4.00 will change from time to time as new features are added.

A simple system

This is shown below. The video router is the system master (third DIP switch in the down position) with the audio routers slaved from it. When the PC sends a 'take' to the router the router software



The router is any standard router with two minor changes. The system software has to have the correct protocol to match the controlling computer. For the RS232 serial port to function the second DIP switch on the router

card must be set to the DOWN position. In addition the jumper on the FU-0003 processor must be set correctly for RS232 or RS422 operation.

The delays that accumulate are the serial delay from the PC to the router and the processing delay within the router. The serial delay will vary with the baud rate and protocol.

Processing delay within the router will depend on processor performance (clock speed), other tasks that need to be performed in parallel, and the protocols complexity.

As an existing design will use a specific processor and clock speed, there is not normally the option of speeding up the processor. Likewise, most designs have fixed tasks that must be completed while dealing with a serial port (other serial ports, writing to Crosspoints, etc) and so little can be done to remove this overhead. This leaves the choice of baud rate and protocol as the single biggest area for improvement.

Some typical examples of serial message delays are shown below

Protocol	**Baud/format**	**Take message**	**Tx Time**
Type 1	9600,n,8,1	typically 11 bytes	11.00ms
Type 1	38400,n,8,1	typically 11 bytes	2.80ms
Type 3	38400,e,8,1	typically 2 bytes	0.57ms
Type 3	38400,n,8,1	typically 2 bytes	0.52ms

Parity is a very basic form of error checking but on serial links using 8 bit data, with start and stop bits, adds a 10% overhead. Parity should therefore be avoided on short links or when the protocol has a checksum.

Some protocols are ASCII based strings (like .SV001,002) and these are slow to decode as the processor has to perform a multiply on each digit. A better approach is to choose a binary coded protocol where the source and destination numbers are sent as numbers and not an ASCII representation of them. These require very little processor intervention.

The Quartz type 1 ASCII protocol can have any leading zero's removed from the controlling computers messages to reduce the transmission time. Also ASCII data can be represented in 7 bits, so 7 bit serial data is faster than 8 bit serial data.

Checksums are considered good for data integrity but require calculation. Data corruption is virtually non-existent on a short cable at the relatively low baud rates used in RS232/422 communications. So checksums should be avoided on short links where speed is important.

Slave devices on the Q-Link have to wait to be polled before they can pass a take back to the master. By contrast the master can process a take immediately. For this reason the fastest response time to serial control is achieved if the serial link is connected directly to the master router. As the master router also needs to be configured from WinSetup a CI-0004 interface must be used.