QMC-2

HD/SD Master Control Switcher

System Manual

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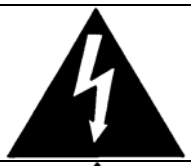
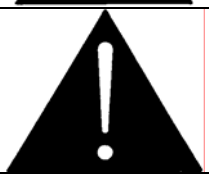
IMPORTANT SAFETY INSTRUCTIONS

	The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of un-insulated “Dangerous voltage” within the product’s enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.
	The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (Servicing) instructions in the literature accompanying the product.

- Read these instructions
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water
- Clean only with dry cloth.
- Do not block any ventilation openings. Install in accordance with the manufacturer’s instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

WARNING
TO REDUCE THE RISK OF FIRE OR ELECTRIC – SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE

WARNING
DO NOT EXPOSE THIS EQUIPMENT TO DRIPPING OR SPLASHING AND ENSURE THAT NO OBJECTS FILLED WITH LIQUIDS ARE PLACED ON THE EQUIPMENT

WARNING
TO COMPLETELY DISCONNECT THIS EQUIPMENT FROM THE AC MAINS, DISCONNECT THE POWER SUPPLY CORD PLUG FROM THE AC RECEPTACLE

WARNING
THE MAINS PLUG OF THE POWER SUPPLY CORD SHALL REMAIN READILY OPERABLE

INFORMATION TO USERS IN EUROPE

NOTE

This equipment with the CE marking complies with both the EMC Directive (2004/108/EC) and the Low Voltage Directive (2006/95/EC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European standards:

- EN60950 Product Safety
- EN55103-1 Electromagnetic Interference Class A (Emission)
- EN55103-2 Electromagnetic Susceptibility (Immunity)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the European Union EMC directive. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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

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

INFORMATION TO USERS IN THE U.S.A.

NOTE

FCC CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Evertz Microsystems Ltd. could void the user's authority to operate the equipment.

Use of unshielded plugs or cables may cause radiation interference. Properly shielded interface cables with the shield connected to the chassis ground of the device must be used.

Evertz Microsystems Ltd  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: This device may cause harmful interference, and This device must accept any interference received, including interference that may cause undesired operation.

REVISION HISTORY

REVISION	DESCRIPTION	DATE
0.1	Preliminary	Nov 07

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Figures

Tables

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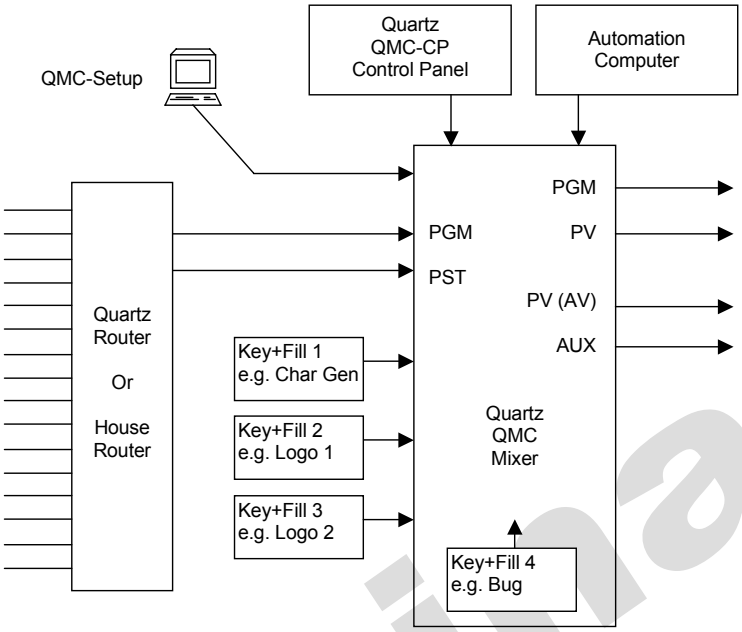
1. INSTALLATION

This section describes how to install the QMC-2 master control switcher. A simple overview of a QMC-2 system is shown below:



1.1. UNPACKING

Carefully remove the equipment from the boxes and check against the Packing List supplied with each unit. 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).

Standard remote panels are mains powered and must be checked to ensure that they have been set to the correct mains (line) voltage. 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.

1.2. QMC-2 INSTALLATION

1.2.1. Physical Location

The frame is normally mounted in standard 19" equipment racks. When preparing for installation bear in mind that the modules are plugged in from the front. You should allow at least 400mm clearance at the front for maintenance. The depth of the frame is 485mm plus connectors from the front of the equipment rack. In addition allowance must be made for the vast amount of cables to be installed at the rear of the frame.

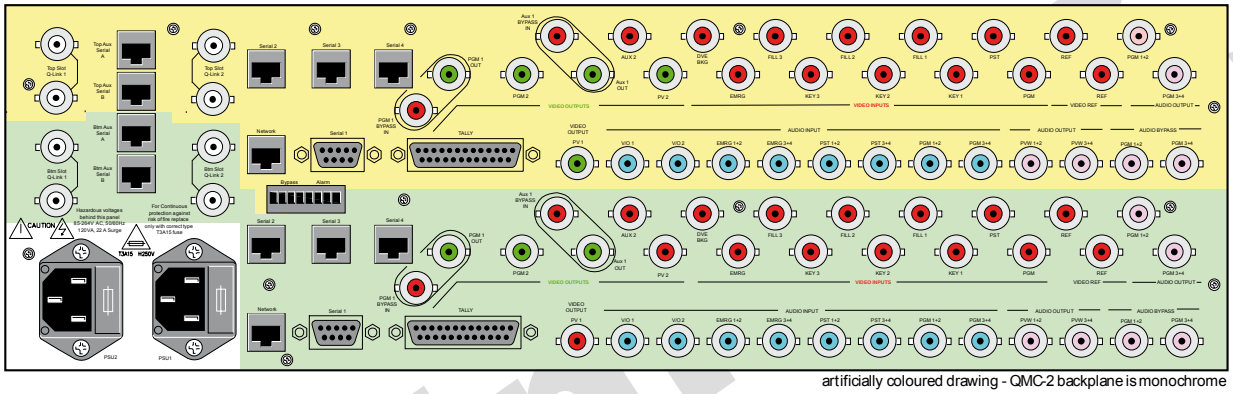
1.2.2. Cooling

Overall power dissipation is relatively low but certain components run hot and cooling is provided for these by door-mounted fans. These draw cool air from the front of the Switcher and expel it through the left and right hand side vents.

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

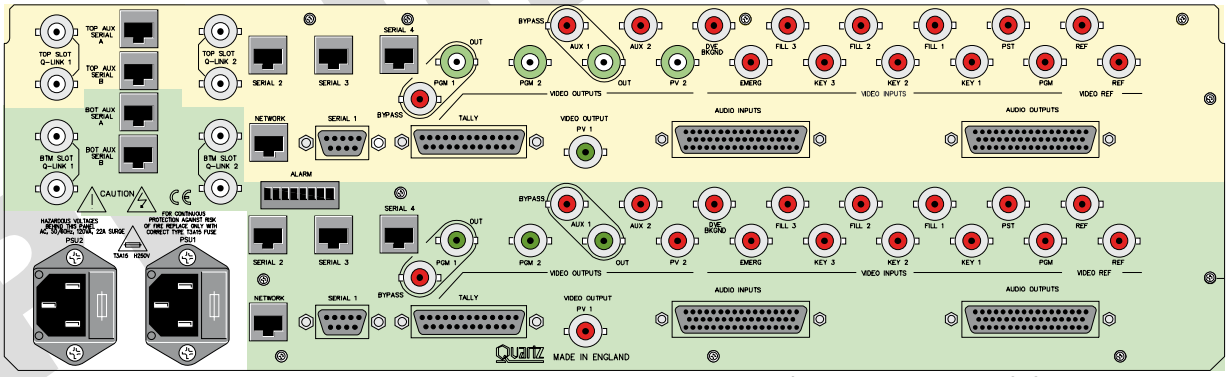
1.2.3. Electrical Connections

There are two versions of the QMC-2 rear panel as shown below. If you have purchased a single channel version of the QMC-2, then the main module will be installed in the lower module position and you will be using the connections in the lower half of the rear panel. If you have a dual channel version of the Switcher then main modules will be installed in both the lower and upper module positions and both sections of the rear panel will be used.



artificially coloured drawing - QMC-2 backplane is monochrome

Figure 1-1: The QMC-2 Un-Balanced Audio Master Control Switcher Frame



Artificially colour coded drawing. The QMC-2 backplane is monochrome

Figure 1-2: The QMC-2 Balanced Audio Master Control Switcher Frame

1.2.4. Video Inputs and Outputs

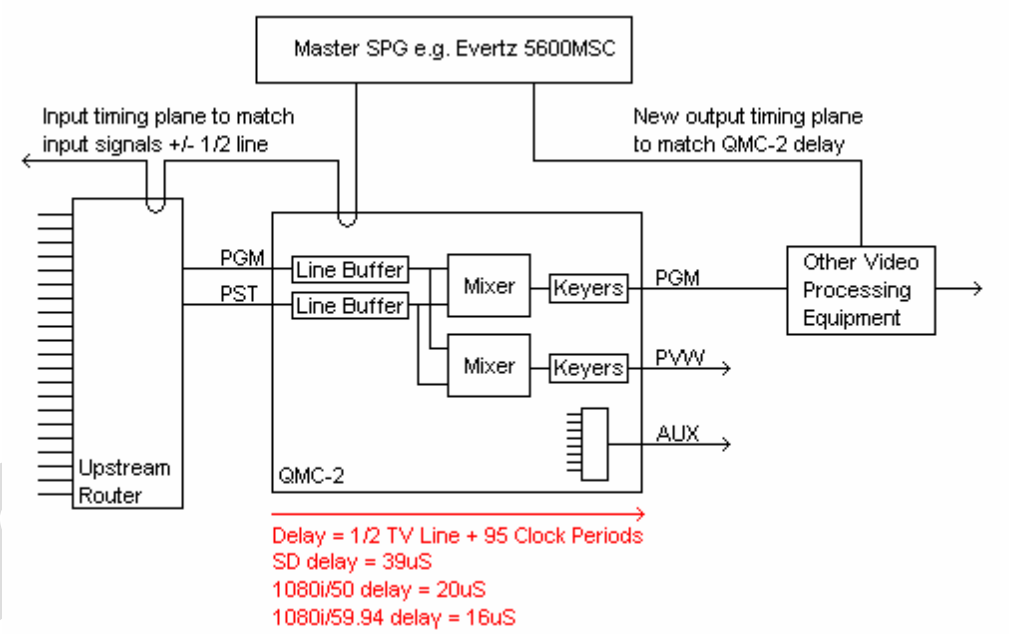
These connections are made using standard 75Ω video coaxial cables. For HD signals a very high quality cable such as Belden 8281 should be used. For SD a high quality cable such as PSF1/2 (TF3255) or PSF1/3 (TF3304) or equivalents should be used. It is both important and good practice that cables are properly supported and not *hanging* on the connectors as this can put unnecessary stresses on the connectors and possibly reduce their working life.

The video inputs are terminated within the equipment. The main video outputs are dual outputs. There is a high density of connectors on the rear panel so space is limited. Be careful to select the correct BNC connector before making your connections.

Note that the rear panel is for two complete QMC Switchers and the connectors are roughly split into a top section and bottom section.

1.2.5. System Timing

The QMC-2 has a fixed delay dependant on the video standard. At SD the QMC-2 output video is 39uS after the QMC reference input. If processing equipment is placed after the QMC-2 then it must be able to cope with this delay using its own input timing window or a new timing plane must be created using a separate SPG output. System timing around the QMC-2 is shown below.



If input timing is out by more than +/-1/2 line then video artefacts will be present. As an example Closed Captioning can be moved down one line if the input video is delayed by more than 1/2 line (assuming ITW register is set to zero, see below).

Upstream Routers

The QMC must be configured correctly to cope with upstream video switches. The best settings are:
Horizontal Blanking Control = Embedded Audio

Vertical Blanking Control = Selective Bypass. Remember to set the selective bypass blanked lines, 6 & 7 for 625 SD, 10 & 11 for 525 SD, and 7 & 8 for HD.

Input Timing Window Adjustment (ITW)

The QMC-2 can correctly process video that is timed to its reference input with an accuracy of +/- 1/2 line. If any of the input video feeds fall outside this timing window, then there will be a disturbance when using that video feed, therefore video content will be shifted by a line. In some facilities all of the video inputs will have been delayed by varying amounts and arrive late relative to the reference. In these cases the input timing window can be offset by up to 1 line to give a different window, for example -1/4 line to +3/4 line, but this change also affects the overall delay through the QMC.

ITW	QMC-2 Delay at SD	Notes
863	7.00uS	
837	8.00uS	
810	9.00uS	

540	19.00uS	
270	29.00uS	
189	32.00uS	Half line delay. Input timing window is +39uS & -25uS
108	35.00uS	
54	37.00uS	
27	38.00uS	
0	39.00uS	Default value. Input timing window is +/-32uS
1728*	39.01uS	
1486*	48.00uS	
1054*	64.00uS	One line delay. Input timing window is +7uS & -57uS
885*	70.60uS	

Note that values 1728-885 are only available on QMC Firmware V2.62 onwards.

ITW	QMC-2 Delay at 1080i/50	Notes
1374	1.14uS	
1370	1.18uS	
1360	1.34uS	
1350	1.46uS	
1300	2.14uS	
1000	6.30uS	
500	12.90uS	
143	17.77uS	Half line delay. Input timing window is +19.70uS & -15.84uS
100	18.30uS	
50	19.10uS	
0	19.70uS	Default value. Input timing window is +/-17.8uS

REF (input): A clean Bi-Level or Tri-Level Sync signal must be connected to the reference input and is used as a master timing reference for all internal Switcher functions. All other SDI inputs must be locked to this reference with a timing offset of no greater than ±½ a TV line, e.g. ±13.3uS at 1080i/60. The Ref input is a high impedance looping connection.

PGM & PST (input): These are the main SDI inputs connecting the Program and Preset inputs of the Switcher. They are normally derived from the output of a router to allow PGM/PST toggle after each transition. QMC can also operate in A/B mode.

KEY1/FILL1 (input): A general-purpose key/fill SDI pair used to connect character generators or logo generators to the Switcher.

EMGY (input): This input is intended for connection of emergency source material, such as a VTR, to allow a station to remain on-air even during major system disruption.

PGM1 BYPASS (input): This is an emergency SDI input that is connected directly to the PGM1 output during a power loss to the switcher or major failure of the switcher. As the bypass relay is installed on the rear motherboard of the Switcher, the main module can be removed while still maintaining the BYPASS-to-PGM1 connection. The bypass relay is also controlled by a rear panel link in the Alarm connector that should be made for normal operation, and broken for bypass mode.

AUX1 BYPASS (input): This is an emergency SDI input that is connected directly to the AUX1 output during a power loss to the switcher or major failure of the switcher. As the bypass relay is installed on the rear motherboard of the Switcher, the main module can be removed while still maintaining the BYPASS-to-AUX1 connection. The bypass relay is also controlled by a rear panel link in the Alarm connector that should be made for normal operation, and broken for bypass mode.
PGM1, PGM2 (output): These are the main SDI program outputs from the Switcher. PGM1 has an internal bypass relay that allows the PGM BYPASS input to connect directly to PGM1 when power to the Switcher is lost. PGM2 has no such protection.

PV1, PV2 (output): These are the main SDI preview outputs from the Switcher. PV1 is identical to PV2. Any Switcher or key/fill effect that will affect the PGM1/2 output at the next transition is made available for previewing on this output.

AUX1, AUX2 (output): This output can be routed from any stage in the PGM or PVW chain, controlled by the setup program. AUX1 has an internal bypass relay that allows the AUX BYPASS input to connect directly to AUX1 when power to the Switcher is lost. AUX2 has no such protection.

KEY2/FILL2 (input): As for Key1/Fill1 but Key2/Fill2 are an option that is only available when the 5 input QMC-2-KEYER option has been installed.

KEY3/FILL3 (input): As for Key1/Fill1 but Key3/Fill3 are an option that is only available when the 5 input QMC-2-KEYER option has been installed.

DVE Background (input): This is separate input for the DVE background. It is an option that is only available when the 5 input QMC-2-KEYER option has been installed.

1.2.6. Audio Connections

1.2.6.1. Audio Connections - Embedded (serial video)

AES audio can be derived from the embedded audio signal carried in the SDI signal but does limit some Switcher functions such as audio breakaway.

1.2.6.2. Audio Connections – AES Unbalanced frame (BNC)

The AES/EBU Audio BNC connectors allow for AES signal mixing in addition to the serial video embedded audio. The connectors are used as follows:

PGM12, PGM34, PST12, & PST34 (input): These are the main AES inputs connecting the Program and Preset inputs of the Switcher. Each BNC handles a single AES signal carrying 2 audio channels. They are normally derived from the output of a router to allow PGM/PST toggle after each transition.

PGM12, PGM34 (output): These are the main AES program outputs from the Switcher. These outputs have an internal bypass relay that allows the PGM inputs to connect directly to these outputs when power to the Switcher is lost.

PVW12, PVW34 (output): These are the main AES preview outputs from the Switcher. Any Switcher effect that will affect the PGM12, PGM34 outputs at the next transition is made available for previewing on this output.

OR

1.2.6.3. Audio Input Connections – AES Balanced frame (50 way 'D' type)

The AES/EBU Audio 50 way female 'D' type connector allows the following audio input signals to be fed into the QMC-2.

PGM 12/34/56/78, PST 12/34/56/78 (input): These are the main AES inputs connecting the Program and Preset inputs of the Switcher. They are normally derived from the output of a router to allow PGM/PST toggle after each transition.

EMG 12/34/56/78 (input): These inputs are intended for connection to an emergency source, such as a VTR, to allow a station to remain on-air even during disruption to the main PGM and PST inputs.

V/O 12/34/56/78 (input): These inputs are intended for connection to an audio source, such as an audio cart machine or voice over booth, to allow a voice to be mixed over the background sound.

Pin	Type	Pin	Type	Pin	Type
1	Screen	18	PGM 1/2 in -	34	PGM 1/2 in +
2	PGM 3/4 in +	19	PGM 3/4 in -	35	Screen
3	Screen	20	PGM 5/6 in -	36	PGM 5/6 in +
4	PGM 7/8 in +	21	PGM 7/8 in -	37	Screen
5	Screen	22	PST 1/2 in -	38	PST 1/2 in +
6	PST 3/4 in +	23	PST 3/4 in -	39	Screen
7	Screen	24	PST 5/6 in -	40	PST 5/6 in +
8	PST 7/8 in +	25	PST 7/8 in -	41	Screen
9	Screen	26	EMG 1/2 in -	42	EMG 1/2 in +
10	EMG 3/4 in +	27	EMG 3/4 in -	43	Screen
11	Screen	28	EMG 5/6 in -	44	EMG 5/6 in +
12	EMG 7/8 in +	29	EMG 7/8 in -	45	Screen
13	Screen	30	V/O 1/2 in -	46	V/O 1/2 in +
14	V/O 3/4 in +	31	V/O 3/4 in -	47	Screen
15	Screen	32	V/O 5/6 in -	48	V/O 5/6 in +
16	V/O 7/8 in +	33	V/O 7/8 in -	49	Screen
17	n/c			50	n/c

1.2.6.4. Audio Output Connections – AES Balanced frame (50 way 'D' type)

The AES/EBU Audio 50 way female 'D' type connector allows the following audio output signals to be fed from the QMC-2.

PGM12/34/56/78 (output): These are the main AES program outputs from the Switcher. The first two AES outputs have an internal bypass relay that allows the relevant PGM inputs to connect directly to these outputs when power to the Switcher is lost.

PVW12/34/56/78 (output): These are the main AES preview outputs from the Switcher. Any Switcher effect that will affect the PGM outputs at the next transition is made available for previewing on this output.

Pin	Type	Pin	Type	Pin	Type
1	Screen	18	PGM 1/2 out -	34	PGM 1/2 out +
2	PGM 1/2 Bypass in +	19	PGM 1/2 Bypass in -	35	Screen
3	Screen	20	PGM 3/4 out -	36	PGM 3/4 out +
4	PGM 3/4 Bypass in +	21	PGM 3/4 Bypass in -	37	Screen
5	Screen	22	PGM 5/6 out -	38	PGM 5/6 out +
6		23		39	Screen
7	Screen	24	PGM 7/8 out -	40	PGM 7/8 out +
8		25		41	Screen
9	Screen	26	PRV 7/8 out -	42	PRV 7/8 out +
10		27		43	Screen
11	Screen	28	PRV 5/6 out -	44	PRV 5/6 out +
12		29		45	Screen
13	Screen	30	PRV 3/4 out -	46	PRV 3/4 out +
14		31		47	Screen
15	Screen	32	PRV 1/2 out -	48	PRV 1/2 out +
16		33		49	Screen
17	n/c			50	n/c

1.2.7. Q-Link

Q-Link is a dedicated control system specific to Evertz brand of Quartz products. The Q-Link system works as a single transmission line with devices connected along the length of the cable. It must be terminated at either end in 75Ω. The QMC-2 frame has pairs of looping connectors to allow the frame to sit at one end of the link (with termination) or sit in the middle of the link with cables running off in different directions.

Q-Link 1 is normally used for direct connection to a manual control panel, QMC-CP, QMC-CP1000, or QMC-CP-FS. These panels are then always available for emergency or other manual control of the QMC channel.

Q-Link 2 is normally used for connection to roving panels in a multi-channel system.

1.2.8. Serial I/O

The QMC-2 has four rear panel serial ports. Serial 1 is always used for the PC running the QMC-Setup program, and is also connected to the FU-0018 processor front D9 connector. Serial 2, 3, and 4 can be used for other functions such as controlling the upstream router or linking to automation systems.

Before the serial ports can be used they must be configured from the QMC-Setup program to have the command protocol and baud rates set correctly.

All the serial ports are derived internally from the FU-0018 processor module. The FU-0018 processor supports two Q-Links and four serial ports (RS232/422).

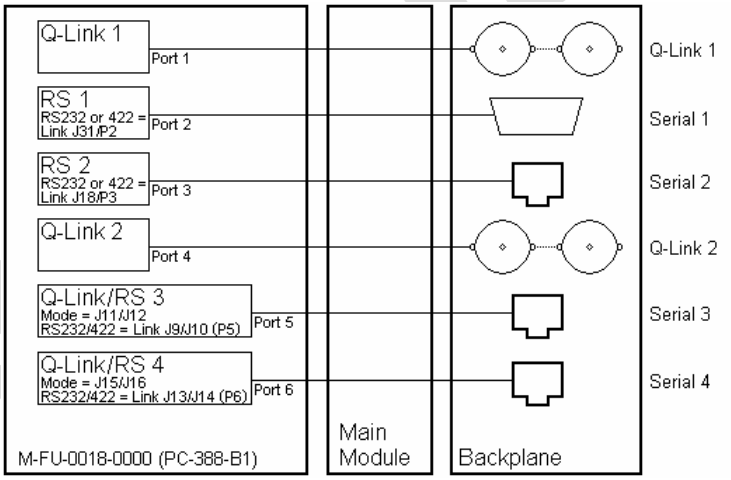
Pin	RS422/485	RS232
1	Chassis	Chassis
2	Tx-	RTS
3	Rx+	Rx
4	0V	0V
5	n/c	n/c
6	0V	0V
7	Tx+	Tx
8	RX-	CTS
9	n/c	n/c

Table 1-1: Serial 1: 9-way 'D' Socket

Pin	RS422/485	RS232
1	0v	0v
2	0v	0v
3	Tx+	Tx
4	Rx-	CTS
5	Rx+	Rx
6	Tx-	RTS
7	n/c	n/c
8	n/c	n/c

Table 1-2: Serial 2,3,4: RJ45 Socket

Serial ports are individually link-selectable between RS422/485 and RS232 on the FU-0018 processor module.



1.2.9. Ethernet

The QMC-2 has an Ethernet port compatible with a 10 Base-T networking running the TCP/IP protocol.

The QMC-2's current MAC and TCP/IP address can be checked at power up or reset using a PC. Connect a PC to serial port 1, start QMCSetup, select PC Comms Window, and then press reset on the QMC-2 processor module using the card edge left hand reset switch. The QMC-2 will send status including its MAC and TCP/IP address.

The QMC-2's MAC address (low level Ethernet address) is stored in the FU-0018 processors internal Flash memory and is programmed at the factory using Firmware Manager (V1.27a or later), and logged in the companies Technical Support database. This address should not be changed, unless instructed to do so by Evertz or a competent network administrator, as it must remain a unique number.

To change the MAC address, first check that the 'FWP' Jumper on the card is set to allow the bootloader to be able to write to the on-chip FLASH. Connect your PC to the QMC-2 and start Firmware Manager. Select Force Bootloader on Reset and then reset the QMC-2 processor module using the card edge left hand reset switch. Select Quick Search (No Validation) and the Flash memory chip should appear in the upper dialog box. Select the Flash memory device by left clicking once, and then right click, and select Change MAC Address. Enter a valid MAC address and then select program.

The QMC-2's TCP/IP address can be set from any serial port running the Quartz standard protocol. Connect your PC to the QMC-2 and start QMC-Setup. Select PC Comms Window and check that you can get an Acknowledgment back from the QMC-2. Now type the following commands, substituting your own IP settings:

.$LOCALTCPIP,192.168.0.25

.$TCPNETMASK,255.255.255.0

.$TCPGATE,192.168.0.1

The QMC-2 TCP/IP address will have been factory set to 192.0.2.200.

For test purposes it is possible to talk directly to the QMC-2 over a network using the PC based Telnet function. From a Windows command prompt, type Telnet <ip addr> and the Telnet window will open. It should then be possible to communicate with the QMC using standard Quartz protocol.

1.2.10. Tally (Parallel) I/O

The QMC-2 has a 25 way female D-type connector with relay tally outputs and TTL level input/outputs.

Pin	Type	Pin	Type	Pin	Type
1	Relay 1	10	Relay 5	19	TTL i/o 4
2	Relay 1	11	Relay 6	20	TTL i/o 3
3	Relay 2	12	Relay 6	21	TTL i/o 2
4	Relay 2	13	Relay 7	22	+5v
5	Relay 3	14	Relay 7	23	TTL i/o 1
6	Relay 3	15	TTL i/o 8 (note 2)	24	0v
7	Relay 4	16	TTL i/o 7 (note 2)	25	Chassis
8	Relay 4	17	TTL i/o 6		
9	Relay 5	18	TTL i/o 5		

Note 1: TTL Tally voltage levels; Inputs are Logic 0 = <0.8V, Logic 1 = >3.5V; Outputs are Logic 0 = <1.0V at 10mA, Logic 1 = >3.5V (thru 4K7).

Note 2: There is a software configurable option to convert TTL tally 7,8 to Relay tally 8.

Relays are software assignable from QMC-Setup but would normally have the following functions

Relay 1 = A input tally	Relay 5 = Aux input tally
Relay 2 = B input tally	Relay 6 = Sound Over 1 input tally
Relay 3 = Key 1 input tally	Relay 7 = Sound Over 2 input tally
Relay 4 = Key 2 input tally	Relay 8 = Emergency input tally (optional)

TTL I/O signals are software assignable from QMC-Setup but are currently not allocated.

1.2.11. Alarm and Bypass Connector

The QMC-2 has two 4-way screw terminal blocks to allow connection to the alarm output and to control the Bypass relay function.

Pin	Function
1,2	Right hand PSU, viewed from front
3,4	Left hand PSU, viewed from front

Table 1-3: Alarm Terminal Block

Pin	Function
1,2	Upper QMC channel. Link made = normal operation Link broken = bypass mode
3,4	Upper QMC channel. Link made = normal operation Link broken = bypass mode

Table 1-4: Bypass Terminal Block

1.3. CONTROL PANEL INSTALLATION: QMC-CP AND QMC-CP1000A

1.3.1. Physical Location

The QMS-CP and QMC-CP1000A control panels are normally mounted in standard 19" equipment racks. The panels are 130mm deep plus connectors.

1.3.2. Cooling

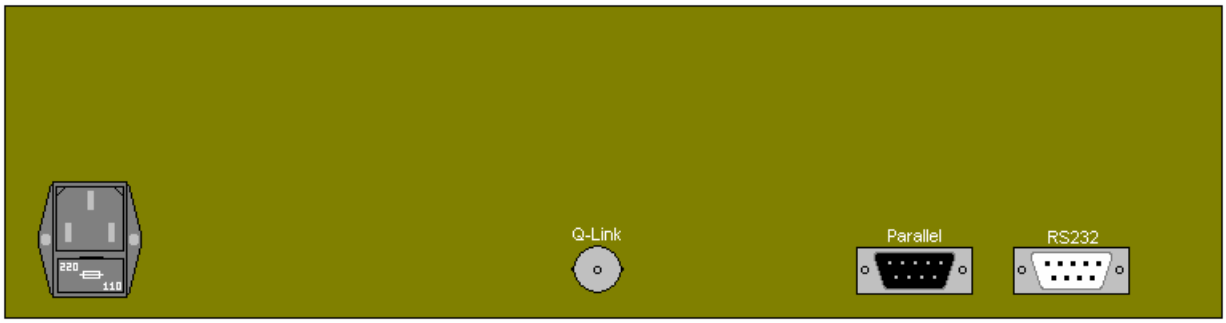
Overall power dissipation is very low and cooling is by natural convection. Do not place the control panels directly above very hot equipment or in sealed equipment racks that are not adequately cooled.

1.3.3. Power

Before connecting power remember to check the Line Voltage is set correctly for your mains voltage, either 115v or 230v. The voltage setting is changed by pulling out the fuse holder draw and rotating it so that the correct voltage is at the top. The latest models are now auto-ranging 100 >>240Volts.

1.3.4. Control

The QMC-CP and QMC-CP1000A control panels only require power and a Q-Link connection from the QMC frame.



The Q-Link cable should be connected to the panel using a BNC T-Piece or goal post connector as this allows the panel to be removed from the Q-Link without disturbing other panels on the link. The T-Piece should be terminated in 75Ω if this is the end of the cable.

The Serial RS232 connector is only used on the Roving panels of a multi-channel system where the Q32-PR or Q6400-PR port router is used. In this case the panel must be fitted with a CI-0003 interface module.

Pin	RS422/485	RS232
1	Chassis	Chassis
2	Tx-	RTS
3	Rx+	Rx
4	0V	0V
5	n/c	n/c
6	0V	0V
7	Tx+	Tx
8	RX-	CTS
9	n/c	n/c

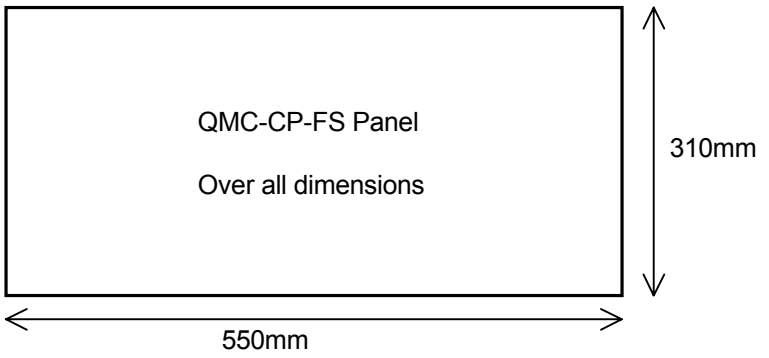
Table 1-5: Serial: 9-way 'D' Socket

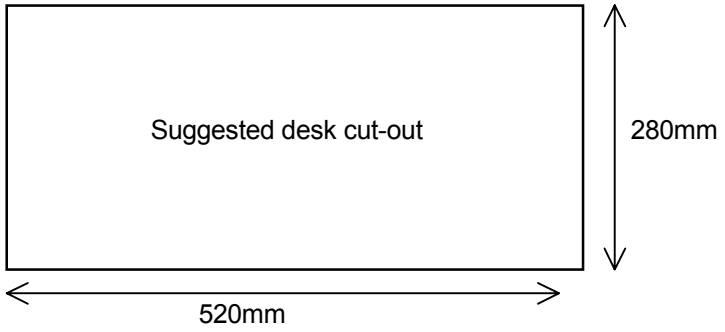
The Parallel connector is not used.

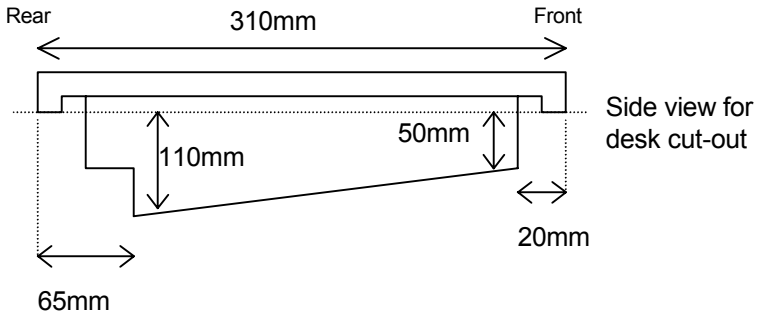
1.4. CONTROL PANELS INSTALLATION: QMC-CP-FS

1.4.1. Physical Location

The QMC-CP-FS panel is designed to be desk mounted, either sitting on the desk surface or recessed into a cut-out in the desk. The following dimensions should be used in planning your installation.







1.4.2. Cooling

Overall power dissipation is very low and cooling is by natural convection but is assisted by two small internal fans that keep air moving over the power supplies.

1.4.3. Power

The internal power supply is auto-ranging so the Line Voltage does not need to be set.

1.4.4. Control

The QMC-CP-FS panel has multiple control connectors, and the rear panel is shown in Figure 1-2.

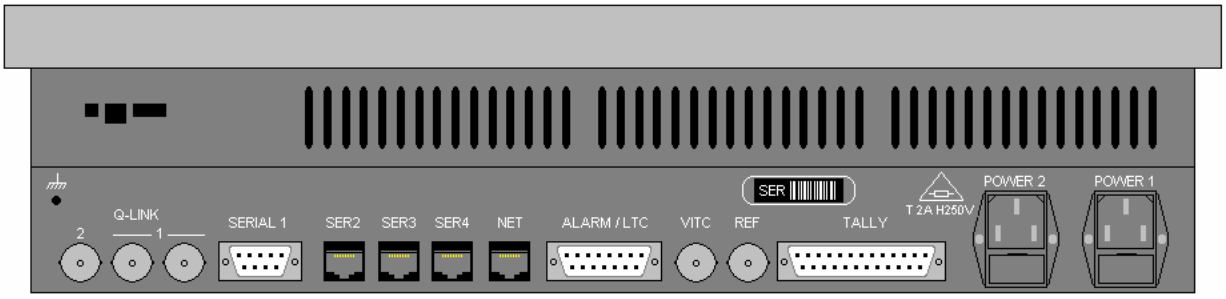


Table 1-6: QMC-CP-FS Rear Panel

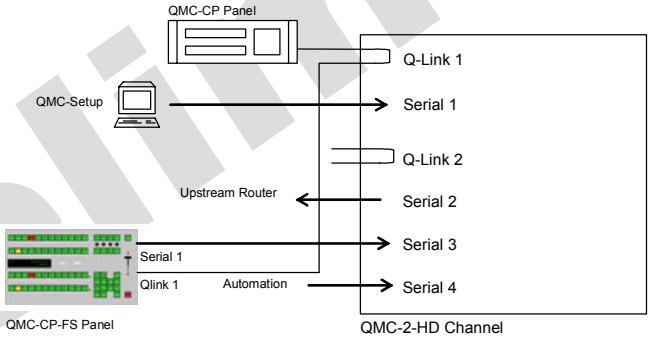
The QMC-CP-FS panel uses a DIP switch (switch 2) on the FU-0003 card to determine whether the panel uses the Q-link connection (switch up) or the serial connection (switch down) to send commands to and receive status from the QMC-2. This switch must be set to the **down** position.

Please note that in order to gain access to the Q-link address and DIP switches the front panel has to be removed by unscrewing a number of black countersunk screws around the edge of the unit and then lifting the top of the panel off.

A new version of QMCSetup (V1.18a or later) is required to support this panel. The QMC-2 serial port will need to be configured to use the QMC Command protocol.

1.4.4.1. Single Panel, Single Channel Systems

In single panel, single channel systems, two control connections are required between the QMC-CP-FS control panel and the QMC Switcher channel.



The panel Q-Link 1 connector is connected to the Q-Link of the QMC Switcher channel and should be terminated in 75Ω if this is the end of the cable. The Q-Link-2 connector is currently not used.

The panel Serial-1 connector is connected to the any spare serial port on the QMC-2 and the link is normally configured for RS-422 operation.

QMC-CP-FS D9		Connects to	QMC Switcher Channel RJ45	
Pin	**RS422/485**		**RS422/485**	**Pin**
2	Tx-		RX-	4
3	Rx+		Tx+	3
4	0V		0V	2
6	0V		0V	1
7	Tx+		Rx+	5
8	RX-		Tx-	6

Table 1-7: RS-422 Serial connection to QMC

1.4.4.2. Single Panel, Multi-Channel Systems

Single panel, multi-channel systems and called Roving Panel systems. In these systems two control connections are required between the QMC-CP-FS control panel and the QMC Switcher channel but the serial connection is usually via an RS422 port router, type Q32-PR or Q6400-PR. Refer to the section on Roving Panels.

1.4.4.3. Other Control Connections

The Serial RJ45 connectors are for general use such as controlling VTR's.

Pin	RS422/485	RS232
1	0v	0v
2	0v	0v
3	Tx+	Tx
4	Rx-	CTS
5	Rx+	Rx
6	Tx-	RTS
7	n/c	n/c
8	n/c	n/c

Table 1-8: Serial 2,3,4: RJ45 Socket

The Alarm/LTC connector is used to indicate failure of one of the internal power supplies or of the control processor. The connector also carries the Longitudinal Time Code signal but this function is only supported if the CI-0008 time code SIMM is installed.

Pin	Function	Pin	Function
1	0V	9	LTC+
2	LTC-	10	+5V (100mA)
3	n/c	11	n/c
4	n/c	12	n/c
5	0V	13	PSU-1 Relay
6	PSU-1 Relay	14	PSU-2 Relay
7	PSU-2 Relay	15	Processor Relay
8	Processor Relay		

Table 1-9: Alarm/LTC: D15 Socket

The VITC connector is used for Vertical Interval Time Code and is only supported if the CI-0008 time code SIMM is installed. The Reference connector is not currently supported. It is used to supply the panel with video sync signals and would normally be connected to any stable analog video signal.

The Tally connector is not currently supported. It provides relay tally outputs and TTL level input/outputs.

Pin	Type	Pin	Type	Pin	Type
1	Relay 1	10	Relay 5	19	TTL i/o 4
2	Relay 1	11	Relay 6	20	TTL i/o 3
3	Relay 2	12	Relay 6	21	TTL i/o 2
4	Relay 2	13	Relay 7	22	+5v
5	Relay 3	14	Relay 7	23	TTL i/o 1
6	Relay 3	15	TTL i/o 8 (note)	24	0v
7	Relay 4	16	TTL i/o 7 (note)	25	Chassis
8	Relay 4	17	TTL i/o 6		
9	Relay 5	18	TTL i/o 5		

Table 1-10: Tally: D25 Socket

Note: There is a factory option to convert TTL tally 7,8 to Relay tally 8. This is controlled by LKxx and LKxx on the main button board module M-PB-0013-0000 (PC-381 Issue X1). Set these links towards Uxx (front of module) for TTL tally mode. Set these links towards Uxx (rear of module) for Relay tally mode.

Relays are software assignable from QMC-Setup but would normally have the following functions

Relay 1 = A input tally	Relay 5 = Aux input tally
Relay 2 = B input tally	Relay 6 = Sound Over 1 input tally
Relay 3 = Key 1 input tally	Relay 7 = Sound Over 2 input tally
Relay 4 = Key 2 input tally	Relay 8 = Emergency input tally (optional)

TTL i/o signals are software assignable from QMC-Setup but are currently not allocated.

1.5. ROVING PANEL SYSTEMS

Any of the QMC control panels can be used in a multi-channel system as Roving panels. This allows a panel to be connected to multiple QMC channels and then select the channel it will control. Once the appropriate manual control functions have been performed the channel can be de-selected and another channel controlled.

In all but the simplest systems the use of roving panels requires the Q32-PR or Q6400-PR port routers to allow the panels to be assigned across the multiple channels. The port routers are shown below:

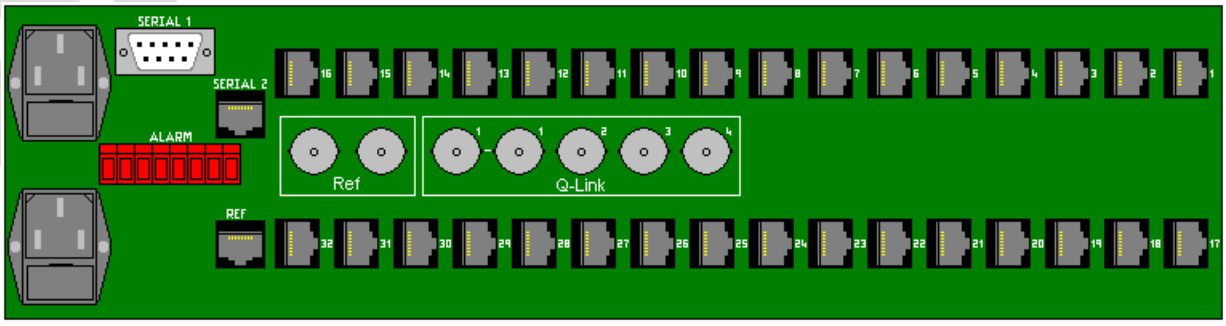


Figure 1-3: Q32-PR

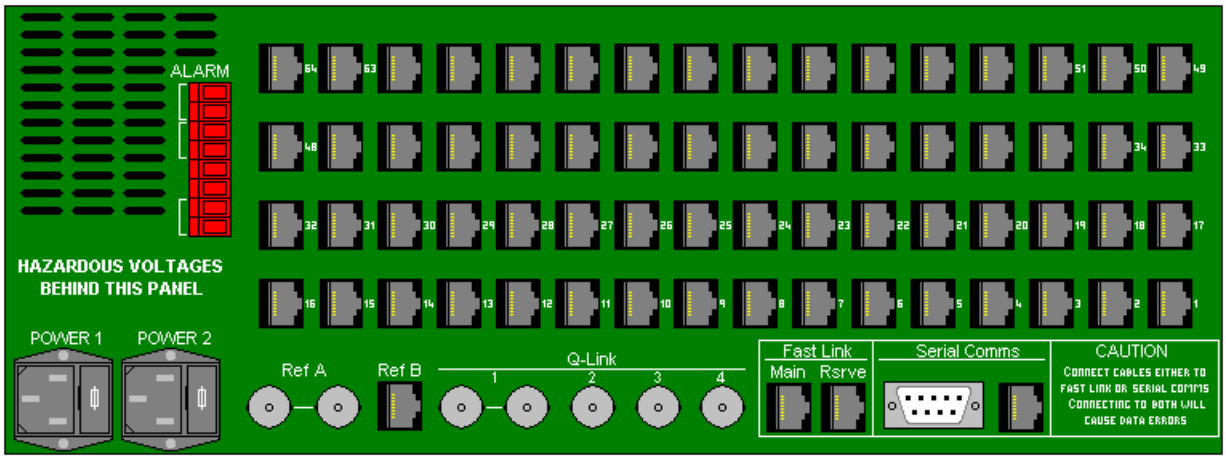


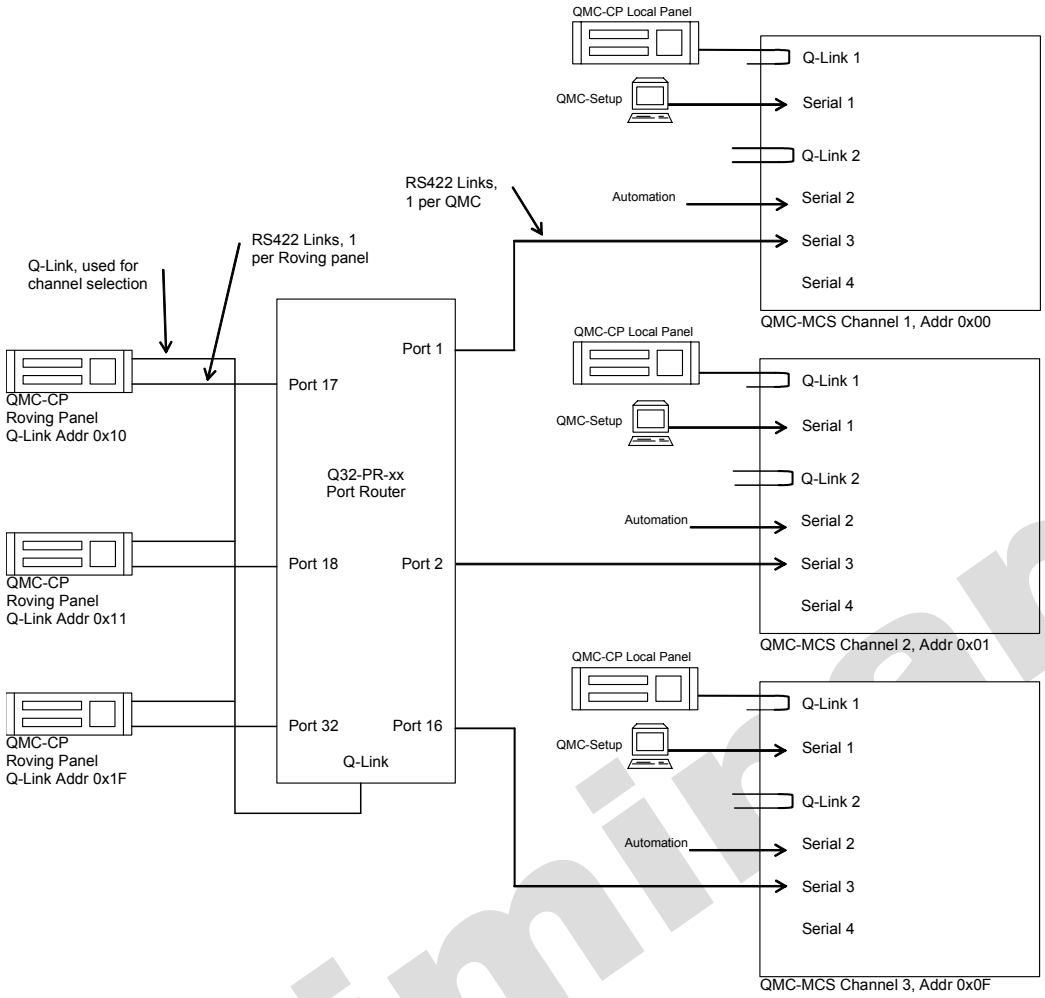
Figure 1-4: Q6400-PR

The port router is required so that each panel can have a dedicated RS422 link back to the QMC channel it is controlling. This allows the maximum possible communications bandwidth between the QMC channel and the control panel, which is essential to eliminate control delays.

The port router also holds the Setup for the roving panels and must be configured before use.

The QMC-CP and QMC-CP1000 control panels must be fitted with a CI-0003 module to enable their serial port before they can be used as roving panels. This does not apply to the QMC-CP-FS panel as its serial ports are always available.

A typical system would be connected as follows:



Roving panels and QMC Channels must be connected to specific ports on the port router, defined by their Q-Link address.

QMC Channel Q-Link Address	Port
0x00	1
0x01	2
0x02	3
0x03	4
0x04	5
0x05	6
0x06	7
0x07	8
0x08	9
0x09	10

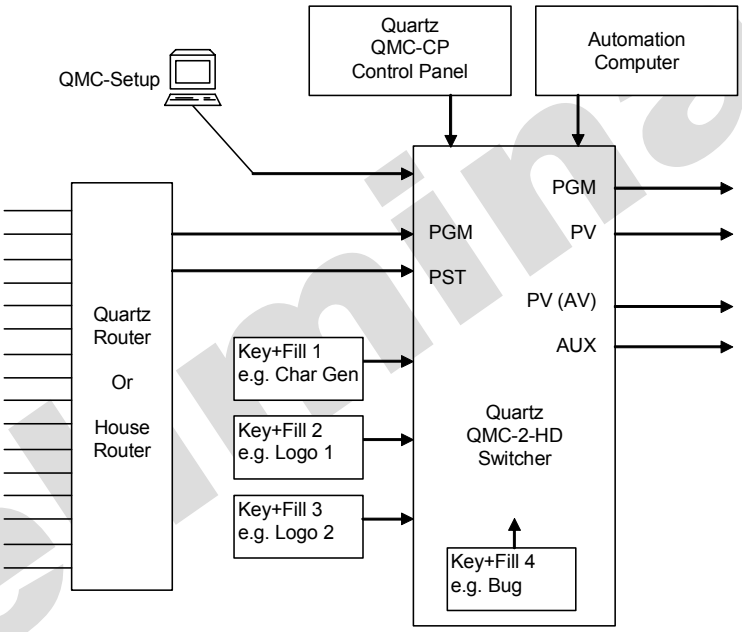
Roving Panel Q-Link Address	Port
0x10	17
0x11	18
0x12	19
0x13	20
0x14	21
0x15	22
0x16	23
0x17	24
0x18	25
0x19	26

2. GENERAL DESCRIPTION

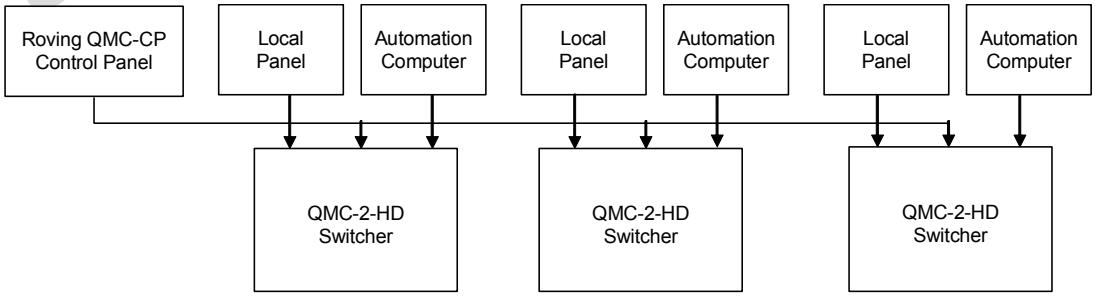
This section describes features of the QMC-2 presentation Switcher. The QMC-2 consists of a 3U rack mount chassis that can hold up to two QMC channels. A channel is one large circuit board that contains all the video and AES mixing circuitry. To this an optional mezzanine card can be added for additional keyers (2 & 3), and 4 more discrete AES I/O channels. Other options include Dolby-E decoder modules, Logo and Frame store SDRAM. Future options will include a DVE and Dolby-E encoders. All of these options allow the user to adjust the feature set to fit the exact requirement.

In most applications the QMC-2 will be controlled by an automation system and several industry standard third party systems are supported. A range of LCD button control panels can be added to the QMC, as a backup or simply for manual control.

An upstream router is used to select the input sources available to the QMC-2 and this supports Quartz routers as well as most third party routers currently on the market, using a serial RS422 control port. The QMC-2 will function without the external router i.e. it can work as a simple A/B Switcher.



A typical multi-channel system:



In a multi-channel system each QMC channel is independent of other channels. Each Automation computer has its own link to the QMC channel that it is controlling. In this way no single point of failure can stop transmission control of the majority of Switcher channels.

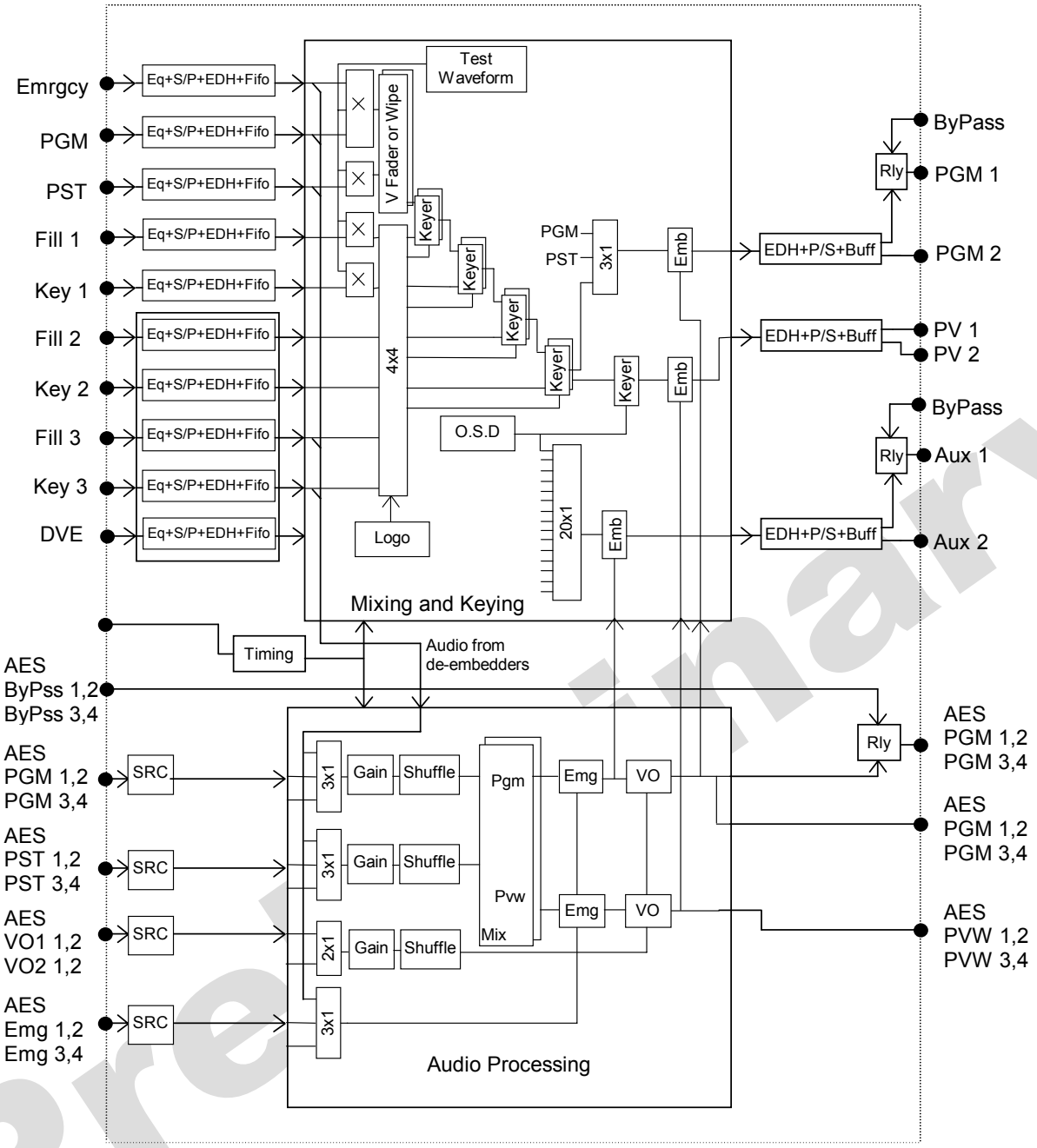


Figure 2-1: Functional Block Diagram

Key: Eq = Cable Equaliser, S/P = Serial to Parallel conversion, EDH = Error Data Handling, P/S = Parallel to Serial.

2.1. AUTOMATION (COMPUTER) CONTROL

The QMC-2 can be connected to automation and scheduling systems to allow fully automatic operation. The Switcher currently supports a protocol based on the GVG/Tektronix M2100 protocol, which is Quartz RCP–37 protocol. This protocol has been tested with the following third party equipment:

Manufacturer	Product
Aveco	Automation system, Astra
Florical	Automation system
Harris-D Series (formerly DAL or Drake Automation and Encoda)	Automation system, A7500
Harris (Louth)	Automation system, Louth NT version
Ibis	Automation system
Pebble Beach	Automation system
Philips	Automation system, MSL4000
Probel	Automation system , Compass
SGT	Automation system
Shanghai TV	Custom automation system
Sundance	Automation system

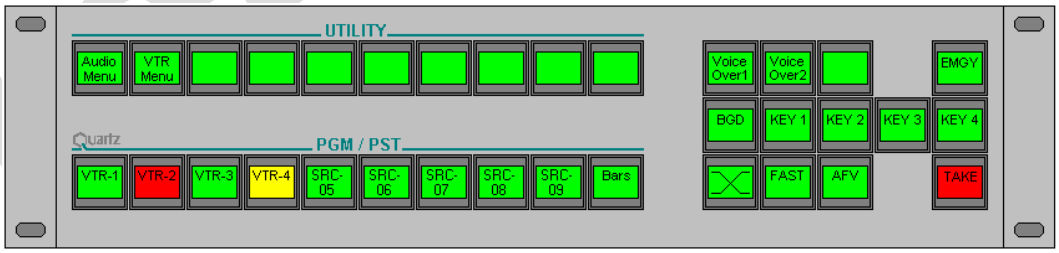
Some automation vendors will control all of the functionality available via the Quartz RCP-37, however, some just support the standard commands from the original GVG protocol. Please contact your automation vendor for more information. The QMC supports As-Run logging to help locate Automation/manual control problems, see QMC-Setup.

2.2. CONTROL PANELS

The QMC system supports a range of manual control panels that can be used individual or in pairs. Panels can be dedicated to a single channel or be allowed to roam across several channels, called Roving panels.

2.2.1. Single Channel Panels

The QMC-2-HD can be connected to various types of control panels (QMC-CP, QMC-CP-FS, QMC-CP1000) to allow manual operation. All the control panels are fully software configurable using QMC-Setup, see section 8.



The buttons on this style of panel are LCD types that display text provided by the control system. This allows buttons to be re-configured for different applications to suit customer preferences. Typical operation involves selecting a preset source, and then selecting the transition type, speed of transition, and then pressing the TAKE button. The button colour changes to show status.

The QMC-CP1000 style control panel is most often used to increase the functionality of the standard panel shown above.

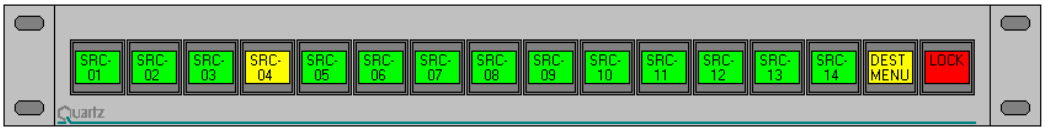


Figure 2-2: QMC-CP1000 Control Panel

The QMC-CP2032 style control panel is also used to increase the functionality of the standard panel.

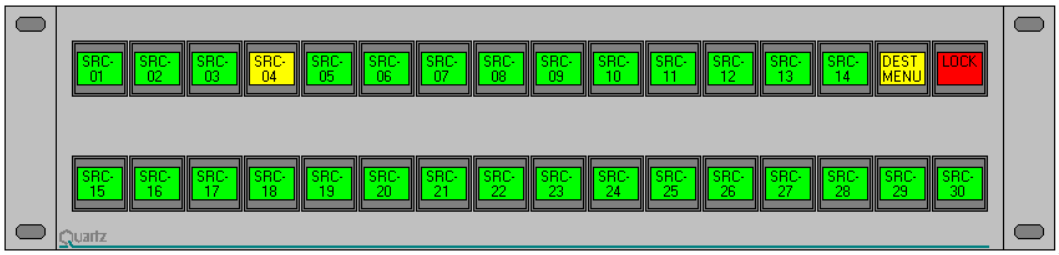


Figure 2-3: QMC-CP2032 Control Panel

The QMC-CP-FS style control panel is used where a high level of manual intervention is required.

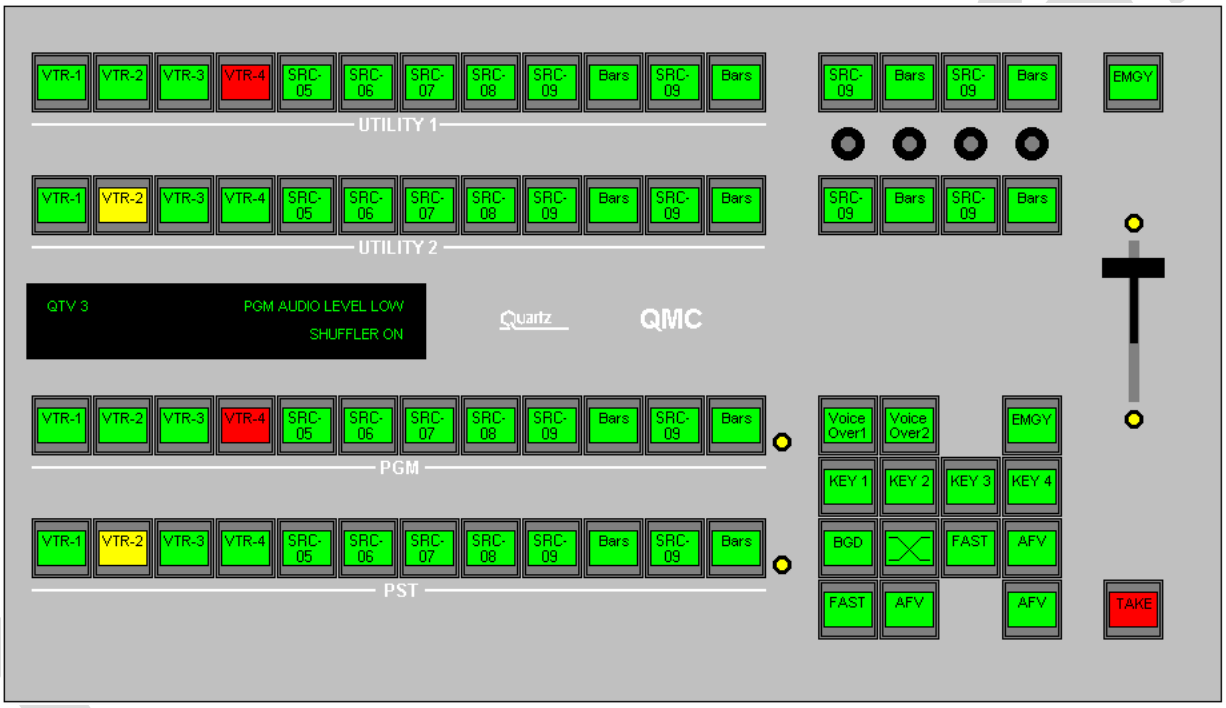


Figure 2-4: QMC-CP-FS Control Panel

2.2.2. Roving Control Panels

Any of the control panels shown above can be used in a multi-channel system as Roving panels. This allows a panel to be connected to multiple QMC channels and then select the channel it will control. Once the appropriate manual control functions have been performed the channel can be de-selected and another channel controlled.

In most systems the use of roving panels requires the Q32-PR or Q6400-PR port routers to allow the panels to be assigned across the multiple channels.

2.3. STANDARD CONTROL CONFIGURATIONS

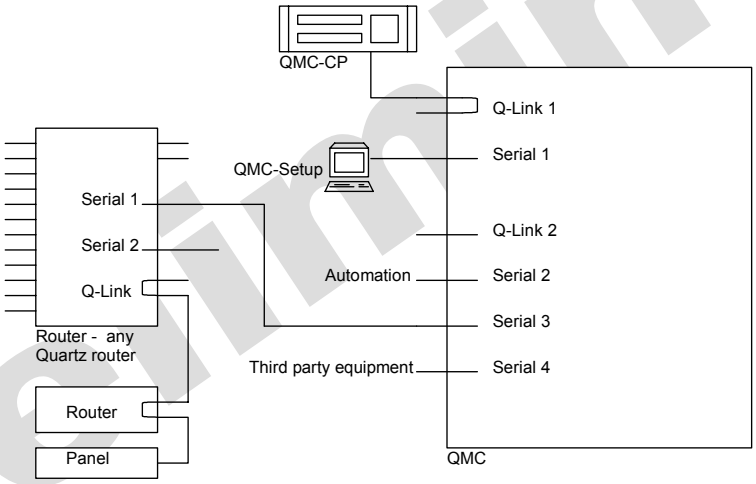
The following are standard configurations of single and multi-channel QMC systems.

Config	Channels	Up-Stream Router	Roving Panels	Port Router	Network to RS232 Hub
A	1 Channel	One small or large router	n/a	None	Optional
B	2 Channels	One small or large router	0 or 1	None	Optional
C	2 Channels	One small or large router	2	Required	Optional
D	3-62 Channels	Several small routers	0 or 1	None	Recommended
E	3-62 Channels	Several small routers	2 or more	Required	Recommended
F	3-54 Channels	One large router	0,1, or more	Required	Required
Non-standard configurations					
G	1 Channel	One small or large router	n/a	None	Optional

All configurations support local panels.

2.3.1. Configuration A: 1 Channel, One small or large router, Roving panels not applicable

This is the basic configuration of a single channel QMC and upstream router.

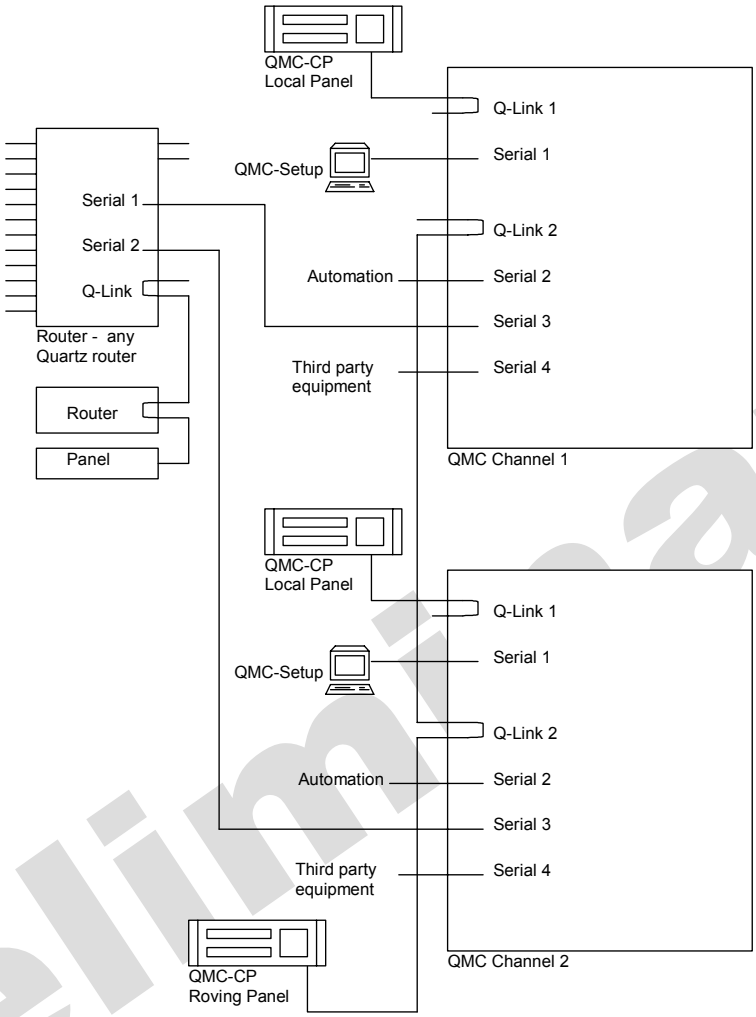


In the example above the QMC control connections are allocated as follows:

- Q-Link 1 is used for the local QMC control panels.
- Q-Link 2 is un-used.
- Serial 1 would normally be used for downloading from a PC running the QMC Setup program.
- Serial 3 is being used to control an upstream Quartz routing system. Two routers are shown but this could be any size of Quartz routing system, configured in the normal way, or any other third party routing system.
- Serial 4 is for other third party equipment or un-used.

2.3.2. Configuration B: 2 Channel, One small or large router, 0 or 1 Roving panels

This is the basic configuration of a dual channel QMC and upstream router. The router would need at least 4 outputs to support the PGM and PVW inputs of each channel.



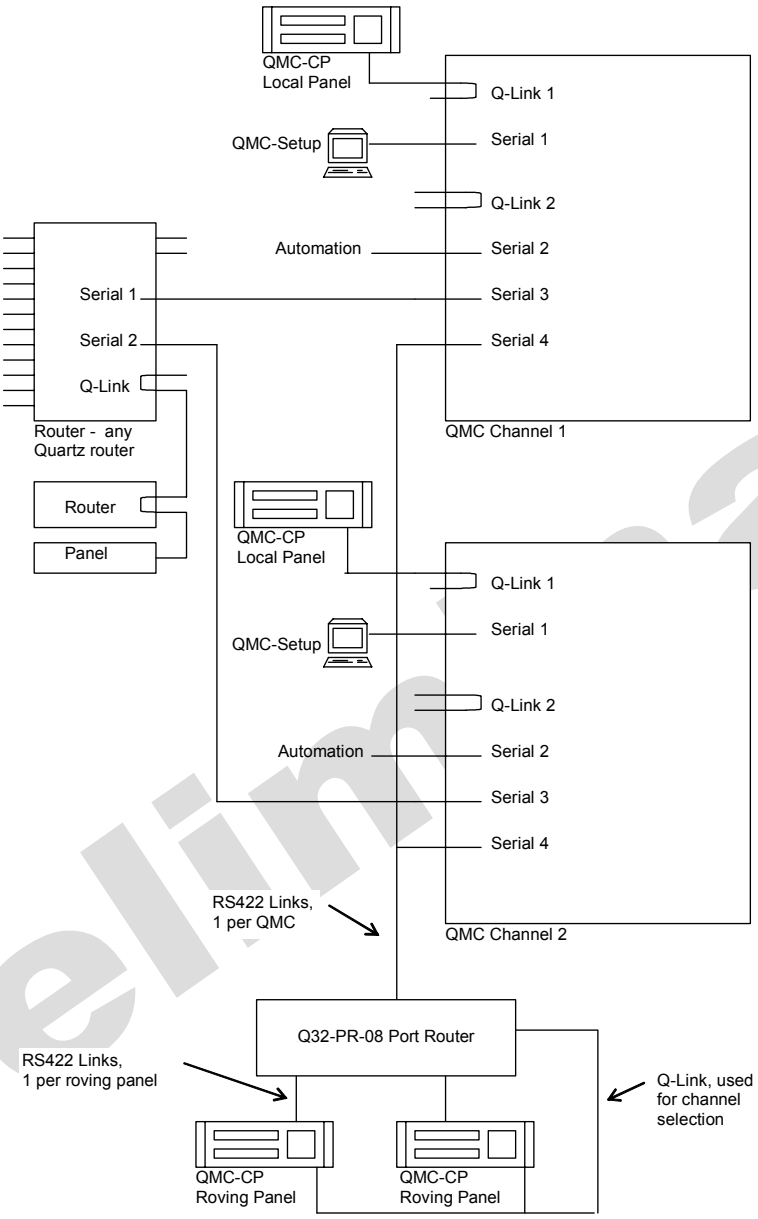
In the example above the QMC control connections are allocated as follows:

- Q-Link 1 is used for the local QMC control panels.
- Q-Link 2 is un-used.
- Serial 1 would normally be used for downloading from a PC running the QMC Setup program.
- Serial 3 is being used to control an upstream Quartz routing system. Only two routers are shown but this would normally be a complete Quartz routing system, configured in the normal way, or any other third party routing system.
- Serial 4 is for other third party equipment or un-used.

The upstream router would normally be fitted with a CI-0001 or CI-0004 interface module to increase the number of serial ports.

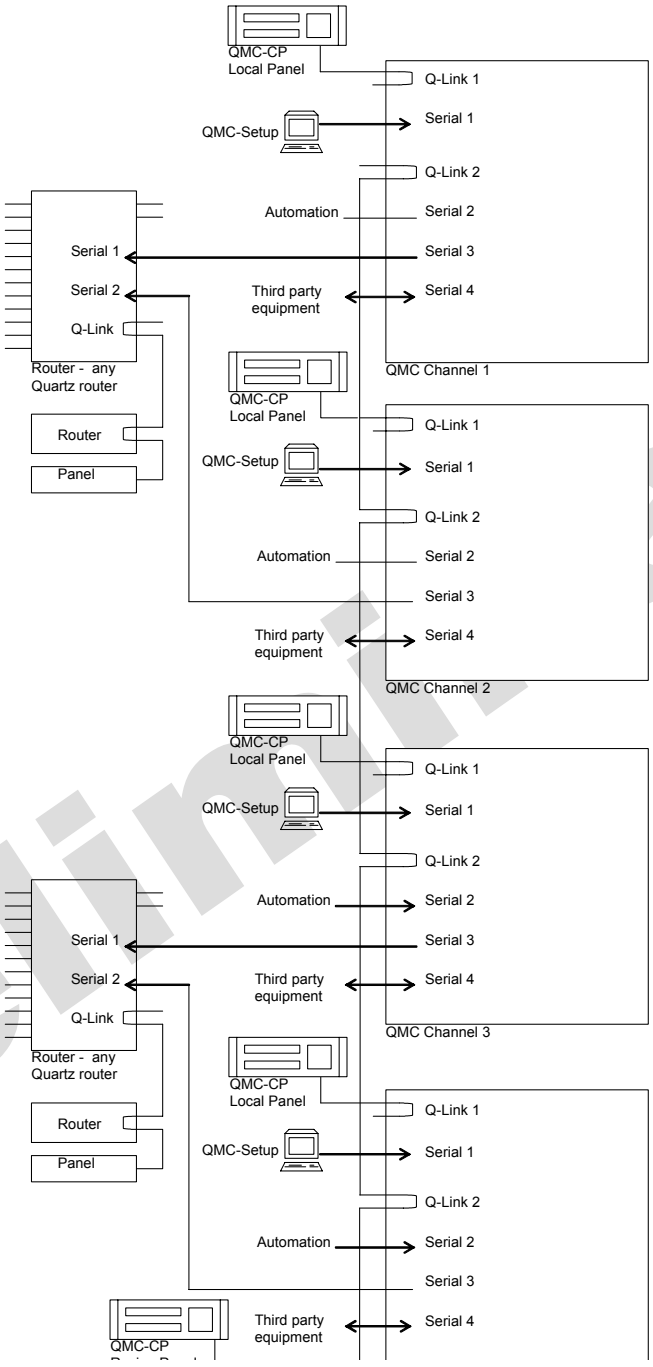
2.3.3. Configuration C: 2 Channel, One small or large router, 2 Roving panels

This is the basic configuration of a dual channel QMC and upstream router. The router would need at least 4 outputs to support the PGM and PVW inputs of each channel. The QMC is equipped with four serial (RS232/422) ports and two Q-Link ports.



2.3.4. Configuration D: 3-62 Channels, Small Up-stream Routers, 0 or 1 Roving panel

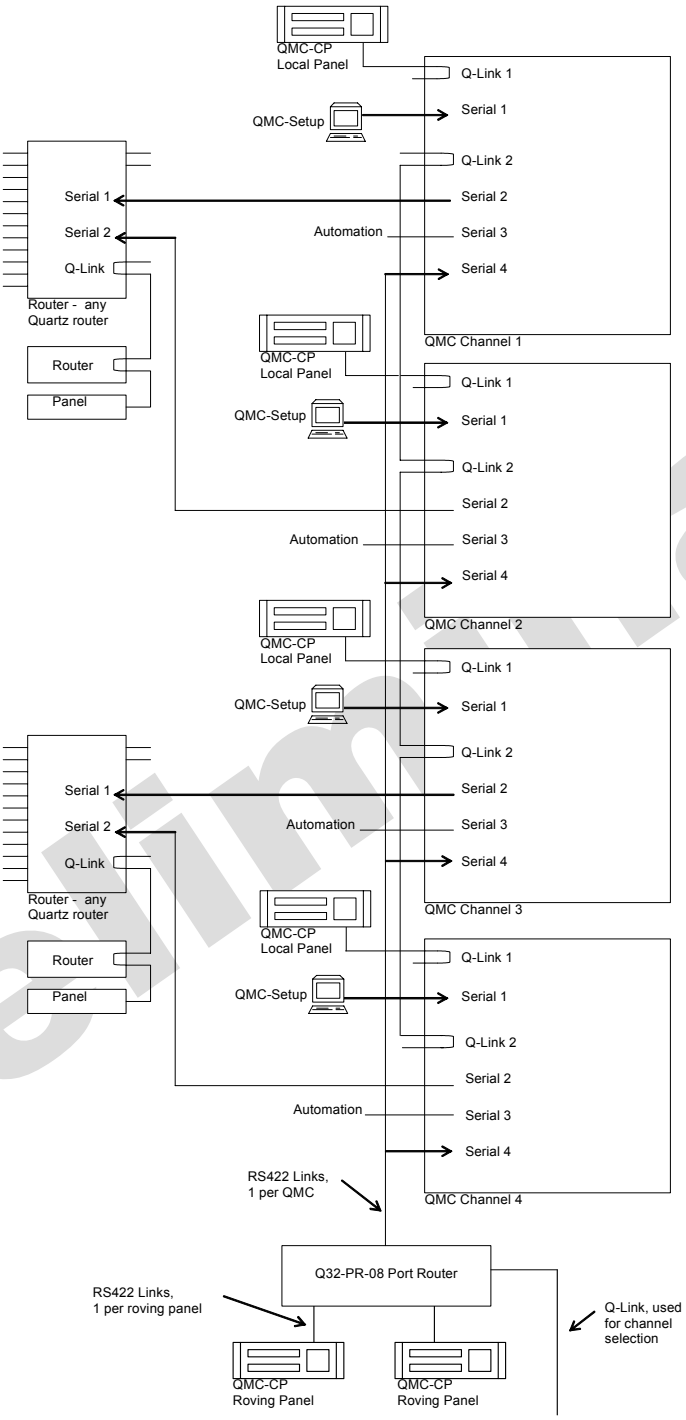
The QMC is designed for multi-channel operation. This example shows multiple small routers (Q32-SV-3204) being used to feed signals to pairs of QMC channels.



The diagram does not show video connections for clarity, but the house router would have multiple outputs of PST and PGM, each feeding one QMC channel. The QMC roving panel means it can be assigned to operate any channel.

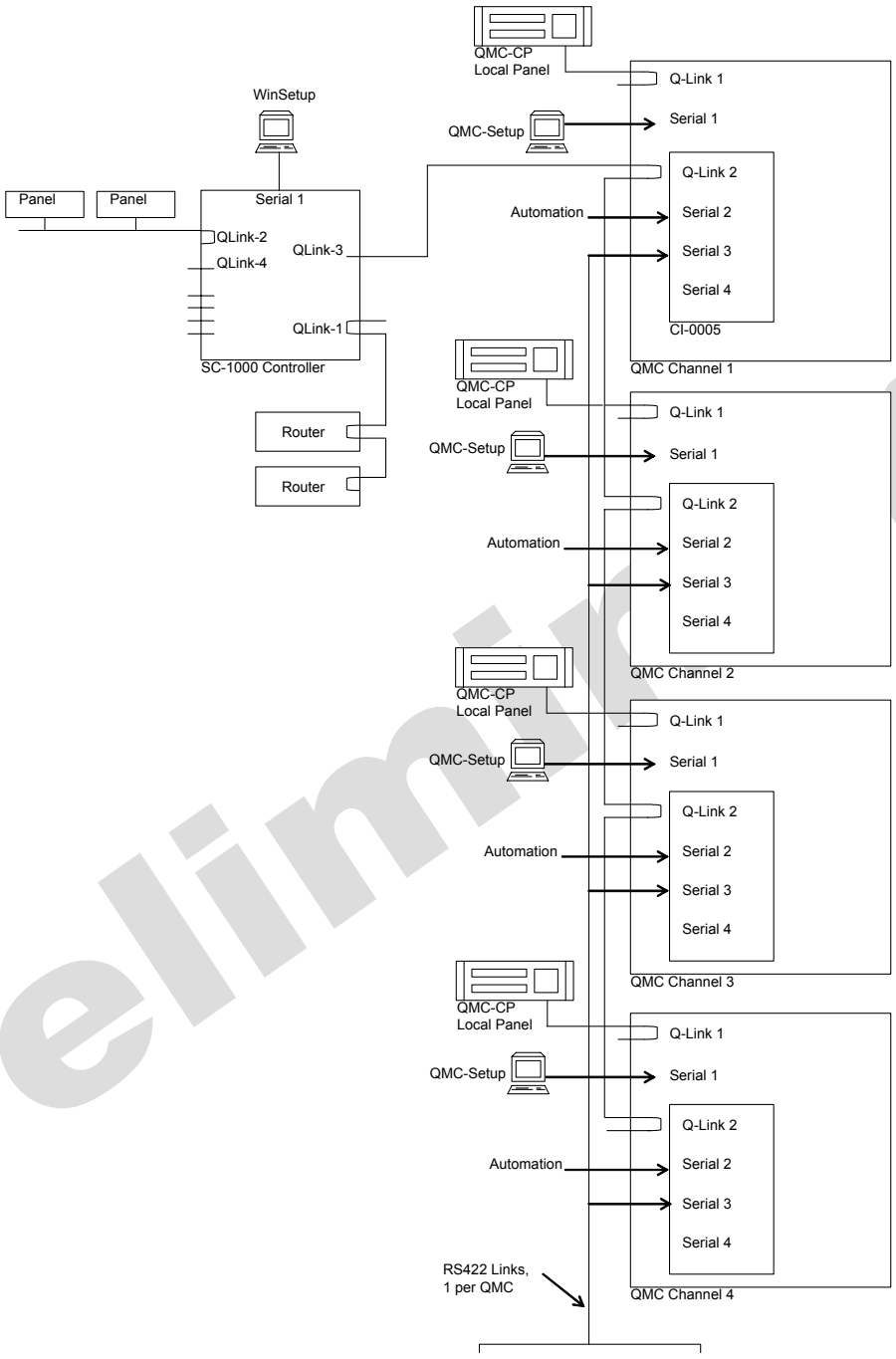
2.3.5. Configuration E: Multi-channel (3-62), Small Up-stream Routers, 2 or more Roving Panels

This example shows multiple smaller routers, each one being used to feed signals to two QMC channels. This is less sensitive to the down time of equipment in any one channel, particularly in 24h operations.



2.3.6. Configuration F: Multi-channel (3-54), Large Up-stream Router, 2 or more Roving Panels

This example shows one large router being used to feed signals to multiple QMC channels.

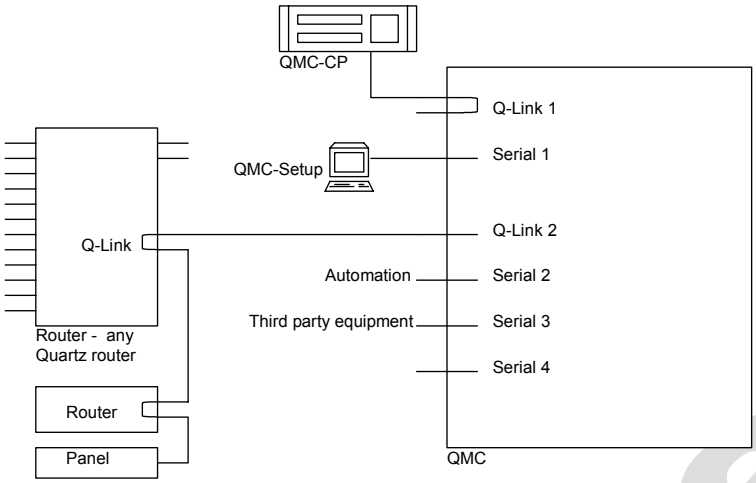


The total number of channels supported is limited by the number of Q-Links available on the SC-1000 and the number of QMC channels allowed per Q-Link. Assuming the SC-1000 needs one Q-Link for routers and one Q-Link for panels leaves nine other Q-Links that can each support 6 QMC channels, giving a total of 54 channels.

If Roving panels are not required then disregard the Q32-PR Port Router and associated connections.

2.3.7. Configuration G: 1 Channel, One small or large router, Roving panels not applicable

This is a non-standard configuration of a single channel QMC and upstream router. The system uses the QMC Q-Link-2 to control the up-stream router but this method is not normally used as the QMC needs priority in switching the upstream router and the timing cannot be guaranteed in this configuration.



In the example above Q-Link 1 is used for the QMC-Link to QMC control panels. Serial 1 would normally be used for downloading from a PC running the QMC Setup program. Q-Link 2 is being used to control an upstream Quartz routing system. Only two routers and one control panel are shown because the upstream router Q-Link must not have more than four devices connected.

The limitation with this type of system relates to the minimum clip time used on the transmission channel and the maximum time delay before the QMC can set up the next transition. As a guide the QMC/Router Q-Link should have no more than one device connected for each Frame of clip length. So if the minimum clip length is 8 frames then the Q-Link should have no more than 12 devices connected.

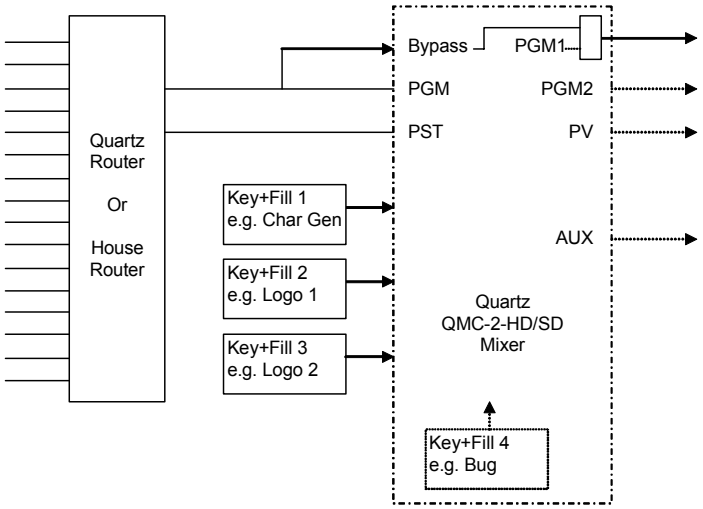
Making this provision does not allow for the situation where the upstream router is very busy due to manual control panel takes or other third party control system takes.

2.4. PROTECTION STRATEGIES

In a live broadcast environment, it is essential to plan for equipment failures and major system failures such as power loss. The QMC-2-HD/SD has been designed with a number of failure protection modes in mind.

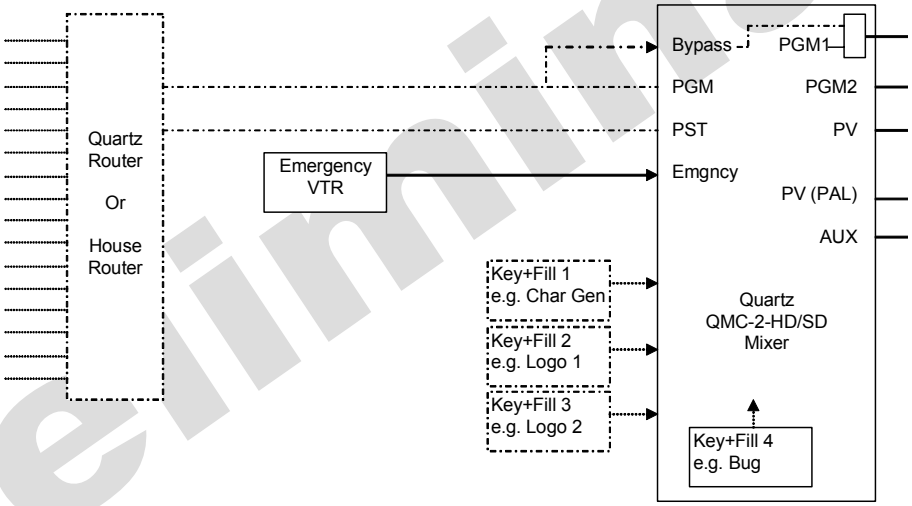
2.4.1. Power Loss or QMC-2 Failure

If the Switcher were to suffer a major failure of its internal power supplies of the external main/line power then the bypass relay would drop to its bypass mode and connect the Bypass input directly to the PGM1 output. This is shown below where all the solid lines represent working elements, and the dotted lines represent failed components.



2.4.2. External System Failure (QMC-2 working normally)

If the system upstream of the Switcher were to suffer a major failure then the Switcher can be used for emergency cuts to any available sources. To guarantee one source is available at all times an emergency VTR can be connected to the EMGY input.



When the emergency button on the control panel is pressed it activates a 2x1 switch on the PGM input. This switch connects the Emergency input in place of the PGM input so that the main PGM output can still function.

2.5. CONTROL SYSTEM

2.5.1. Q-Link

The QMC-2 has two pairs of Q-Link connectors on the rear panel, labelled Q-Link 1 and Q-Link 2. Q-Link 1 pair runs a special protocol dedicated to the QMC-2, and this is used to link to the QMC-CP or other QMC control panels. Q-Link 2 is normally used for connection to a SC-1000 in a multi-channel system.

2.5.2. Serial I/O

The QMC-2 has four rear panel serial ports. Serial 1 is always used for the PC running the QMC-Setup program. Serial 2, 3, and 4 can be used for other functions such as controlling the upstream router or linking to automation systems.

Before the serial ports can be used they must be configured from the QMC-Setup program to have the command protocol and baud rates set correctly.

2.5.3. Tally I/O

The QMC-2 has a 25 way female D-type connector with relay tally outputs and TTL level input/outputs. The relays are software assignable from QMC-Setup.

2.5.4. Ethernet

The QMC-2 has an Ethernet port compatible with a 10 Base T networking running the TCP/IP protocol.

The QMC-2's current MAC and TCP/IP address can be checked at power up or reset using a PC. Connect a PC to the serial port 1, start QMCSetup, select PC Comms Window, and then press reset on the QMC processor module using the card edge left hand reset switch. The QMC will send status including its MAC and TCP/IP address.

The QMC-2's MAC address (low level Ethernet address) is stored in the FU-0018 processors internal Flash memory and is programmed at the factory using Firmware Manager (V1.27a or later), and logged in the companies Technical Support database. This address should not be changed, unless instructed to do so by Evertz or a competent network administrator, as it must remain a unique number.

To change the MAC address, first check that the 'FWP' Jumper on the card is set to allow the bootloader to be able to write to the on-chip FLASH. Connect your PC to the QMC and start Firmware Manager. Select Force Bootloader on Reset and then reset the QMC processor module using the card edge left hand reset switch. Select Quick Search (No Validation) and the Flash memory chip should appear in the upper dialog box. Select the Flash memory device by left clicking once, and then right click, and select Change MAC Address. Enter a valid MAC address and then select program.

The QMC's TCP/IP address can be set from any serial port running the Quartz standard protocol. Connect your PC to the QMC and start QMCSetup. Select PC Comms Window and check that you can get an Acknowledgment back from the QMC. Now type the following commands, substituting your own IP settings:

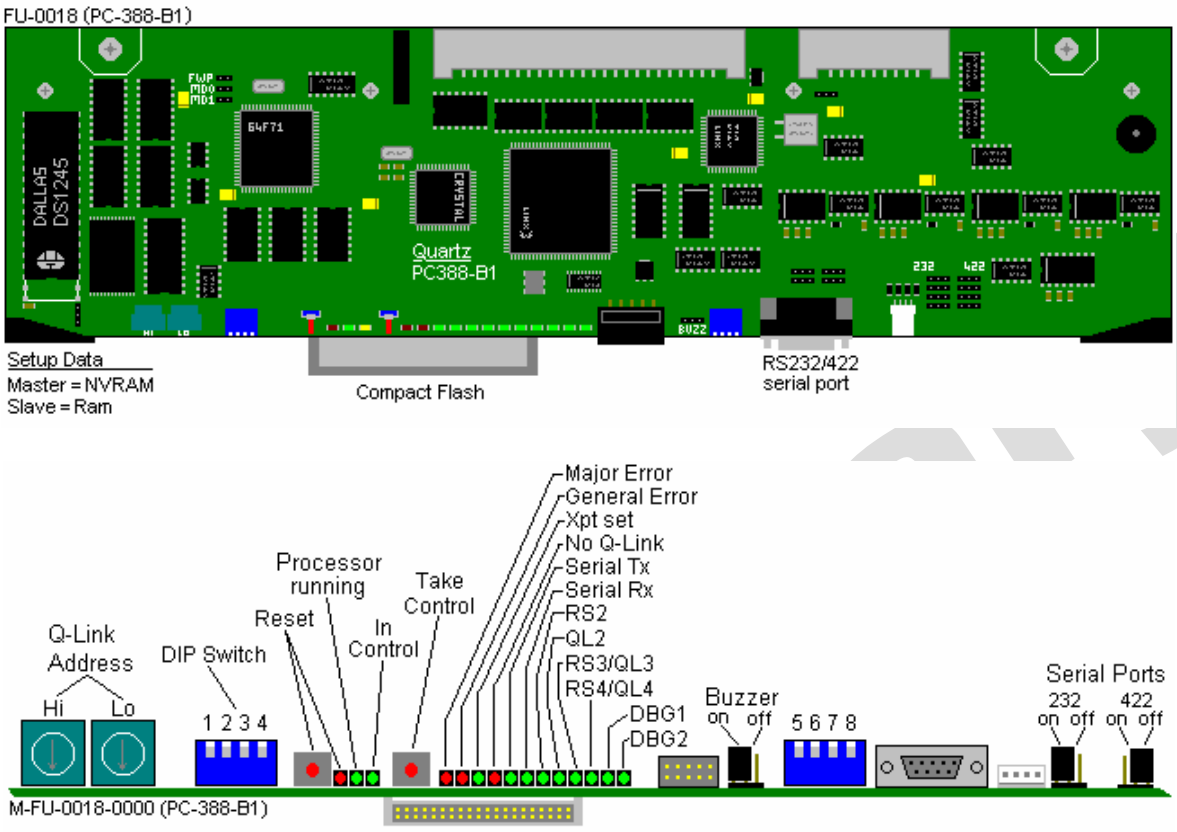
.$LOCALTCPIP,192.168.0.25
.$TCPNETMASK,255.255.255.0
.$TCPGATE,192.168.0.1

The QMC TCP/IP address will have been factory set to 192.0.2.200.

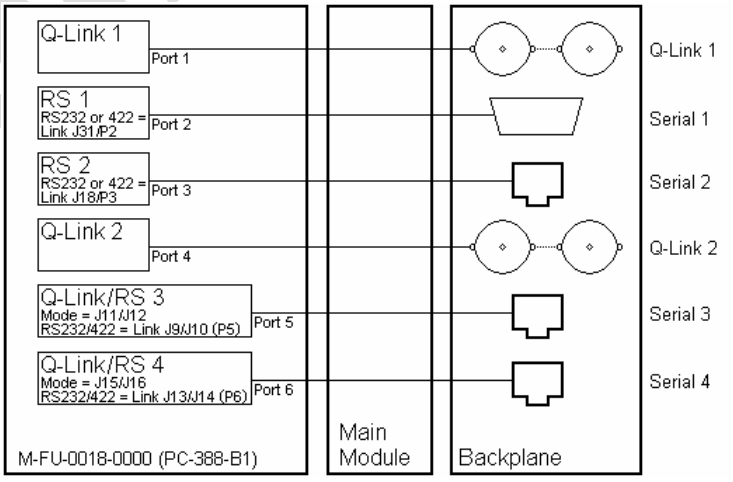
For test purposes it is possible to talk directly to the QMC-2 over a network using the PC based Telnet function. From a Windows command prompt, type Telnet <ip addr> and the Telnet window will open. It should then be possible to communicate with the QMC-2 using standard Quartz protocol.

2.5.5. Processor Module: FU-0018

The FU-0018 processor connected to the front of the main module controls the QMC. This processor is responsible for updating the video Switcher circuitry, controlling the Q-Link communications, and decoding messages from an automation system.



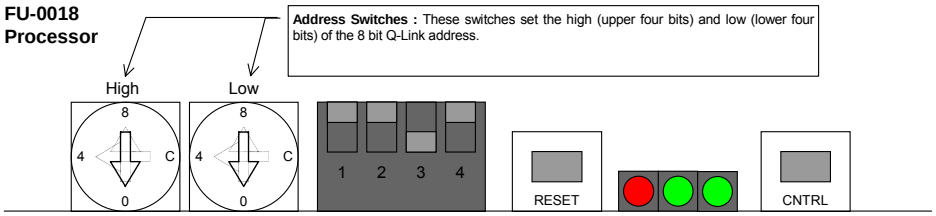
The FU-0018 processor has four RS232/422 serial ports and two Q-Link ports.



There are a number of status LED's and DIP switches on the front of the processor.

2.5.5.1. Address Switches

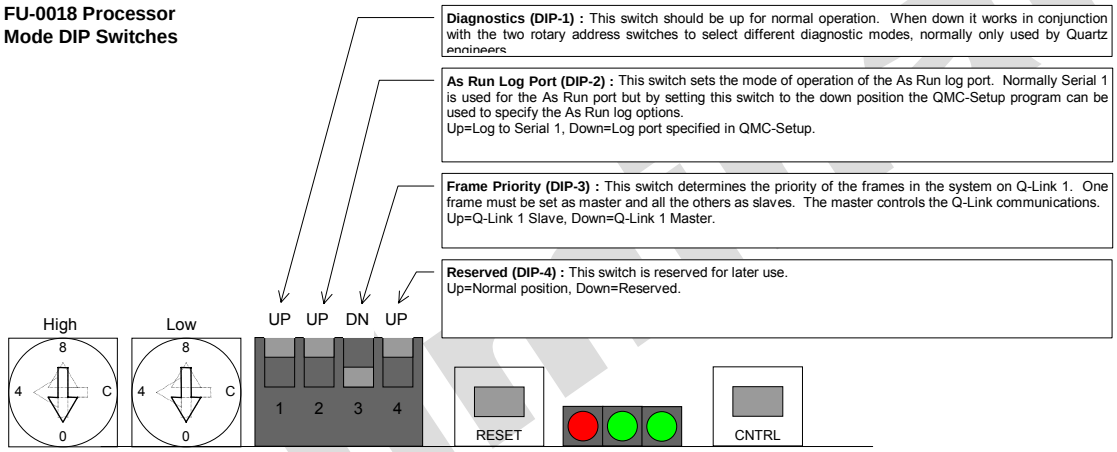
The two rotary *hex* switches in each frame determine its unique *address* in the system. This ensures that all devices have a different code allowing communications down the coaxial **Q-link** to distinguish different units.



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

2.5.5.2. Processor DIP Switches

There are four MODE DIP switches at the front left of the matrix modules. The DIP functions are:

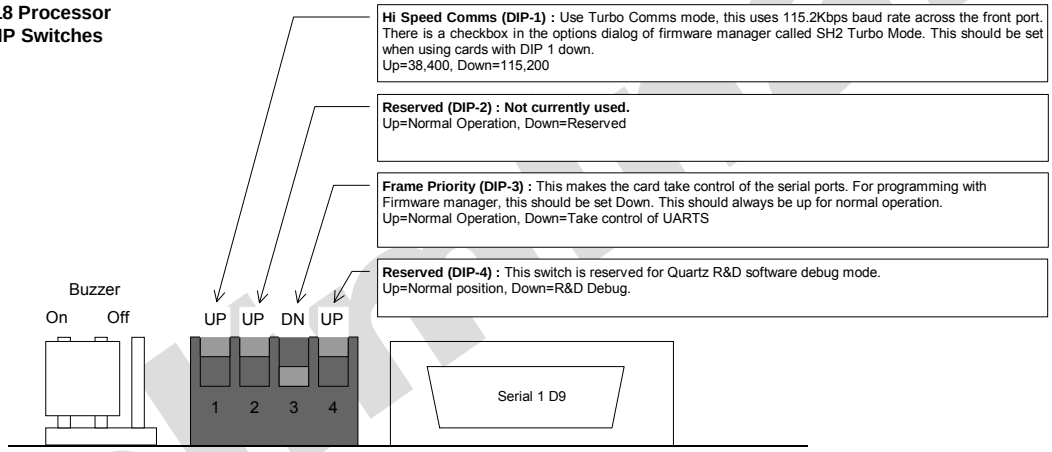


The reset switch must be pressed after changing the DIP switch.

Diagnostic modes set by DIP-1 is down using the rotary address switches.

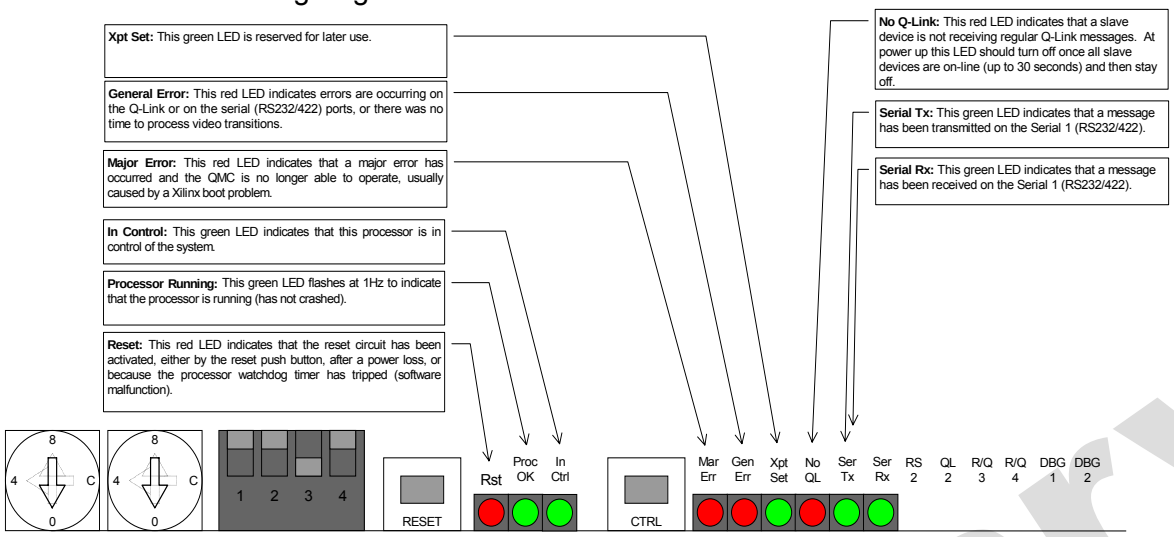
Rotary Setting	Mode
00	Serial Port Test. Will report Port 2 = 19, Port 3 = 28, Port 4 = 37, Port 5 = 46, then output a text string 'Port n' to all serial ports at 19200,N,8,1.
01	Test NVRAM by writing and reading back values. Will destroy any stored setups or logo's.
02	Test system RAM by writing and reading back values.
03	Processor I/O data/addr bus test sequence.
04	Demo mode. Does not wait for Xilinx boot sequence or rely on feedback from an upstream router.
05	Reserved
FD	Reset Logo vector table (flush logo memory)
FE	Reset QMC channels 00-0F.
FF	Reset NVRAM vector table (flush all setup and logo memory).

FU-0018 Processor OPT DIP Switches



2.5.5.3. Processor Status LED's

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



2.6. LOGO STORE

The QMC-2 has an optional built in logo store, typically used to place station ident logo (bugs) onto the final transmission output. The logos are downloaded to the QMC from the QMC-Setup program, and multiple logo's can be stored at any one time, the exact number depending on the individual logo sizes and complexity. Each logo has an associated name and can be called up from an automation system or the QMC-CP control panel.

The logo files are sent to the QMC in a Quartz file format (QLF), these files can be converted using the QMC-Setup program from standard graphics file formats such as Truevision Targa (tga), Joint Photographic Experts Group JPEG (jpg), Tagged-Image File Format TIFF (tif) and Windows bitmaps (bmp) files.

The QLF file format is in either 8 or 10 bit Y,Cr,Cb format which can optionally be run length encoded for compression of large areas of repetitive data.

The QMC-2 has two areas of RAM used to store the logos, the first is the Compact Flash storage that is currently 32M bytes but can change depending on the size of Compact Flash used. The Compact Flash uses the PC/DOS filing system and can therefore have logos loaded on any Windows PC. When using a PC to directly load logo's to the Compact Flash the procedure below should be followed:

- Insert the Compact Flash into the PC adaptor socket.
- Use Windows Explorer to view the Compact Flash folder.
- Ensure the Compact Flash is formatted using the FAT filing system, reformat if necessary.
- Create a folder called LOGOS (in capitals).
- Copy your QLF format logo files to this folder.
- Use Eject to ensure the data is safely written before removing the Compact Flash.
- Now insert into the QMC.

The number of logos that can be stored in this area depends on the size and complexity of the logo. This will range from 16000 small sized logos to 150-350 full frame complex logos, typical examples are shown below:

Typical SD Logo	SD Size	SD Memory	Typical SD Qty
Small bug	40x20 pixels	1K-3K	64000
Medium bug	80x40 pixels	4K-12K	20000
Large bug	120x80 pixels	11K-34K	7000
Small text banner	280x20 pixels	7K-20K	12000
Medium text banner	320x40 pixels	15K-45K	5500
Large text banner	440x60 pixels	31K-93K	2500
Full screen logo	720x575	483K-1449K	170

Typical HD Logo	HD Size	HD Memory	Typical HD Qty
Small bug	120x40 pixels	6K-18K	10000
Medium bug	240x80 pixels	24K-72K	3300
Large bug	360x160 pixels	66K-204K	1150
Small text banner	840x40 pixels	42K-120K	2000
Medium text banner	960x80 pixels	156K-270K	900
Large text banner	1320x120 pixels	186K-558K	400
Full screen logo	1920x1080	2898K-8694K	28

The second storage area is the on-screen video RAM which is used to display the logos on the video output. This is currently 32Mbytes but stores the logos in an uncompressed format. Each pixel takes up 4 bytes. So a SD logo of 100x100 will take 40K (10000 x 4). A full frame of SD logo will use (720x576) 1.6Mbytes of storage.

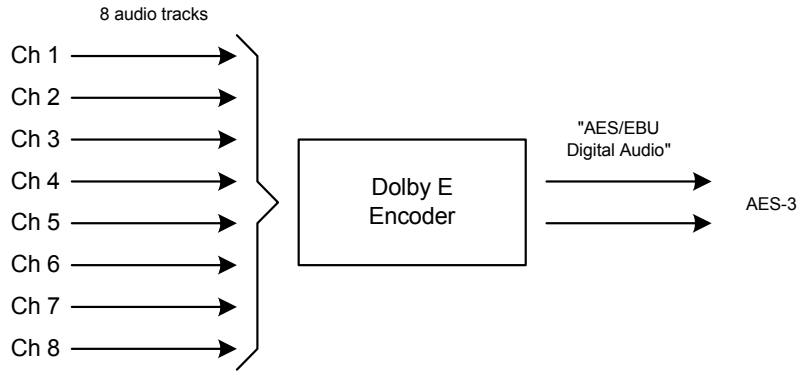
When a logo is downloaded from the configuration program it is stored in the Compact Flash area and will reside there until deleted by the configuration program. When the user wishes to either preview the logo or present it on-air it can be selected either via one of the control panels or using automation. This will then load the logo into the on-screen video RAM from which it can be previewed using a keyer of the QMC. In order to load a logo into this RAM the logo has to be removed from the program output. A number of logos can be loaded into this RAM until this memory storage is full. These logos are then available for presentation immediately to the user.

When the logos are loaded in the video RAM area the user can cut between logos while the keyer is on-air or change between logos at the next background transition.

The logo can be previewed and moved around the screen from the control panel to avoid presentational problems with graphics on the background video.
Only one logo can be ‘on screen’ at any one time. If your application requires multiple logo’s on air then external logo generators should be connected to the external key inputs of the QMC. Alternatively, two small logo’s can be defined within a larger logo but these can then only be keyed in and out as a single entity.

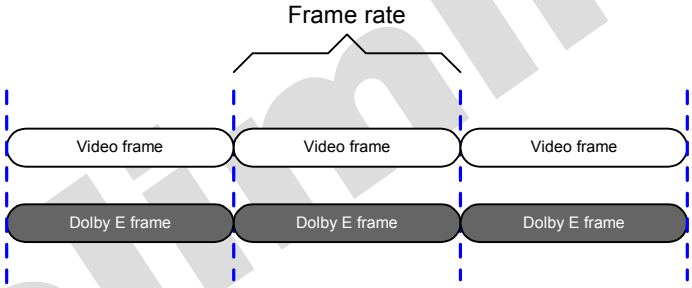
2.7. DOLBY-E

Dolby E is a high quality eight-channel audio coding system designed specifically for broadcast distribution, an application for which Dolby Digital is not suitable. Integration into an existing two-channel infrastructure is facilitated by the fact that the Dolby E bitstream looks exactly like AES/EBU digital audio.



This enables distribution via a single AES-3 pair or recording on two audio tracks of a digital video tape, to create a standard exchange format for sound with picture. Dolby E encoded audio is designed to withstand ten or more of the encode/decode cycles typically required during the distribution phase of DTV programs.

As the frame rate of Dolby E matches that of the video it accompanies, insert or assemble edits on tape and audio-follow-video cuts between programs can be made without pops or clicks.



Dolby E encoding and decoding takes exactly one video frame each, simplifying audio/video synchronization, and Dolby Digital metadata (data about the audio data) is also conveniently transported within the Dolby E bitstream. Audio remains in the robust Dolby E format right up to the final master control, and is then re-encoded into Dolby Digital for transmission.

2.7.1. QMC-2 and Dolby E

There are three different ways of handling a Dolby E audio signal with the QMC-2. By using:

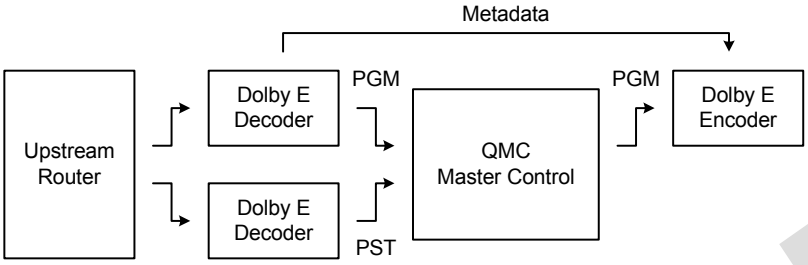
1. External decoders and encoders
2. Internal decoders and encoders
3. Pass through mode

In order to process the program audio, including any kind of fade, mix or voiceover, the Dolby E signal must be decoded back to baseband. Without this the signal may be passed but only cut transitions may be performed on the audio tracks carrying the Dolby E signal. In addition the associated metadata must be preserved.

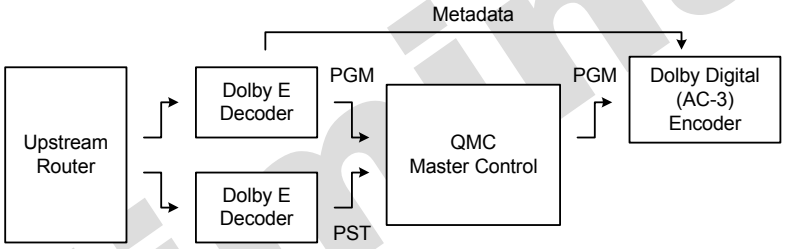
2.7.1.1. Using External Decoders and Encoders

Using a Dolby E decoder in the Program (PGM) and Preset (PST) paths between the upstream router and QMC-2 allows the incoming Dolby E audio signals to be decoded into baseband audio. The baseband audio can then be fed into the QMC-2 and processed.

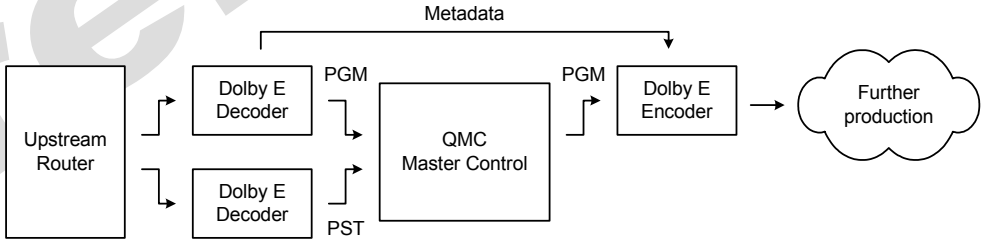
This requires 8 channels of audio I/O and processing within the QMC-2. The Meta data must be fed around the QMC from the Program channel (PGM) decoder to the Program channel (PGM) encoder, as shown below.



If the signal is being fed to through a link directly to a transmitter then the final encoder may be a Dolby Digital (AC-3) encoder rather than a Dolby E encoder.



If the signal is to be fed to a downstream studio for further processing then it is more likely to be re-encoded as Dolby E.

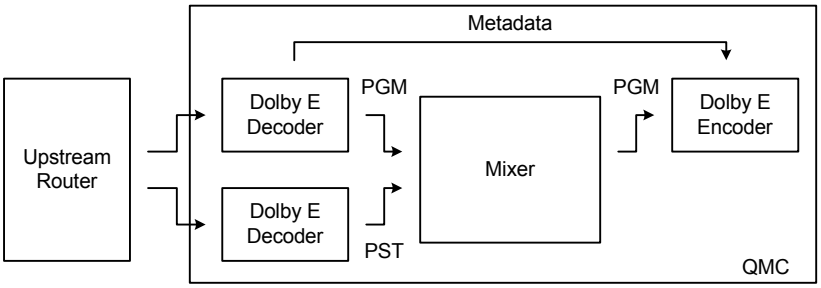


With this arrangement all transitions are possible in the QMC-2, including voiceovers. During a dissolve the meta data will continue to come from the outgoing source until the end of the transition, at which point it will cut to the meta data from the incoming source.

Although there may be an abrupt change in the metadata value at this point the Dolby encoder is designed to smoothly transition these values and avoid clicks in the audio. If a stereo AES audio signal is selected on the upstream router then the Dolby E decoder will switch into a bypass mode, allowing dissolves between the stereo and Dolby audio. The stereo feed will be presented to the front stereo inputs of the Dolby E encoder.

2.7.1.2. Internal Decoders and Encoders

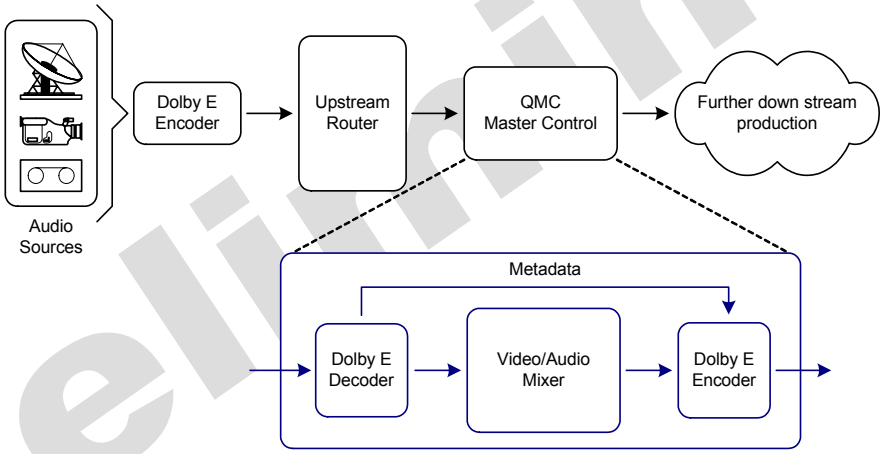
Dolby E signals are fed into the QMC-2 through the AES inputs or as embedded audio data. Optional plug-in Dolby E decoders inside the QMC-2 then decode the Dolby E signals.



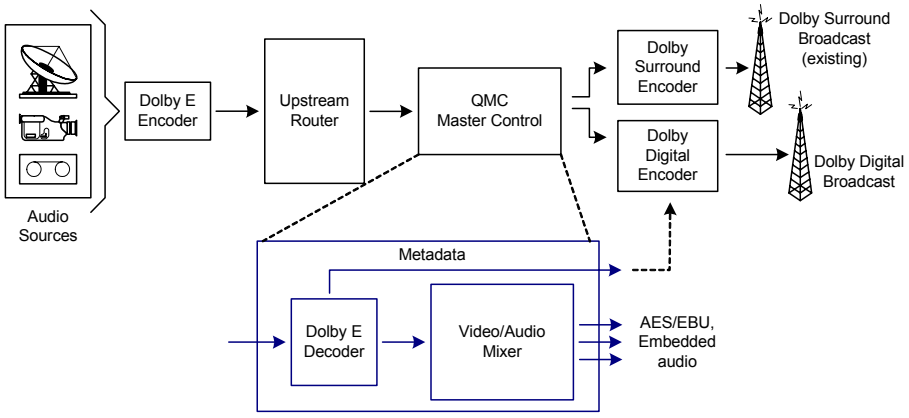
All 8 channels are then processed internally and output as two groups of four audio signals. In this configuration input AES and Dolby E audio can be mixed, and voiceovers inputs used as normal.

Metadata is fed out from the internal Program (PGM) Dolby E decoder and fed back into the Dolby E encoder. The Metadata will be switched to the new Preset (PST) feed at transition point.

At the output side of the mixer all 8 channels of AES audio (the two groups of four audio signals) are re-embedded and fed back into Dolby E encoder for further down stream production.

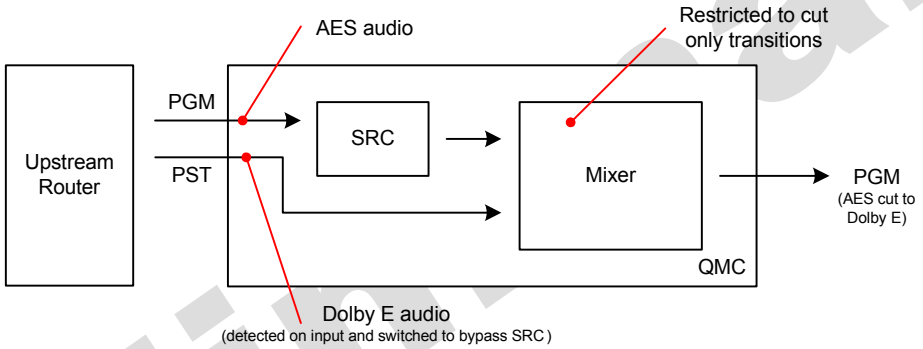


Alternatively these 8 channels can also be set to "bypass" the Dolby E encoder and therefore output the QMC-2 as an embedded AES audio stream allowing them to be encoded as required, for example, either as Dolby Digital or Dolby Surround. It this case the metadata is fed through to the RJ 45 metadata connector on the rear of the QMC-2.

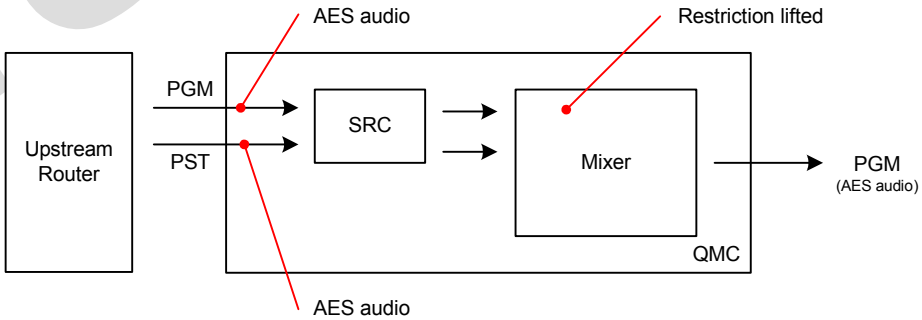


2.7.1.3. Bypass Mode

When Dolby E data is detected on the Preset input of the QMC-2 it automatically bypasses the input sample rate converter (SRC). It also inhibits all transitions, such as fades and mixes, to the audio tracks carrying the Dolby E signal.



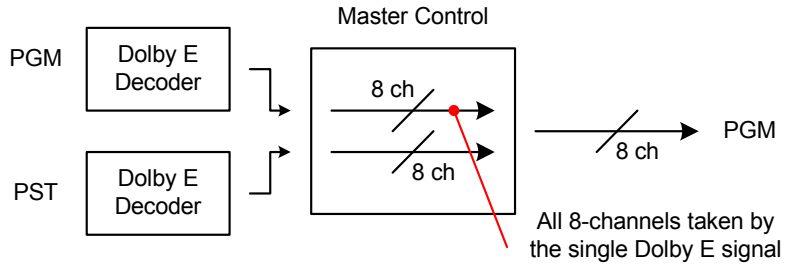
Therefore the audio transition for the Dolby E signal will always be an audio cut at the end of the transition as long as either of the program or preset source are in the Dolby E format. However, once the Program and Preset inputs are in stereo AES audio format the QMC-2 resumes normal operation, such as fades and mixes as well as the mixing of the audio from the voice over input.



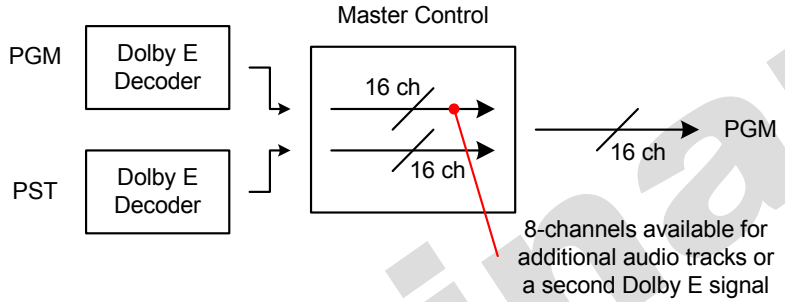
In the Bypass mode transitions between stereo AES audio and Dolby E are possible, but only as cuts. Since there is no Dolby E decoding metadata preserved on all Dolby E streams.

2.7.1.4. Mix and Match Dolby E and AES/EBU Audio

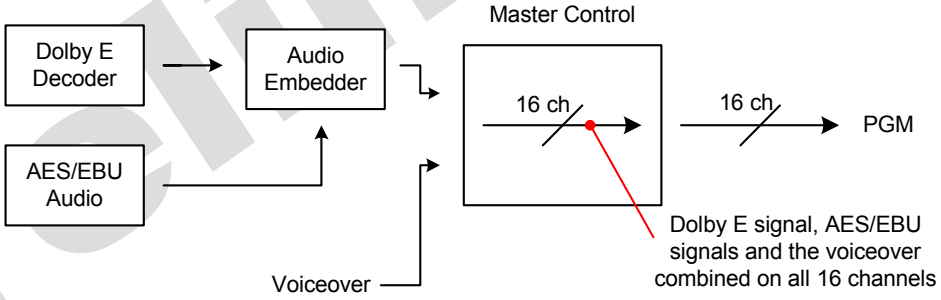
As stated above, when Dolby E audio is decoded back to baseband audio it utilizes 8 audio tracks (two groups of four). This means that within the system that provides the ability to handle 8 channels of audio all of the available audio tracks are used by the one Dolby E signal.



However, within a 16 channel system, such as the QMC-2, 8 of the 16 channels are still available. These channels can be used to carry a second Dolby E signal or 8 additional and independent AES/EBU audio signals, such as a separate language track, natural sound etc.



For example, within an embedded SDI feed additional audio tracks can be added upstream of the QMC-2, as well as added into the Program path via the Voiceover facility. These additional audio tracks are then processed through the QMC and carried out to its Program output.



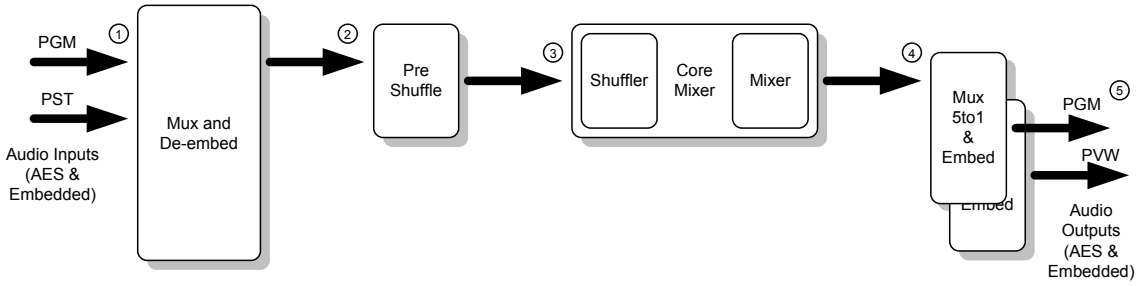
2.7.2. The internal audio path of the QMC-2

AES and embedded audio can be routed through the QMC-2 in a number of different ways depending upon the format of the audio signal. There are three options:

1. AES & embedded audio only.
2. AES, embedded and bypassed Dolby E audio.
3. AES, embedded and processed Dolby E audio.

The audio path for each of the above options is shown below.

2.7.2.1. Switching AES and Embedded Audio (no Dolby E signals)



The above diagram shows the audio path taken through the QMC-2 of a non Dolby E AES and embedded audio feed.

Audio Inputs①:
The QMC-2 has both AES and Embedded audio inputs, the number of which is dependant upon the frame type, as shown below:

AES Audio

a.	Program	- 8 mono channels, balanced - or 4 mono channels, unbalanced
b.	Preset	- 8 mono channels, balanced - or 4 mono channels, unbalanced
c.	Voice Over 1	- 4 mono channels, balanced - or 2 mono channels, unbalanced
d.	Voice Over 2	- 4 mono channels, balanced - or 2 mono channels, unbalanced
e.	Emergency	- 8 mono channels, balanced - or 4 mono channels, unbalanced

Embedded Audio

f.	Program	- 16 mono channels
g.	Preset	- 16 mono channels
h.	Emergency	- 16 mono channels

Audio that is embedded into the video stream is de-embedded and passed onto the Pre Shuffler along with all of the incoming AES audio.

Pre Shuffle②:
All of the incoming audio signals from the input stage of the QMC-2 are presented to the Pre Shuffler as mono AES audio channels. The Pre Shuffler selects and switches the required audio through to the Core Mixer.

Core Mixer – Input③:
The Core Mixer contains the audio shuffler and audio mixer. It accepts a maximum of 56 mono audio channels, as shown below:

a. Program - 16 mono channels

b. Preset - 16 mono channels

c. Voice Over 1 - 4 mono channels

d. Voice Over 2 - 4 mono channels

e. Emergency - 16 mono channels

It is within the Core Mixer that all of the audio processing, such as level changes and transitions take place as well as the audio shuffling.

Core Mixer – Output④:
The processed audio is sent from the Core Mixer onto the final output stage of the QMC-2. At this point the audio will be a mix of inputs, for example the main program audio and a voice over.

Output Stage⑤:
At this stage the AES audio for the Program and Preview output is fed through to the output connectors of the QMC-2 as well as being embedded in to the output video signal. The audio signals presented at the output of the QMC-2 are as follows:

AES Audio
a. Program - 8 mono channels, balanced
- or 4 mono channels, unbalanced

b. Preset - 8 mono channels, balanced
- or 4 mono channels, unbalanced

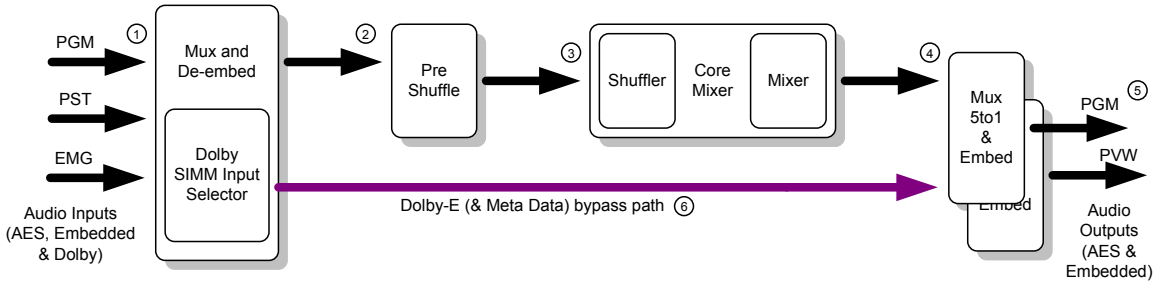
c. Emergency - 8 mono channels, balanced
- or 4 mono channels, unbalanced

Embedded Audio
d. Program - 16 mono channels

e. Preset - 16 mono channels

f. Emergency - 16 mono channels

2.7.2.2. AES and Embedded Audio with Dolby E Bypass

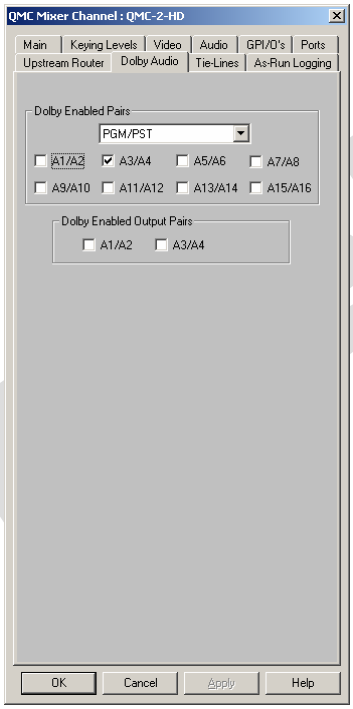


The diagram above shows the audio path taken through the QMC-2 of an AES and embedded audio feed with the Dolby E bypass selected.

The audio path is identical to the previous example with the addition of a Dolby E bypass path⑥. This allows an incoming Dolby E signal (including the Meta data) to be selected and bypassed around the Pre Shuffle, Sample Rate Converters and Mixer. It is then fed back into the audio Mux & Embedder.

Note: When in the Dolby E Bypass mode the audio transitions are limited to cuts only for the AES pair carrying the Dolby-E signal, all other normal AES audio tracks are transitioned as normal.

To use Dolby-E bypass simply change the QMCSetup options (V1.28f or later) for Dolby.



Select the QMC channel that requires Dolby-E bypass.

Select the Dolby Audio tab.

Select PGM/PST

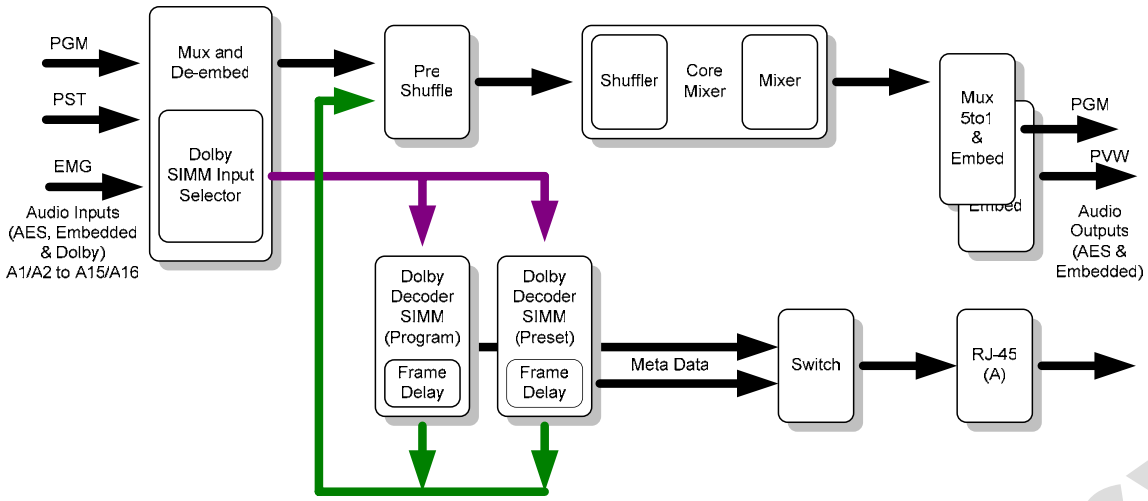
Select the AES pair (A1/A2 etc) that carries the Dolby-E data.

Save the Setup changes.

Download the setup to the QMC.

2.7.2.3. AES and Embedded Audio with Dolby E Decoders

The diagram below shows the audio path taken through the QMC-2 of AES and embedded audio signals, which has the Dolby E decoders fitted.



The audio path is identical to the previous example shown but with the addition of two Dolby E decoders[7]. These decoders are optional and are fitted to the main QMC-2 module.

The audio input selector automatically detects the presence of a Dolby E signal and switches the incoming through to the decoder SIMM.
The decoders allow the incoming Dolby E signal, which may arrive as an AES or embedded audio input, to be decoded into a standard AES signal.

It is then looped back into the audio path just before the Pre Shuffle stage. From there it passes through the audio mixer in the normal way.

Decoding the Dolby E signal allows audio processing, such as audio transitions, to be applied. Each decoder has the ability to decode a single Dolby E signal. One decoder is required for both the Program and Preset input.

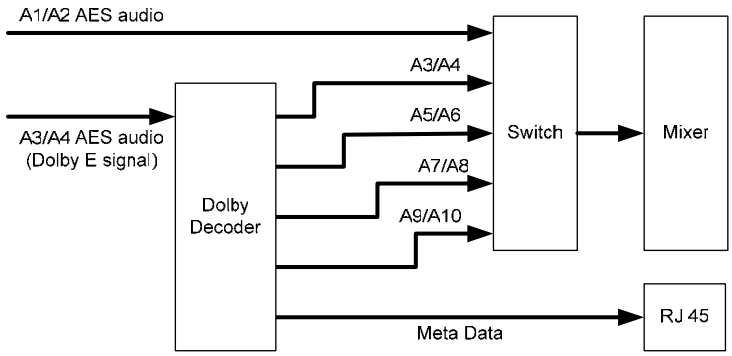
The QMC-2 is also fitted with frame stores, one on the Program path and one on the Preset path. They allow the video signal to be delayed in order to match the audio delay caused by the Dolby E decoders.

The Meta Data associated with the incoming Dolby E signal is extracted by the decoders and is passed on and fed out of the QMC-2 via an RJ-45 connector.

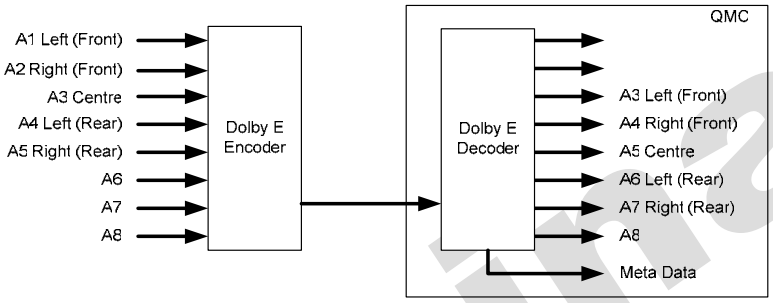
2.7.2.4. Typical Dolby E Application

The diagram below shows a typical Dolby E application where tracks A1/A2 are carrying an AES stereo signal and tracks A3/A4 are carrying a Dolby E signal.

The non-Dolby E signal on tracks A1/A2 are passed straight through to the selection switch. The Dolby E signal on tracks A3/A4 are sent to the Dolby E decoder where they are decoded into discrete AES audio signals. These signals are then passed onto the selection switch before being transferred to the audio mixing stage.



The Dolby E decoder in the QMC will maintain the order of the audio tracks as they had been set prior to the encoder. However, the track numbering can be changed if required as shown in the diagram below.



The Meta data that is extracted from the Dolby E signal during the decoding process is passed onto the RJ 45 connector where it becomes available as a serial RS422 signal.

The Serial (RS422) RJ45 connectors for the Meta Data:

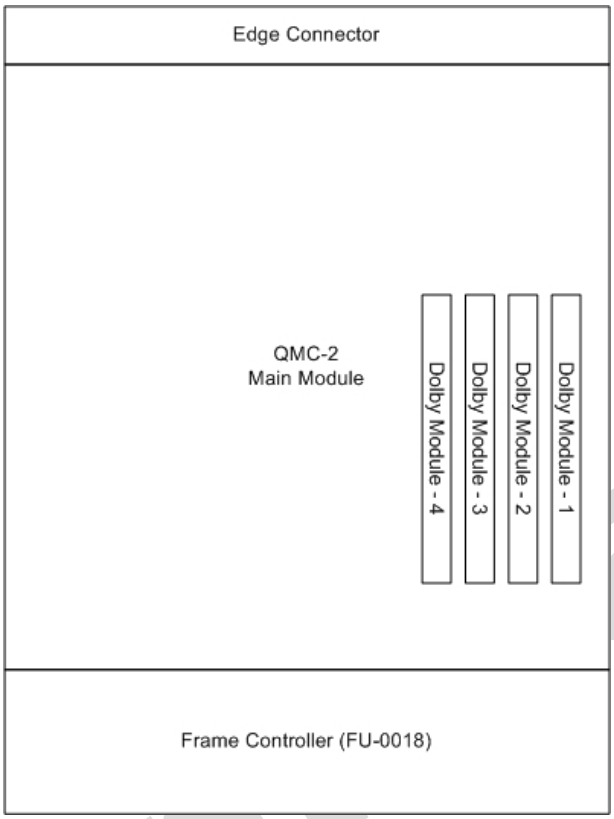
Pin	RS422/485	RS232
1	0v	0v
2	0v	0v
3	Tx+	Tx
4	n/c	n/c
5	n/c	n/c
6	Tx-	RTS
7	n/c	n/c
8	n/c	n/c

Table 2-1: Meta Data RJ45 Socket

2.8. DOLBY-E DECODER SIMM'S

The QMC-2 has positions for 4 Dolby-E SIMM's on the main module. The first two sockets, the two mounted towards the edge of the main module are labelled "Dolby Decoder" while the other two sockets that are mounted towards the center of the main module are labelled "Dolby Encoder". However, as these sockets are software configured it is possible to fit a third Dolby-E decoder into the third SIMM socket.

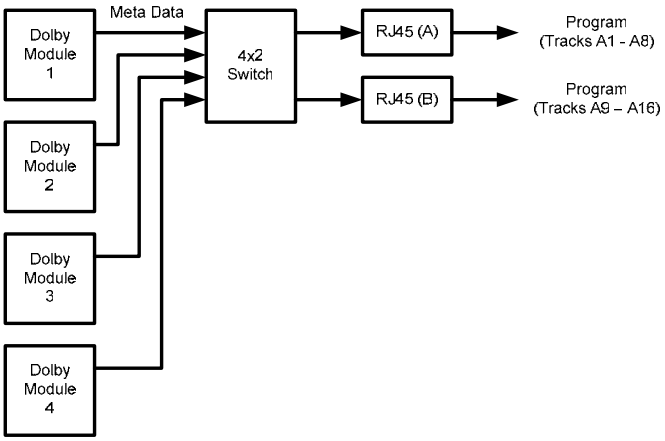
The chart below shows a selection of common combinations of Dolby E decoders and encoders that can be fitted to the QMC-2.



	Dolby Module-4	Dolby Module-3	Dolby Module-2	Dolby Module-1
Example 1	Empty	Empty	Decoder for PST	Decoder for PGM
Example 2	Empty	Decoder for Emergency	Decoder for PST	Decoder for PGM
Example 3	Encoder* for PGM	Decoder for Emergency	Decoder for PST	Decoder for PGM
Example 4	Encoder* for PGM	Empty	Decoder for PST	Decoder for PGM

Note: * Dolby Encoder option not yet available and requires XC2V4000 based main module.

As the QMC can be fitted with multiple Decoders and Encoders, the QMC needs to be configured in such a way as to ensure that only the Meta Data that relates to the program output is sent to the RJ 45 serial ports. Therefore the Meta Data is routed through a 4x2 switch thus ensuring that the correct data is sent to the correct RJ 45 serial port. This switching is handled automatically by the QMC.



2.9. DVE

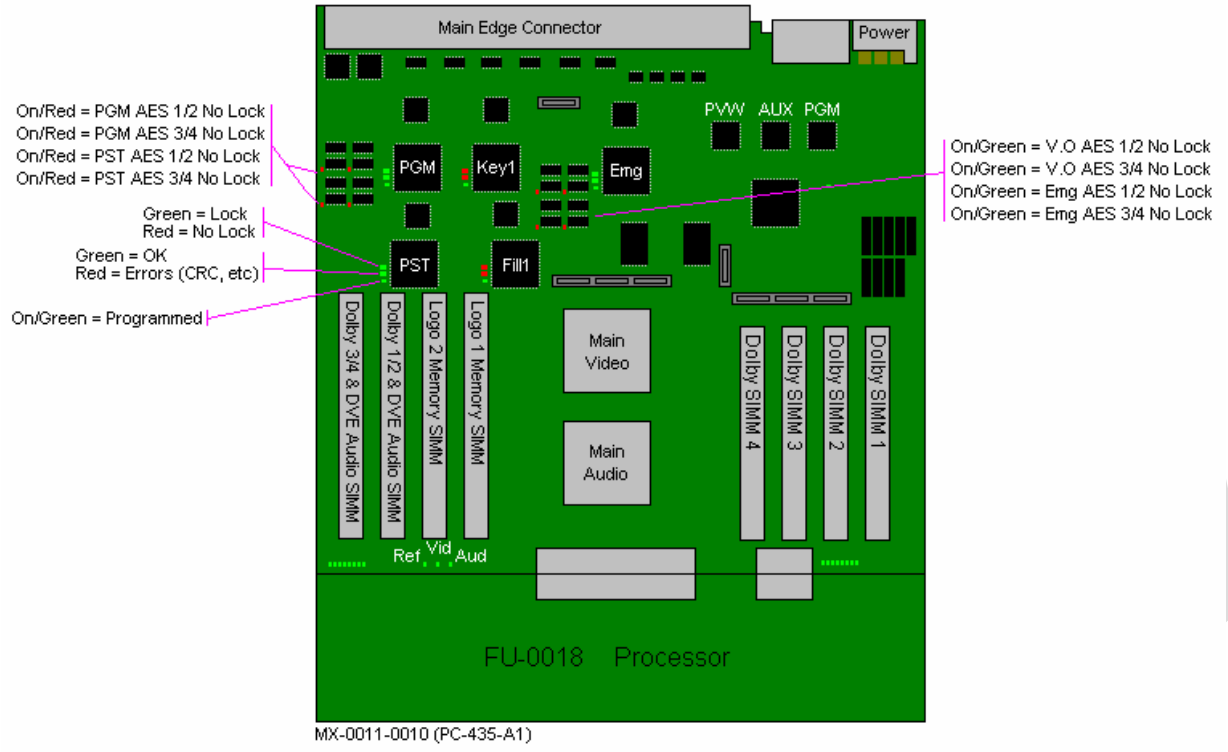
The QMC-2 has the option for fitting a DVE module providing two channels of 2 dimensional digital video effect moves (one channel on the program path and one channel on the Preview path through the QMC-2).

The DVE is a small daughter module that is mounted onto the QMC-2 main module. It provides digital video effects Size, Position, Squeeze and Crop.

The normal DVE background is derived from a separate input to the QMC-2, although this can also be configured to be one of the other inputs to the QMC-2.

The outputs from the QMC-2 are delayed by approximately 35uS with respect to the reference input. The QMCSetup horizontal timing configuration item for a channel can alter this delay, but it will also change the timing window of the inputs, which is normally ±½ line with respect to the reference input.

If a DVE module option is fitted in the frame then this delay increases to 1 frame and 35uS. When the DVE module is fitted the audio needs to be delayed by an equal amount. This is achieved by fitting a pair of video frame stores (PC-MEM-SDRAM-32MB) into the 1st and 2nd frame store socket on the main QMC module, as shown on the diagram below.



Please refer to the operational manual for further information regarding the DVE.

2.10. SERIAL PORT HUBS

In multi-channel systems there is often the requirement for one computer to configure multiple QMC channels. This is achieved using a third party Network to RS232 hub. These are available in 8 and 16 RS232 port versions.

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3. OPERATION

There is a separate User Manual that describes how to operate a QMC system. This section only gives a brief description intended to allow testing of a QMC during installation.

3.1. BASIC VIDEO CROSS FADE

Using the QMC-CP control panel it is very easy to make a manual transition. The panel can operate in two modes. In standard mode, shown below, the upper left hand row of ten buttons is the Programme Bus and the lower row is the Preview Bus.

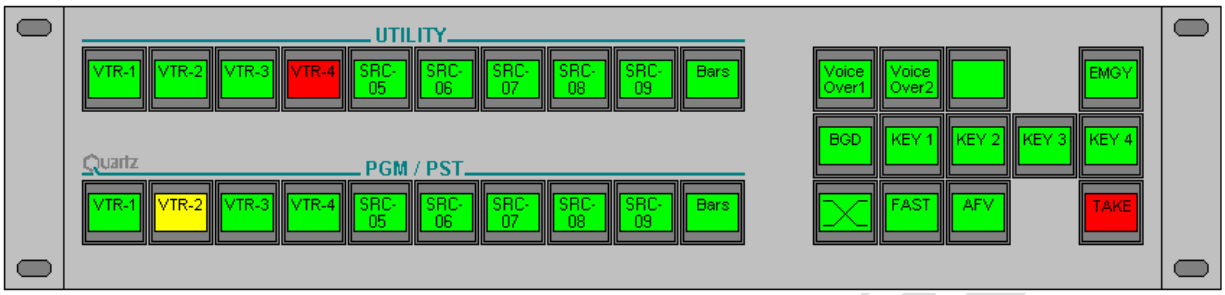
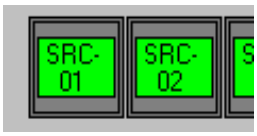


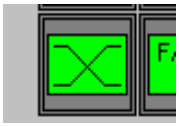
Figure 3-1: QMC-CP in Standard Mode

To make a simple cross fade:

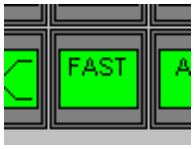
First select a new source on the lower Preview Bus. This will show orange on the preview bus of the panel and will be visible on the preview monitor.



Now select the transition type using the transition button. Options available are cross fade (shown), cut, fade-then-cut, cut-then-fade, and V fade.



Next select the transition speed. Options available are slow, medium, or fast.



Lastly, press the Take button to make the transition to the Programme output. A red button on the upper row will indicate the new programme source.

In Quartz mode, shown in Figure 3-2, the upper left hand row of ten buttons is a Utility menu. The lower row of ten buttons is a combined Programme and Preview bus, using colour to show the current status. Red indicates the current Programme Output, orange indicatedsthe Preview selection that will become the Programme selection after the Take button has been pressed.

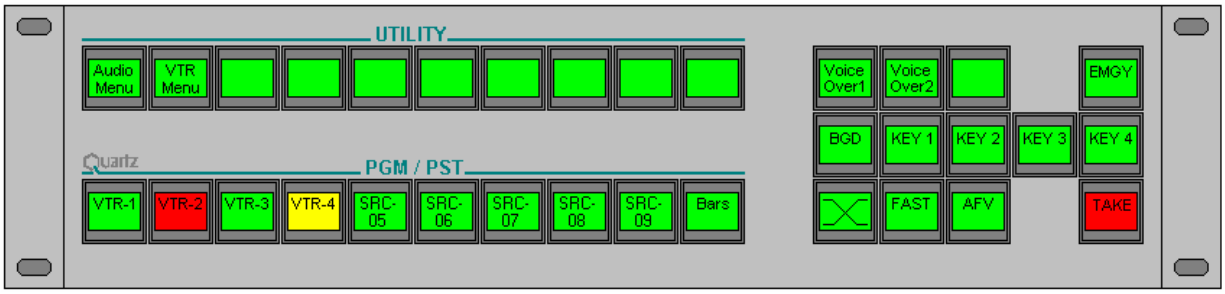
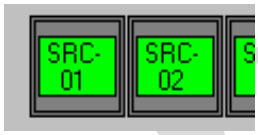


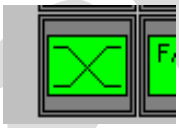
Figure 3-2: QMC-CP in Quartz Mode

To make a simple cross fade:

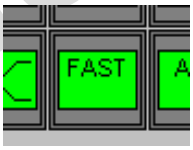
First select a new source on the lower Preview Bus. This will show orange on the preview bus of the panel and will be visible on the preview monitor. The red button indicates the current Programme selection.



Now select the transition type using transition button. Options available are cross fade (shown), cut, fade-then-cut, cut-then-fade, and V fade.



Next select the transition speed. Options available are slow, medium, or fast.



Lastly, press the Take button to make the transition to the Programme output. A red button on the lower row will indicate the new programme source.

3.2. AUDIO SIGNAL TYPE (EMBEDDED, OR AES)

Once the QMC is powered up the manual control panel QMC-CP can be used to select the audio source type. As standard the QMC-2 will always give embedded and AES outputs.

From the QMC-CP, select the *Audio Input* button. You will see two rows of buttons showing the audio signal type and the QMC inputs. Ignore the current display until one of the QMC input buttons has been selected. To change the source signal type, select the QMC source button (PGM12, PGM34, etc) and then select AES, or Embedded.

Once all the QMC sources have been setup press the *Main Menu* button to return to normal Switcher operation.

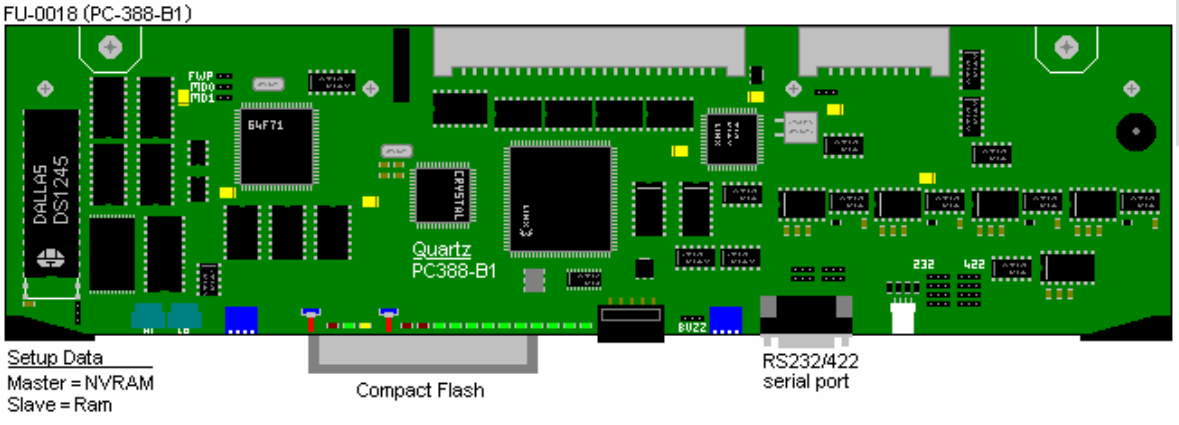
4. MAINTENANCE

4.1. COOLING FANS

The front door on the QMC-2 main frame is fitted with 12V DC cooling fans powered directly from the main power supply, PS-0013. The fans should be checked periodically to ensure there are no blockages and that the fans have a reasonable rotation speed, and are replaced if necessary.

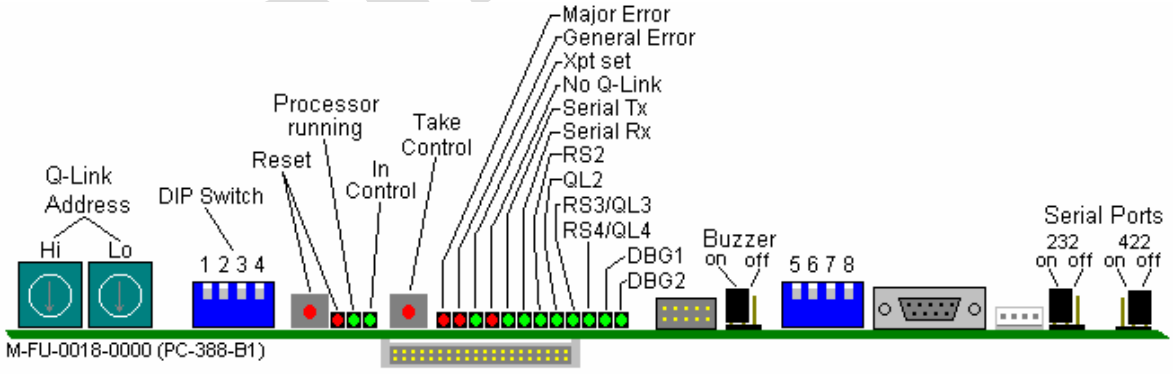
4.2. THE FU-0018 PROCESSOR MODULE

The QMC-2 uses a microprocessor control module, FU-0018, to handle the Q-Link, RS232/422 serial communications, and any setup parameters.



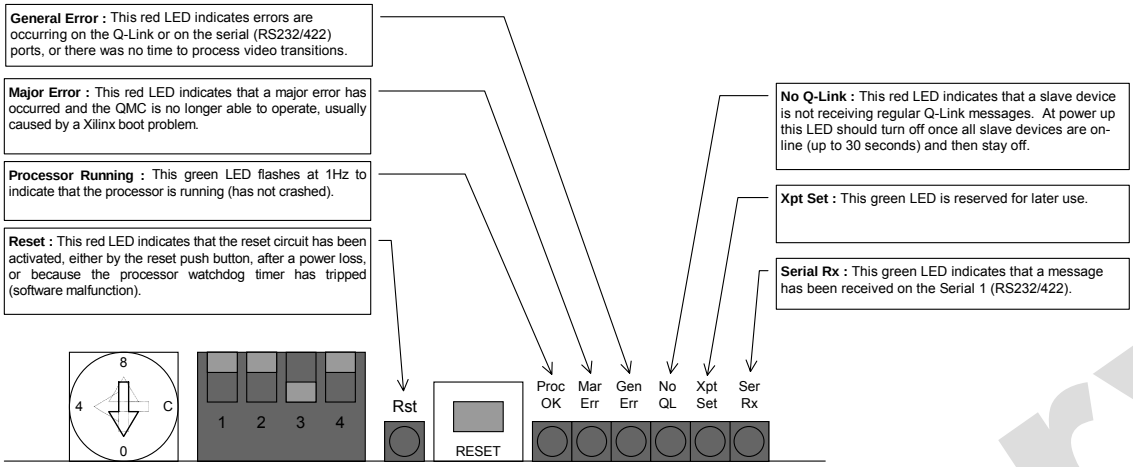
The System Software flash memory device contains all the operation firmware defining how the QMC will operate. The NVRAM stores current settings, setup data, etc.

There are switches and status LED's on the front of the FU-0018.



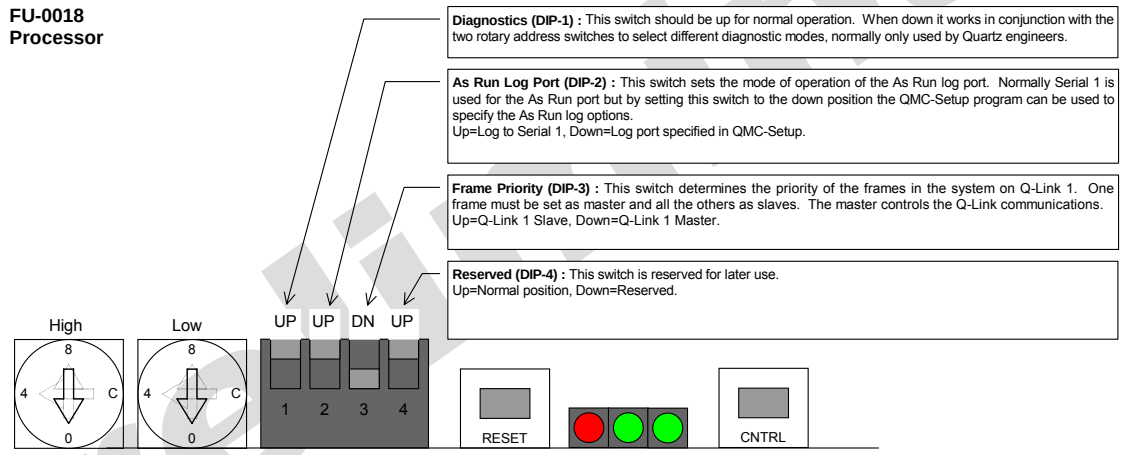
4.2.1. Processor Status LED's

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



4.2.2. Processor DIP Switches

There are four DIP switches at the front of the matrix modules. The DIP functions are:

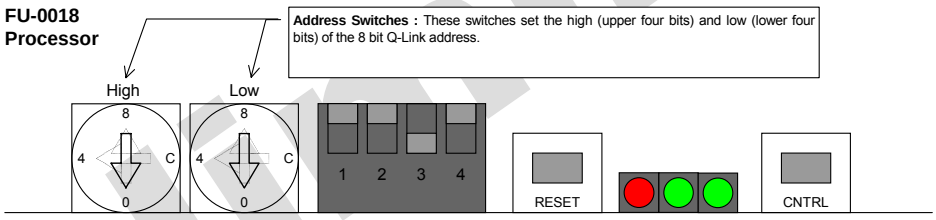


The reset switch must be pressed after changing the DIP switch. Diagnostic modes set by DIP-1 is down using the rotary address switches.

Rotary Setting	Mode
00	Serial Port Test. Will report Port 2 = 19, Port 3 = 28, Port 4 = 37, Port 5 = 46, then output a text string 'Port n' to all serial ports at 19200,N,8,1.
01	Test NVRAM by writing and reading back values. Will destroy any stored setups or logo's.
02	Test system RAM by writing and reading back values.
03	Processor I/O data/addr bus test sequence.
04	Demo mode. Does not wait for Xilinx boot sequence or rely feedback from an upstream router.
05	Reserved
FD	Reset Logo vector table (flush logo memory)
FE	Reset QMC channels 00-0F.
FF	Reset NVRAM vector table (flush all setup and logo memory).

4.2.3. Address Switches

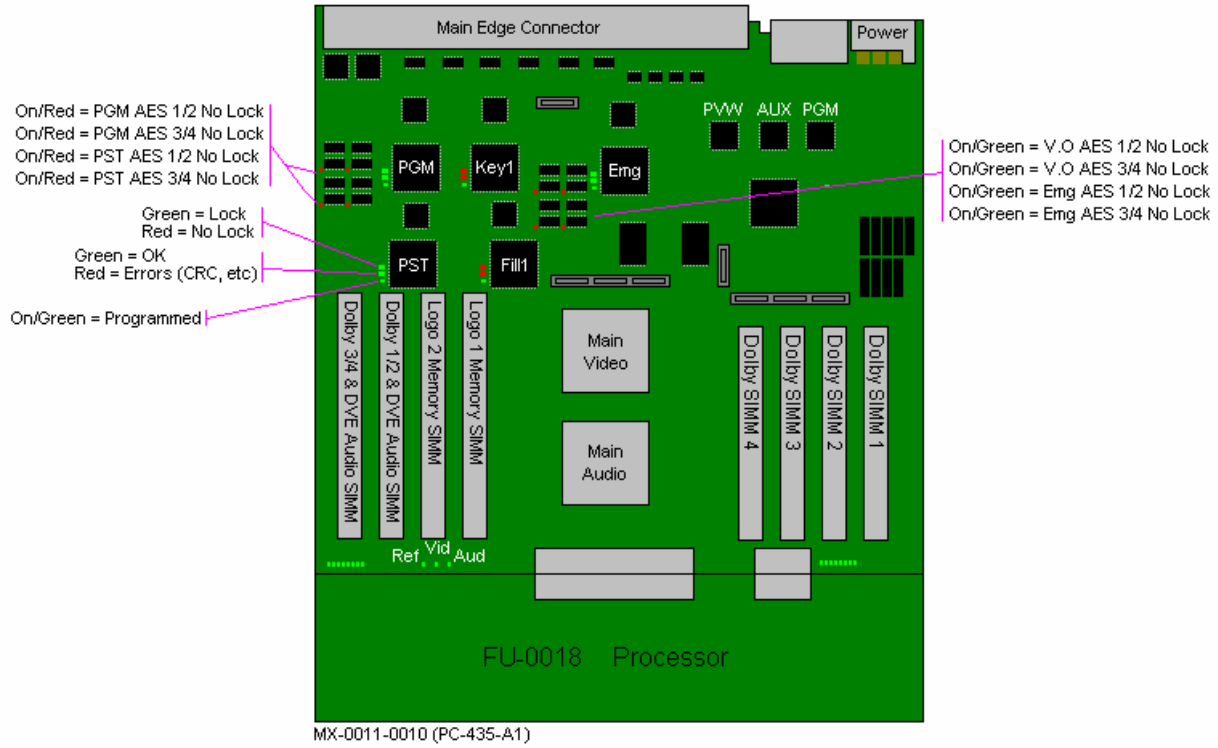
The two rotary *hex* switches on each FU-0018 determine its unique *address* in the system. This ensures that all devices have a different code allowing communications down the coaxial **Q-Link** to distinguish different units.



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

4.3. THE MX-0011 MAIN MODULE

The QMC-2 uses a single main module for all the video and audio processing.



The QMC-2 main module has 5 HD/SD inputs for PGM, PST, KEY/FILL 1 and Emergency, outputs for PGM, PVW and AUX, and all the AES inputs and outputs. A daughter module can be added to give five additional inputs of KEY/FILL2, KEY/FILL 3, and DVE background.

Each input has an 'Input Stage Programmed' status LED (green = OK) and a bi-color LED for input not present (red) and input present (green). These LED's are located close to each input stage to assist factory testing, but are also duplicated as close as possible to the modules front left hand edge.

The main module has 2 large programmable logic chips that process all the video and audio, including de-embedding, embedding, video and audio mixing, video keying, and logo insertion. The logo video memory is located in a pair of SD-RAM memory SIMM's.

The outputs are all processed by one programmable logic chip which has an 'Output Stage Programmed' status LED (green = OK) and one status LED for each output (PGM, PVW, and AUX).

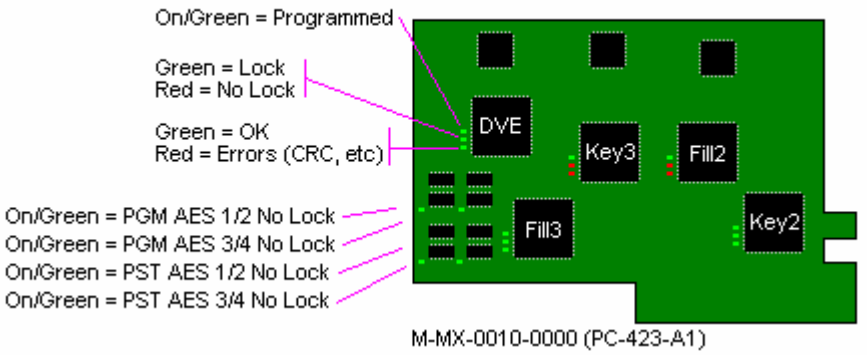
The main module has positions for 4 Dolby-E decoder SIMM's. Two SIMM's would normally be used for PGM/PST decoding, with two positions spare for Dolby-E Voice Overs or Dolby-E encoding.

5. OPTIONS

This section describes options that can be added to the QMC-2 master control switcher.

5.1.1. QMC-2-KEY

The QMC-2 is supplied as standard with one external key channel fitted. By adding a daughter module, 5 additional inputs can be added to provide 2 additional key inputs and the DVE background input.



5.1.2. QMC-2-LOGO

The QMC-2-HD is supplied as standard with NO internal logo capability. An additional software option, SD-RAM SIMM, and Compact Flash will enable the internal logo feature. Refer to section 2.6 for details on the number and size of logos that can be stored in the QMC-2-HD.

5.1.3. QMC-2-DVE

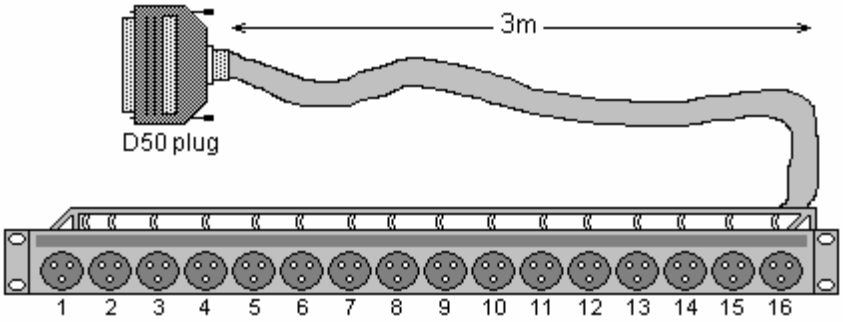
The QMC-2 is supplied as standard with NO internal DVE capability.

Dolby-E Decoder, Dolby-E Encoder, and QMC-MG not available.

5.1.4. Audio Breakout Panels (D50 to XLR)

Two audio breakout cables are available from Quartz to allow easy connection of XLR audio leads.

AK-0008 D50 to 16 XLR male connectors on a 1U rack panel
AK-0009 D50 to 16 XLR female connectors on a 1U rack panel



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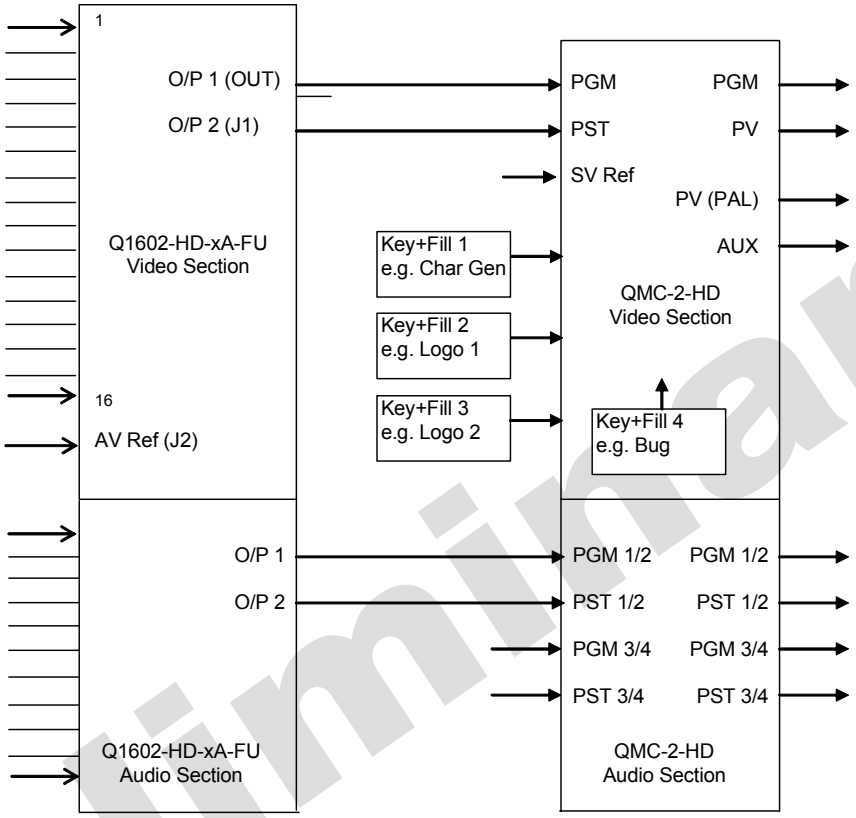
6. APPLICATIONS

6.1. USING AN EXTERNAL Q1602-SV-XA-FU ROUTER

The Quartz Q1602 is a 16 input, 2 output serial video (SDI) and audio (AES) router that can be controlled transparently from the QMC.



The following can be used to expand the sources available to the QMC.

Q1602-HD-DA-FU router (HD serial video + AES)

Note that the audio source must be selected to be either serial video embedded or AES. The audio output is always available as embedded and AES.

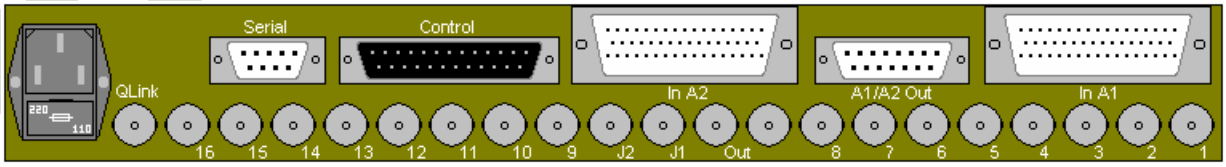


Figure 6-1: The Q1602-SV-xA Router

6.1.1. Video Connections - Using a Q1602-HD-xA-FU

The number of serial video sources can be expanded to 16 using a Q1602 router. The Q1602 is a 16 input, 2 output serial video (SDI) router that can be controlled transparently from the QMC. The 16 inputs

are allocated as required. Either of the Q1602 OUT connectors (dual O/P 1) is connected to the QMC PGM input. The Q1602 J1 connector (O P 2) is connected to the QMC PST input.

When using the Q1602 for video expansion, it must also be used for audio expansion. If embedded audio is used then no further action is required, but if AES audio is used then audio wiring into and out of the Q1602 must be provided.

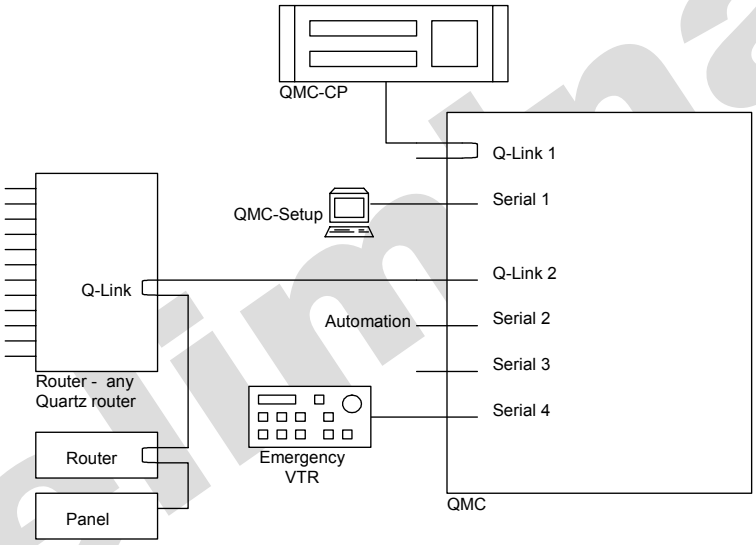
6.1.2. Audio Connections - AES using a Q1602-HD-DA-FU

The number of AES audio sources can be expanded to 16 using a Q1602-SV-DA-FU router.

For video connections see section 6.1.1. The 16 AES audio inputs are allocated as required. The Q1602 audio outputs are on a D15 connector. Wire the Q1602 AES output 1 to the QMC AES PGM 1/2 input. Wire the Q1602 AES output 2 to the QMC PST 1/2 input. For two channel AES (A1 to A4) a second Q1602 router is required.

6.2. VTR CONTROL

Once the QMC-2 is powered up the manual control panel QMC-CP can be used to control a number of VTR's using RS422 control.



To use this function the QMC-2 must first have a serial port configured for VTR control and set to RS422 mode. Then select the VTR Menu, select the VTR to control (if multiple VTR configured), and then select the control function such as play, rewind, or stop.

7. TECHNICAL DESCRIPTION

7.1. SPECIFICATIONS

7.1.1. Video Connections

Inputs:

7 Standard: Program, Preset, Keyer-1 Fill, Keyer-1 Key, Emergency, Program Bypass, Auxiliary Bypass

5 Optional: Keyer-2 Fill, Keyer-2 Key, Keyer-3 Fill, Keyer-3 Key, DVE Background

Outputs: Program, Preview, Auxiliary

7.1.2. Standard Definition

Inputs: *apart from bypass inputs*

Signals Supported: SMPTE 259M
Signal Level: 800mV p-p nominal
Impedance: 75Ω terminating
Return Loss: 15dB typical, 5 - 270MHz
Cable Equalization: *Belden 8281*
BBC PSF1/2: 250m min
BBC PSF1/3: 150m min

Timing Window: ±½ line w.r.t. Reference input
Connectors: BNC, 75Ω terminating

Outputs:

Signal Level: 800mV p-p ±10%
Impedance: 75Ω terminating
Return Loss: 15dB typical, 5 - 270MHz
DC Offset: 0 ±0.5V
Rise/Fall Time: < 0.4ns
Output Jitter: 0.2UI p-p
Connectors: BNC, 75Ω

Switching Reference:

Reference Input: Analog 525/625
Signal Level: 1V p-p ±3dB
Connector: BNC, 75Ω with looping connector

7.1.3. High Definition

Inputs: *apart from bypass*

Signals Supported: SMPTE 292M-1998
Signal Level: 800mV p-p nominal
Impedance: 75Ω terminating
Return Loss: 15dB typical, 5 - 1485MHz
Cable Equalization:
Belden 1694A: 90m min

Timing Window: ±½ line w.r.t. Reference input
Connectors: BNC, 75Ω terminating

Outputs:
Signal Level: 800mV p-p ±10%
Impedance: 75Ω terminating
Return Loss: 15dB typical, 5 - 1485MHz
DC Offset: 0 ±0.5V
Connectors: BNC, 75Ω
Rise/Fall Times: < 0.270ns
Output Jitter: 0.2UI p-p at 100kHz, 1UI at 10Hz

Switching Reference:
Reference Input (HD/SD): Analog 525/625 or Tri-level 50/59.94/60Hz
Signal Level: 1V p-p ±3dB
Connector: BNC, 75Ω with looping connector

7.1.4. Audio Connections (Balanced Frame)

Type Balanced frame
Inputs
18 Standard Program (A1/A2, A3/A4, A5/A6, A7/A8), Preset (A1/A2, A3/A4, A5/A6, A7/A8), Emergency (A1/A2, A3/A4, A5/A6, A7/A8), Voice Over-1 (A1/A2, A3/A4), Voice Over-2 (A1/A2, A3/A4), Program Bypass (A1/A2, A3/A4)
Signals Supported: AES-3
Signal Frequency: 32 - 96kHz
Audio Resolution: 24 bit
Signal Level: 200mV - 10V p-p
Impedance: 110Ω terminating
Return Loss: 0.1 - 6MHz: > 20dB
Connectors: D50 female

Outputs
8 Standard: Program (A1/A2, A3/A4, A5/A6, A7/A8), Preview (A1/A2, A3/A4, A5/A6, A7/A8)
Signal Level: 2V - 7V, nominally 5V p-p ±10%
Signal Frequency: 48kHz
Impedance: 110Ω
Return Loss: 20dB typical, 0.1 - 6MHz
Intrinsic Jitter: < 0.025UI
Connectors: D50 female

7.1.5. Audio Connections (Unbalanced Frame)

Type: Un-balanced frame
Inputs:
10 Standard: Program (A1/A2, A3/A4), Preset (A1/A2, A3/A4), Emergency (A1/A2, A3/A4), Voice Over-1 (A1/A2), Voice Over-2 (A1/A2), Program Bypass (A1/A2, A3/A4)
Signals Supported: AES-3id, SMPTE 276M unbalanced
Signal Frequency: 32 - 96kHz
Audio Resolution: 24 bit

Signal Level: 320mV - 1.2V p-p
Impedance: 75Ω terminating
Return Loss: > 15dB, 0.1 - 6MHz
Connectors: BNC, 75Ω

Outputs

8 Standard: Program (A1/A2, A3/A4), Preview (A1/A2, A3/A4), Program (A1/A2, A3/A4)
Signal Level: 1V p-p ±20%
Signal Frequency: 48kHz
Impedance: 75Ω
Return Loss: 15dB typical, 0.1 - 6MHz
Intrinsic Jitter: < 0.025UI
Connectors: BNC

7.1.6. Metadata Connections (Dolby E decoder option)

Serial: 2 x 8 pin RJ45 RS232/ RS422 link selectable

7.1.7. Control

Q-Link: 2 x BNC with loop-through connections, 75Ω (max length 500m)
Serial: 1 x D9 female, 3 x 8 pin RJ45, RS232/RS422 link selectable.
Ethernet: 10BaseT, 8 pin RJ45
Tally: 1 x D25 female
Inputs: 7 or 8 TTL inputs, < 0.8V for logic low, > 3.5V for logic high
Outputs: 7 or 8 normally open contact pairs, Contact rating 24A @ 0.5A DC resistive load
Bypass Control and Alarm: 4 way Klippon, mating connector supplied

7.1.8. Physical

Height : 3RU, 133mm
Width: 19" Rack mount
Depth: 485mm
Weight:
Single Channel: 9kg
Dual Channel: 10.5kg

Operating Temperature: 0 - 40°C
Ventilation: Fan cooled, air drawn from front, exhaust at rear and sides

7.1.9. Electrical

Supply: 90-264V AC universal 50/60Hz
Power :
Single Channel: 125 Watts
Dual Channel: 250 Watts

Backup: Optional
EMC: Meets CE requirements

7.2. MAIN MODULE: M-MX-0011-0000

The main module, M-MX-0011-0000 (PC-435) performs the majority of the video and audio processing. The majority of the main module functionality is controlled by Xilinx programmable logic chips. These are programmed at the factory using the JTAG programming system with a Xilinx supplied program called iMPACT and a PC parallel printer port to JTAG adaptor.

The iMPACT screen for a main module with various options looks similar to the following image:

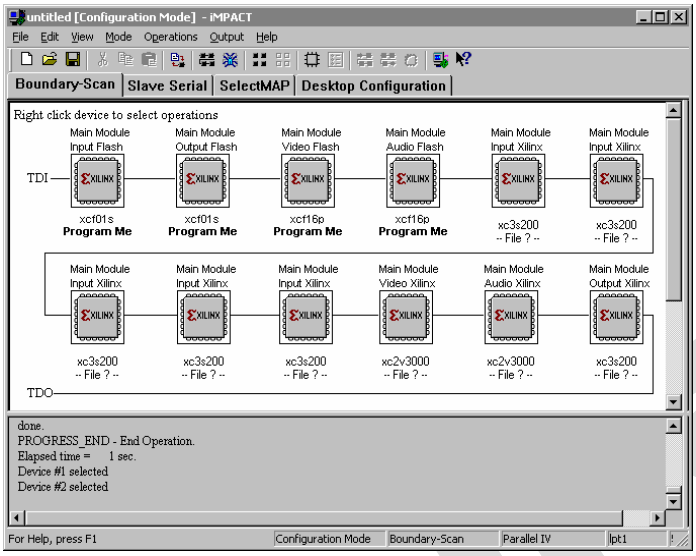


Figure 7-1: PC-435-A1 Main Module only, No Input Expansion, No DVE

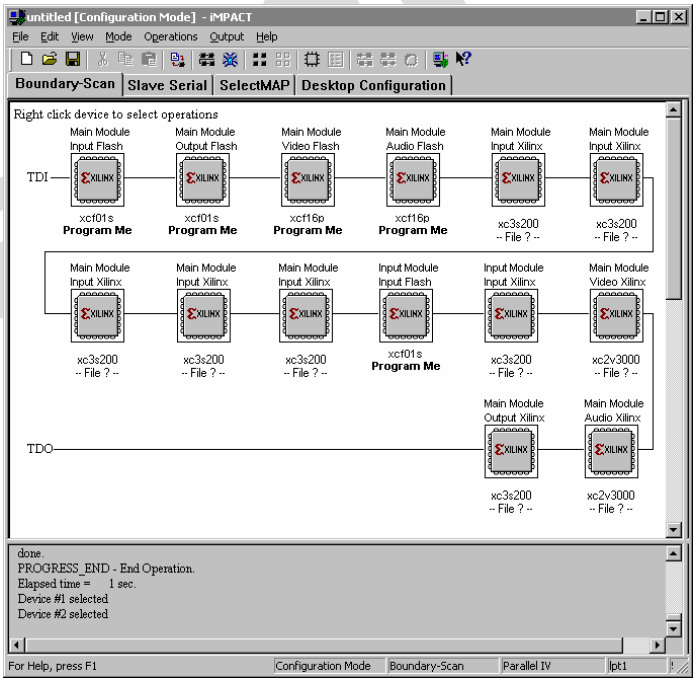


Figure 7-2: PC-435-A1 Main Module with Input Expansion, No DVE

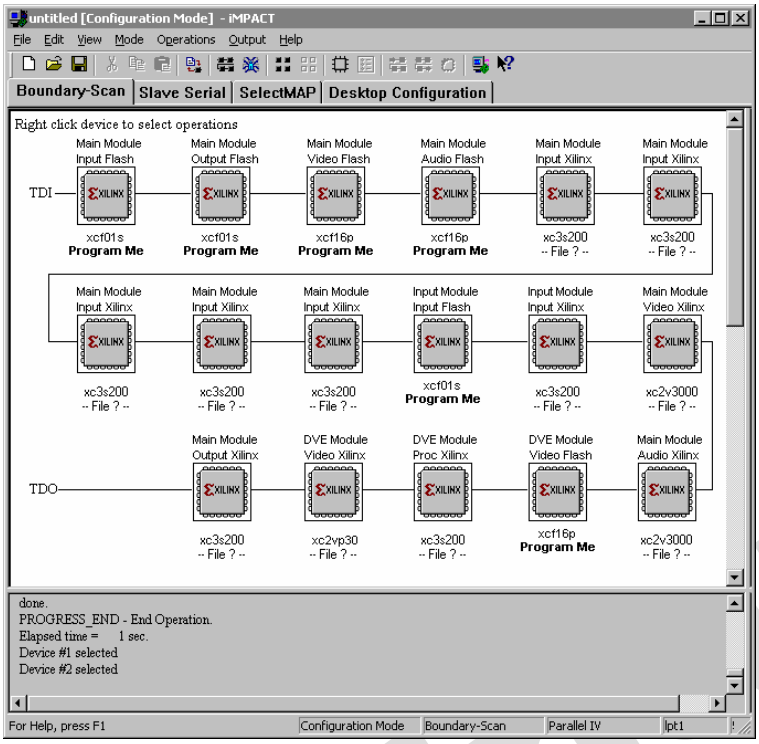


Figure 7-3: PC-435-A1 Main Module with Input Expansion and DVE

Only the Flash chips are programmed, all other devices appear in the JTAG chain for development purposes only.

The appropriate files are attached to the Flash memory devices and then programmed. Current device files are:

PC435-A1: SD/HD variant

F105	V1.3	Input for main and daughter
F106	V1.1a	Output
F107	V1.1d	Video
F108	V1.1c	Audio
F111		DVE

PC435-A1: HD Only variant

F099	V1.0a	Input for main and daughter
F100	V1.0	Output
F101	V1.2d	Video
F102	V1.1b	Audio
F111		DVE

PC435-X1

F085	V1.1	Input for main and daughter
F086	V1.0	Output
F087	V1.2b	Video
F088	V1.1c	Audio
		DVE (not supported)

7.3. INPUT VIDEO EXPANSION: M-MX-0010-0000

The video input expansion module, M-MX-0010-0000 (PC-423-A1) receives the incoming video and performs serial-to-parallel conversion and line synchronisation.

7.4. LOGO GENERATOR STORAGE

The QMC-2 has two areas of RAM used to store the logos. The first is the Compact Flash storage, which is currently 256M bytes but can change depending on the size of Compact Flash used. The Compact Flash uses the PC/DOS/FAT filing system and can therefore have logos loaded on any Windows PC. The number of logos that can be stored in this area depends on the size and complexity of the logo. This will range from 16000 small sized logos to 150-350 full frame complex logos, typical examples are shown below:

Typical SD Logo	SD Size	SD Memory	Typical SD Qty
Small bug	40x20 pixels	1K-3K	64000
Medium bug	80x40 pixels	4K-12K	20000
Large bug	120x80 pixels	11K-34K	7000
Small text banner	280x20 pixels	7K-20K	12000
Medium text banner	320x40 pixels	15K-45K	5500
Large text banner	440x60 pixels	31K-93K	2500
Full screen logo	720x575	483K-1449K	170

Typical HD Logo	HD Size	HD Memory	Typical HD Qty
Small bug	120x40 pixels	6K-18K	10000
Medium bug	240x80 pixels	24K-72K	3300
Large bug	360x160 pixels	66K-204K	1150
Small text banner	840x40 pixels	42K-120K	2000
Medium text banner	960x80 pixels	156K-270K	900
Large text banner	1320x120 pixels	186K-558K	400
Full screen logo	1920x1080	2898K-8694K	28

The second storage area is the on-screen video RAM which is used to display the logos on the video output. This is currently 64Mbytes but stores the logos in an uncompressed format. Each pixel takes up 4 bytes. Therefore, a logo of 100x100 will take 40K (10000 x 4). A full frame of logo will use (720x576) 1.6Mbytes of storage.

7.5. CONNECTOR SCHEDULES

7.5.1. Tally I/O: Parallel 25-way D-type socket

Pin	Type	Pin	Type	Pin	Type
1	Relay 1	10	Relay 5	19	TTL i/o 4
2	Relay 1	11	Relay 6	20	TTL i/o 3
3	Relay 2	12	Relay 6	21	TTL i/o 2
4	Relay 2	13	Relay 7	22	+5v
5	Relay 3	14	Relay 7	23	TTL i/o 1
6	Relay 3	15	TTL i/o 8 (note)	24	0v
7	Relay 4	16	TTL i/o 7 (note)	25	Chassis
8	Relay 4	17	TTL i/o 6		
9	Relay 5	18	TTL i/o 5		

Note: There is a software configurable option to convert TTL tally 7,8 to Relay tally 8.

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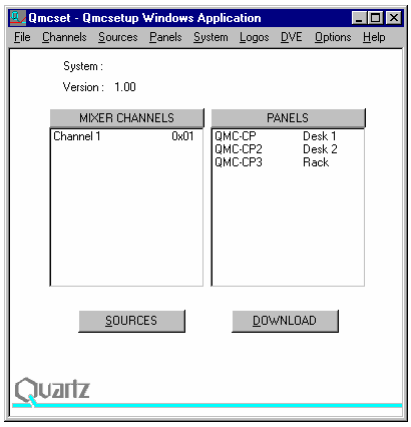
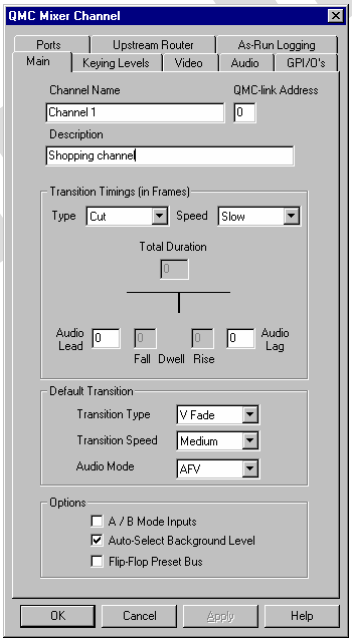
8. SOFTWARE

This section describes the software used with the Switcher. Every QMC is supplied with the QMC-Setup software, which is a PC Windows package. The following screens were taken from V1.18 of the software.



The Switcher Channels section lists all the QMC Switchers being used in a multi-channel system. A single channel system will only show one QMC channel. Any manual QMC-CP control panels are shown under the panels section.

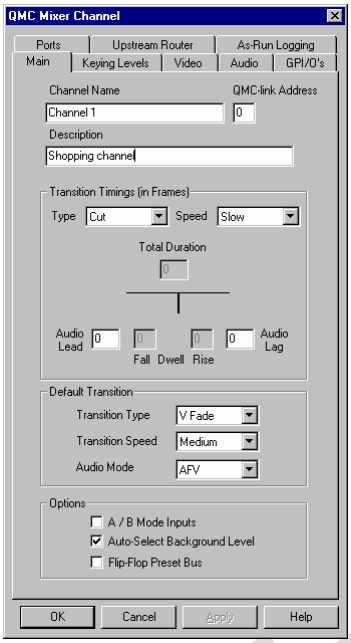
Select a Switcher channel for editing by double clicking on the required channel to show the following dialog.



Important: The remainder of this section gives a brief guide to QMC-Setup and some of its capabilities. However you should treat the QMC-Setup PC help as the definitive source of information. The **Help** option can be invoked from any dialog screen by pressing the F1 key or using the on-screen **Help** button.

8.1. CONFIGURING THE MAIN CHANNEL FUNCTIONS

The QMC main channel functions are configured from the dialog shown below.

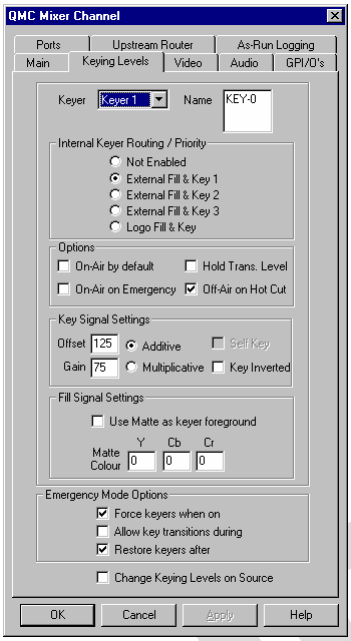


The parameters that can be configured are:

- **Channel Name:** Each Channel should be given a descriptive name.
- **QMC-Link Address:** This is the Q-Link address of the QMC channel and should match the Q-Link address set on the processor module.
- **Description:** Each Switcher channel can be given a further description to help identify it.
- **Transition Timings:** For each of the transition types (Cut, V-Fade, etc) set parameters for each of the four Speeds (Slow, Medium, Fast). The timing will be used later from the manual control panels. The timing diagram graphic changes for each transition type to assist you in setting the timings.
- **Default Transition:** This is the transition type that will be first displayed on a manual control panel at power up.
- **Options:** Used to set A/B Switcher mode, and various other functions.

8.2. CONFIGURING THE KEYING LEVEL FUNCTIONS

The QMC supports four levels of keying, 3 external key/fill signals and the internal logo generator. Not all of these options may be installed in your QMC, therefore you must check hardware setup before configuration. The Keyer functions are configured from the dialog shown below.



The Keyer parameters that can be configured are:

- **Name:** Each Keyer should be given a descriptive name and this will be displayed on the manual control panels.
- **Internal Keyer Routing/Priority:** The four internal Keyers, Keyer-1, Keyer-2, etc selected on the drop down box can be connected to any of the keyer sources, external KEY/FILL 1, Logo, etc. Keyer-1 has the lowest priority, then Keyer-2, then Keyer-3, then Keyer-4. A lower priority Keyer will always be displayed below a higher priority Keyer occupying the same area of the display.

8.3. CONFIGURING SERIAL PORTS

The QMC-2 has 4 serial ports that can be independently configured. Serial-1 is nearly always used for the QMC-Setup PC so this port should NOT be re-configured unless you make a note of the settings. If the port is accidentally re-configured and you cannot establish communication with the QMC then refer to section 4.2.2.

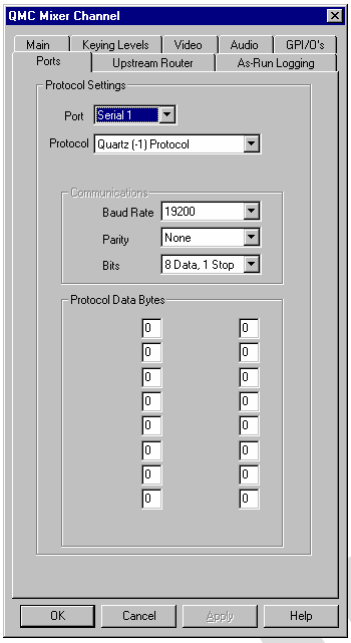
The QMC is normally controlling an upstream router on one of its serial ports.

Before configuring the Serial ports, clearly plan as to which port is to be used for each function, a typical setup would be:

Serial-1	D9	QMC-Setup, As-Run logging
Serial-2	RJ45	Automation
Serial-3	RJ45	Up-stream router
Serial-4	RJ45	Spare, VTR control

From the QMCSetup main dialog, select the QMC channel that is to be configured.

First select the Ports tab and configure the serial port to be used, usually Serial 2, 3, or 4, leaving Serial 1 free for connection to the QMCSetup computer.



8.4. CONFIGURING AN UPSTREAM ROUTER

The QMC can control an upstream router to increase the number of sources available to the PGM and PST inputs, see section 6. The QMC must be configured to control the upstream router and this involves several separate settings:

1. Decide whether you will use a serial connection or Q-Link (Quartz routers only)
2. Configure the upstream router
3. Tell the QMC which serial port it is to use, the protocol, and which upstream router destinations it is to control.
4. Define the source names for the upstream router.
5. Test the upstream router

1. Decide on the connection, Serial or Q-Link

Serial RS232 or RS422 can be used with nearly all upstream routers. Serial is the best approach but the QMC must support the same control protocol as the upstream router.

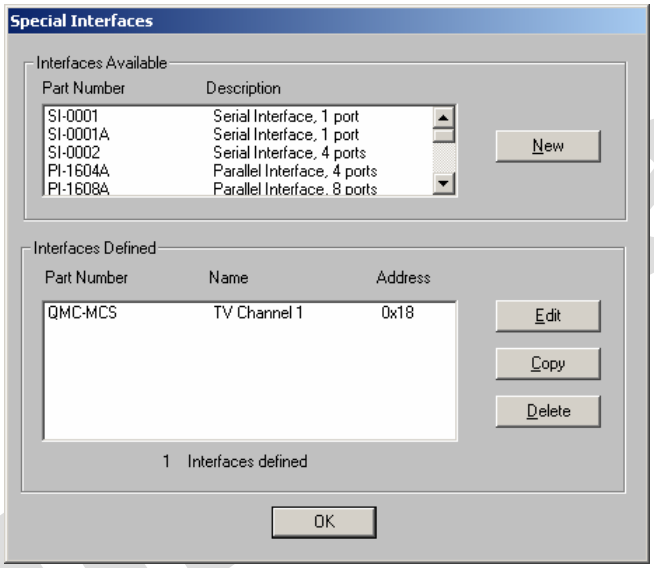
The Quartz Q-Link system can be used but this is only applicable where the upstream routing system has a small number of devices (less than 8) on the Q-Link, due to timing constraints. The QMC must use Q-Link-2.

2. Configure the Upstream Router

If the upstream router is a Quartz router using a RS232/422 serial port, then it is best to use a port on the master router (DIP-3 down). Set the router serial port to either RS232 or RS422 and confirm in the router configuration that the serial port is configured for "-1 Quartz Standard" protocol using the Frame, Properties dialog. Prepare a suitable serial cable.

If the upstream router is a non-Quartz router using a RS232/422 serial port, then you will need to refer to the manufacturers manual to check whether the port is in RS232 or RS422 mode and which protocol is being used. Prepare a suitable serial cable.

If the upstream router is a Quartz router using Q-Link, then a QMC-HD/SD must be added to the router setup file using WinSetup. Give the QMC-HD/SD a Q-Link address and make a note of it.

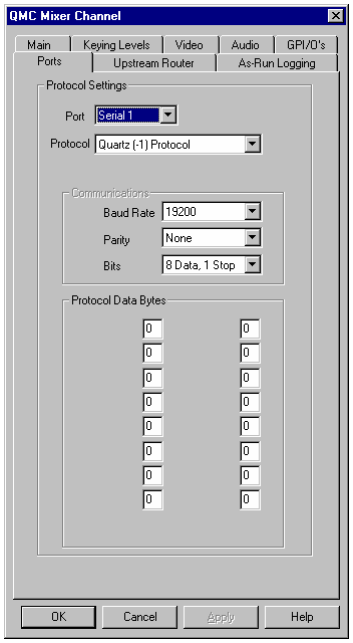


3. Tell the QMC which Serial Port is to be used

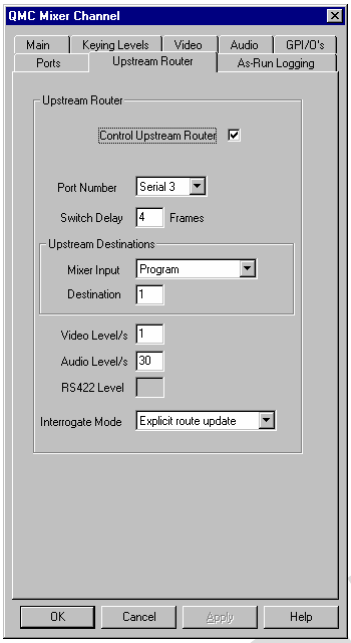
From the QMCSetup main dialog, select the QMC channel that is to be configured.

If a serial R232/422 port is being used, select the Ports tab and configure the serial port to be used, usually Serial 2, 3, or 4, leaving Serial 1 free for connection to the QMCSetup computer.

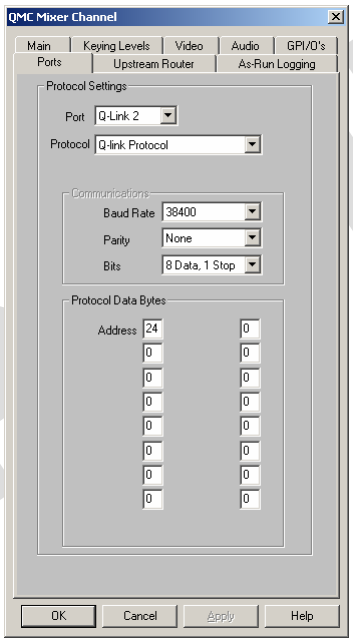
Then select the Upstream Router tab and select the serial port and define the upstream router destinations that are to be used.

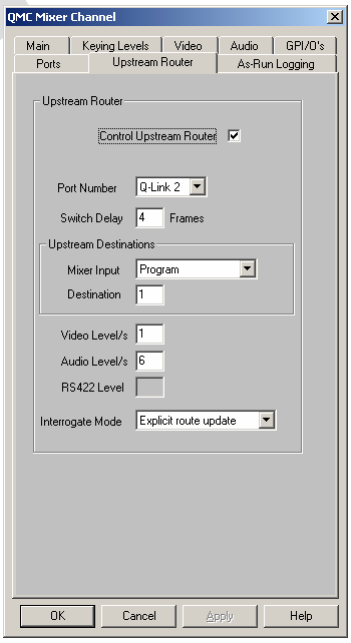


If Q-Link is being used, select the Ports tab and configure Q-Link-2. Remember to add the Q-Link address of the QMC-HD/SD as specified in the router setup. This address is entered into the first Protocol Data Byte **but must be entered as a decimal number** (18 hex = 24 decimal).



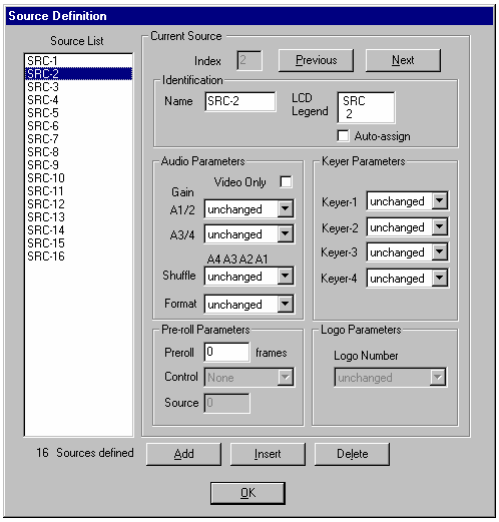
Then select the Upstream Router tab and select Q-Link-2. Define the upstream router destinations that are to be used, and set the correct level numbers





4. Define the source names for the upstream router

From the QMCSetup main dialog, select the Sources button and then enter the names of the upstream router sources.

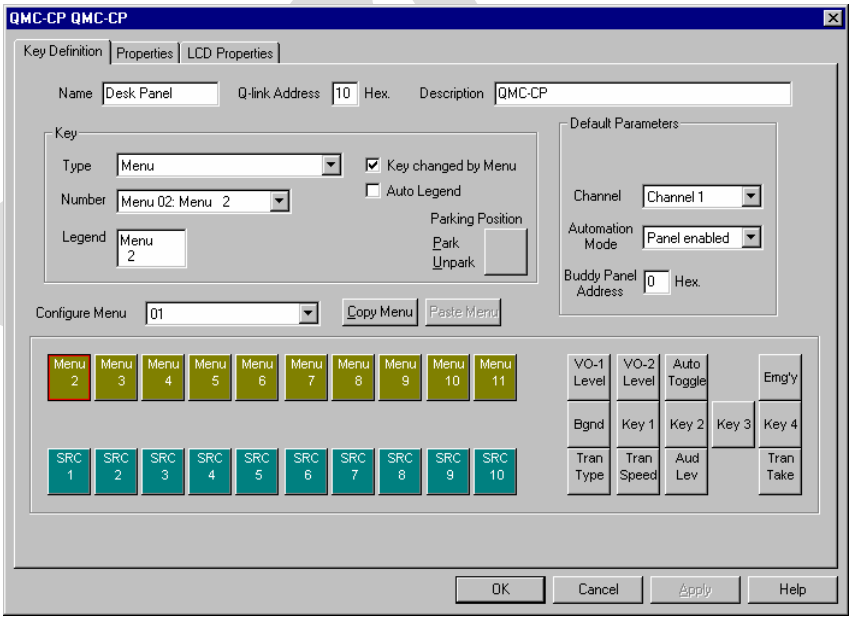


5. Test the upstream router

Connect the QMC to the upstream router using either the serial cable or Q-Link cable. Go to the QMC manual control panel and change sources on the preview bus. Sources should be selected on the upstream router and the panel buttons should track the selected source.

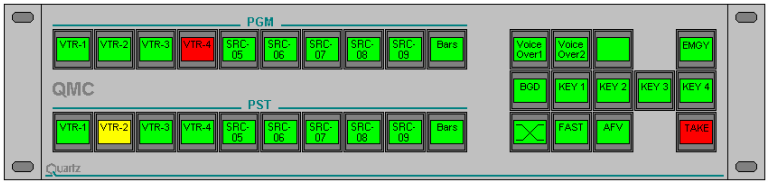
8.5. CONFIGURING CONTROL PANELS

The QMC supports local control panels that can operate individually or in pairs, and also supports roving panels in a multi-channel system. A typical panel configuration dialog is shown below.

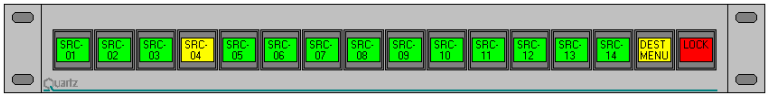


The QMC system currently supports four types of control panels.

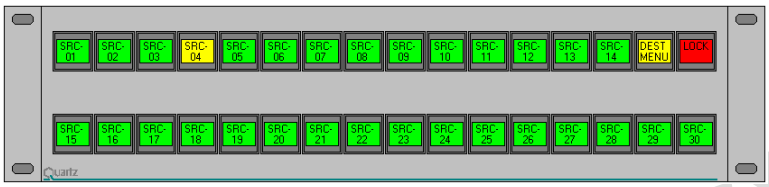
QMC-CPA
Setup name: QMC-CP



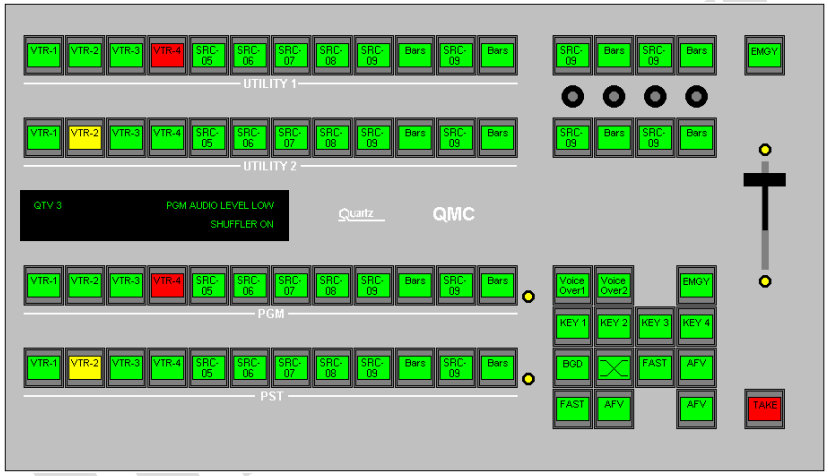
QMC-CP1000A
Setup name: QMC-CP2



QMC-CP2032A
Setup name: QMC-CP3



QMC-CP-FS-FP



To add a new panel:

- From the QMC-Setup main dialog, press the **Panels** button, press the **New** button, then select the panel type you want to add.
- Give the panel a specific name that describes its function or location. Further information can be added to the Description field.
- Set the Q-Link address to be the same as the real panel, noting that no two panels can have the same address.
- Set the QMC channel that the panel is to control.

To configure an existing panel:

- From the QMC-Setup main dialog, select the Panel you want to configure.
- To configure a button, first select the button in the lower panel graphic area. The current function assigned to that button will be displayed in the Key section. Now change the button to the desired function.
- The Park position can be used to temporarily hold a button while other buttons are moved around on the panel. Press ‘P’ to park and ‘U’ to un-park

To configure a two panel set:

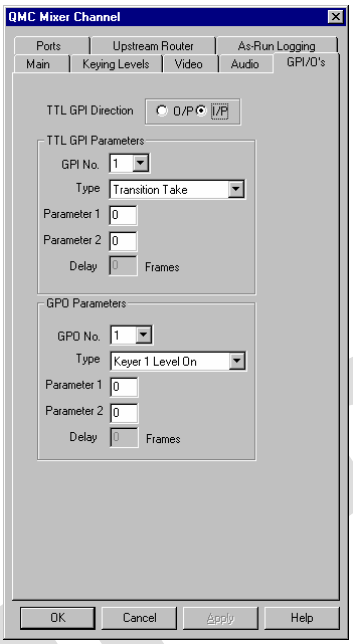
- First add both panels to the setup using the methods described above.
- On each panel set the Buddy Panel Address to be that of the associated panel.

8.6. CONFIGURING THE TALLY GPI'S

The QMC-2 has a general purpose Tally/GPI connector that is configurable from QMC-Setup.

From the QMC-Setup main dialog, select the QMC channel that is to be configured.

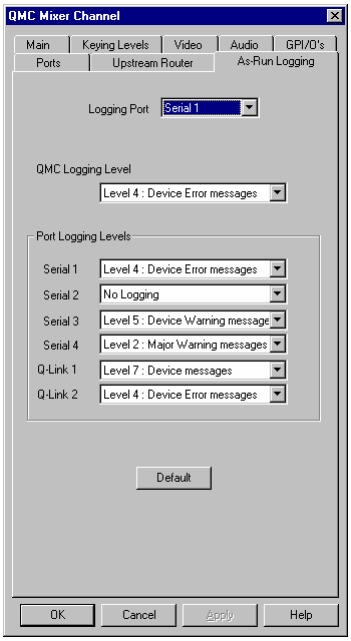
Select the GPI/O's tab and configure the TTL GPI (inputs or outputs) and the GPO (outputs).



8.7. CONFIGURING AS-RUN LOGGING

The QMC can be configured from QMC-Setup to log different levels of activity. This is normally used during installation to confirm correct operation of the Automation system or could be used during live operation to track down unexplained Switcher effects, sometimes caused by operator error.

From the QMC-Setup main dialog, select the QMC channel that is to be configured. Then select the As-Run Logging tab. The As-Run dialog is shown below.



The As-Run log would normally be configured to log to port Serial-1 as this usually has the QMC-Setup PC connected. As-Run logging should normally be turned off. Do not set an unnecessarily high level of logging, as this will eventually slow down the QMC operation.

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