Quartz

Q6400

Routing Switcher

System Manual

Quartz Electronics Limited

59 Suttons Business Park
Reading
England
RG6 1AZ

Telephone	**+44 (0)118 935 0200**
Facsimile	**+44 (0)118 935 0202**
Web	**www.quartzuk.com**
Sales e-mail	**sales@quartzuk.com**
Technical Support Telephone	**+44 (0)118 935 0203**
Emergency Technical Support Mobile	**+44 (0)7714 102 629**
Technical Support e-mail	support@quartzuk.com

Manual-01

PREFACE

Thank you for buying a Quartz routing switcher. We are confident that you have made a sound investment in equipment that will give satisfaction for many years to come. This manual is a complete guide to the installation, operation and maintenance of your system.

SAFETY

WARNING: Dangerously high voltages are present inside this equipment.

WARNING: To reduce the risk of fire or electrical shock, do not expose this appliance to rain or moisture.

WARNING: This equipment uses power/mains connectors fitted with earth pins. It is most important as a matter of personal safety that the equipment is properly earthed.

CAUTION: This equipment may have more than one power supply cord. To reduce the risk of electric shock, disconnect all power supply cords before servicing.

CAUTION: These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified personnel.

CAUTION: To reduce the risk of electric shock, plug each power supply cord into separate branch circuits employing separate service grounds.

NEVER use flammable or combustible chemicals for cleaning components.

NEVER operate this product with any covers removed.

NEVER wet the inside of this product with any liquid.

NEVER bypass any fuse or replace any fuse with a value or type other than those specified.

NEVER operate this product in an explosive atmosphere.

NEVER block the airflow through ventilation slots.

NEVER expose this product to extremely low or high temperatures.This product complies with the requirements of the product family standards for video, audio, audio-visual entertainment, and lighting control apparatus for professional use as mentioned below.

CE	EN60950	Safety
	EN55103-1: 1996	Emission
	EN55103-2: 1996	Immunity

EN504192 2005
Waste electrical products should not be disposed of with household waste. Contact your Local Authority for recycling advice

Quartz Electronics Ltd

FC

For Home or Office Use

Tested to comply with FCC Standards

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may cause harmful interference, and
2) This device must accept any interference received, including interference that may cause undesired operation.

Contents

INSTALLATION

Introduction
This section describes how to install your Q6400 system with the minimum of fuss and time. The system has been designed with the aim of being simple to install.

Unpacking
Carefully remove the equipment from the boxes and check it against the Packing List. This shows what items have been shipped against your order and includes all options. Any error should be reported to your supplier immediately. After you have unpacked the equipment please save all the packing material as this could be useful in the future if the unit needs to be returned for maintenance.

Check each item supplied for transit damage. Any damage should be reported in detail to your supplier. You must state the serial number of the unit (to be found on the rear or side of each unit).

Check that power cords supplied are suitable for your country and that the equipment has been set to the correct mains (line) voltage. Note that standard remote panels are mains powered and must also be checked. Instructions are to be found later in this section on how to change the voltage.

Do NOT change any DIP switch or rotary switch settings at this stage as these will have been correctly set before leaving the factory.

Physical Installation
All frames are designed for mounting in standard 19" equipment racks. When preparing for installation bear in mind that the modules are plugged in from the front and extra space is required for the modules to mount on an extender module. You should allow at least 800mm clearance at the front for maintenance.

The depth of most router frames is 485mm plus connectors from the front of the equipment rack. In addition allowance must be made for the high numbers of cables to be installed at the rear of the frame.

Power dissipation in most frames is relatively low and cooling is achieved by natural convection through the sides of the frame. In the interests of long term reliability it is advisable, where possible, to leave a 1U gap or to fit a unit with a depth of less than 200mm above every router.

The **Q6400 Serial Digital Video Router, Q6400 Analogue Video Router,** and **Q6400 Analogue Audio Router** are fan cooled, drawing cool air from the front of the router and expelling it through the right hand side vents.

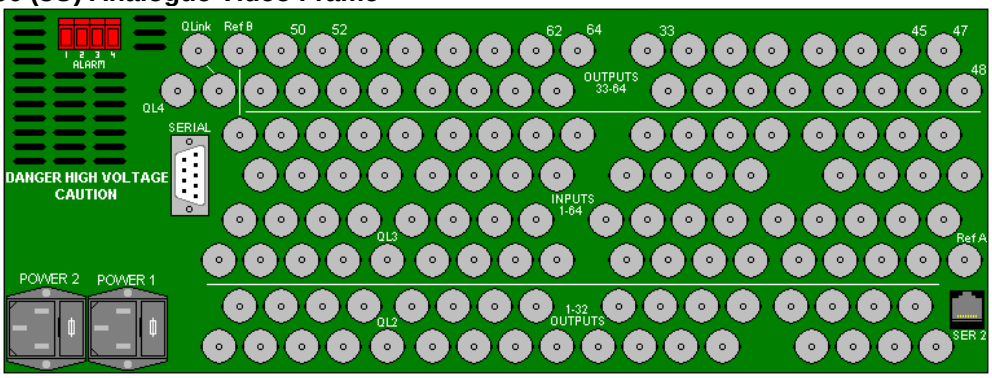
In all cases, **it is important to keep the apertures clear of obstructions** e.g. cables.

Electrical Connections
This section shows the rear panel views of the Q6400 frames.

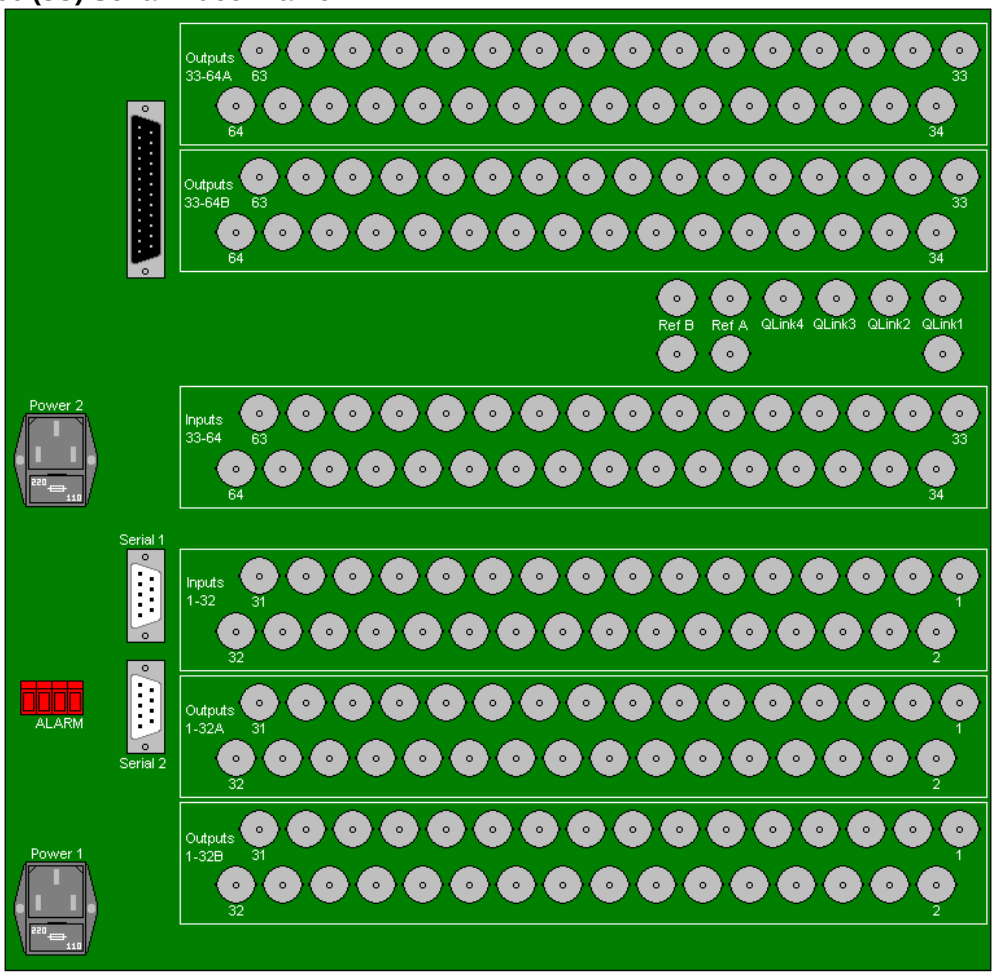
Video Inputs and Outputs
These connections are made using standard video 75Ω coaxial cable. A high quality cable such as PSF1/2 (TF3255) or PSF1/3 (TF3304) or equivalents should be used for optimum performance. It is both important and good practice that cables are properly supported and not *hanging* on the connectors as this can put unnecessary stresses on the connectors.

The video inputs are terminated within the equipment. The video outputs are dual outputs on Q6400-SV systems.

The Q6400 (3U) Analogue Video Frame



The Q6400 (8U) Serial Video Frame



Video Reference

The Ref input is a looping input. Any video signal with standard syncs may be used as a reference signal to determine when cuts are made during vertical (picture) blanking. Whilst a burst is not required the use of colour black is the most commonly available signal and is preferred. This can be looped through into a video input on composite video systems.

Mixed sync pulses of 2v amplitude may also be used. 4v pulses can be used but a modification is required to the main video router module and involves the addition of a single 4.7K 5% resistor.

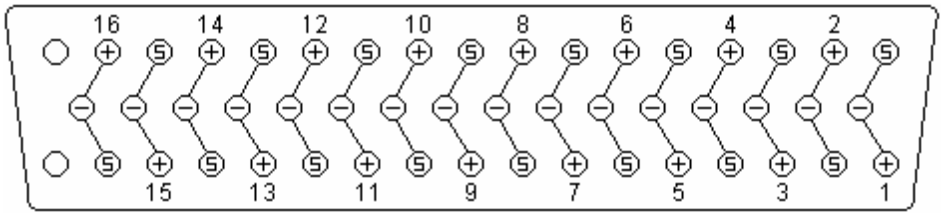
Note: If one of the looping input connectors is not used then a 75Ω terminator plug must be fitted on the unused connector. Otherwise the level on the line will be twice that expected, and may cause incorrect operation of other equipment attached to the line.

The Q6400-SV router has two looping reference inputs “REF-A” & “REF-B” intended to allow mixed 625 and 525 working. In a 625/50Hz only installation then the sync reference must be looped through both pairs of connectors.

If no reference signal is connected then the unit will switch at random intervals at a rate of about 40Hz.

Audio Inputs and Outputs

The connections of the audio signals to the equipment are made using 50 way multi-way connectors. One connector is used for 16 inputs and another for 16 outputs. The same type or polarity of connector is used for inputs and outputs. A larger drawing is included at the end of this section.



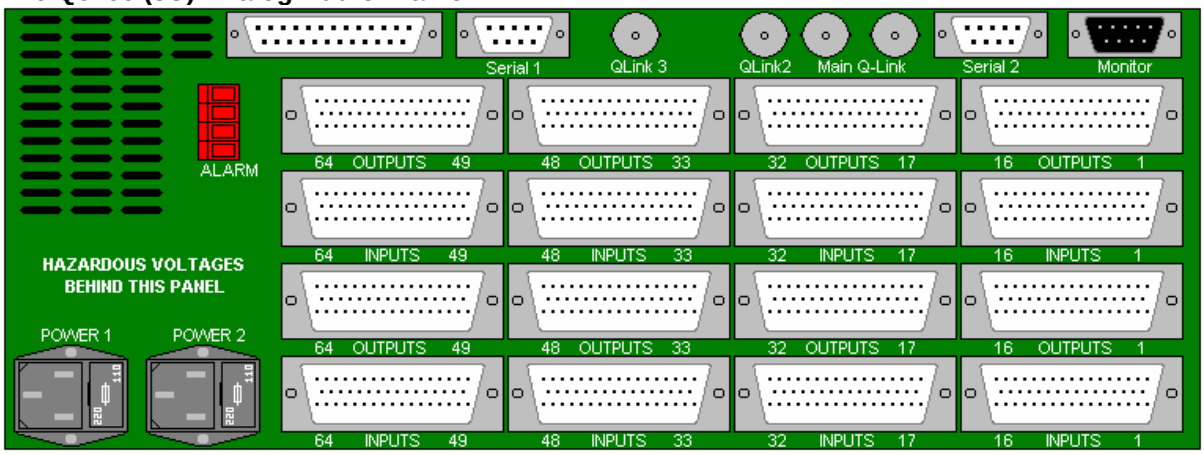
Standard D50 pin-out

The mating halves of these connectors are PLUG types and available as options (AK-0006). They are not supplied as standard because many customers prefer to buy their connectors in bulk and prepare the cables in advance of the equipment being shipped.

Each connector has three pins for each signal: signal hot (+), signal cold (-) and screen. The same pattern of wiring is used on all connectors, i.e. Input 1 is wired the same as Output 1. All the connectors on the rear of the frames are sockets. It is sound analogue audio practice not to earth the cable screens at both ends, as sometimes hum can be introduced owing to earth potential differences. However, with digital audio is better to ground at both ends.

For unbalanced AES audio, standard video cable and frames with BNC connectors are used.

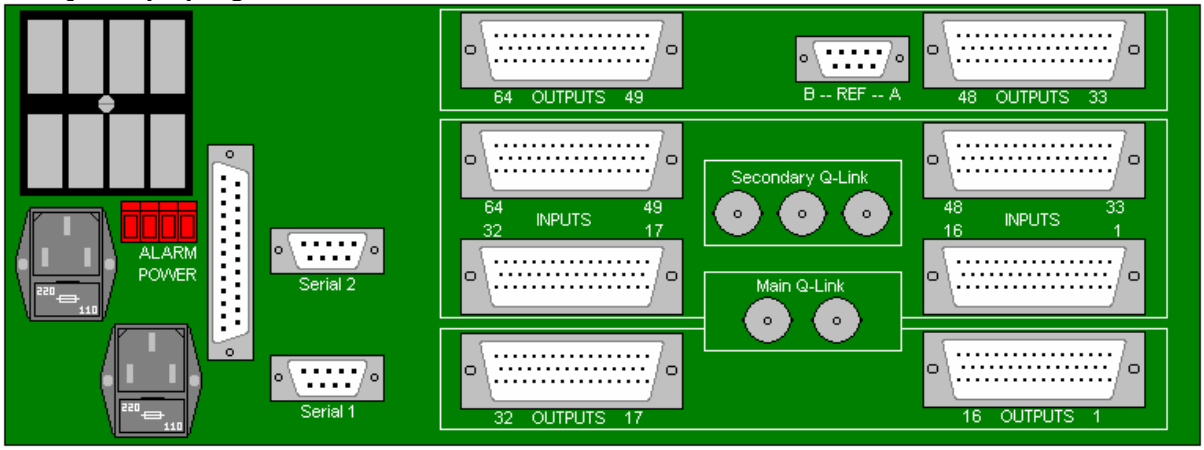
The Q6400 (3U) Analog Audio Frame



Q6400-AA-6464-S(P)	Out 49-64 (A2) In 49-64 (A2) Out 49-64 (A1) In 49-64 (A1)	Out 33-48 (A2) In 33-48 (A2) Out 33-48 (A1) In 33-48 (A1)	Out 17-32 (A2) In 17-32 (A2) Out 17-32 (A1) In 17-32 (A1)	Out 1-16 (A2) In 1-16 (A2) Out 1-16 (A1) In 1-16 (A1)
Q6400-AA-12864-M(P)	Out 49-64 (2) In 113-128 Out 49-64 (1) In 49-64	Out 33-48 (2) In 97-112 Out 33-48 (1) In 33-48	Out 17-32 (2) In 81-96 Out 17-32 (1) In 17-32	Out 1-16 (2) In 65-80 Out 1-16 (1) In 1-16

One frame can handle stereo signals. Four connectors are provided for the left or A1 inputs 1-16, 17-32, 33-48, and 49-64. Four connectors are provided for the left or A1 outputs 1-16, 17-32, 33-48, and 49-64. These are then duplicated for the second audio channel. Above 64x64 this router can also be supplied in mono only in matrix sizes up to 128x64.

The Q6400 (3U) Digital Audio Balanced AES Frame



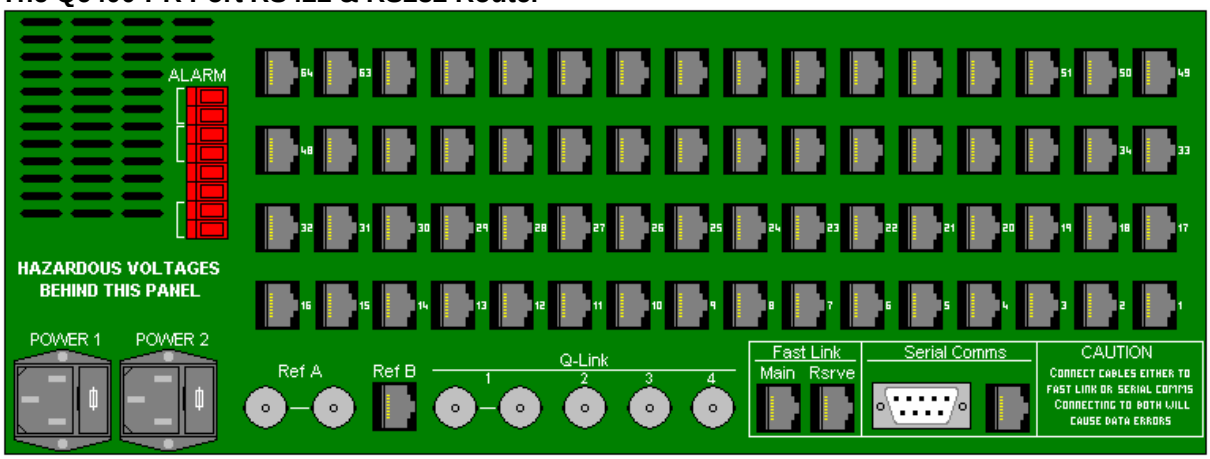
For digital audio it is important to use data cable with a characteristic impedance of 110Ω rather than audio cable. For error free transmission, care should be taken to ensure the cable losses are acceptable over the intended length.

The unbalanced audio version of this product uses the Q6400-SV router frame shown earlier in this section.

RS422 Data Routers

There are several different types of RS422 data router to support different applications. Port routers allow any one connector to be routed to any one other connector, making a point-to-point connection. Matrix routers have both input and output connectors that are permanently connected to either controlling devices such as edit controllers or controlled devices such as VTR's. See application note AN-0014 for further information.

The Q6400-PR Port RS422 & RS232 Router



The Q6400-PR port router can be supplied with 16, 32, 48, or 64 ports. Extra ports can be added by installing internal dual channel SIMM modules. Ports can work in an electronic 'auto-sense' mode to correctly assign the RS422 Tx/Rx pairs to pins 3 & 6 or 5 & 4. This allows a mixture of controlling and controlled devices to be connected through the port router with the minimum of effort.

RJ45 (RS422)	
Pin	Signal
1	GND
2	Sony
3	TX+ (Note A)
4	RX- (Note A)
5	RX+ (Note A)
6	TX- (Note A)
7	Not used
8	Not used

RJ45 (RS232)	
Pin	Signal
1	0V
2	n/c
3	TXD
4	CTS
5	RXD
6	RTS
7	Not used
8	Not used

Note A: The TX+/- and RX+/- pairs are assigned electronically and normally work in auto-sense mode to detect the type of device connected to the port. Auto-sense mode can be disabled from WinSetup.

In some installations the auto-sense capability can cause problems. This is possible with controlled (slave) devices that tri-state their RS422 drivers when not transmitting. This then stops the auto-sense circuit from ever configuring the correct pin-out. If a direct connection between the controlling and controlled device works but routing through the port routers does NOT work then try using WinSetup to configure the controlled (slave) device port to have a fixed Tx/Rx pair. See WinSetup, Frame Dialog, Frame System Data.

RJ45 RS422 Fixed Tx/Rx Mode (WinSetup data 10)	
Pin	Signal
1	GND
2	Not used
3	RX+
4	TX-
5	TX+
6	RX-
7	Not used
8	Not used

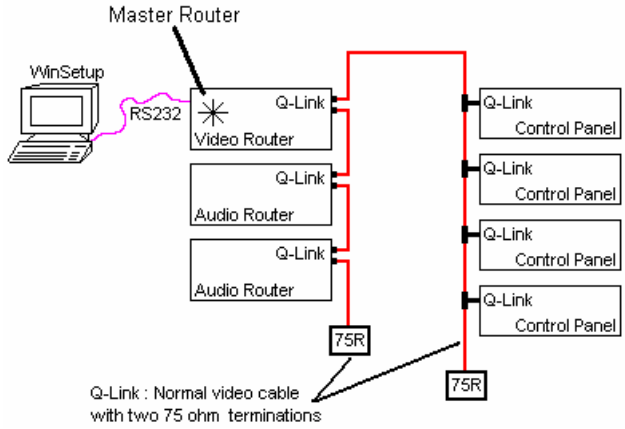
RJ45 RS422 Fixed Rx/Tx Mode (WinSetup data 11)	
Pin	Signal
1	GND
2	Not used
3	TX+
4	RX-
5	RX+
6	TX-
7	Not used
8	Not used

If one of the above Tx/Rx configurations does not work on the controlled (slave) device port then the controlling (master) device port might also need to be configured to have a fixed Tx/Rx pair.

Remote Control - Q-link

All the frames and remote control panels are connected by a single coaxial link called **Q-link**. This link uses standard 75Ω video cable daisy-chained from frame to frame and panel to panel. **Each end of the link must be terminated in 75Ω.** A pair of connectors is fitted to the frames and the link looped through them.

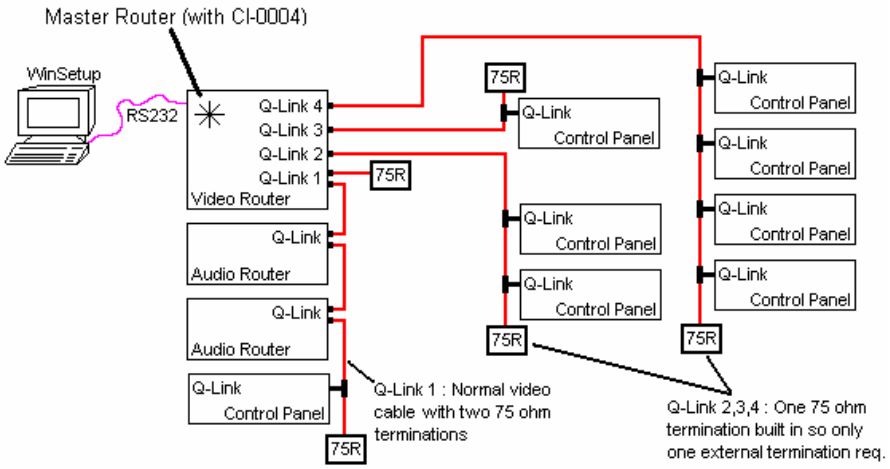
On frames with several Q-Link connectors the "Q-Link-1" or "Q-Link 1a/1b" is always available. The extra Q-link connectors are only supported when a CI-0004 module is installed on to the FU-0003 processor. Only one connector is fitted on the panels and a T-piece needed to tap off the **Q-link**. In this way a panel can be removed from service and replaced without disrupting the link, even temporarily.



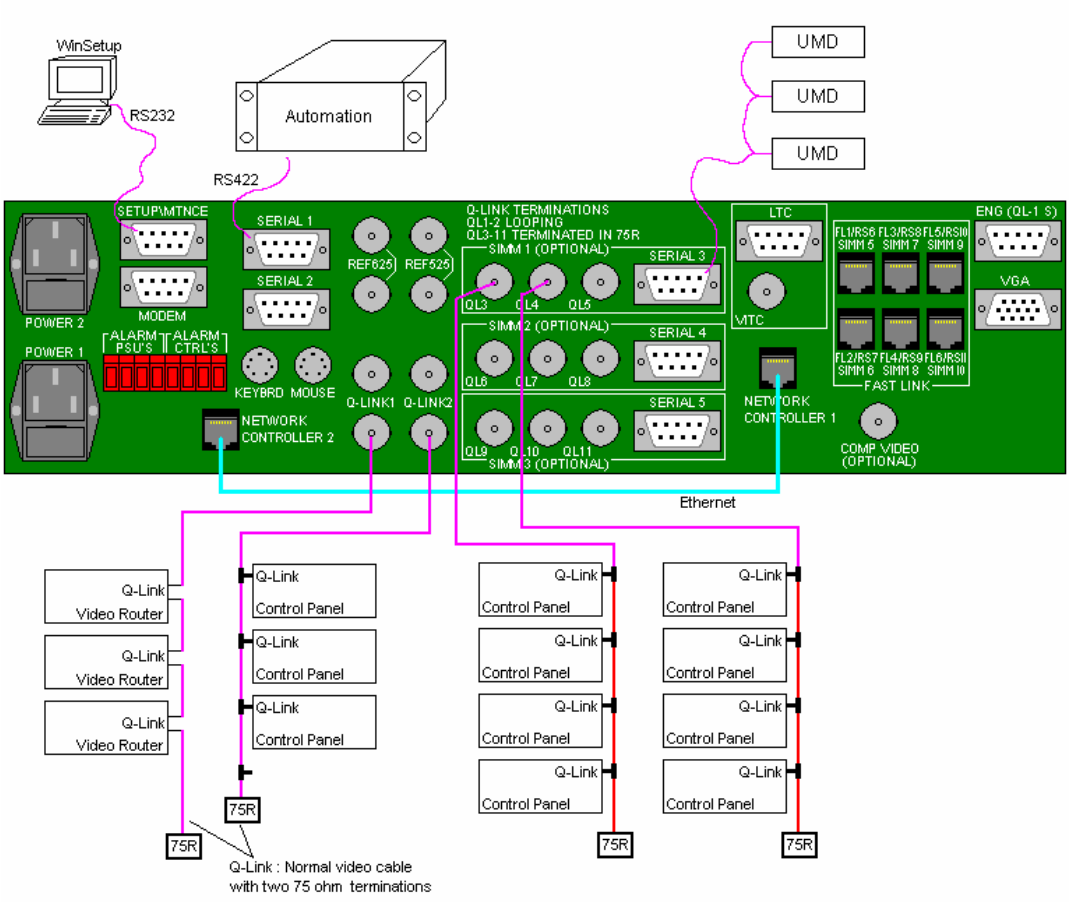
This daisy chain method ensures the best transmission quality of the control signals down the cable. Short cuts that might save cable, such as running stubs to some panels, are not recommended as this may cause data errors under certain circumstances. The maximum cable length is shown in the Technical Specification in Section 2 of this manual.

A total of 64 devices (V5 firmware) can be supported, normally organised as 16 frames and 48 panels. Each unit connected to the **Q-link** has its own *address* switch that is set up as part of the system setup.

In medium sized systems it may be more suitable to have several Q-Links on the master frame and to wire off in different directions. This requires a CI-0004 module in the master router.

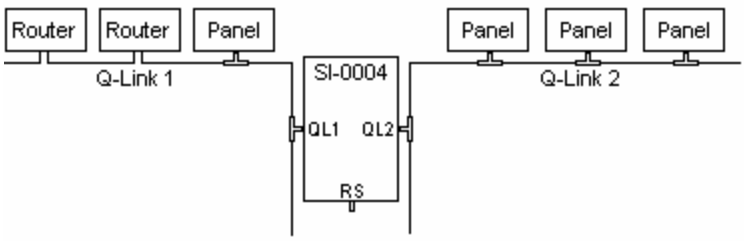


In larger systems the extra processing power of the SC-1000 is often required. This is a separate 2U controller that supports an optional backup controller and backup PSU. The large number of Q-Links allows a system to be split into physical areas such as vision control, audio, production, and engineering.

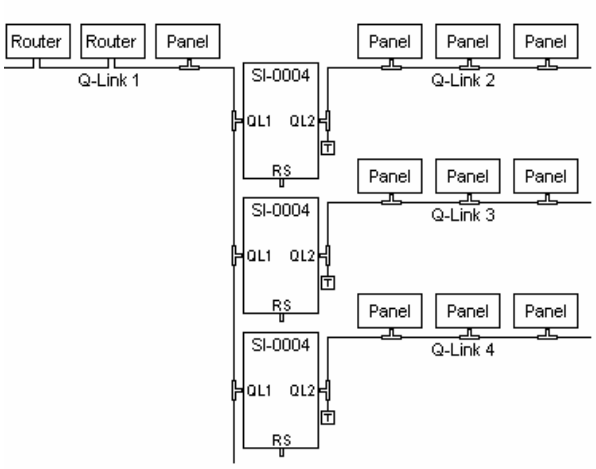


As a system design guide the SC-1000 should be considered when the router grows above 128x128 single level or has more than 10-15 total Q-Link devices. See section 6.10 for further information on the SC-1000.

In large buildings or outside broadcast vehicles (OB trucks) the Q-Link system can be affected by mains earth differences between physically remote areas. This causes currents to flow in the outer of the Q-Link cable that can disrupt the Q-Link communications. To prevent this problem Quartz can supply a SI-0004 Q-Link opto-isolator unit.



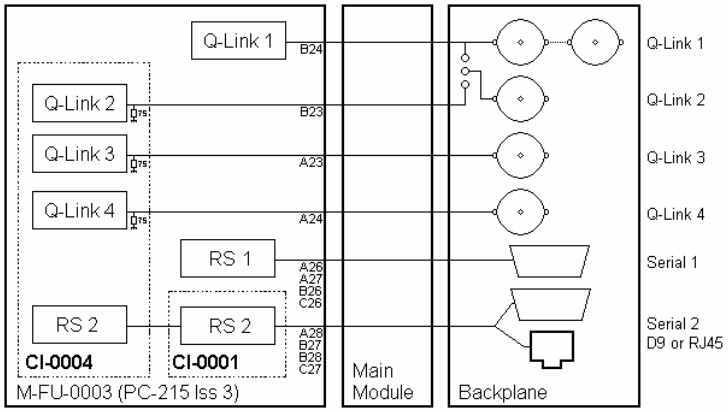
In large buildings the SI-0004 would only be installed once a problem had been identified. In OB trucks it is good practice to install an SI-0004 between the internal Q-Link and any external 'tail gate' or bulk head patch panels. Multiple SI-0004 units can be used where several external Q-Links are required.



Refer to Application Note AN-0016 for further information on the SI-0004 interface.

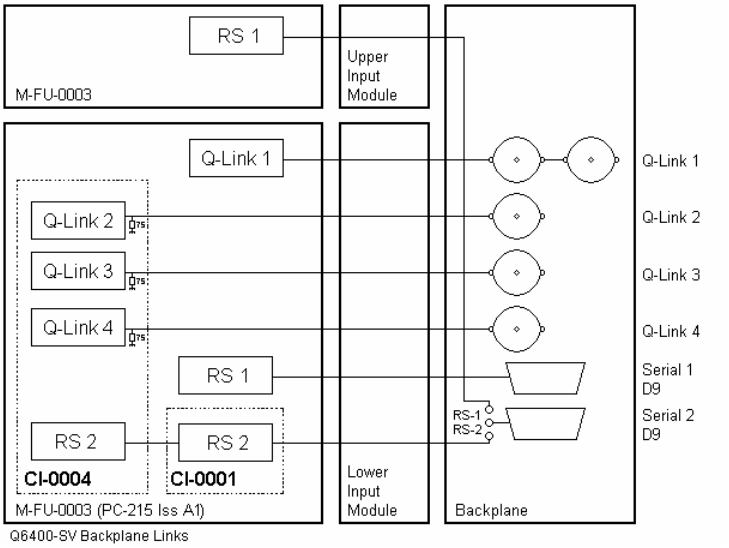
Remote Control - RS232/422 Computer Port

The connectors (9 way D-type or RJ45 sockets) for the computer ports are fitted on the rear of each router frame. All routers fitted with the FU-0003 processor have one computer port driver fitted, and this normally connects to the 'Computer' or 'Serial 1' connector. Second serial ports may require a CI-0001 or CI-0004 module to be installed, refer to the Router Options manual for further details.

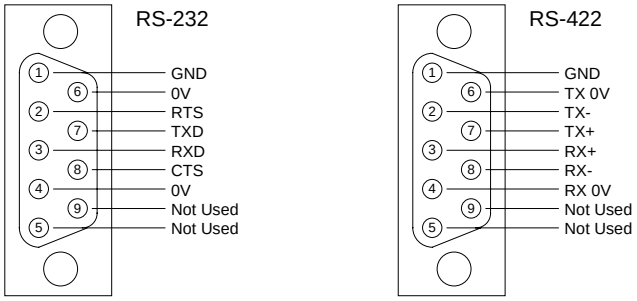


For real time or high-speed control it is essential that the serial port on the master router be used. As Serial 1 is normally required to configure the routing system from WinSetup, Serial 2 would normally be used for the high-speed connection and this requires a CI-0001 or CI-0004 module.

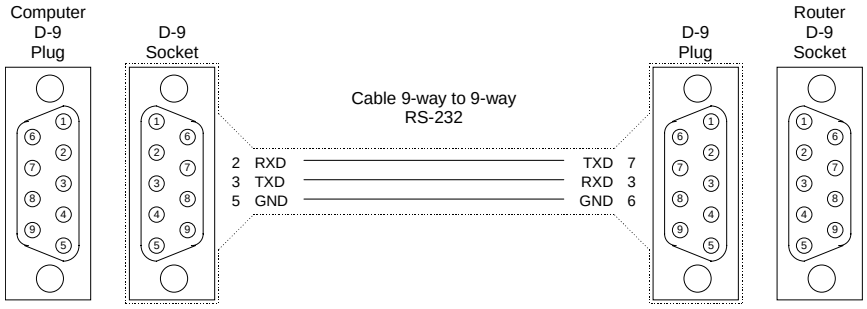
The Q6400-SV router has a four way backplane link to allocate the rear panel 'Serial 2' connector to either the upper input module FU-0003 processor or the second serial port provided by the lower input module CI-0001 or CI-0004 module. The factory default setting for these links is the RS-1 position.



All Quartz products use the same pin-out for the serial D9 connectors. The wiring of the connectors is different for RS232 and RS422.



The cable between the PC and the router (RS232) only needs to use TX, RX, and GND as shown below.



The computer port connector on the rear of a remote control panel only functions if a CI-0003 module is installed. Controlling the routing system through a panel computer port is possible but is not recommended, these ports are only provided for stand-alone S7 panels i.e. CP-3200-S7.

Alarm Connector

This connector allows remote sensing of a power supply failure in dual PSU systems or control processor failure. The exact connection details vary depending on the product.

Product	Alarm Functions
Q6400-AA	Pins 1, 2 = Right PSU, Pins 3, 4 = Left PSU (viewed from front)
Q6400-AV	Pins 1, 2 = Right PSU, Pins 3, 4 = Left PSU (viewed from front)
Q6400-DA-xxxx-B	Pins 1, 2 = Upper PSU, Pins 3, 4 = Lower PSU
Q6400-DA-xxxx-D	Pins 1, 2 = Upper PSU, Pins 3, 4 = Lower PSU
Q6400-SV	Pins 1, 2 = Upper PSU, Pins 3, 4 = Lower PSU

Each PSU and the controller alarm is a relay with normally open contacts that are held closed for a working system. An alarm will therefore be indicated for a fault, loss of power, or a disconnected/broken cable. Alarm functions can be daisy-chained together to give a single alarm or wired back individually to give more information.

Power

IEC connectors are used to supply power to frames and panels alike. Each connector has an earth pin and as matter of safety this earth pin must be connected to a *solid* ground to ensure proper earthing of the metalwork.

In the UK equipment is often supplied with a power cord suitable for wiring into a plug of the user's choice. Please wire the plug using the colour code below:

Brown	Live (Line or Phase)
Blue	Neutral (Return)
Green/Yellow	Earth (Ground)

Some of the frames are fitted with screw terminals so that the CHASSIS and TECHNICAL earth can be wired to different earth points. The equipment is shipped with a wire link fitted between these terminals. If the link is disconnected then it is imperative for personal safety that a proper earth connection is established.

Setting the Power Line Voltage in the Frames and Panels

All Q6400 frames PSU's are auto ranging and therefore do not need the power line voltage set.

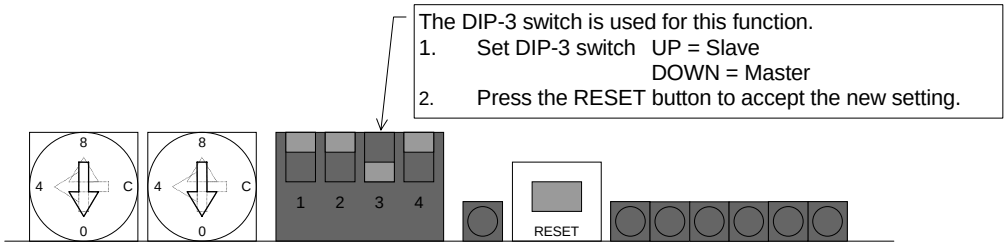
Configuring The Frames

Winsetup and the configuration file largely define how the router frames work within a routing system. Before using WinSetup some basic hardware parameters must be set up. This section describes how to do this for all video and audio frames. The next section covers the same processes for the remote control panels.

Note: The rotary *hex* and DIP switches are only read at power up or following a RESET. If you make any changes you must press the RESET button so that the new settings are acted upon.

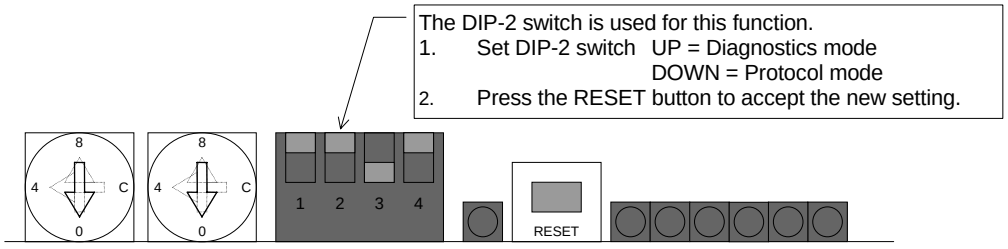
Frame Mode: Master or Slave

One matrix module in the system must be set as the Master and the others as Slaves. This is very important, as there will not be proper communications unless this rule is followed. The Master frame contains the non-volatile RAM (NVRAM) to store the complete matrix route status and the separate NVRAM in which to store the setup or configuration of the system.



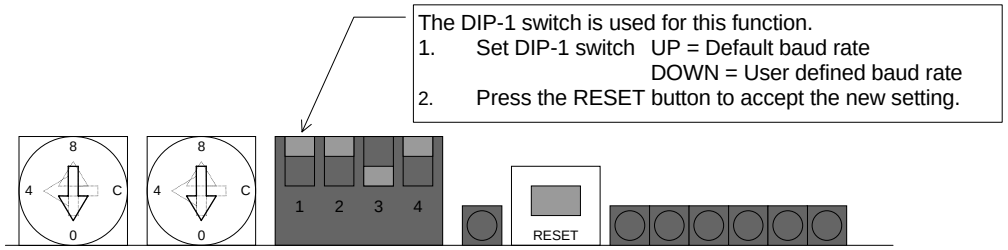
Serial Port Mode: Diagnostics or Protocol

The computer port can be set to diagnostics mode or protocol mode. Normally the setting is for diagnostics mode so that the matrix outputs basic error logging information. Use this mode with the WinSetup 'PC Comms Window' or any dumb terminal. The protocol mode is used if a computer is being used to download a new system configuration from WinSetup, or if the matrix is to be controlled from an external computer in a remote switching application.



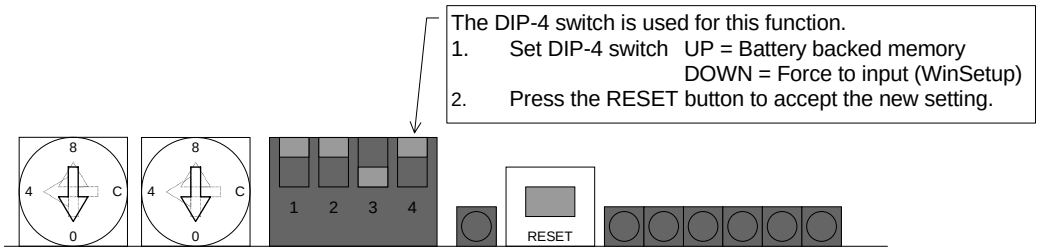
Serial Port Baud Rate: Default or User

The baud rate can be set to default (38400 or 9600), or to a user defined baud rate, using WinSetup.



Force Input: Force input or use battery back settings

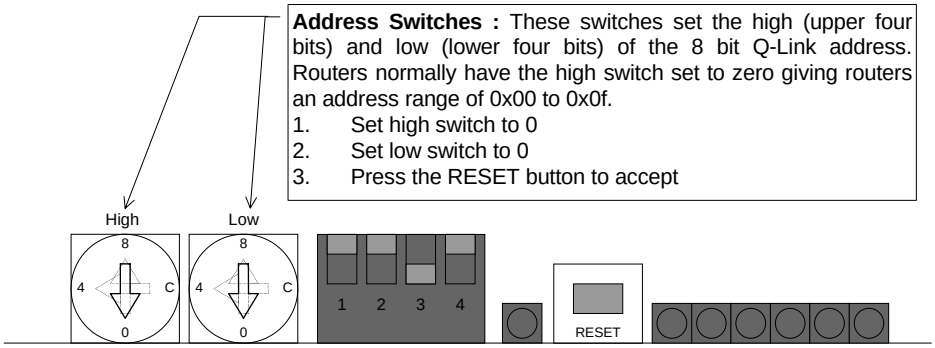
The router system normally remembers the crosspoint settings after a power loss. In some situations it may be preferable to restore the router to a defined input, say bars/tone, after a power loss. This switch overrides the normal battery backed memory operation, but can only be set on the master router.



Address Switch

The rotary hex switches are used to set the unique address of the matrix modules in the frame. The purpose of the switch setting is to ensure that each matrix module has a different code. This distinguishes different frames in a multi-frame system so each is updated with the correct crosspoint settings. The exact setting will depend on your WinSetup configuration.

A small screwdriver is needed to fit the slot and make the selection. Rotate the switches, which have 16 positions from 0 through 9, then A to F (hexadecimal notation).



Buzzer

The sounder fitted on most matrix modules is used to provide warnings when certain buttons on a local panel are pressed. This can be enabled or disabled by moving a link adjacent to the buzzer.

Analogue Video Routers

The items covered in this section are specific to the analogue video routers.

Input Coupling Mode

Normally there is a dc restorer on each video input. These restore the sync tips (the lowest part of the signal) to a voltage of -300mv. Then, irrespective of the dc or average picture level of the incoming signal, the dc of the black level on the output will be constant.

This is fine for composite video signals, but component video signals: Pr (V) and Pb (U) have the potential for signal content both above and below black level. A dc restorer is not suitable for such signals and the signal is dc coupled through the matrix. The restorers are controlled in groups of eight and can be linked in or out of circuit. The links are located near the edge connector by the input circuits. For each group of eight inputs there are two links. With the module placed with the handles nearest you (South) and the edge connectors furthest away (North):

> Set the jumper links North, North (DC) for component signals and South, South (ON) for composite signals.

TV Line Switching
Sometimes it is important to change the TV line in the vertical-blanking interval during which the routing switcher makes its cuts. Any line from 6/319 to 10/323 may be selected using the three jumper links LK6, 7, 8. The diagram on the PCB shows the positions of the links.

It is also possible on this version of the module to choose whether to permit switching on every TV field or just on the first field of each picture. This can be important in certain editing applications.

The factory settings are line 6/319 and every field.

Serial Digital Video Routers

The items covered in this section are specific to the serial digital video routers.

Output Standards
The routers are capable of handling up to four different output standards with each output automatically selecting the correct standard.

TV Line Switching
Sometimes it is important to change the TV line in the vertical-blanking interval during which the routing switcher makes its cuts. Any line from 6/319 to 10/323 (PAL) may be selected using the three jumper links LK6, 7, 8. The diagram on the PCB shows the positions of the links.

It is also possible to choose whether to permit switching on every TV field or only on the first field of each picture. This can be important in certain editing applications.

The factory settings are line 6/319 and every field.

Analogue Audio Routers

The items covered in this section are specific to the analogue audio routers.

No user settings.

AES/EBU Digital Audio Routers

The items covered in this section are specific to the digital audio routers.

No user settings.

WinSetup

The WinSetup program is used to configure most of the routing functions, including control panel operation. It allows such things as the number of signal levels to be defined, which routing frames and panels are connected to the system, what the names are for the inputs and outputs.

Refer to the Router Control System Manual for further help on WinSetup, or use its comprehensive help system that can be accessed by pressing **F1** (function key F1) from any screen (dialog). The help system can also be entered from the *Help, Index* menu.

GENERAL DESCRIPTION

Introduction

This section describes features of the Q6400 routing systems and how to apply them in your own particular situation.

The Quartz range of routing switchers handles virtually all signal formats in sizes from 16x1 to 1024x1024. Sophisticated control is built into each router (except Q1601/Q1602) allowing the full range of standard Q-Link panels to be added to a system. Any mix of routers and control panels is possible within one system as all products share a common control system.

Q1601/Q1602 range of routing switchers that can handle 8 or 16 inputs and 1 or 2 outputs is covered in Manual-06. The video and audio is contained in a 1U package and can be expanded for more inputs by cascading. These routers are normally supplied with a simple control system, but this can be upgraded by the addition of a standard processor module enabling all the control features found in the larger routers.

Topaz range handles 16 inputs to 16 outputs or 32 inputs to 32 outputs, with each signal format in a separate 2U package. Backup power supplies are available as an option.

Q16 range handles 16 inputs and up to 16 outputs, with each signal format in a separate 1U package. Backup power supplies are not available in this range, see equivalent Q32 product.

Q32 range handles 32 inputs and up to 32 outputs, with each signal format in a separate 2U package. Backup power supplies are available as an option.

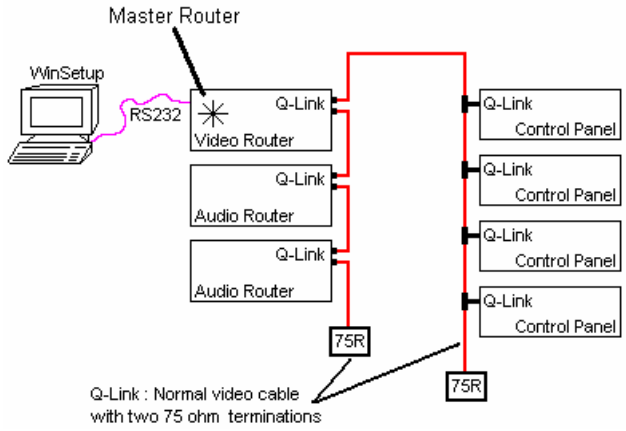
Q6400 range handles up to 64 inputs and up to 64 outputs, with each signal format in a separate package ranging from 3U to 8U. Backup power supplies are available as an option.

Xenon range handles up to 128 inputs and up to 128 outputs, with different signal formats being mixed within the 4U or 8U chassis. Backup controllers and power supplies are available as an option. There is no expansion outside the 4U or 8U chassis.

Q128 range handles up to 128 inputs and up to 128 outputs, with each signal format in a separate package ranging from 6U to 12U. Backup power supplies are available as an option. Expansion to 256x256 is available using external signal splitters and the expansion output module option.

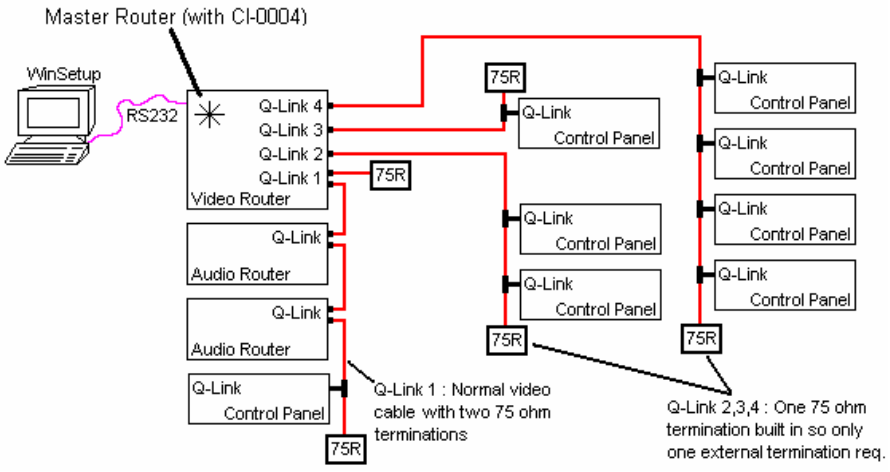
Q256 range handles up to 256 inputs and up to 256 outputs in a single frame or up to 1024x1024 by combining frames. The Q256 is covered in a Manual-08.

Units are stacked together to provide multiple levels. E.g. a system could be provided with serial digital, composite video, three levels of component video, four levels of audio, time code and RS422. Remote control panels are usually supplied as part of a system and these are connected back to the routers by a standard video co-ax cable called **Q-Link**.

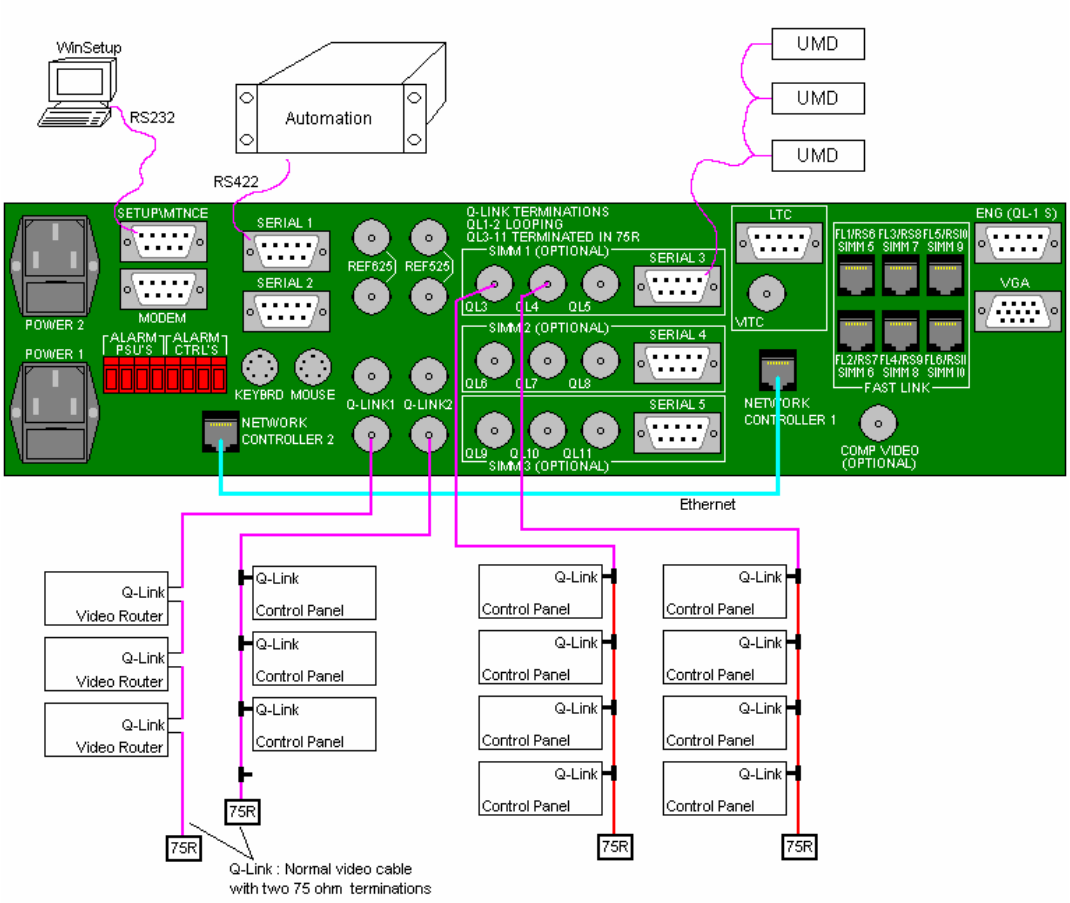


To allow re-configuration, all systems are supplied with WinSetup, which is a Windows program enabling the user to edit the PC based setup files and then download the selected file to the router.

In medium sized systems it may be more suitable to have several Q-Links on the master frame and to wire off in different directions. This requires a CI-0004 module in the master router. Only Q32 routers and above have the extra BNC connectors to support a CI-0004.



In larger systems the extra processing power of the SC-1000 is often required. This is a separate 2U controller that supports an optional backup controller and backup PSU. The large number of Q-Links allows a system to be split into physical areas such as vision control, audio, production, and engineering.



As a system design guide the SC-1000 should be considered when the router grows above 128x128 single level or has more than 10-15 total Q-Link devices. See section 6.10 for further information on the SC-1000.

A variety of other options may be supplied. These include additional RS232/422 Computer Interface Cards to communicate with computers, Parallel Interfaces for connection to custom control panels, or a Video Status Display to show on a TV picture monitor how the routes have been assigned. The options are fully described in the Router Options manual.

The Routers

The router frames are of robust construction and house plug-in modules: the main router modules - video, audio or control level - on the left-hand side and the power supplies on the right.

The plug-in modules are positively locked in place and will not come loose when installed in an OB vehicle, except under the most severe circumstances. By removing the front panel/local control panel and releasing the special quick release handles the modules can be easily removed from the front of the frame.

An optional kit is available to support the rear of the 1U and 2U frames to the rear of the rack in which it is mounted. This is particularly important if the matrix is installed in an OB vehicle.

Control System

The microprocessor based control system activities are:

- Read buttons and update displays on both local and remote control panels,
- Respond to data received through the computer port
- Update the router crosspoint switches.
- Handle the communications between different switching levels e.g. audio and video frames.

The system is configured before shipment to make it work in the unique way required by each customer. This configuration is generated by the WinSetup program and downloaded to the **master** router, where it is stored in non-volatile memory (NVRAM).

Finally, the control system maintains its status in a battery-backed memory so that when the unit is powered down the router remembers its current settings and on powering up again it switches the unit to those settings. The non-volatile RAM that stores this information is fitted inside the Master unit of the system (see below).

There are a number of switches provided which are used to configure the system to suit your own requirements. They are briefly described below, but for more details and a procedure for how to set them up you should refer to the Installation Section.

Embedded Control: FU-0003

All routers use a standard processor module called the FU-0003. The FU-0003 is capable of acting as a Q-Link master and running a routing system up to approximately 128x128 single level with 10-15 devices on the Q-Link. For systems above this size it is recommended that the SC-1000 be used.

System Controller: SC-1000

The SC-1000 acts as the system controller in larger systems and supports multiple Q-Links and serial ports. It has many advantages over the FU-0003 in larger systems such as:

- Larger database support.
- Faster boot-up time on large systems.
- No disruption as panels are added and removed on large systems.
- Supports multiple Q-Links and Serial ports.
- Dual redundant controller option
- Reduced down-time during re-configuration

Firmware Versions

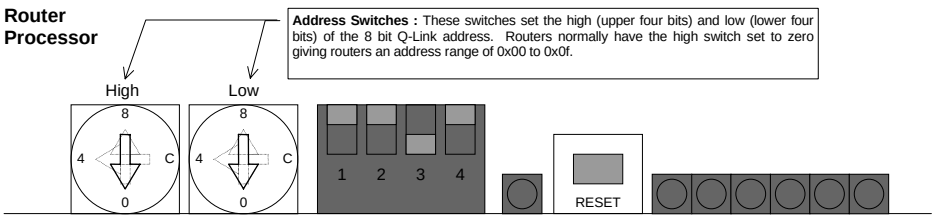
When the FU-0003 processor is used in a router it is fitted with firmware, typically labelled

PC215 V5.00

The **V5**.xx is the major firmware version, and all devices on one Q-Link must have the same major firmware version. The Vx**.00** is the minor firmware version and is used to indicate small improvements and bug fixes.

Address Switches

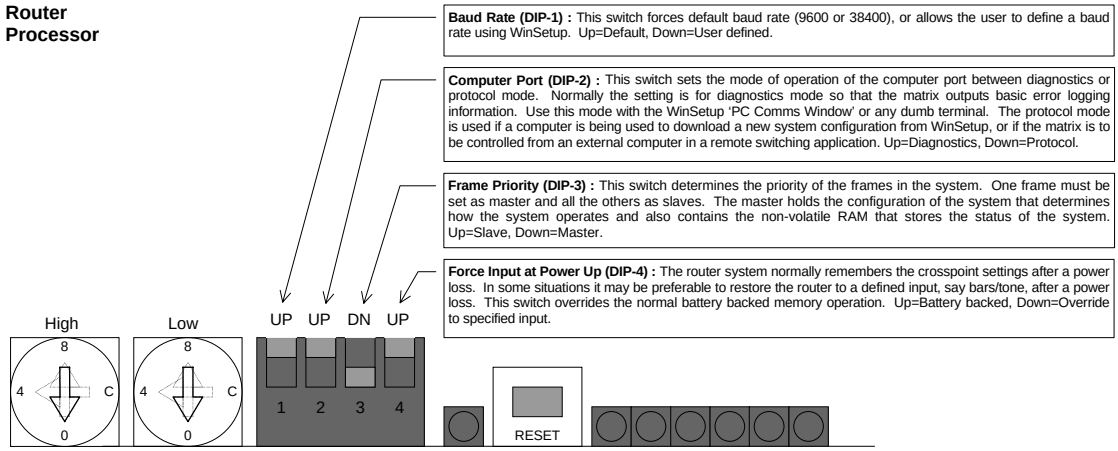
The two rotary *hex* switches in each frame determine its unique *address* in the system. This ensures that all devices have a different code allowing communications down the coaxial **Q-link** to distinguish different units.



The reset switch must be pressed after changing the address switch.

DIP Switches

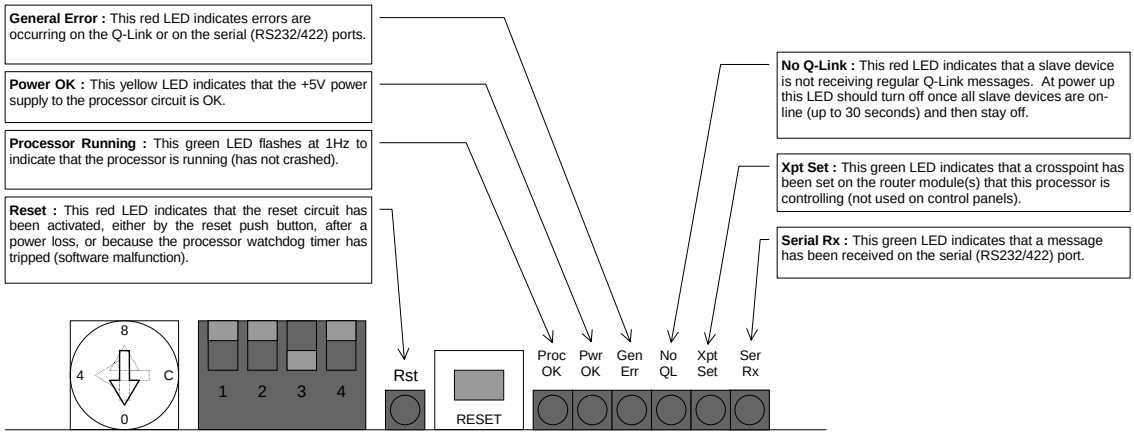
There are four DIP switches at the front of the matrix modules. They operate in the same way for video and audio matrix modules. The DIP functions are :



The reset switch must be pressed after changing the DIP switch.

Status LED's

There are a number of LED's giving status information.



System Control Bus: Q-Link

The **Q-link** used to interconnect the panels and frames uses a single coaxial cable. This method was chosen because it is the easiest for installation.

The **Q-link** is daisy-chained from one panel to the next and between the frames. Messages are sent by injecting signal currents onto the link, to be received by all the other panels or frames on the line. The link is terminated with 75Ω at both ends, as is standard video practice, and will not work without at least one termination.

A *hex* switch in each frame and panel sets the identity of each so that they are correctly addressed by the control system. A total of 64 devices (V5 firmware) can be supported normally organised as 16 frames and 48 panels.

Two BNC sockets are provided on the frames fed from a single driver/receiver. Thus short lengths of coax cable can be used to interconnect the frames in a multi-frame system by looping through the frames. The panels are however fitted with just one BNC connector, as it is better practice to use a T-piece to *tap off* the **Q-link** into the panels. In this way a panel can be removed from service without the **Q-link** being interrupted.

A total run of over 500 metres of video cable can be used between panels and the frames. For installations that require several long runs in different directions the CI-0004 module or SC-1000 System Controller should be used. The SI-0004 Q-Link Opto-Isolator can be used to eliminate earth current problems, particularly in OB installations or large buildings, see section 3 for more details.

As part of the fault diagnosis system detectors are provided in the frame and panels to identify loss of Q-Link to slave devices. This is highlighted by the control system with a LED on the front of the router or panel processor module ('No QL' LED on previous page). This feature is very useful at installation as it enables the cable and its terminations to be verified.

Serial Port

The serial port is used to download from WinSetup (master router only) and to connect to automation computers and other studio equipment.

One serial port is built in as standard to all routers using the FU-0003 processor. A second serial port can be provided within a router by use of the optional interface modules CI-0001 or CI-0004, refer to the Router Options manual.

Serial Digital Video Routing

The Q6400 router uses two cards of 32 inputs each. These connect via the backplane to two 64x32 combined crosspoint and output cards.

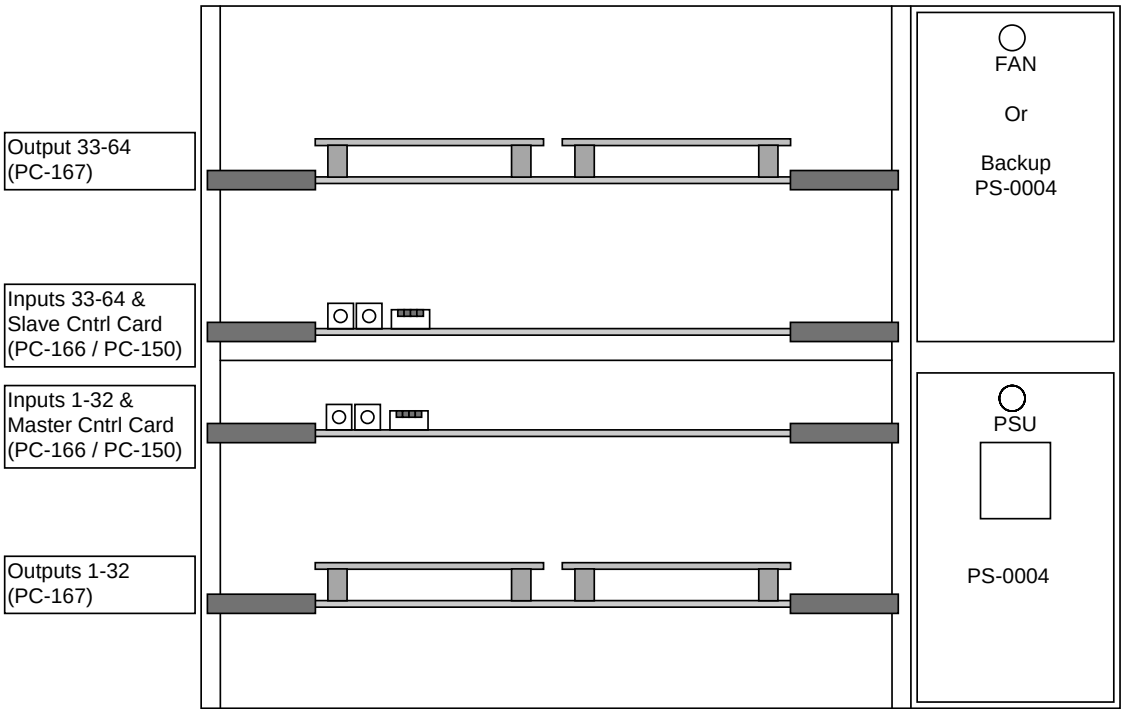
These routers are capable of handling signals in the following formats:

143Mb/s	D2 NTSC composite
177Mb/s	D2 PAL composite
270Mb/s	D1 component
360Mb/s	Reserved for possible future 16:9 standard

Signal Path

The signal path is differential throughout which optimises waveform symmetry and reduces crosstalk, so important if transmission down long cables is to be achieved reliably.

The 8U frame is shown in schematic form below:



Inputs
In the Q6400 routers there can be up to two modules each capable of handling up to 32 inputs. The input stages are mounted on plug-in SIMM modules. The re-clocking function is located on the output stage. This reduces costs in a router with less outputs i.e. 64x32.

Matrix
The Q6400 system uses a total of four crosspoint assemblies similar to the Q32 system. These work in pairs to form a 64x32 block. The outputs of the crosspoints are combined in the output stage.

Outputs
The output stages perform three functions. Firstly they form a 2x1 crosspoint to combine the outputs of the 32x32 crosspoints. Then they re-clock the signal to restore the mark-space ratio. Finally there is a cable driver with twin outputs to drive 75Ω video cables.

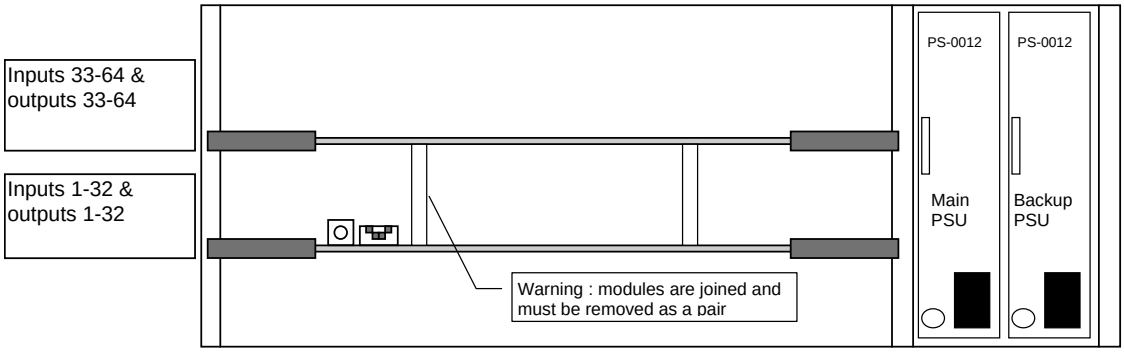
Analogue Video Routing

The Q6400 64x64 video matrix is based on a pair of matrix modules that hold the inputs, crosspoints, and outputs, and is available in various sizes up to 64x64. All circuitry is 'surface mount' and there are no adjustments for gain or HF. The unit has a bandwidth of 30MHz. Four sets of jumper links are fitted to allow blocks of 8 inputs to be set for *Restored* (PAL or Y component) or *DC Coupled* (U and V components). The frame is 3U high and dual power supplies can be fitted in this frame.

The crosspoints are switched during the vertical interval using the reference input signal and both units have jumper links to set the TV switching line (line 6 to 10) and to select field or frame rate switching. If a reference input is not connected then the unit free runs i.e. switches at random.

Signal Path
The signal path has been designed to be as short as possible. This reduces the variations in path length between channels and maintains the overall transparency through the router so important in broadcast applications.

The 3U Q6400 frame is shown in schematic form below:



Inputs
The video inputs are terminated in 75Ω.

The router module pair contains input buffers that have high input impedance to aid the return loss performance and an output to drive the crosspoint switch(s). The buffers can operate in two modes: dc restored for use with composite signals or component signals with sync present. Alternatively, the buffers can be set to operate in a dc-coupled mode for use with RGB or colour difference signals that have no sync component. The user selects the mode for each block of 8 inputs by jumper links on the main plug-in router module. This means that the matrix can handle a mixture of composite and component inputs.

The dc restorer is a feedback sync tip restorer that prevents any crushing of the sync signal.

Inputs 1-32 are connected to the lower module input buffers, and from there are fed to the crosspoint IC's on the lower module and to the intermediate connector module, to feed the upper module. Likewise, inputs 33-64 are connected to the upper module input buffers, and from there are fed to the crosspoint IC's on the upper module and to the intermediate connector module, to feed the lower module.

Matrix
The crosspoint array is formed from 16 IC's each of 16x16. Each module forms a 64x32 crosspoint array, taking half its inputs from each of the upper and lower modules.

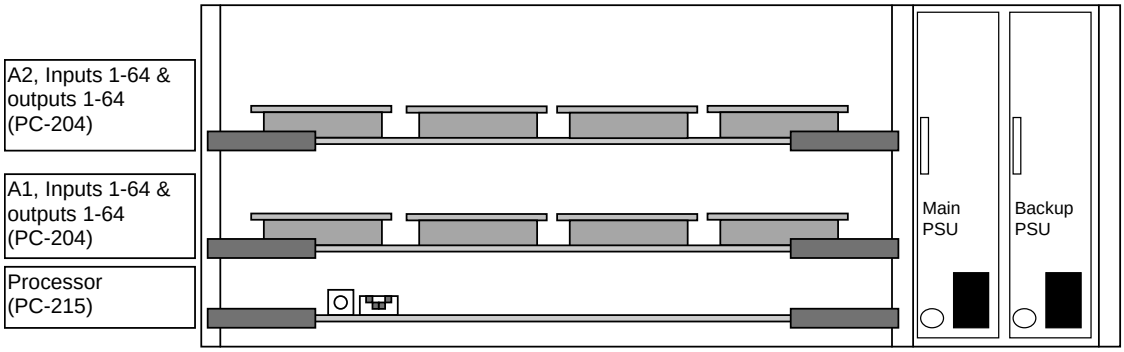
Outputs
Each module contains 32 output amplifiers. The outputs do not incorporate adjustment controls for insertion gain or high frequency response as the product has been designed to give unity gain and a flat frequency response.

Analogue Audio Routing

The Q6400 router uses a single main module for 64 inputs and all the crosspoints. To this can be added output modules that are available in two formats. Two of these main modules can be fitted into a 3U chassis. The Standard output module has 16 outputs. The Crossover output module has 16 outputs but also allows selection of silence, an audio source from the adjacent main audio module, or a mono mix of the local audio and the adjacent audio. With this crossover module fitted, a two channel audio router can allow stereo left/right swap, or in a four channel arrangement, A1/A3 swaps with A2/A4.

The Q128 router is based on the Q6400 router with crossover modules fitted to both main modules. The software re-configures the router hardware to allow inputs 1-64 (one main module), or inputs 65-128 (other main module) to be routed to an output.

The 3U Q6400 frame is shown in schematic form below:



Inputs

The inputs are electronically balanced. This provides a very good common mode rejection ratio over a wide frequency range. Also, the balance is maintained even if the source is floating. Some designs of electronically balanced inputs cause the input lines to become unbalanced which can cause an increase in crosstalk if the input cables are unscreened and run together over long distances.

The input and output connectors are D50 multi-way types. The signals are filtered to reduce out-of-band high frequency signals.

Matrix

The matrix uses un-balanced 16x8 crosspoint chips. These exhibit excellent signal path performance together with minimal crosstalk and switch click noise.

Standard Outputs

These outputs are balanced with 16 channels on each output module. Up to four output modules can be fitted to give a total of 64 outputs.

There is only one adjustment in the audio path to allow the gain to be adjusted up slightly if the outputs are terminated in 600Ω. As this is now an unusual practice, the insertion gain is factory set for unity into a load of 10kΩ.

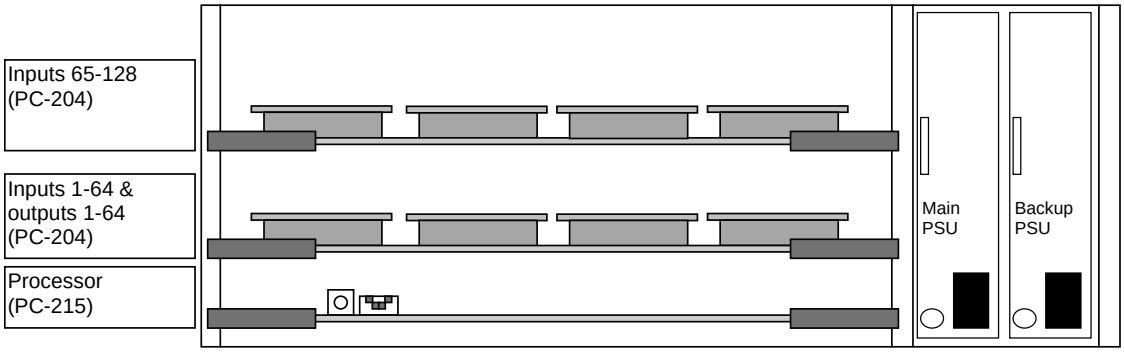
Crossover Outputs

These outputs are balanced with 16 channels on each output module. Up to four output modules can be fitted to give a total of 64 outputs.

This output module has additional circuitry including a 4-to-1 switch. This allows a choice of four modes: normal audio output; silence to output; audio from the adjacent main module; and a mono mix of the audio from the adjacent and main module. With this module fitted the control system allows features such as stereo left/right swap, left to both outputs, right to both outputs, and left+right mix to either output.

There is only one adjustment in the audio path to allow the gain to be adjusted up slightly if the outputs are terminated in 600Ω. As this is now an unusual practice, the insertion gain is factory set for unity into a load of 10kΩ.

This router can also be supplied in matrix sizes up to 128x64 in mono only. The frame is shown in schematic form below:



Inputs
The inputs are electronically balanced. This provides a very good common mode rejection ratio over a wide frequency range. Also, the balance is maintained even if the source is floating. Some designs of electronically balanced inputs cause the input lines to become unbalanced which can cause an increase in crosstalk if the input cables are unscreened and run together over long distances.

The input and output connectors are D50 multi-way types. The signals are filtered to reduce out-of-band high frequency signals.

Matrix
The matrix uses un-balanced 16x8 crosspoint chips. These exhibit excellent signal path performance together with minimal crosstalk and switch click noise.

Outputs
These outputs are balanced with 16 channels on each output module. Up to four output modules can be fitted to give a total of 64 outputs.

This output module has additional circuitry including a 4-to-1 switch that allows the audio output from either the lower or upper module, making a total of 128 inputs available to any of the 64 outputs.
There is only one adjustment in the audio path to allow the gain to be adjusted up slightly if the outputs are terminated in 600Ω. As this is now an unusual practice, the insertion gain is factory set for unity into a load of 10kΩ.

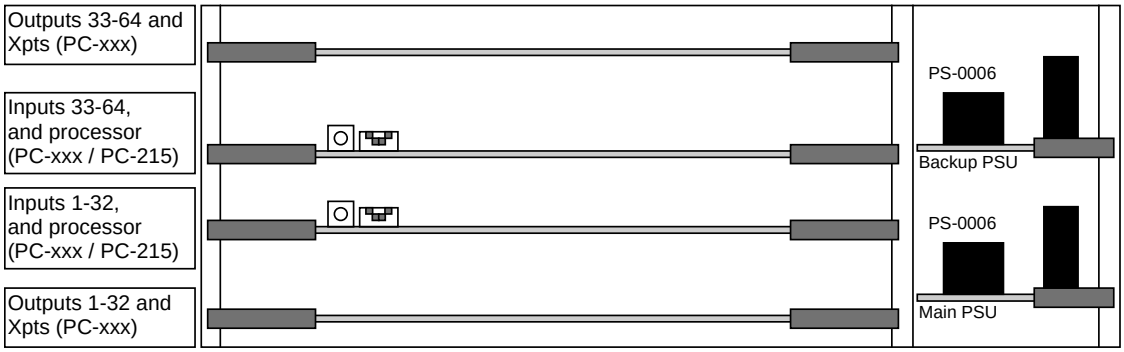
AES/EBU Digital Audio Routing

The Q6400 router allows a 64x64, using two cards of 32 inputs each. These connect via the backplane to two 64x32 combined crosspoint and output cards. The Q6400 is available in an 8U BNC frame providing the 75Ω AES3-ID coaxial interface, or a 3U D50 frame providing the standard 110Ω AES3-1992 interface.

The AES/EBU digital audio matrix is capable of handling signals in the following formats:

32KHz	Broadcast standard e.g. NICAM
44.1KHz	Compact disk
48KHz	Professional standard
96KHz	Professional standard, DVD authoring (non-reclocked versions only)

The 3U Q6400 frame for balanced signals is shown in schematic form below



Inputs

The 3U frame audio inputs are transformer coupled and normally terminated in 110Ω, but can be factory-fitted for S/PDIF inputs which are unbalanced and of 75Ω impedance. The input connectors are D50 multi-way types.

The 8U frame uses BNC connectors. The audio inputs are transformer coupled and terminated in 75Ω, to comply with AES3-ID/SMPTE 276M.

The audio signal passes through an input receiver circuit that locks an oscillator to re-clock the signal so that the correct pulse widths and timings are regenerated. The circuit can cope automatically with any of the standards mentioned above. The phase-locked loop is designed to minimise the jitter on the signal.

Inputs 1-32 are installed on the lower input module and inputs 33-64 on the upper Input module.

Matrix

The Q6400 system uses a total of four 32x32 crosspoints combined as pairs on two crosspoint sub-assemblies. Each sub-assembly provides a 64x32 block, and can be found at the front of the upper and lower Output modules.

Outputs

The output drivers are normally arranged to drive 110Ω lines in 3U frames and AES3-ID/SMPTE 75Ω lines in 8U frames. As was the case with the inputs, the 3U frames can be factory-fitted to drive S/PDIF 75Ω cables.

Each Output module has the capability of 32 outputs.

RS422 Control Level Routing

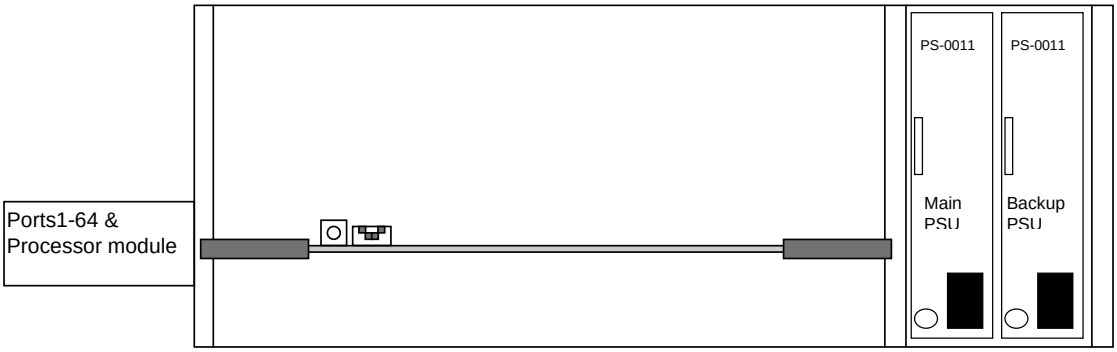
The RS422 Control Level Router is used mainly for machine control, to assign e.g. VTRs to an edit controller. RS422 uses four wires with one pair used for the transmit signal and the other pair for the receive, so the router handles both a forward and a reverse signal path through the matrix. The bi-directional nature of the RS422 signal imposes a limitation such that an RS422 device can only be routed to one other RS422 device. This is known as XY lock out. The router control system provides two mechanisms to prevent multiple devices being connected together.

> **Last Take Wins (chronological):** when a user routes an RS422 'input' device to an RS422 'output' device, any other device previously connected to the input or output device is routed to the IDLE route (no connection).
>
> **Take From Idle:** this prevents accidental changes to existing RS422 routes by only allowing devices to be routed if they are currently connected to the IDLE route.

There are currently two sizes of RS422 port router, the Q32-PR and Q6400-PR. Port routers treat all the RS422 RJ45 connectors on the rear panel as general connectors, i.e. neither inputs nor outputs. Therefore any RJ45 connector can be routed to any other RJ45 connector and is a very flexible approach to machine control routing.

Both routers can also support RS232 by changing any dual channel RS422 SIMM for the dual channel RS232 SIMM.

The 3U Q6400-PR frame is shown in schematic form below



Tally Routing

The Tally Router is described in the Router Options manual.

Power System

The Q6400 frames use large switch mode power supplies. Mains voltages from the rear IEC connector are brought on to the switch mode supply via power connectors. The power supply assembly slides in and mates with this connector. A mains switch is provided with an LED showing the status of the low voltage outputs. The supply is normally configured to give -5V and +5V at up to 80A.

Cooling Fans

Q6400-SV (8U frame): These have a cooling fan fitted in the rear of the plug in PSU module that draws cool air from the front of the router and expels it through the right hand side vents. It is powered from both power modules, so that if either fails then it continues to run.

Ground and Power Fail Alarms

A terminal strip is provided on some units to allow connection to the PSU alarm and processor alarm outputs. On the Q6400 frames the terminal strip has two pairs of contacts, one for each PSU, held closed so long as each power supply is fitted, switched on, and working

Remote Control Panels

Refer to the manual on Router Control Systems for details of the control panels available for this system and their operation. The following points apply to most panels.

Remote panels are used to indicate current routes and to make new route selections at various locations to suit the user. Most panels are connected to the frame via the 'Q-link' coaxial link. The identity of each panel is determined by the unique setting of a rotary hex switch in each panel.

Each panel is set up to operate in a particular way by the *system setup* located in the master frame of the system and edited using the WinSetup program. This determines, for instance, which destinations can be controlled from each panel. The rotary hex switch mentioned above serves to route the correct setup to each panel.

Custom panels using button-per-source selection can be connected back to the matrix frames via the Parallel Interface PI-1604A or PI-1608A (see Sec 6: Options) and then the Q-link.

Technical Specification

Analog Video

VIDEO INPUTS	
Nominal signal level	
video signal	1v p-p
sync pulses	2v p-p
subcarrier	1v p-p
Max signal level	
dc restored inputs	
video signal	+6dB
sync pulses	2.5v p-p
dc coupled inputs	
video or subcarrier	+/-0.7v
Impedance	75Ω terminating
Return Loss to 5.5 MHz	40dB
dc on input (dc restored)	+/-3v
VIDEO OUTPUTS	
Impedance	75Ω
Return Loss to 5.5 MHz	35dB
dc on output (see note 1)	+/-50mV
INSERTION GAIN	
Insertion gain	+/-0.1dB
Gain spread between inputs	+/-0.05dB
Adjustment range	+/-0.5dB
LINEAR DISTORTION	
HF response 15KHz to 5.5MHz	+/-0.1dB
5.5 to 10MHz	+/-0.2dB
10MHz to 100MHz	+0.5, -1.0dB
above 100MHz	smooth roll off
HF adjustment at subcarrier	+/-0.5dB
LF response, tilt at 50 Hz	+/-0.5%
Y-C gain inequality	+/-0.5%
Y-C delay inequality	+/-5nsec
NON-LINEAR DISTORTION	
Differential Gain(10-90% APL)	0.15%
Differential Phase(10-90%APL)	0.15°
Luminance non-linearity	0.2%
C-Y intermodulation	0.5%
Dynamic gain (Y, C, sync)	0.5%
Transient gain (Y, C, sync)	1%
PROPAGATION DELAY	
Path length - Q16 and Q32	13nsec typical
Timing spread at 4.43MHz	
one output	+/-1°
all outputs	+/-2°

UNWANTED RESIDUAL EFFECTS	
Crosstalk, to 5.5MHz worst case	58dB
Noise to 5.5MHz	-70dBrms
video spikes at switching	+/-20mv
SWITCHING REFERENCE	
Signal level	
1v p-p	+/-3dB
1-4v pulses	
Impedance	looping
dc on input	+/-1v
Switching occurs on lines	6/319 to 10/323
field or frame rate	link selectable
POWER	
Voltage, universal	90-264v, 50/60Hz
Power consumption (Q16, Q32)	20watts
Connector (Q16)	IEC with latch
Connector (Q32)	IEC with latch x 2
Power Fail Alarm Output (Q32)	screw terminals
Power Supply good	closing relay contact rated at 250mA, 50v
Power Supply failed\absent	open relay contact
CONTROL	
Q-link to remote panels	75Ω video cable 500M max. length
Computer port RS232/RS422	D9 socket
MECHANICAL	
Height	
Q16	1U, 44mm, 1.75"
Q32	2U, 88mm, 3.5"
Width	19" rack mount
Depth	500mm
Weight	
Q16	6Kg
Q32	12Kg
ENVIRONMENTAL	
Operating and storage (ambient)	0-40°C
Specification maintained (ambient)	10-30°C
Humidity	10-90% non-condensing

Note 1: In the dc coupled mode the dc on the output is specified with the input terminated in 75Ω. In the dc restored mode the specification refers to the black level when the sync amplitude is 300mv.

Analogue Audio

Audio Inputs

Signal level	0dBu nominal, +24dBu maximum
Impedance	20KΩ
Common Mode Rejection	
20Hz to 3KHz	-80dB, -100dB typical
3KHz to 20KHz	-60dB, -70dB typical
Common Mode Level (Q16, Q32)	+30dBu maximum with no signal
Common Mode Level (Q6400)	+27dBu maximum with no signal

AUDIO OUTPUTS

Impedance	40Ω balanced
dc on output	+/-50mV

SIGNAL PATH

Insertion gain	+/-0.1dB
Frequency Response 20Hz to 20KHz	+/-0.25dB
to 150KHz	-3dB
Relative delay between two routes	1 μsec
Total Harmonic Distortion	0.02%, 0.01% typical
	-10dBu to +20dBu, 20Hz to 20KHz
Crosstalk 20Hz to 20KHz (Q16, Q32)	-90dB worst case, -105dB typical
Crosstalk 20Hz to 20KHz (Q6400)	-80dB worst case, -105dB typical
Noise 20Hz to 20KHz	-85dBu rms. unweighted, -90dBu typical

POWER

Voltage, universal	90-264v, 50/60Hz
Power consumption (Q16)	20 watts, (35 watts driving max signal into 600Ω loads)
Power consumption (Q32)	40 watts, (70 watts driving max signal into 600Ω loads)
Power consumption (Q6400)	120 watts, (195 watts driving max signal into 600Ω loads)
Connector (Q16)	IEC with retaining latch
Connector (Q32, Q6400)	IEC with retaining latch, backup optional
Power Fail Alarm Output	screw terminals
Either Power Supply good	closing relay contact, rated at 250mA, 50v
Either Power Supply failed or absent	open relay contact

CONTROL

Q-link to remote panels	75Ω video cable
	500M max. length
Computer port RS232/RS422	D9 socket

PHYSICAL

Height (Q16)	1U, 44mm, 1.75"
Height (Q32)	2U, 88mm, 3.5"
Height (Q6400)	3U, 88mm, 5.25"
Width	19" rack mount
Depth	500mm
Audio Connectors	50 way D connector
Weight	6Kg (Q16), 10Kg (Q32), 12.7Kg (Q6400)

ENVIRONMENTAL

Operating and storage (ambient)	0-40 ^{o}C
Specification maintained (ambient)	10-30 ^{o}C
Fan cooled (*DO NOT OBSTRUCT VENTS*)	Q32, Q6400 draws cool air from the front of the frame and exhausts the warm air from both sides.
Humidity	10-90% non-condensing

Serial Digital Video

VIDEO INPUTS

Signal level	800mV p-p, nominal
Impedance	75Ω terminating
Return Loss, 5 to 270 MHz	15dB, 16dB typical
dc on input	+/-3V
Cable equalisation at 270Mb/s (Q16/Q32)	250M, 300M typical Belden 8281, PSF1/2 200M, 230M typical PSF 1/3
Cable equalisation at 270Mb/s (Q6400)	220M, 250M typical Belden 8281, PSF1/2 175M, 200M typical PSF 1/3
Cable equalisation at 270Mb/s (128)	200M, 250M typical Belden 8281, PSF1/2 150M, 200M typical PSF 1/3

VIDEO OUTPUTS

Signal Level	800mV +/-10%
Impedance	75Ω
Return Loss, 5 to 270MHz	15dB
dc offset	+/-0.5V
Rise/fall times into 75Ω resistive load, 20 to 80%	0.6 to 0.9ns
Jitter	500ps p-p max.

SWITCHING REFERENCE

Signal level	1v p-p +/-3dB or 1-4V pulses
Impedance	looping
dc on input	+/-1v
Switching occurs on lines	6/319 to 10/323, field or frame rate, link selectable

POWER (Q16 & Q32)

Auto-ranging	85-264v 50/60Hz
Power consumption	Q16 = 30 watts, Q32 = 60 watts
Connector (Q16)	IEC with retaining latch
Connector (Q32)	IEC with retaining latch, backup optional
Power Fail Alarm Output	screw terminals
Both Power Supplies good	closing relay contact, rated at 250mA, 50v One Power Supply failed or absent open relay contact

CONTROL

Q-link to remote panels	75Ω video cable, 500M max. length
Computer port RS232/RS422	D9 socket

MECHANICAL

Height	Q16 = 1U, 44mm, 1.75", Q32 = 2U, 89mm, 3.50"
Width	19" rack mount
Depth	Q16, Q32 = 500mm
Weight	Q16 = 5.2Kg, Q32 = 6.6Kg

ENVIRONMENTAL

Operating and storage (ambient)	0-40 °C
Specification maintained (ambient)	10-30 °C
Fan cooled (*DO NOT OBSTRUCT VENTS*)	Q16/Q32 draws cool air from the front of the frame and exhausting the warm air from both sides (and lid if clear of obstructions).
Humidity	10-90% non-condensing

AES/EBU Digital Audio

AUDIO INPUTS

Sample rates	32, 44.1, 48KHz
Impedance	110Ω +/-20%
transformer coupled	
Signal level	0.2-7 volts p-p
dc on input	+/-50v

AUDIO OUTPUTS

Rise/fall times into 110Ω resistive load	5-30ns
Jitter	<20ns
Signal Level	2-7 volts p-p
Impedance	110Ω
transformer coupled	
dc isolation	+/-50v

POWER (Q16 & Q32)

Auto-ranging	85-264v 50/60Hz
Power consumption	15watts
Connector (1U frame)	IEC with retaining latch
Connector (Q32 only)	IEC with retaining latch, backup optional
Power Fail Alarm Output (only)	screw terminals
Both Power Supplies good	closing relay contact, rated at 250mA, 50v
Power Supply failed or absent	open relay contact
Technical and chassis earth, cable screens	screw terminals

POWER (Q6400)

Line Voltage (8U BNC Version)	Auto-ranging, 85-264v 50/60Hz
Line Voltage (3U D50 Version, rear	90-132v 50/60Hz
panel voltage selector)	180-264v 50/60Hz
Power consumption	75watts
Connector	IEC with retaining latch, backup optional
Power Fail Alarm Output	screw terminals
Both Power Supplies good	closing relay contact, rated at 250mA, 50v
Power Supply failed or absent	open relay contact
Technical and chassis earth, cable screens	screw terminals

CONTROL

Q-link to remote panels	75Ω video cable
	500M max. length
Computer port RS232/RS422	D9 socket

MECHANICAL

Height (Q16/Q32)	1U, 44mm, 1.75" (Q1600), 2U, 89mm, 3.50" (Q3200)
Width	19" rack mount
Depth	500mm
Weight (Q16/Q32)	5.2Kg (Q16), 6.6Kg (Q32)
Audio Connectors for balanced	50 way D connector
Audio Connectors for un-balanced	75Ω BNC

ENVIRONMENTAL

Operating and storage (ambient)	0-40 ^{o}C
Specification maintained (ambient)	10-30 ^{o}C
Humidity	10-90% non-condensing

RS422 Control Level

MATRIX ROUTER RS422 SIGNAL INPUTS

Impedance	110Ω
Maximum baud rate	1Mbaud
Connector	D9 socket

MATRIX ROUTER RS422 SIGNAL OUTPUTS

Signal Level	2-7 volts p-p, differential
Impedance	110Ω
Rise/fall times into 110W resistive load	5-30ns
Connector	D9 socket

PORT ROUTER

The signal path is through relays	
Connector	D9 socket

POWER

Q1600-RS, rear panel voltage selector	90-132v 50/60Hz 180-264v 50/60Hz
Q6400-PR, auto-ranging	85-264v 50/60Hz
Power consumption	15watts
Connector	IEC with retaining latch

CONTROL

Q-link to remote panels	75Ω video cable 500M max. length
Computer port RS232/RS422	D9 socket

MECHANICAL

Height (Q1600-RS)	2U, 89mm, 3.5"
Height (Q6400-PR)	3U, 133mm, 5.25"
Width	19" rack mount
Depth	500mm
Weight	10Kg

ENVIRONMENTAL

Operating and storage (ambient)	0-40 ^{o}C
Specification maintained (ambient)	20-30 ^{o}C
Humidity	10-90% non-condensing

MAINTENANCE

Maintenance Philosophy

Customers have different approaches to equipment maintenance. As technology becomes more complex it becomes increasingly difficult for technicians to maintain equipment. Also equipment is so much more reliable than only a few years ago, so there are less opportunities to repair it!

Quartz can supply spare modules if you can fault find down to module level or spare parts and extender modules if you are able to diagnose faults down to component level. If your approach is to undertake at least some of your own maintenance then read on!

Module Removal and Replacement

The modules in the frame can be removed for maintenance. Unscrew the two front panel catches and lower the front panel. Note that the Local Control Panel, if fitted, is attached to the plug-in modules by a pair of ribbon cables. Switch off the unit with the standby/on switch (left = off or standby) at the front of the power module. Open the latches of the ribbon cable connectors and disconnect the panel.

A blank front panel, usually with a **power on** indicator board, is fitted to most units not having a control panel. It is attached to the power supply module by a flying lead which can be detached from the power supply module by pulling upwards. Do not allow the blank front panel to hang by the lead as this may apply excess stress to the lead and cause premature failure.

The plug-in modules can be removed using the handles. These handles act as levers to aid removal and insertion of the module plus they incorporate a locking mechanism to prevent the modules coming loose, especially useful in a mobile application. Pull the handles to initially release the lock and then to withdraw the module.

When replacing the module it is essential to ensure that the handles are wide open as you push the module into the guides until the resistance of the edge connectors is felt. Then push evenly on the handles to push the module securely home. Check that it is locked in place by pulling the handles without releasing the lock.

Fault Finding

Experience shows that the most common faults are the simplest! This section describes some of the most likely faults to be encountered in this equipment and how to rectify them.

Initial Checks

Before assuming that there is a fault in the routing system, check the equipment connected to the system and its cabling to ensure that the signals and power are reaching the equipment correctly.

Fuses

These are probably the most likely part to fail during the equipment's life.

If there is no sign of *life* from the frame or panel check the mains/power fuse. This is located inside a drawer in the mains/power inlet socket. To check the fuse unplug the power cord, open the drawer and check the rating. Replace with the value marked on the unit. Push the drawer home and plug the power cord in again.

If one or more of the two left-hand pilot LEDs in the power module is out then check the dc fuses. These are located on the power module. Remove the front panel of the frame and withdraw the module after first releasing the module lock on the handle. Replace any defective fuses with ones of the correct rating. Replace the module in the frame locking it in place.

The DC fuse for the remote panel can be accessed by removing the panel from its installation. Unplug the Q-link T-piece and then the power cord, remove the top cover and check the fuse. Replace with one of the correct rating. Replace the cover and re-install.

Reset Microprocessor
A green LED on the matrix modules and the remote control panels denotes that the microprocessor is running by flashing once a second. If this is not the case try pressing the RESET push button. The adjacent red LED shows briefly the reset condition.

Visual Inspection
It is surprising how many faults can be located by visual checks. Unplug the modules. Check the condition of the gold edge connector fingers (see below). Check that all the components fitted in sockets are correctly seated. Refit the modules ensuring that they are locked in place. Remove the cover of the unit and check that internal cables are correctly plugged in.

Edge Connector Contacts
Despite the gold plating of edge connector contacts they are apt to collect dust and grease which can degrade the contact. When you remove a module check the fingers are clean, free of grease and undamaged. If necessary clean the fingers with a clean cloth and a solvent based cleaner such as alcohol. Take care not get the solvent on plastic parts as it can cause damage. Avoid touching the clean edge connector contacts with your fingers!

Configuration
Check that the equipment is correctly configured including any hardware links. Refer to **Section 1: Custom** and **Section 3: Installation**.

Some Common Faults

Below are some of the most common problems encountered in Quartz router installations.

Frame

1. Q-link has not been terminated properly. One end at least **must** be terminated in 75Ω. In fact, the system is **guaranteed to function on long cables only if both ends have been terminated.**
2. Two frames have the same address (hex) switch setting.
3. Two frames or no frame have been set to have **master** status.
5. A DIP or address switch has been changed but the RESET has not been pressed to **take** the new setting.

Further Fault Finding

Further fault finding will usually involve the use of schematic diagrams and optional extender modules. This should be entrusted to an experienced technician.

Alignment

The Q6400 products use modern high stability components, have a conservative design, and have low heat dissipation. Therefore there are no user alignments needed.

Routine Maintenance

The only items requiring routine maintenance are the cooling fans fitted in some matrix frames. Where the fan has a filter, this should be cleaned periodically. The fans used are rated at 50,000 hours so one can expect to replace them after five years. There is no monitoring of the fan so it is recommended that the fan is replaced during a period of routine maintenance rather than waiting for the fan to fail. However the equipment will continue to run without the fan in ambient temperatures of up to 35°C but extended use without the fan may reduce the life of other components in the unit.