Mentor CX
Mentor Automatic Changeover
User Guide

ISSUE 1.3

TRILOGY COMMUNICATIONS LIMITED
2000 Beach Drive
Cambridge Research Park
Cambridge CB25 9TP
United Kingdom
www.trilogycomms.com

DOCUMENT NUMBER **33190600.docx** **ISSUE 1.3**

Issue	Date	Reason for Change	Approved
1.0	29 October 2018	Initial release	
1.1	4 December 2018	Safety notice updated	
1.2	5 July 2019	New contact address	
1.3	14 May 2020	Correct front panel indicators	

CONTENTS

1. APPLICATION

1.1 INTRODUCTION

The Trilogy 331-00-xx Mentor CX Changeover Unit is designed to complement the Trilogy RG Reference Generator. The Mentor product family is suitable for any digital or mixed format environment where a high quality digital SPG is required. Mentor CX provides a manual or automatic changeover between a pair of Mentor RG generators, providing the maximum possible security for on-air applications.

The following features and facilities are offered:

- Compact 1RU rack mounting package matching the Mentor RG
- Single or redundant dual power supplies
- Base Mentor CX provides:
    - 4 channels which monitor and switch Black and burst, Tri-Level-Sync, AES/DARS, word clock, 10 MHz and 27 MHz
    - 2 channels which monitor and switch SDI – SD/HD/3G signals but do not detect or report the standard
    - Monitoring and switching of balanced AES and LTC signals
- Comprehensive range of expansion modules, up to a total of 18 channels
- Both actively monitored and passively switched channels for a range of signals
- Front panel control and status indication
- Vector management, tightly integrated with Mentor RG provides full setup, monitoring and control

In addition, an internal redundant power supply is available to increase MTBF, or to allow AC power diversity in critical applications. An Ethernet port is provided for the Vector browser-based management feature and to facilitate software upgrades.

This User Guide concentrates on the operational aspects of the Mentor CX and includes a full technical specification.

1.2 VECTOR - BROWSER BASED MANAGEMENT

A browser-based configuration tool is provided, offering:

- Initial setup and management of Mentor CX
- Status overview of the entire reference chain comprising Mentor CX and the associated pair of Mentor RG generators
- Control - including choice of manual and automatic modes

Please see section 4.2 of this manual for information on getting started with Vector.

1.3 RELATED DOCUMENTS

Document	*Description*
33190600	Mentor CX User Guide - *This Document*
36090602	Quick Start Guide: Mentor RG plus Mentor CX
36090600	Mentor RG User Guide

1.4 Available Features and Options

Six option card slots are available. The Mentor CX auto detects which type of option card is fitted and presents the user with appropriate on-screen options within Vector.

Several additional hardware options are available for the Mentor CX. At the time of writing in July 2018, these are:

Part Code	*Description*	*Note*
331-00-00	Mentor CX Changeover unit	Inclusive of one PSU module and no option modules
331-20-00	Two channel Universal CO option module	
331-21-00	Two channel Passive CO option module	
331-22-00	Two channel SD/HD/3G video CO option module	
331-50-00	PSU module	

1.5 Technical Support

UK & International

Please contact Trilogy at the UK headquarters.

Trilogy Communications Ltd.
2000 Beach Drive
Cambridge Research Park
Cambridge CB25 9TP
United Kingdom
Tel: +44 (0) 1264 384000
www.trilogycomms.com

Alternatively, please contact your reseller. Contact details may be found at www.trilogycomms.com.

1.6 Warranty

Conditions of the warranty may vary according to your terms of purchase. Please consult your sales documentation or if in doubt, contact your original supplier or Trilogy, quoting date of purchase and unit serial number.

2. INSTALLATION

2.1 UNPACKING

Carefully unpack the unit from its transit material and check the unit for signs of damage. Check the contents of the box against our despatch note and your original order to ensure that you have received the correct parts.

If the unit has been damaged or does not match your order, immediately contact your supplier or Trilogy at the address given at the front of this guide.

2.2 RACK MOUNTING

The 1U rack frame has integral 19" mounting ears for direct mounting in a standard 19" rack. Carefully place the unit in your rack and firmly attach it to the rack using four bolts.

IMPORTANT: Mentor CX has air intakes on the front of the chassis and fan assisted exhaust vents on the rear of the chassis. Ensure that these have an unobstructed air flow, otherwise the unit may overheat. Pay particular attention to ensure that any rack wiring or cable trays do not obstruct the vent. 60mm of clear space should be allowed between the vents and any potential obstruction.

2.3 EARTHING REQUIREMENTS

The unit is provided with a single 4mm earthing stud on the rear panel. Incoming mains earth from the IEC connector is internally bonded to both the chassis and technical 0V to meet safety requirements and performance specifications. The stud allows the addition of an earth strap, if required, in rack installations.

2.4 Mains Connection and Fusing

Important
Power Supply Cord(s) Used as Disconnect Means

CAUTION: THE POWER SUPPLY CORDS ARE USED AS THE MAIN DISCONNECT DEVICE. ENSURE THAT THE SOCKET-OUTLETS ARE LOCATED / INSTALLED NEAR THE EQUIPMENT AND ARE EASILY ACCESSIBLE.

THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT TWO POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK.

ATTENTION: LES CORDONS D'ALIMENTATION SONT UTILISÉS COMME DISPOSITIF DE DÉBRANCHEMENT PRINCIPAL. ASSUREZ-VOUS QUE LES PRISES DE SOCKET SONT SITUÉES / INSTALLÉES PRÈS DE L'APPAREIL ET SONT FACILEMENT ACCESSIBLES.

CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DEBRANCHER LES DEUX CORDONS D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE.

The power supplies within the unit are a switched mode design and will cope automatically with a wide input voltage range (see specification, section 9.3).

The standard Mentor CX is fitted with a single mains power supply unit (PSU), with an option to fit a second PSU. Each PSU has its own, dedicated, IEC mains plug on the rear of the Mentor CX. These should be wired according to the instructions provided with a mating mains socket using suitable cable. See above for earthing requirements.

Mains cable conductors are to be three-core (two-wire with ground), wire gauge 18 AWG (cross sectional area 0.75mm²) Jacket to be type SJT.

Covers are only to be removed by trained personnel. Shock hazard exists with covers removed; therefore disconnect mains supply before removal. See the warning notice above. Interconnection between circuit boards and panels are all safety extra low voltage (SELV) as defined by IEC/EN/CSA/UL 60950-1-200X. The equipment signal connections must only be connected to SELV circuits to prevent hazards from improper connection.

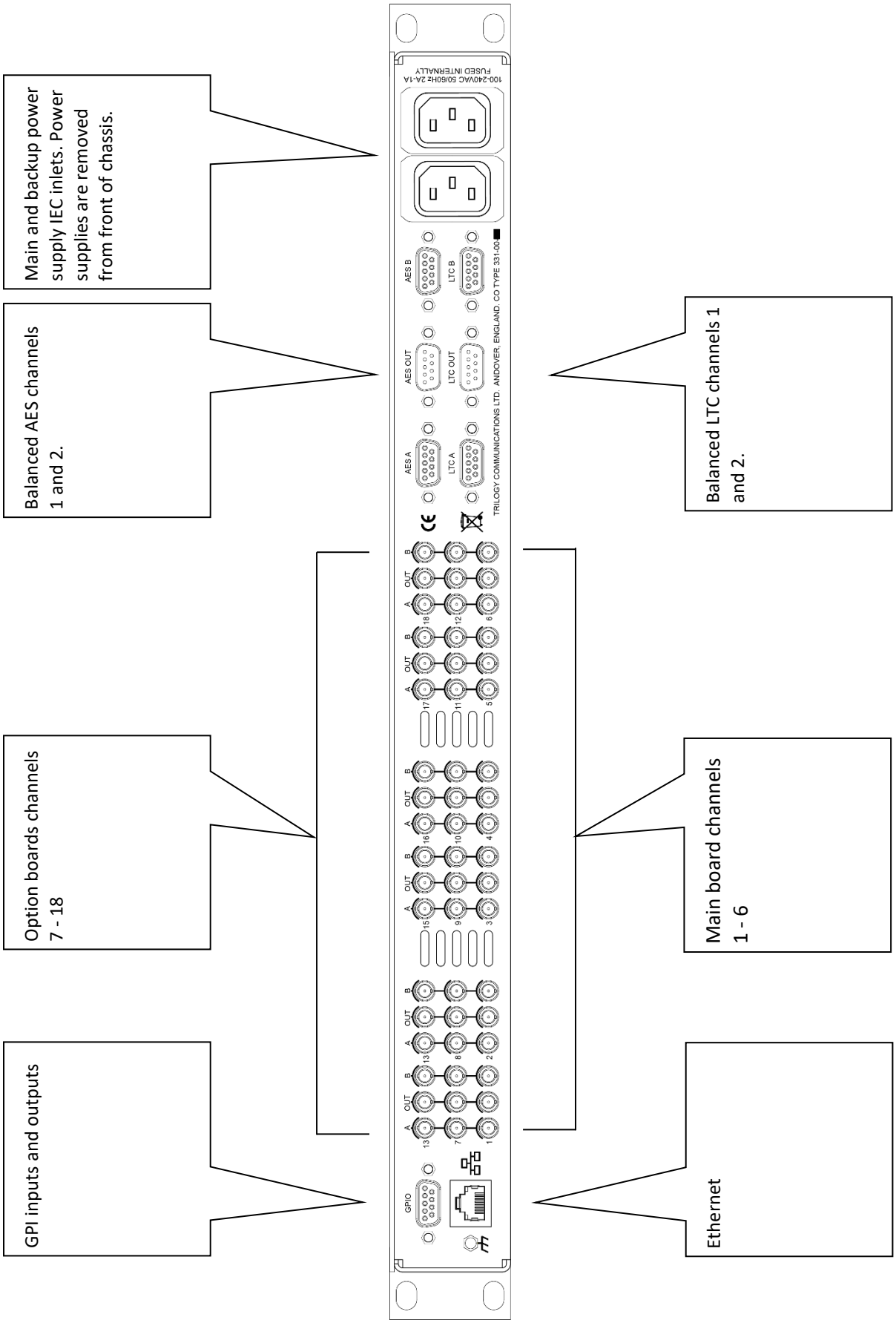
2.5 Battery

Mentor CX is fitted with an internal lithium battery.

CAUTION:
RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.
DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

ATTENTION
IL Y A RISQUE D'EXPLOSION SI LA BATTERIE EST REMPLACÉE PAR UNE BATTERIE DE TYPE INCORRECT.
METTRE AU REBUT LES BATTERIES USAGÉES CONFORMÉMENT AUX INSTRUCTIONS.

2.6 REAR PANEL CONNECTIONS



2.7 Channel Input and Output

Mentor CX uses the 'Micro BNC' connector type, which is interchangeable with the Amphenol 'HD BNC' range. Connector performance exceeds the requirements of SMPTE ST 2082-1 making them suitable for composite and component video, 270 Mb/s SDI, uncompressed 1080i or 1080p HD-SDI video and 4K UHD (2160P60) video up to 12GHz.The Micro BNC series is used to achieve a very high density of connections on equipment rear panels and thus requires the use of a dedicated slim-line fitting and removal tool to mate and un-mate the connector. Trilogy offers a short interconnect cable for Mentor RG outputs to Mentor CX channel inputs – please contact your usual sales channel for more information.

2.8 AES and LTC in from SPG A and B

There are two male D9 plugs for AES inputs and two identical connectors for LTC signals. AES inputs are the upper connectors and LTC inputs are the lower connectors.

From SPG A **From SPG B**

AES in from SPG A: Chassis D9 plug (male)	
Pin	**Description**
1	AES 1 + (in)
2	AES 1 - (in)
3	n/c
4	n/c
5	n/c
6	n/c
7	AES 2 + (in)
8	AES 2 - (in)
9	n/c

AES in from SPG B: Chassis D9 plug (male) - identical

LTC in from SPG A: Chassis D9 plug (male)	
Pin	**Description**
1	LTC 1 + (in)
2	LTC 1 – (in)
3	n/c
4	Fault Loop + (in)
5	n/c
6	n/c
7	LTC 2 + (in)
8	LTC 2 – (in)
9	Fault Loop – (in)

LTC in from SPG B: Chassis D9 plug (male) - identical

Input pins are arranged to match the corresponding output pins of the Mentor RG, allowing 1:1 cabling to be installed.

The LTC input connectors also have provision to connect the fault loop general system failure signal from each Mentor RG. This may be combined with system health data from Mentor CX to provide an overall fault loop for the associated hardware (2 x Mentor RG plus 1 x Mentor CX). See section 2.10.

2.9 AES AND LTC OUT

There are two female D9 sockets for the output of AES and LTC channels. AES out is the upper connector and LTC out is the lower connector.

AES out: Chassis D9 socket (female)	
Pin	**Description**
1	AES 1 + (out)
2	AES 1 - (out)
3	Shield
4	Fault Loop + (out)
5	0V GND
6	Shield
7	AES 2 + (out)
8	AES 2 - (out)
9	Fault Loop - (out)

LTC out: Chassis D9 socket (female)	
Pin	**Description**
1	LTC 1 + (out)
2	LTC 1 – (out)
3	Shield
4	TXD (see note 1)
5	0V GND
6	Shield
7	LTC 2 + (out)
8	LTC 2 – (out)
9	RXD (see note 1)

Note 1 – serial data is for internal debug purposes only.

2.10 FAULT LOOP

Mentor CX has a fault loop output indicating a combined general system failure when open. The output is presented on the AES output connector as shown above. Electrically, the opto-isolated output is identical to the GPI Outputs described in section 2.11.

A fault condition on one or more of the items listed causes the Mentor CX fault loop to open.

- Mentor CX Fan 1
- Mentor CX Fan 2
- Mentor CX PSU 1
- Mentor CX PSU 2
- Fault loop primary Mentor RG (SPG A)
- Fault loop secondary Mentor RG (SPG B)

Overall fault status from each associated Mentor RG is connected to the LTC input connectors on Mentor CX to provide an overall fault loop for the entire reference system.

2.11 GPI IN AND OUT

A D9 chassis mounted socket (female) provides GPI (general purpose interface) inputs and outputs.

GPI: Chassis D9 socket (female)	
Pin	**Description**
1	GND
2	GPI input 1
3	GPI input 2
4	GPI out 2 -
5	+12VDC (fused 500 mA)
6	GPI out 1 +
7	GPI out 1 -
8	GPI out 2 +
9	GND

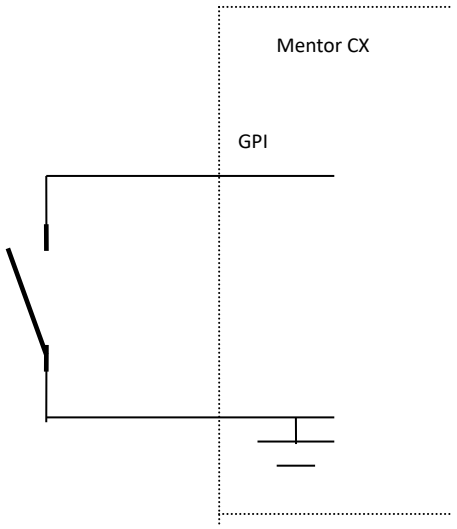
GPI Inputs 1 and 2
GPI input 1 is used to switch between A and B inputs when the unit is configured to use GPI to control the changeover. A floating input selects “A” inputs: closure to ground selects “B” inputs.

GPI input 2 is reserved for future use.

Connecting GPI Inputs

Mentor CX GPI inputs comprise single ended ground-to-operate inputs. Maximum input voltage is +60 V.

To assert a GPI input, connect the input pin to Mentor CX ground.



GPI Outputs 1 and 2

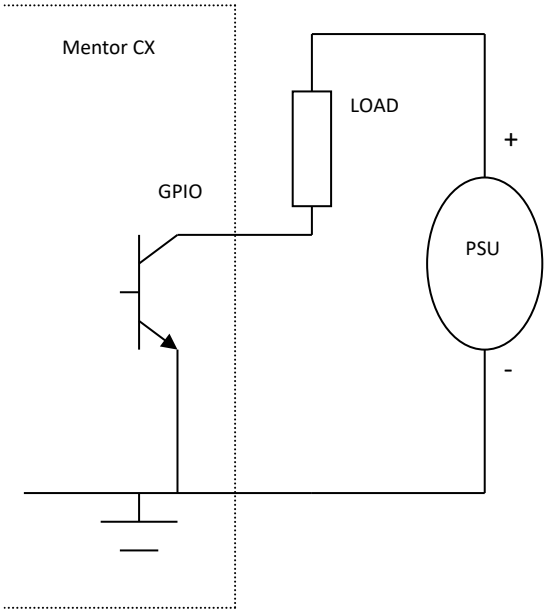
Output 1 indicates which set of inputs are routed to the output. When open, “A” inputs are routed, when closed “B” inputs are routed. GPI Output 1 is a latching mechanical relay and retains its setting when power is removed from the unit.

Output 2 indicates if the A&B input sets signals differ or if there is a PSU failure. When open, inputs A&B differ, or a PSU failure has been detected: when closed A&B have equivalent signals and PSUs are OK. PSU failure occurs when the PSU is detected as present, but PSU DC voltage output is not OK, or PSU fan is not OK. GPI Output 2 is an opto-isolated, floating type.

Connecting GPI Output 2

GPI outputs comprise single ended open collector outputs with a 30V / 190mA rating, 600mW dissipation.

To use an output, a load should be connected between the output and an external power supply, with the negative end of the power supply connected back to the ground pin on the D type. As an alternative to an external power supply, a +12V, 500 mA feed is available on pin 5 of the D9 connector.



2.12 ETHERNET

The Mentor CX is equipped with a 10/100 Base-T Ethernet port. This port may be configured for either dynamic (DHCP) address mode, or static address mode. In most instances, we recommend the static mode. These options are in the Admin menu. The Mentor CX should be connected to the network in the same way as any other networked device (e.g. computer or laptop) using a 1:1 CAT 5 RJ45 cable (not provided).

If connected directly to a computer or laptop for initial configuration, either a crossover or straight through style Ethernet cable may be used.

3. OPERATION

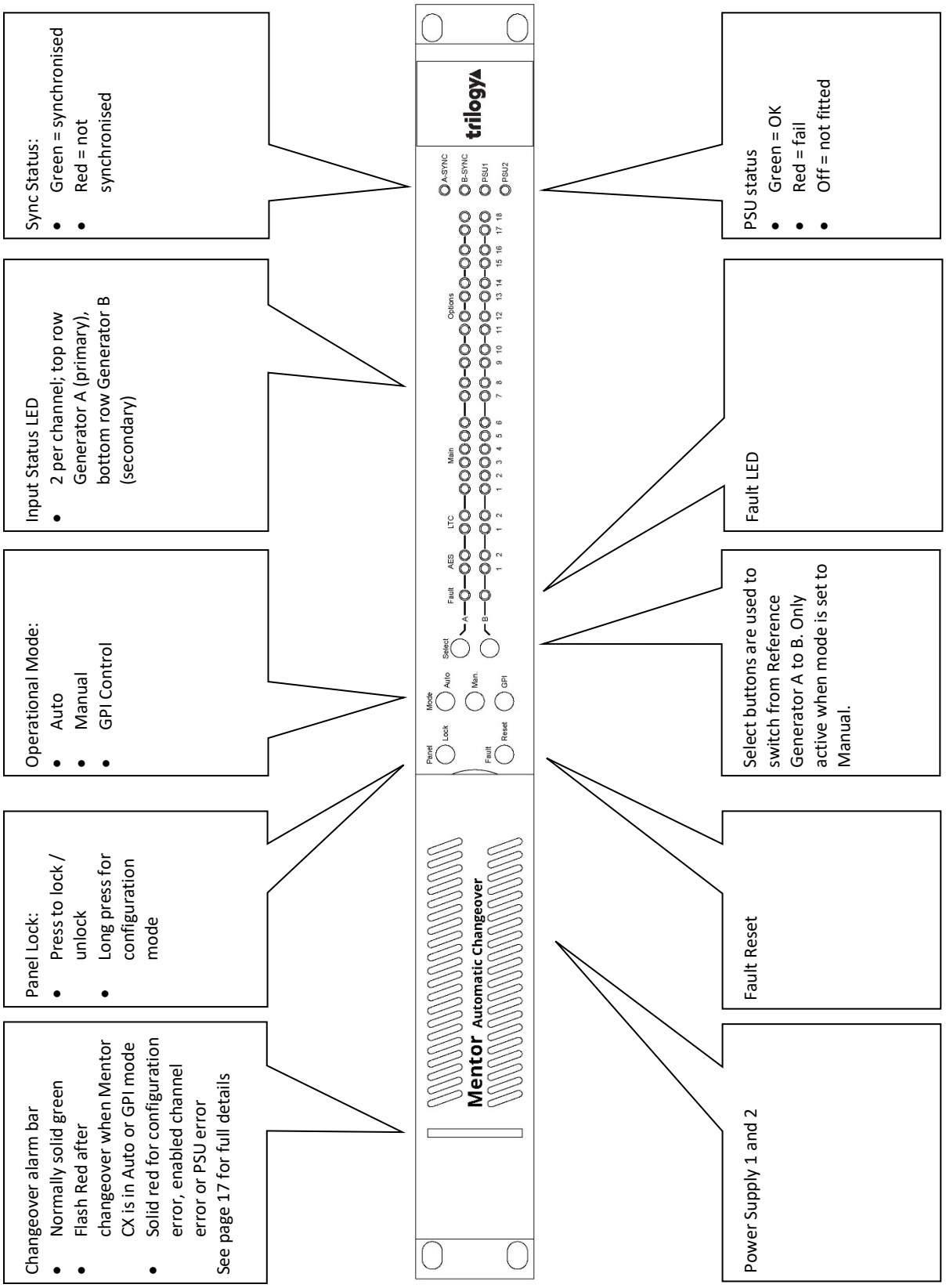
3.1 INTRODUCTION

There are some basic principles which are key to operation of the Mentor CX.

1. Signal faults are classified as either “errors” or “warnings”. An error is more serious and will normally cause the Mentor CX to perform a changeover to the secondary generator. The exceptions to this rule are covered in point 3 (below). Channels may be included or excluded from the decision making using front panel controls or Vector management. A warning is less serious, does not cause a changeover but nevertheless requires urgent attention.
2. Most faults, “errors” and “warnings”, result from a problem detected on one generator alone. Format difference warnings are normally the result of misconfiguration and Mentor CX cannot determine which generator is at fault. In this instance, channel input LEDs will flash yellow, alternately.
3. Changeover will only take place if the alternate generator is operating correctly. This means that the alternate must not show any errors, nor must there be any format difference warnings on monitored channels.
4. The logic underpinning automatic changeover is fundamentally “one time only”. So, if an error occurs, Mentor CX will switch from primary to secondary generator. A further switch back to primary will not occur without manual intervention. This is to eliminate the possibility of repeated back and fore switching which would be very disruptive. The “one time only” approach means that the reserve generator will now remain in service until the problem is resolved and the Mentor CX is manually reset.

A limited amount of information and key aspects of control are presented at the front panel and these are described first. More complete operation and system setup are provided by Vector management and this is described in section 4 - Using Vector | Browser Based Management.

3.2 FRONT PANEL



3.3 CONTROLS

Panel controls are only active when the panel is unlocked. *Control actions related to configuration mode are shown in italics.*

	Button	Indicator
Panel Lock	Momentary press alternates between locked and unlocked. When unlocked, if there is no user input for 30 seconds, the panel will automatically lock. *5 second press to enter configuration mode – momentary press to exit configuration mode. When in configuration mode, if no action has been performed on the switches used in configuration mode (i.e. buttons A and B) then after a 15 second timeout, the panel will go back to normal mode.*	On = locked Off = unlocked (normal mode) *Flashing = configuration mode*
Operational Mode	Three interlocked buttons: • Automatic • Manual • GPI Input control	On = mode currently selected
Select	Two interlocked buttons, only active in manual operation mode: • Select Reference Generator A • Select Reference Generator B *Button A – cycle through channels* *Button B – enable / disable selected channel*	On = currently selected – displayed in all operational modes
Fault Reset	Momentary press to reset changeover alarm Press and hold on power-up to set IP address to factory default (192.168.1.252).	

3.4 INDICATORS

PSU1 and PSU2

- **Green** = PSU module in normal operational mode, AC input is applied, the DC voltage rail is within specification and the fan is OK
- **Red** = There is an error with a PSU module (AC input is not applied; DC voltage is out of range or fan fail.)
- **Off** = PSU module not fitted.

Reference Generator Sync Status, A (primary) and B (secondary)

- **Green** = Generator synchronised
- **Red** = Generator not synchronised.

Input status

There are individual LED indicators for each input, 2 per channel. They also have a secondary purpose when Mentor CX is in *configuration mode.*

Normal mode	*Configuration Mode*
Green = input OK **Flashing Green** = input "Warning" – see note below **Red** = input "ERROR" – see note below **Both flashing yellow alternately** = inputs A and B are different format – see note below **Flashing Red** = invalid state **Off** = channel not enabled	***Green** = channel is enabled* ***Red** = channel is disabled.*

Note: For details of specific warning and error indications for each channel input, please refer to the detailed specifications commencing in section 9.8 on page 38 of this manual.

Changeover Alarm Bar

This translucent LED bar is located to the left side of the front panel.

- **Green** for normal operation
- **Flashing Red** to indicate a changeover has occurred when the unit is in auto or GPI control mode
- **Flashing Green** to indicate a firmware update is in progress
- **Flashing Green** at a **rapid** rate to indicate the system is in boot recovery mode
- **Red** when there is a configuration error i.e. no channels are enabled for monitoring. It is also red if an enabled channel is in error or if there is a PSU error.

4. USING VECTOR | BROWSER BASED MANAGEMENT

4.1 INTRODUCTION

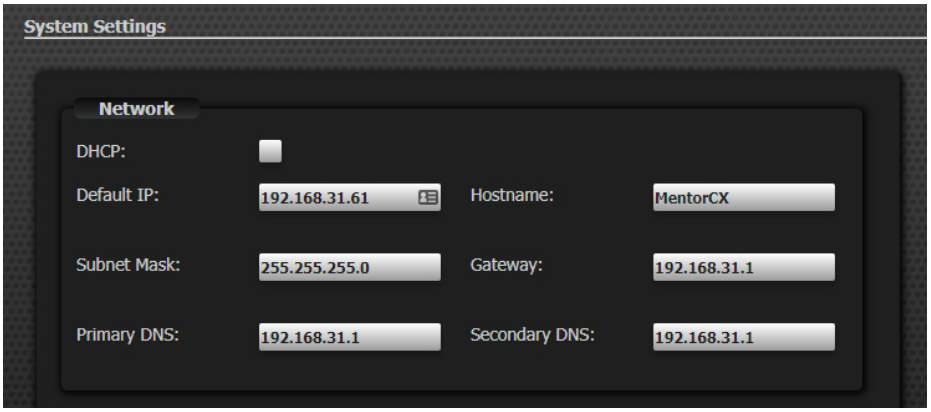
Vector, a browser-based configuration tool provides:

- Greatly simplified initial setup
- Online editing of Mentor CX configurations
- Visibility of your entire Trilogy Mentor reference system
- Partial or incremental updates without causing disruption (where possible)
- The ability to copy, backup and restore configuration data

4.2 GETTING STARTED

To start using Vector, follow these simple steps to set the Mentor CX IP address:

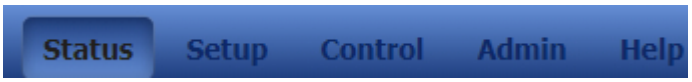
- Power up the Mentor CX while holding down the “Fault Reset” button on the front panel. The IP address will return to factory default of 192.168.1.252.
- Connect the Ethernet port on the Mentor CX to a laptop, using a standard RJ-45 cable (not supplied). Give the laptop a temporary IP address within the same subnet (e.g.192.168.1.20).
- Open your web browser and Navigate to the address http://192.168.1.252.
- Select Admin from the top menu and at the log-in screen, enter the default username ***admin*** and password ***trilogy***. The System Settings page will then be displayed.



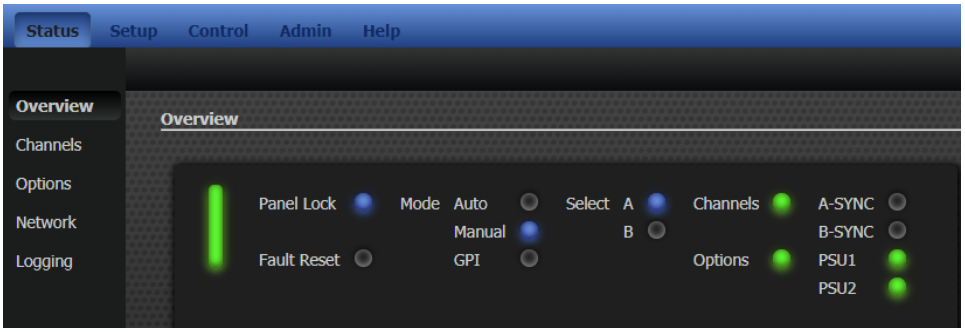
- As a minimum, enter values for Default IP and Subnet Mask which are appropriate for your in-house network. A Gateway address will be required if you intend to access the Mentor CX across a wider network. Use of DHCP is not normally advised for technical equipment.
- A change of Default IP address will mean that you lose contact from the laptop. Once the change has taken place you can disconnect the laptop and connect Mentor CX to your LAN.
- Log in again from a PC connected to your LAN.

4.3 Top Level Menu

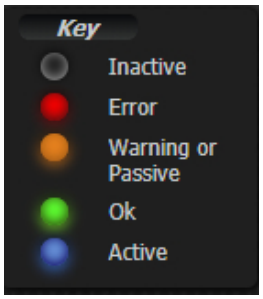
From the web browser, the top level menu is always displayed within the blue horizontal bar. The selected item is indicated by a “pressed button” image.



The second navigation level is a vertical side-bar and the selected item, in this case “Overview”, is repeated within the panel immediately to the right.



Here is the key:



Note:

1. Signal status or health is indicated by the “traffic signal” colours.
2. A selected mode, or active state is indicated in blue.
3. An inactive state is shown by a clear indicator.

Examples below show the optional power supply, PSU2.

PSU2 is present and operating correctly

PSU2 is fitted but has failed

PSU2 is not fitted

The content and features of each menu branch are explained later in this section of the manual.

4.4 VECTOR | STATUS

The status menu has five branches, as shown in the first image below.

4.4.1 Vector | Status | Overview

This page provides an overview of the entire Mentor reference system, i.e. the Mentor CX and the two associated Mentor RG. The IP addresses of the linked Mentor RG should be entered on the Admin | System Settings page – see section 4.7.

4.4.2 Vector | Status | Channels

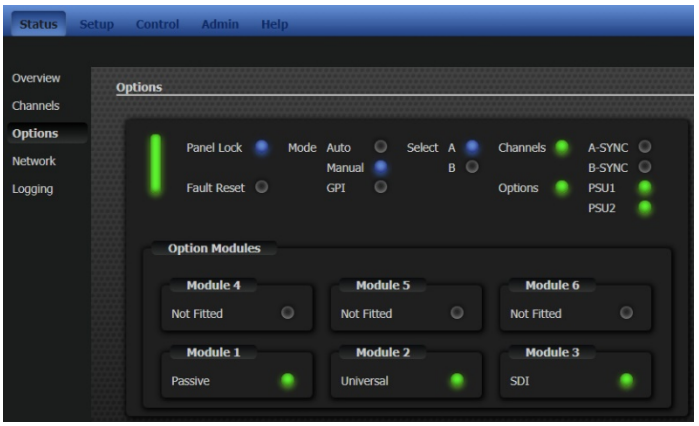
Channel status is provided on three pages.

All Channels

Main Channel Formats

Option Channel Formats

4.4.3 Vector | Status | Options



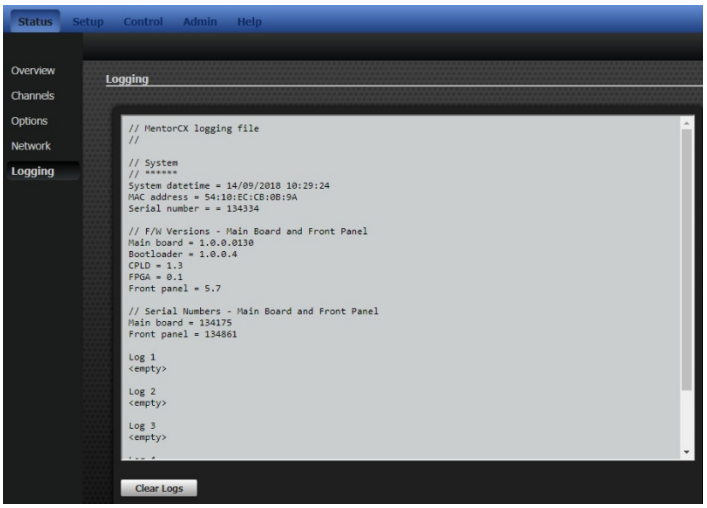
Installed Option Modules are denoted by a green indicator and appropriate text to identify module type.

4.4.4 Vector | Status | Network

This page provides read-only information for the current network settings. Any changes can be made after logging in to the Admin page – see section 4.7.

Links to the associated Mentor RG Reference Generators will open in new browser tabs.

4.4.5 Vector | Status | Logging



4.5 VECTOR | SETUP

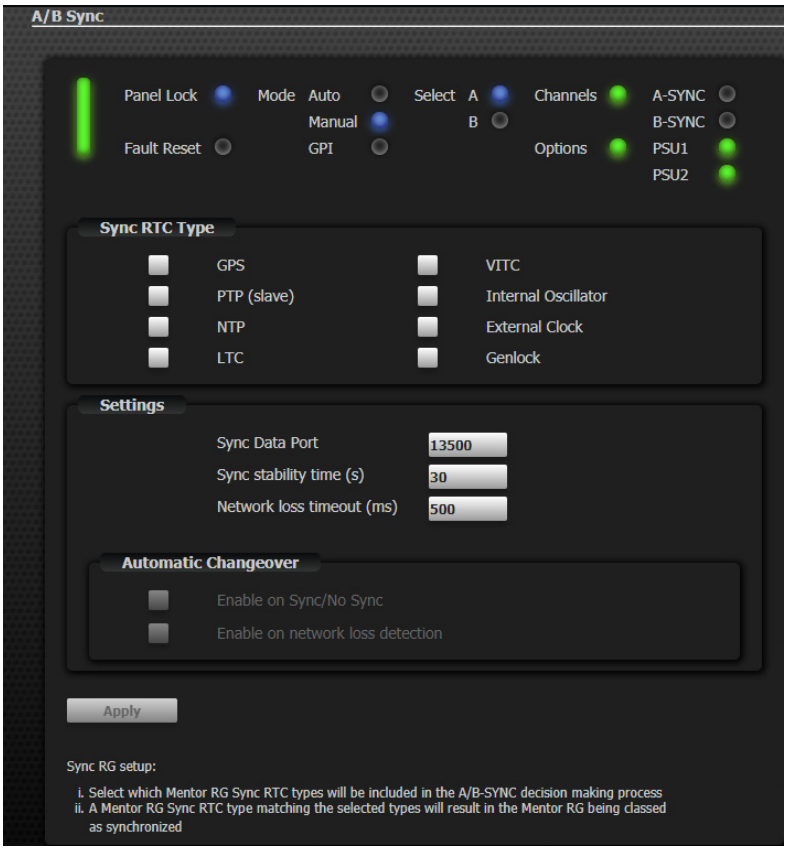
4.5.1 Vector | Setup | Channels

This screen allows channels to be included in or excluded from the changeover decision making process.

Channel setup:

- Select which channels will be included in the changeover decision making process
- An error condition on any of the channels included in the changeover decision making will cause the unit to changeover to the alternate SPG
- If channels are not included in the decision making process, the status of the inputs will not be monitored

4.5.2 Vector | Setup | A/B Sync



The Mentor CX monitors the status of linked Mentor RGs to see if they are locked using one of the approved synchronisation method(s) e.g. GPS, PTP, NTP etc. The list of approved synchronisation methods is configured on this screen. The status of each Mentor RG is monitored via the network and reported accordingly.

The following will cause a sync fail condition:

- The Mentor RG reports a synchronisation method not approved in the configured list.

The following causes a sync warning :

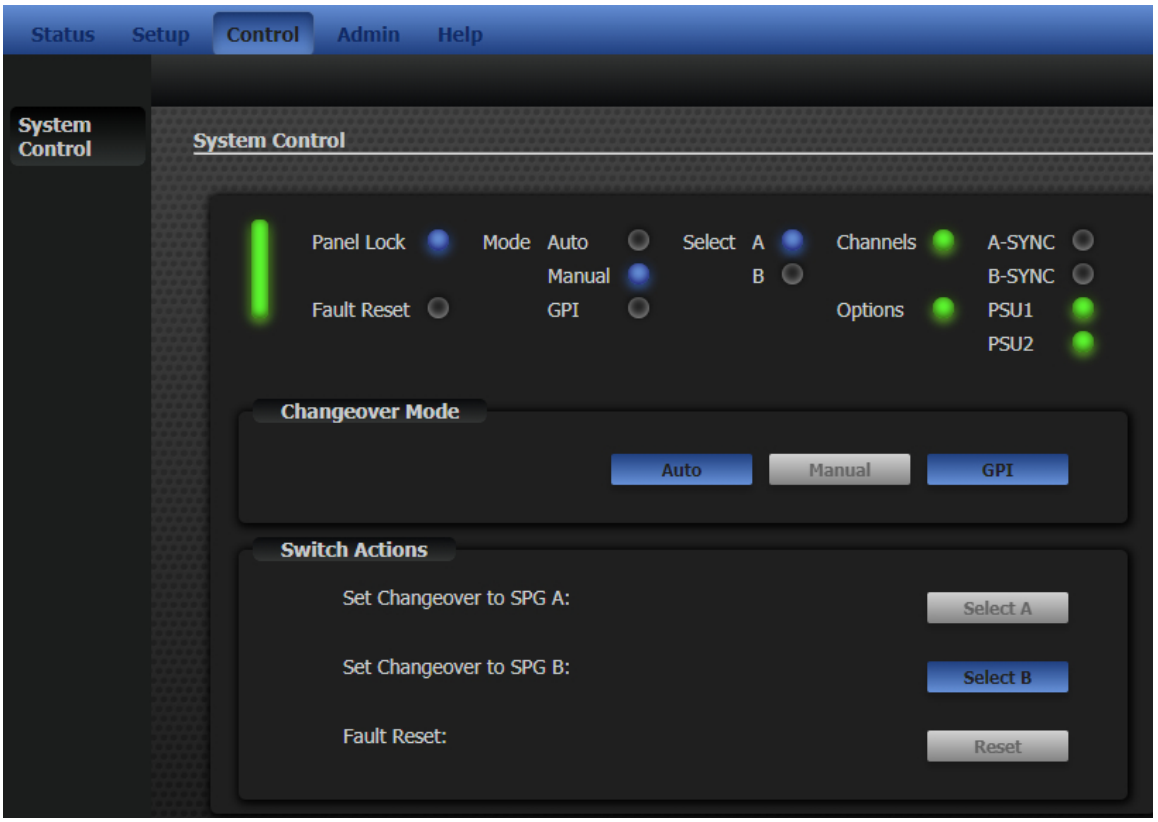
- Both Mentor RG report a synchronisation method from the approved configured list, but the synchronisation methods differ.

The Mentor RG synchronisation methods are:

- GPS
- PTP (slave)
- NTP
- LTC
- VITC
- Internal oscillator
- External clock; and
- Genlock

The settings section is there to ensure we don't get a period of changeover when there are network stability issues.

4.6 VECTOR | CONTROL



The control screen provides all elements of control.

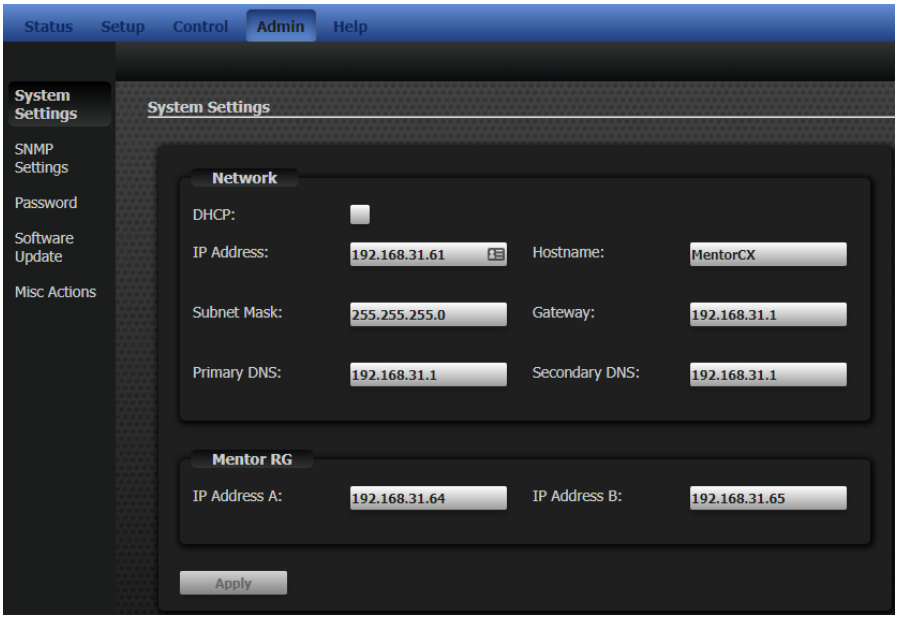
- Changeover Mode:
  - Auto = controlled by detecting errors on incoming signals from connected Mentor RG
  - Manual = controlled on-screen or from front panel
  - GPI = external control connected to GPI input. See section 2.11.
- Switch Actions:
  - Select A / B causes an immediate changeover when in manual mode (above)

Fault Reset clears any existing fault alarms

4.7 VECTOR | ADMIN

The Admin menu comprises five branches, as shown in the first image below.

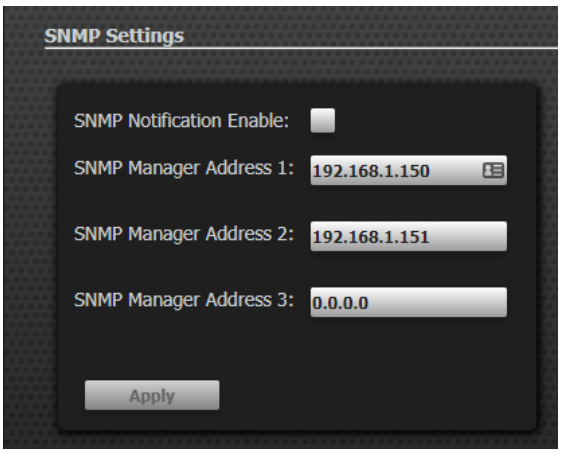
4.7.1 Vector | Admin | System Settings



The Admin | System Settings page allows the Mentor CX IP address to be set correctly, to match local network requirements. Although DHCP is supported, it is not normally appropriate in a technical environment such as a broadcast studio.
The minimum values required for correct operation are Default IP and Subnet Mask. These values alone will allow the Mentor CX to be accessed by an admin PC located on the same subnet. If you plan to access the Mentor CX from a different subnet then a Gateway address must be entered. Factory default IP address is 192.168.1.252 with subnet mask 255.255.255.0.

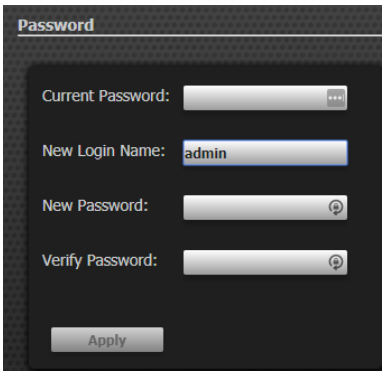
Each Mentor CX Changeover is normally connected to a pair of Mentor RG Reference Generators. If the IP addresses of these linked reference generators are entered, the main status page will display an overview of the status of the entire system. In depth status reporting and setup of the Mentor RG is available by browsing directly to each unit.

4.7.2 Vector | Admin | SNMP Settings



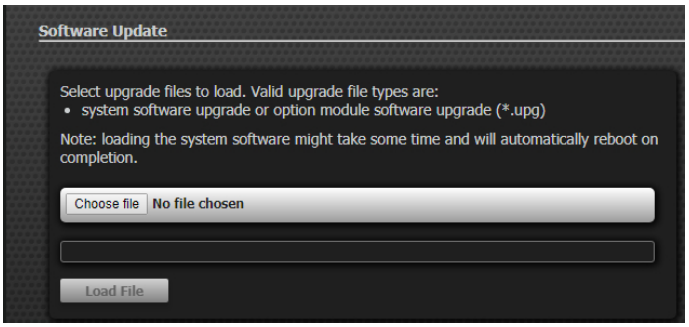
Check the box to enable SNMP notifications. A maximum of three SNMP managers may be added.

4.7.3 Vector | Admin | Password



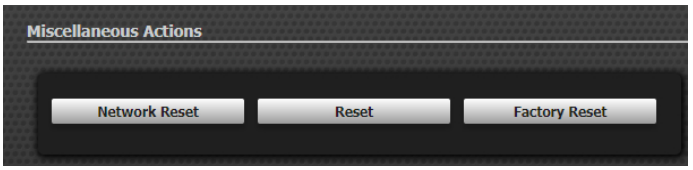
Factory defaults are:
Login name – ***admin***
Password - ***trilogy***

4.7.4 Vector | Admin | Software Update

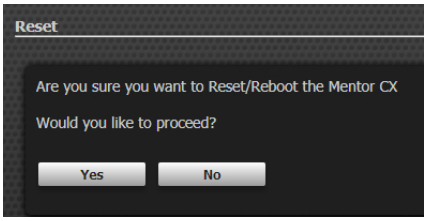


Update files for Mentor CX and option boards will be supplied by Trilogy Technical Support. Any software update may be disruptive and should be carefully scheduled. Please contact Trilogy for further details.

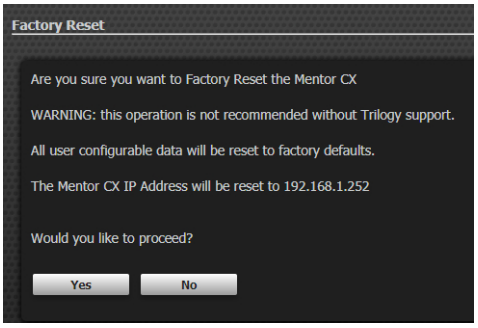
4.7.5 Vector | Admin | Misc Actions



Three miscellaneous actions are presented. Network reset occurs as soon as the button is clicked. The interface is reset but settings are retained.



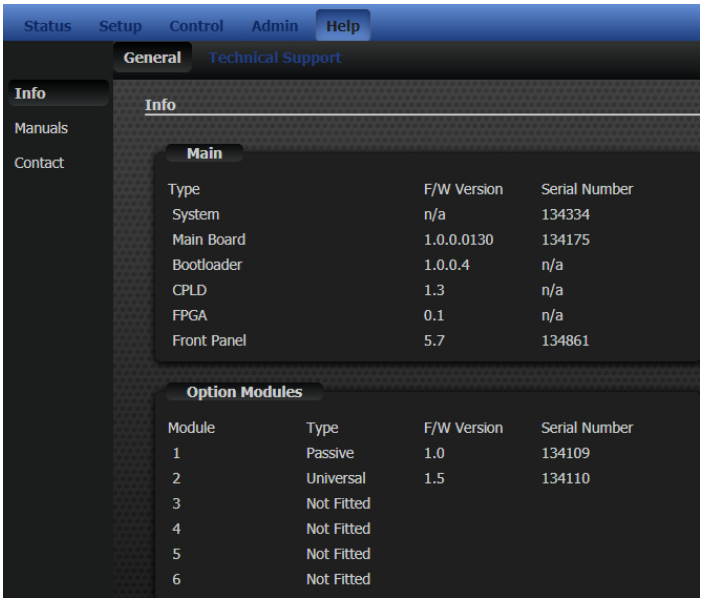
This warning prompt is shown for the “Reset” action.



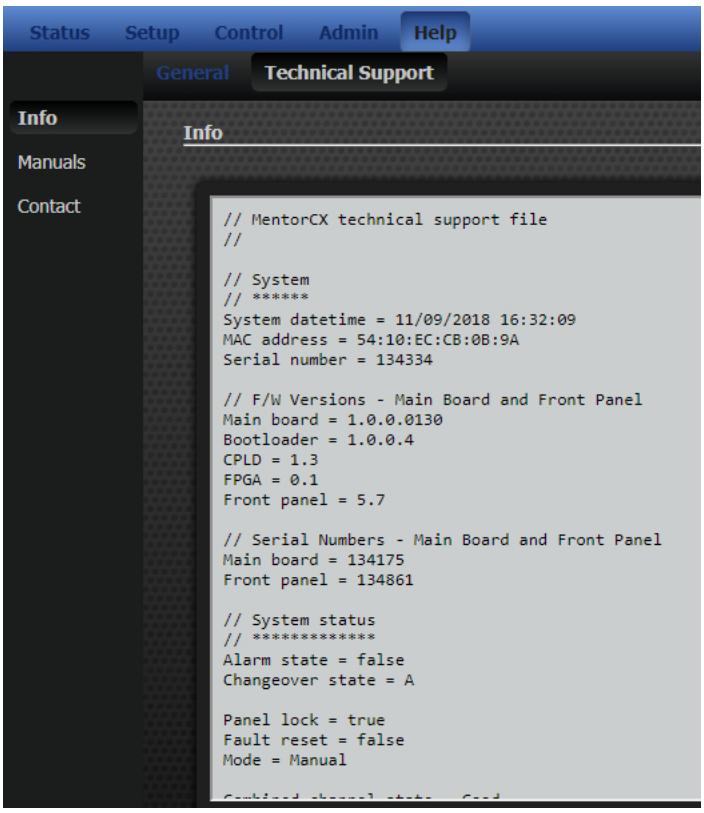
This warning prompt is shown for the “Factory Reset” action. Please read the note carefully before proceeding.

4.8 VECTOR | HELP

There are three items on the Help menu, as shown below. The info page has two tabs.



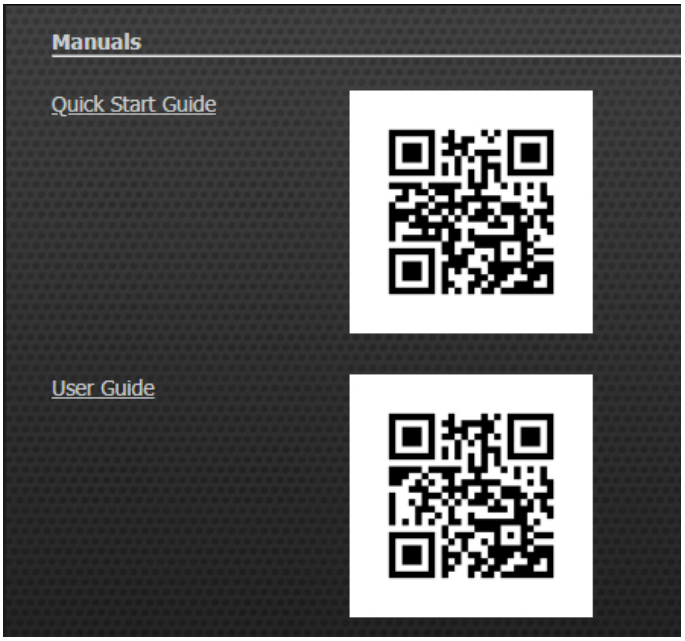
The info page provides a summary of currently installed software for the Mentor CX and any fitted option boards. There are two tabs, ***General*** and ***Technical Support***. The General tab presents an overview, in a user friendly format.



If you contact Trilogy Technical Support, our engineers will request information from this screen to assist in answering your question.

To make a copy of the complete information:

- Place your cursor anywhere within the text area
- Press <ctrl + A> to select all the text
- Press <ctrl + C> to copy
- Create a new plain text (.txt) file on your desktop and open the file
- Place your cursor in the new text file and press <ctrl + V> to paste
- Save the text file with an appropriate filename



PDF versions of the Mentor CX User Guides can be downloaded from the support website by clicking the short links on this page. QR codes provide an easy way for smartphone users to download the documents.

5. MAIN CONTROLLER BOARD

5.1 INTRODUCTION

In addition to providing overall control of the Mentor CX, the main controller board carries the following channels which constitute the "base" unit:

- 2 x SDI - channels 1 - 2
- 4 x Analogue - channels 3 - 6
- 2 x AES (balanced via D-type connectors)
- 2 x LTC (balanced via D-type connectors)

The features of each channel type are described below.

5.1.1 SDI Channels (1 - 2)

The inputs monitor SDI – SD/HD/3G signals, but do not detect or report the format/standard.
The following error causes an error condition:

- Signal level approx. <500 mV.

5.1.2 Analogue Channels (3 – 6)

There are 4 analogue channels which can monitor and switch the following signal types:

- Black and burst (BB)
- Tri-Level-Sync (TLS)
- AES/DARS (unbalanced via BNC)
- Word clock, 10 MHz, 27 MHz

Black and burst (BB)

Mentor CX monitors PAL and NTSC BB and reports the detected standard.

- Signal amplitude <180 mV causes an error condition
- Signal amplitude <210 mV (double terminated) or >500 mV (un-terminated) causes a warning condition.

Tri-Level Sync (TLS)

The following 22 standards are monitored, detected and reported (see exceptions listed).

Description		Description	(reports as)
1920x1080/60/p		1920x1080/30/sF	1920x1080/60/i
1920x1080/59.94/p		1920x1080/29.97/sF	1920x1080/59.94/i
1920x1080/50/p		1920x1080/25/sF	1920x1080/50/i
1920x1080/60/i		1280x720/60/p	
1920x1080/59.94/i		1280x720/59.94/p	
1920x1080/50/i		1280x720/50/p	
1920x1080/30/p		1280x720/30/p	
1920x1080/29.97/p		1280x720/29.97/p	
1920x1080/25/p		1280x720/25/p	
1920x1080/24/p		1280x720/24/p	
1920x1080/23.98/p		1280x720/23.98/p	

- Signal amplitude <180 mV causes an error condition
- Signal amplitude <210 mV (double terminated) or >500 mV (un-terminated) causes a warning condition but does not cause changeover to occur.

AES/DARS (unbalanced via BNC)
AES signals from the Mentor RG can be transmitted as unbalanced via a 75Ω BNC output, or balanced via a D-type connector. See section 5.1.3 for information about balanced connection. Mentor CX supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies.
The following faults cause an error condition:

- Peak-to-peak signal level <320 mV
- Incorrect AES preamble.

Word Clock, 10 MHz and 27 MHz
The word clock, 10 MHz and 27 MHz signals from the Mentor RG are transmitted as 75 Ω BNC outputs. The maximum amplitude the unit has to cope with is 10V peak to peak. The signal type is automatically detected and reported.
The following fault causes an error condition:

- Peak-to-peak signal level <320 mV.

5.1.3 AES (balanced via D-type connectors)

AES signals from the Mentor RG can be transmitted as unbalanced via a 75Ω BNC output, or balanced via a D-type connector. See section 5.1.2 for information about unbalanced connection. Mentor CX supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies.
The following faults cause an error condition:

- Peak-to-peak signal level <200 mV
- Incorrect AES preamble.

5.1.4 LTC (balanced via D-type connectors)

LTC from the Mentor RG is transmitted as a balanced signal via a D-type connector.
The following faults cause an error condition:

- Peak-to-peak signal level <500 mV
- Incorrect LTC sync word.

The following fault causes a warning condition but does not cause changeover to occur:

- Discontinuous timecode.

6. OPTION: 331-20-00 UNIVERSAL OPTION MODULE

6.1 INTRODUCTION

This optional module can handle the following signals:

- Black and burst (BB)
- Tri-Level-Sync (TLS)
- AES/DARS (unbalanced via BNC)
- Word clock, 10 MHz, 27 MHz

Each option module provides two changeover "channels", where a channel comprises two inputs (A and B) plus one switched output. The module may be fitted in any of the six available option slots.

6.2 SIGNAL HANDLING

Black and burst (BB)
Mentor CX monitors PAL and NTSC BB and reports the detected standard.

- Signal amplitude <180 mV causes an error condition
- Signal amplitude <210 mV (double terminated) or >500 mV (un-terminated) causes a warning condition.

Tri-Level Sync (TLS)
The following 22 standards are monitored, detected and reported (see exceptions listed).

Description		Description	(reports as)
1920x1080/60/p		1920x1080/30/sF	1920x1080/60/i
1920x1080/59.94/p		1920x1080/29.97/sF	1920x1080/59.94/i
1920x1080/50/p		1920x1080/25/sF	1920x1080/50/i
1920x1080/60/i		1280x720/60/p	
1920x1080/59.94/i		1280x720/59.94/p	
1920x1080/50/i		1280x720/50/p	
1920x1080/30/p		1280x720/30/p	
1920x1080/29.97/p		1280x720/29.97/p	
1920x1080/25/p		1280x720/25/p	
1920x1080/24/p		1280x720/24/p	
1920x1080/23.98/p		1280x720/23.98/p	

- Signal amplitude <180 mV causes an error condition
- Signal amplitude <210 mV (double terminated) or >500 mV (un-terminated) causes a warning condition but does not cause changeover to occur.

AES/DARS (unbalanced via BNC)
AES signals from the Mentor RG can be transmitted as unbalanced via a 75Ω BNC output, or balanced via a D-type connector. See section 5.1.3 for information about balanced connection.
Mentor CX supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies.
The following faults cause an error condition:

- Peak-to-peak signal level <320 mV
- Incorrect AES preamble.

Word Clock, 10 MHz and 27 MHz

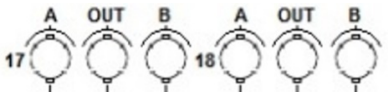
The word clock, 10 MHz and 27 MHz signals from the Mentor RG are transmitted as 75 Ω BNC outputs. The maximum amplitude the unit has to cope with is 10V peak to peak. The signal type is automatically detected and reported.

The following fault causes an error condition:

- Peak-to-peak signal level <320 mV.

6.3 CONNECTORS

Each option module provides two changeover “channels”, where a channel comprises two inputs (A and B) plus one switched output. The module may be fitted in any of the six available option slots. Mentor CX uses the high density ‘Micro BNC’ connector type, which is interchangeable with the Amphenol ‘HD BNC’ range. The image below shows the option module fitted in the last available option slot, numbered 17/18.



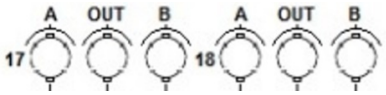
7. OPTION: 331-21-00 PASSIVE OPTION MODULE

This optional module can change over the following signals:

- Black and burst (BB)
- Tri-Level-Sync (TLS)
- AES/DARS (unbalanced via BNC)
- Word clock, 10 MHz, 27 MHz
- SD/HD/3G SDI video

There is no monitoring, detection or reporting capability.

Each option module provides two changeover “channels”, where a channel comprises two inputs (A and B) plus one switched output. The module may be fitted in any of the six available option slots. Mentor CX uses the high density ‘Micro BNC’ connector type, which is interchangeable with the Amphenol ‘HD BNC’ range. The image below shows the option module fitted in the last available option slot, numbered 17/18.



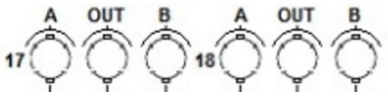
8. OPTION: 331-22-00 SD/HD/3G SDI VIDEO OPTION MODULE

This optional module is capable of monitoring and changing over the following signals:

- SD/HD/3G SDI video

The signal format is automatically detected and reported. Formats detected are listed in the Specifications – see section 9.12.

Each option module provides two changeover “channels”, where a channel comprises two inputs (A and B) plus one switched output. The module may be fitted in any of the six available option slots. Mentor CX uses the high density ‘Micro BNC’ connector type, which is interchangeable with the Amphenol ‘HD BNC’ range. The image below shows the option module fitted in the last available option slot, numbered 17/18.



9. SPECIFICATION

9.1 GENERAL

Width	482 mm (including rack ears) 19” rack mounting
Height	44 mm (1U)
Depth	433 mm (excluding connectors)
Weight	4kg with no option boards 5kg max. with all option boards
Operating temperature range	0°C to 50°C
Storage temperature range	-20°C to 60°C
Operating humidity	20% - 90% (non-condensing when operating at 40°C)

9.2 EMC & SAFETY

Emissions	EN 55032:2015
	FCC CFR 47 Part 15.107 & 15.109 and ICES-003 Issue 6
	EN 61000-3-2:2014, EN 61000-3-3:2013
Immunity	EN 55103-2:2009
Safety	IEC 60950-1:2005/A2:2013

NOTE: Immunity is specified to criterion B - the outputs may suffer some degradation during the disturbance but will recover on removal of the disturbance source and continue to operate as intended.

9.3 POWER

Power Supplies	The Mentor CX can accommodate two PSU modules providing the option to support PSU redundancy. PSU modules are load sharing and hot swappable.
Mains input x 2	100-240VAC, 50/60Hz, auto select
Power consumption	80 W maximum (depending on number of option boards fitted)
Internal Fuse	3.15A

9.4 GPI Input 1: Remote Changeover Control

Type	Current sinking type (also referred to as ground closure type).
Purpose	Controls output selection when the system changeover mode is configured for GPI.
Input activation	Selects secondary channel set ≤1.0 V (wrt interface system 0V) ≤6 k Ω (contact to interface system ground)
Input deactivation	Selects primary channel set ≥2.0 V (wrt interface system 0V)
Maximum input voltage	+ 60 V

9.5 GPI Input 2

Type	Current sinking type (also referred to as ground closure type).
Purpose	TBD
Input activation	≤1.0 V (wrt interface system 0V) ≤6 k Ω (contact to interface system ground)
Input deactivation	≥2.0 V (wrt interface system 0V)
Maximum input voltage	+ 60 V

9.6 GPI Output 1: Remote Changeover Output

Type	Relay contact -Latched
Purpose	Indicates current output channel set (Retains indication when system loses power).
Sense	Open = Primary channel set selected Closed = Secondary channel set selected
Max. load voltage	+30 VDC
Max. load current	1 A

9.7 GPI Output 2: Remote Alarm Output

Type	Opto-isolated floating type
Purpose	Indicates if primary and secondary channel set signals are different format or if there is PSU module failure. Note: PSU module present but not powered or PSU module fan failure constitutes PSU module failure.
Sense	Floating = Alarm Closed = OK
Max. load voltage	+60 VDC
Max. load current	250 mA
Max. power dissipation	450 mW

9.8 SYSTEM BASE MODULE

Channel Set Type	Balanced AES/LTC
Number of Channel Sets	2 AES pairs/2 LTC pairs
Changeover Type	Latching relay Retains selected channel set on power fail Unselected channel terminated into 100 Ω.
Switching Time	Typically, <1.5 ms (max <3.0 ms)
Crosstalk	[Unselected input to output, channel to channel] <-50dB 100kHz to 12MHz.
Fault detection condition	**Signal Type: LTC** Error condition • Signal low level threshold <500 mVpp • Incorrect LTC sync word Warning condition • Discontinuous timecode. • Detected format difference (see Note 1 below)
	Signal Type: AES Error condition • Signal low level threshold <200 mVpp • Incorrect AES preamble Warning condition • Detected format difference (see Note 1 below) Supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies.

NOTE 1: Detection between different signal types – for example, between AES and LTC.

SYSTEM BASE MODULE (CONT'D)

Channel Set Type	NTSC, PAL, Tri-level Sync (TLS), AES/DARS, word clock, clock 10 MHz, clock 27 MHz
Number of Channel sets	4
Changeover Type	Latching relay Retains selected channel set on power fail. Unselected channel terminated into 75 Ω.
Switching Time	Typically, <1 ms (max <3 ms)
Return Loss	Better than -40dB to 6 MHz
Crosstalk	[Unselected input to output, channel to channel] <-60dB, 100 kHz to 6 MHz <-50dB, 6 MHz to 50 MHz
Fault detection condition	**Signal Type: NTSC, PAL, TLS** Error condition • Signal low level threshold <180 mV Warning condition • Signal low level threshold <210 mV • Signal high level threshold >500 mV • Detected format difference Format detection as detailed in section 5.1.2
	Signal Type: AES Error condition • Signal low level threshold <320 mVpp • Incorrect AES preamble Warning condition • Detected format difference Supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies

SYSTEM BASE MODULE (CONT'D)

Channel Set Type	SD-SDI, HD-SDI, 3G-SDI
Number of channel sets	2
Changeover Type	HF 3 GHz latching relay Retains selected channel set on power fail
Switching Time	Typically <1.5 ms (max <10 ms)
Return Loss	<-15dB 5 MHz to 1.5 GHz <-10dB 1.5 GHz to 3 GHz
Crosstalk	[Unselected input to output, channel to channel] <-55dB, 100 kHz to 900 MHz <-30dB, 900 MHz to 3 GHz
Timing Jitter	[100% Colour bars] < 0.20 UIpp [>10 Hz] - SD-SDI < 0.30 UIpp [10 Hz-20 kHz] - HD-SDI < 0.60 UIpp [10 Hz-20 kHz] - 3G-SDI
Alignment Jitter	[100% Colour bars] < 0.20 UIpp [1kHz -27 MHz] < 0.20 UIpp [0.1 -148.5 MHz] < 0.30 UIpp [0.1 – 297 MHz]

9.9 331-20-00 UNIVERSAL OPTION MODULE

Channel Set Type	NTSC, PAL, Tri-level, AES/DARS, word clock, clock 10 MHz, clock 27 MHz
Number of channel sets	2
Changeover Type	Latching relay Retains selected channel set on power fail. Unselected channel terminated into 75 Ω.
Switching Time	Typically, <1 ms (max <3 ms)
Return Loss	Better than -40dB to 6 MHz
Crosstalk	[Unselected input to output, channel to channel] <-60dB, 100 kHz to 6 MHz <-50dB, 6 MHz to 50 MHz
Fault detection condition	**Signal Type: NTSC, PAL, Tri-level** Error condition • Signal low level threshold <180 mV Warning condition • Signal low level threshold <210 mV • Signal high level threshold >50 0mV • Detected format difference Format detection as detailed in section 6.2
	Signal Type: AES Error condition • Signal low level threshold <320 mVpp • Incorrect AES preamble Warning condition • Detected format difference Supports AES with 32, 44.1, 48 and 96 kHz sampling frequencies.
	Signal Type: Word clock, 10 MHz clock, 27 MHz clock Error condition • Signal low level threshold <320 mVpp Warning condition • Detected format difference Note: for 27 MHz, clock threshold accuracy margin increased to 25%. Supports 10 MHz, 27 MHz and Word clock at the detected AES sample rate.

9.10 331-21-00 Passive Option Module

Channel Set Type	Single-ended video up to 3 GHz
Number of channel sets	2
Changeover Type	HF 3 GHz latching relay Retains selected channel set on power fail
Switching Time	Typically <1.5 ms (max <10 ms)
Return Loss	<-40dB up to 5 MHz <-15dB 5 MHz to 1.5G Hz <-10dB 1.5GHz to 3GHz
Crosstalk	[Unselected input to output, channel to channel] <-55dB, 100 kHz to 900 MHz <-30dB, 900 MHz to 3 GHz
Timing Jitter	[100% Colour bars] < 0.20 UIpp [>10Hz] - SD-SDI < 0.30 UIpp [10Hz-20kHz] - HD-SDI < 0.60 UIpp [10Hz-20kHz] - 3G-SDI
Alignment Jitter	[100% Colour bars] < 0.20 UIpp [1 kHz -27 MHz] < 0.20 UIpp [0.1 -148.5 MHz] < 0.30 UIpp [0.1 – 297 MHz]
Fault detection condition	None

9.11 331-22-00 SD/HD/3G SDI Video Option Module

Channel Set Type	SD-SDI, HD-SDI, 3G-SDI
Number of channel sets	2
Changeover Type	HF 3GHz latching relay Retains selected channel set on power fail
Switching Time	Typically <5ms (max <10ms)
Return Loss	<-15dB 5 MHz to 1.5 GHz <-10dB 1.5GHz to 3GHz
Timing Jitter	[100% Colour bars] < 0.20 UIpp [>10Hz] - SD-SDI < 0.30 UIpp [10 Hz-20 kHz] - HD-SDI < 0.60 UIpp [10 Hz-20 kHz] - 3G-SDI
Alignment Jitter	[100% Colour bars] < 0.20 UIpp [1 kHz -27 MHz] < 0.20 UIpp [0.1 -148.5 MHz] < 0.30 UIpp [0.1 – 297 MHz]
Fault detection condition	Error condition • No signal detected (carrier detect). • No signal lock Warning condition • Cable length detected exceeds threshold • Format difference detected Format detection as detailed in section 9.12.

9.12 331-22-00 SD/HD/3G SDI Video Option Module – Formats Detected and Reported

	Physical	Hactive x Vactive/Frame rate Hz/scan type
3G	SMPTE 425-X	1920x1080/30/sF (*note: will be reported as 1920x1080/60/i)*
3G	SMPTE 425-X	1920x1080/29.97/sF *(note: will be reported as 1920x1080/59.94/i)*
3G	SMPTE 425-X	1920x1080/25/sF *(note: will be reported as 1920x1080/50/i)*
3G	SMPTE 425-X	1920x1080/24/sF *(note: will be reported as 1920x1080/48/i)*
3G	SMPTE 425-X	1920x1080/23.98/sF *(note: will be reported as 1920x1080/47.95/i)*
3G	SMPTE 425-X	1920x1080/60/p
3G	SMPTE 425-X	1920x1080/59.94/p
3G	SMPTE 425-X	1920x1080/50/p
3G	SMPTE 425-X	1920x1080/60/i
3G	SMPTE 425-X	1920x1080/59.94/i
3G	SMPTE 425-X	1920x1080/50/i
3G	SMPTE 425-X	1920x1080/30/p
3G	SMPTE 425-X	1920x1080/29.97/p
3G	SMPTE 425-X	1920x1080/25/p
3G	SMPTE 425-X	1920x1080/24/p
3G	SMPTE 425-X	1920x1080/23.98/p
HD	SMPTE 292	1920x1080/30/sF *(note: will be reported as 1920x1080/60/i)*
HD	SMPTE 292	1920x1080/29.97/sF *(note: will be reported as 1920x1080/59.94/i)*
HD	SMPTE 292	1920x1080/25/sF *(note: will be reported as 1920x1080/50/i)*
HD	SMPTE 292	1920x1080/24/sF *(note: will be reported as 1920x1080/48/i)*
HD	SMPTE 292	1920x1080/23.98/sF *(note: will be reported as 1920x1080/47.95/i)*
HD	SMPTE 292	1920x1080/60/i
HD	SMPTE 292	1920x1080/59.94/i
HD	SMPTE 292	1920x1080/50/i
HD	SMPTE 292	1920x1080/30/p
HD	SMPTE 292	1920x1080/29.97/p
HD	SMPTE 292	1920x1080/25/p
HD	SMPTE 292	1920x1080/24/p
HD	SMPTE 292	1920x1080/23.98/p
HD	SMPTE 292	1920x1035/59.94/i
HD	SMPTE 292	1920x1035/60/i
HD	SMPTE 292	1280x720/60/p
HD	SMPTE 292	1280x720/59.94/p
HD	SMPTE 292	1280x720/50/p
HD	SMPTE 292	1280x720/30/p
HD	SMPTE 292	1280x720/29.97/p
HD	SMPTE 292	1280x720/25/p
HD	SMPTE 292	1280x720/24/p
SD	SMPTE 292	1280x720/23.98/p
SD	SMPTE 259-C	720x576/50/i
SD	SMPTE 259-C	720x486/59.94/i