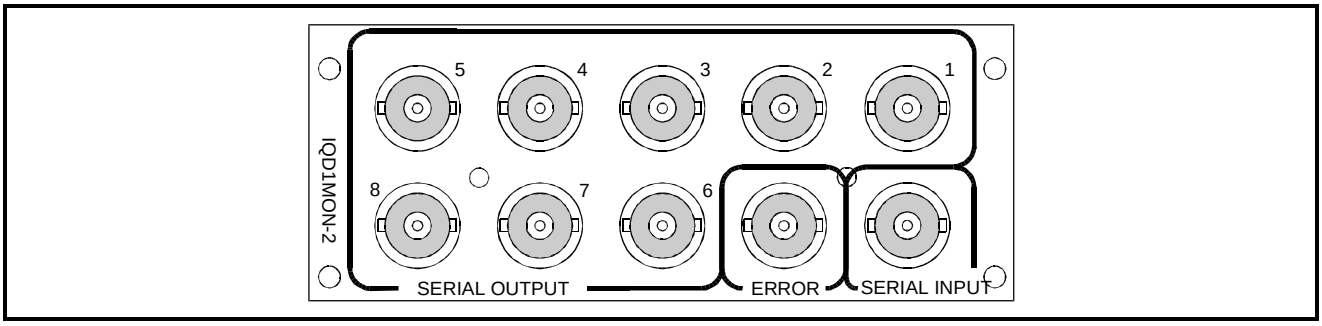
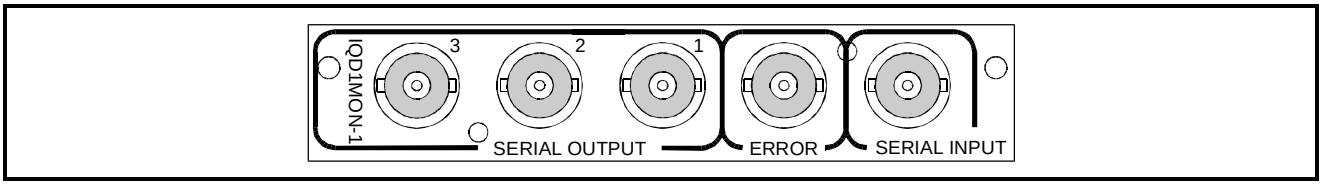
IQD1MON D1 EDH Inserter and D1 Monitor

Module Description

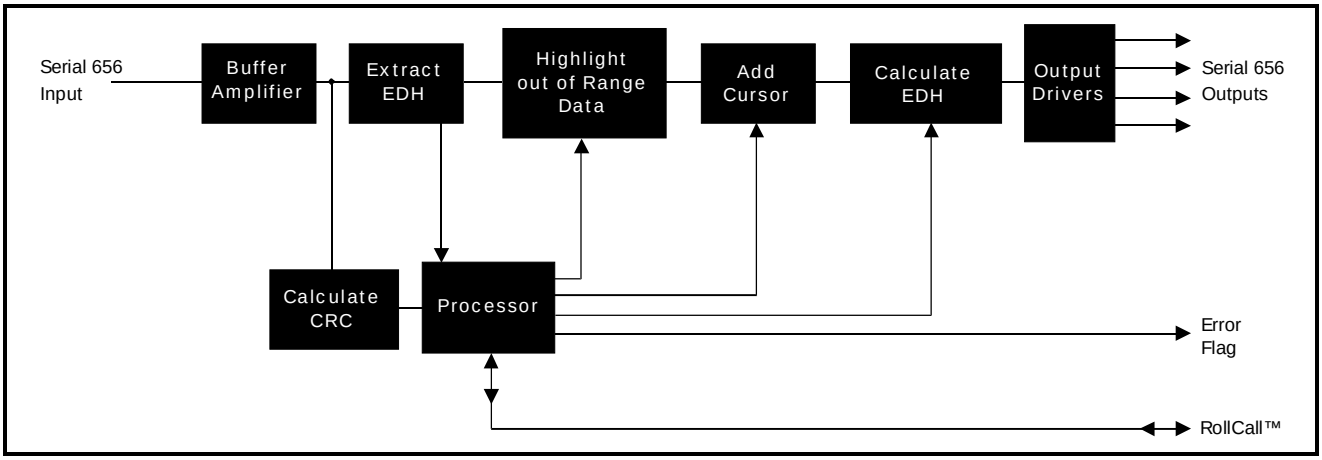
The IQD1MOn-1 and IQD1MOn-2 are two modules for monitoring D1 signals for EDH, Gamut and level errors, and inserting EDH data into a D1 data stream.
These modules can mark on screen and warn by means of on board LED's such pixels which fall outside a set of user defined legal levels enabling their identification and hence correction.
Illegal conditions that can be checked for are Y level, C level and RGB gamut checking, each of which is individually programmable by the user using RollCall™.
A detailed study of each pixel, both in the active video region and in the non visible blanking regions of the frame can be made with data being displayed as either Y, Cr and Cb values or as pure byte-by-byte data. While the active picture part of a frame is being scrutinised, a cursor is superimposed onto the video data.
The ability to study the incoming data stream on a byte-by-byte basis is an extremely powerful debugging aid for technicians, enabling the output from other pieces of equipment to be studied directly.
Returned data can be displayed in any one of four numbering standards, namely 8-bit decimal, 10-bit decimal, 8-bit hexadecimal or 10-bit hexadecimal.
The IQD1MOn-1 module provides 3 serial outputs, the IQD1MOn-2 provides 8 serial outputs and an error status output is available from both units

REAR PANEL VIEWS





BLOCK DIAGRAM



Features

- 4:2:2 serial input with serial output
- Error status report in accordance with SMPTE 269M
- Checks, adds and extracts EDH information
- Gamut checking
- 4:2:2 level checking
- 4:2:2 sample data output
- Returned data displayed in 4 numbering standards
- Examination of individual pixels by means of a cursor
- Byte-by-byte examination of input serial stream

Versions of the module cards available are:

IQD1MON-1	3 Serial outputs. EDH processing, Gamut and level Checking	Single width module
IQD1MON-2	8 Serial outputs. EDH processing, Gamut and level Checking	Double width module
IQD1EDH-1	3 Serial outputs. EDH processing	Single width module
IQD1EDH-2	8 Serial outputs EDH processing	Double width module

Features

Signal Inputs

Serial Input	D1 serial digital

Signal Outputs

Serial	3 sets (IQD1MOn-1) or 8 sets (IQD1MOn-2) of Serial Digital
Error	Error Status to SMPTE 269M

Controls

Reset error log indicator	On/Off

Additional Controls via RollCall™ Remote Control System

EDH packet information
Long term error logging
Sample Value Extraction

Specifications

Input Return Loss	better than 15dB to 270 MHz
Maximum Input Cable Length	200 m
Output Return Loss	better than 15dB to 270 MHz
Error Output	Opto-coupled; open for OK, closed for fault or power fail in accordance with SMPTE 269M. A field error will produce a closed condition for 2ms.

Preset Control Ranges

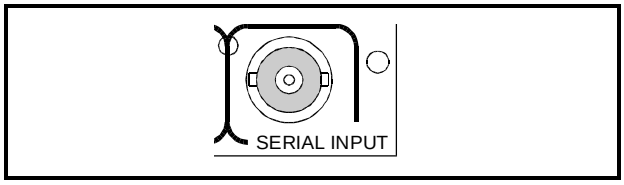
Reset error log indicator	On/Off

Additional RollCall™ Functions

EDH	Packet information
Logging	Long term errors
Extraction	Sample Values

INPUTS AND OUTPUTS

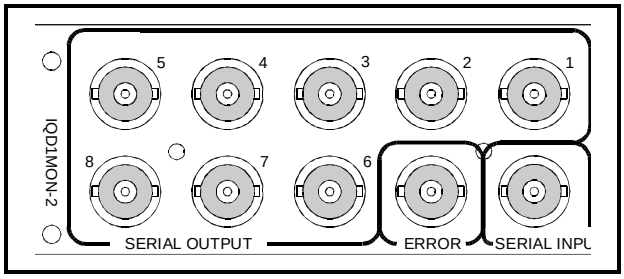
The serial digital input to the unit is made via this BNC connector which terminates in 75 Ohms.

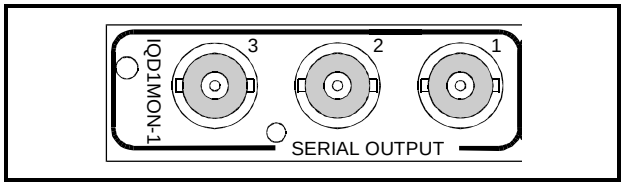


SERIAL OUTPUTS

Serial digital signals are available from the unit via BNC connectors for 75 Ohms.

The IQD1MON-2 provides 8 outputs and the IQD1MON-1 provides 3 outputs.

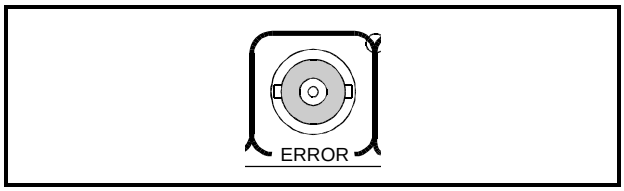




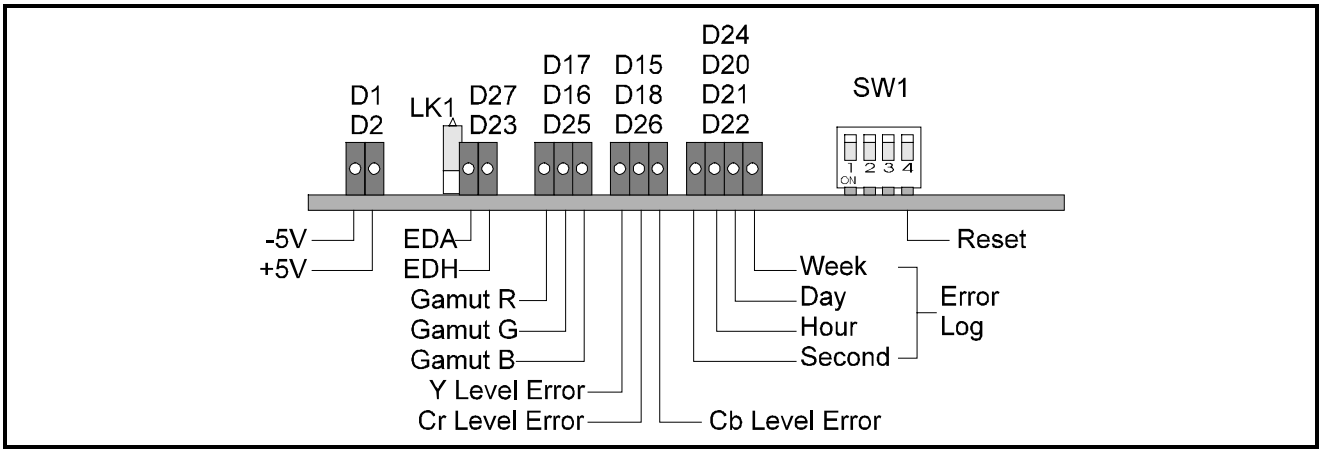
ERROR

This BNC connector provides an output for error status reporting in accordance with SMPTE 269M. This is an Opto-coupled output, open for OK, closed for fault or power fail and 2 ms pulse to indicate a field error.

For more details refer to the Appendix.



CARD EDGE CONTROLS

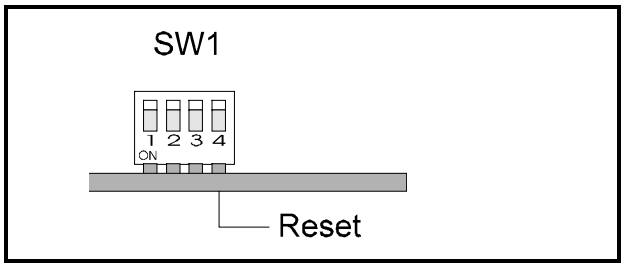


Adjustment of the settings for the IQD1MON is available either via card edge controls (Reset only on this module) and/or via a more comprehensive remote control system using RollCall™.

Note that the unit will respond to both local and remote control, one system overriding the settings of the other For cards using the RollCall™ remote control system, activating these switches will override the remote control settings. The RollCall control panel will then follow these settings.

Note that in Main-frames where RollCall is not available the remote link, LK1, located at the front of the card, should be removed. This ensures that when the unit is powered-up the factory default settings are loaded. With LK1 fitted the card will power-up with the last settings sent by the remote control panel.

SW1



By setting these switches various modes of operation may be selected.

Position 1

This position has no function on this unit

Position 2

This position has no function on this unit

Position 3

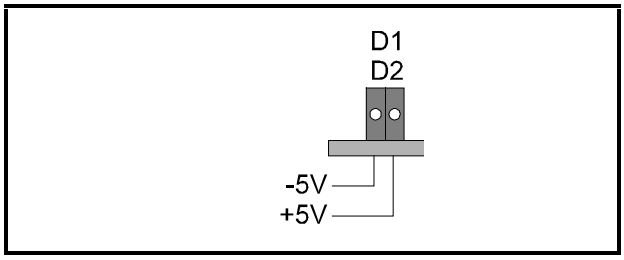
This position has no function on this unit

Position 4

Setting this switch to the ON position resets the error log indicators.

LED INDICATORS

When illuminated D1 indicates that the -5V power supply is present and D2 indicates that the +5V supply is present.



EDH REPORTING

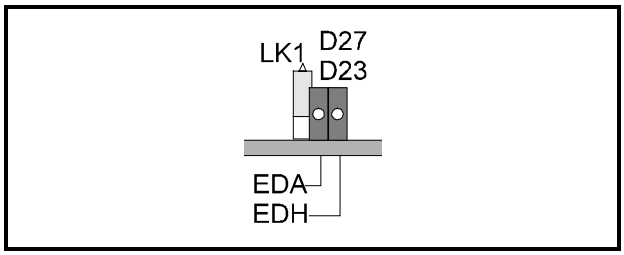
D27 EDA (Error Detected Already)
D23 EDH (Error Detected Here)

These LED's have three conditions:

OFF (not illuminated) indicates that there is no EDH or EDA information available in the data stream (no flags set)

FLASHING indicates that EDH/EDA information is available in the data stream and there are EDH or EDA errors.

ON (illuminated) indicates that EDH/EDA information is available in the data stream and there are no EDH or EDA errors.



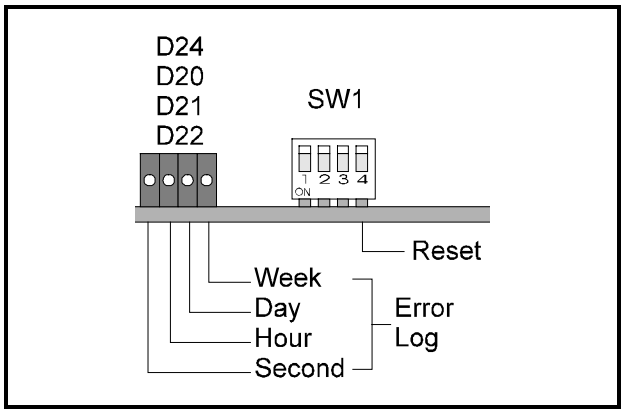
D24, D20, D21 and D22 indicate that EDH errors have occurred during a particular time period.

D24 indicates that an error has occurred in the last second

D20 indicates that an error has occurred in the last hour

D21 indicates that an error has occurred in the last day

D22 indicates that an error has occurred in the last week

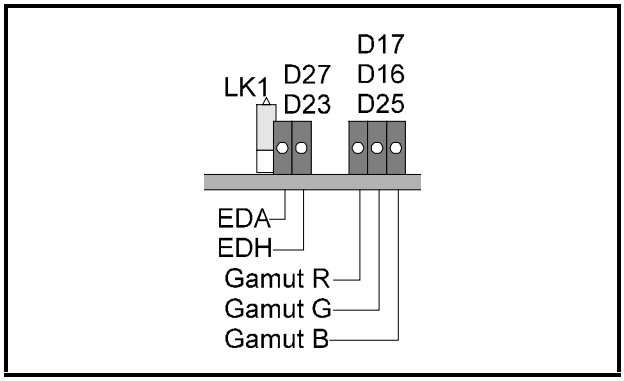


D17, D16 and D25

These LEDs will become illuminated if the particular component signal (R,G,B) is out of Gamut (the legal amplitude range) and is detected when the digital signal exceeds user settable levels.

i.e. if Y level exceeds 2358 if Cb or Cr exceeds 2408 or less than 168

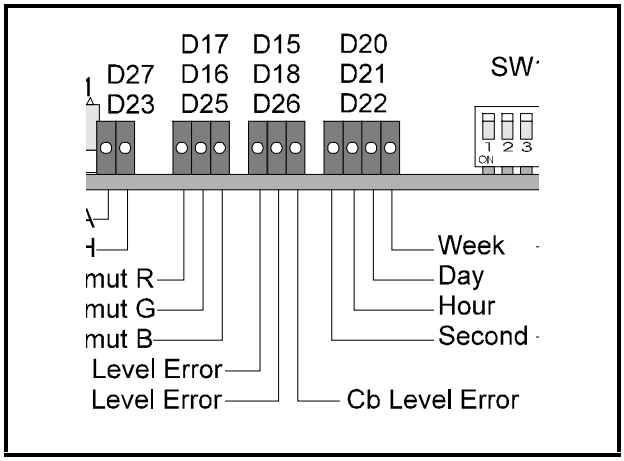
They will flash at a rate of one flash per second to indicate an input signal loss.



D15, D18 and D26

These LEDs will become illuminated if the particular component signal (Y,Cb,Cr) is out of the legal amplitude range as specified by the user by means of a remote control system.

i.e.if Y level exceeds 2358 if Cb or Cr exceeds 2408 or less than 168

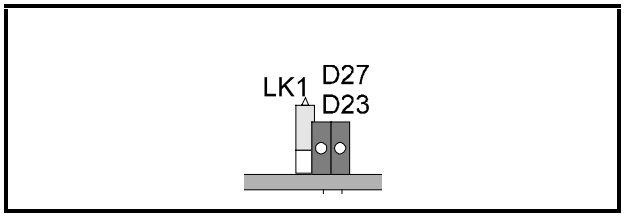


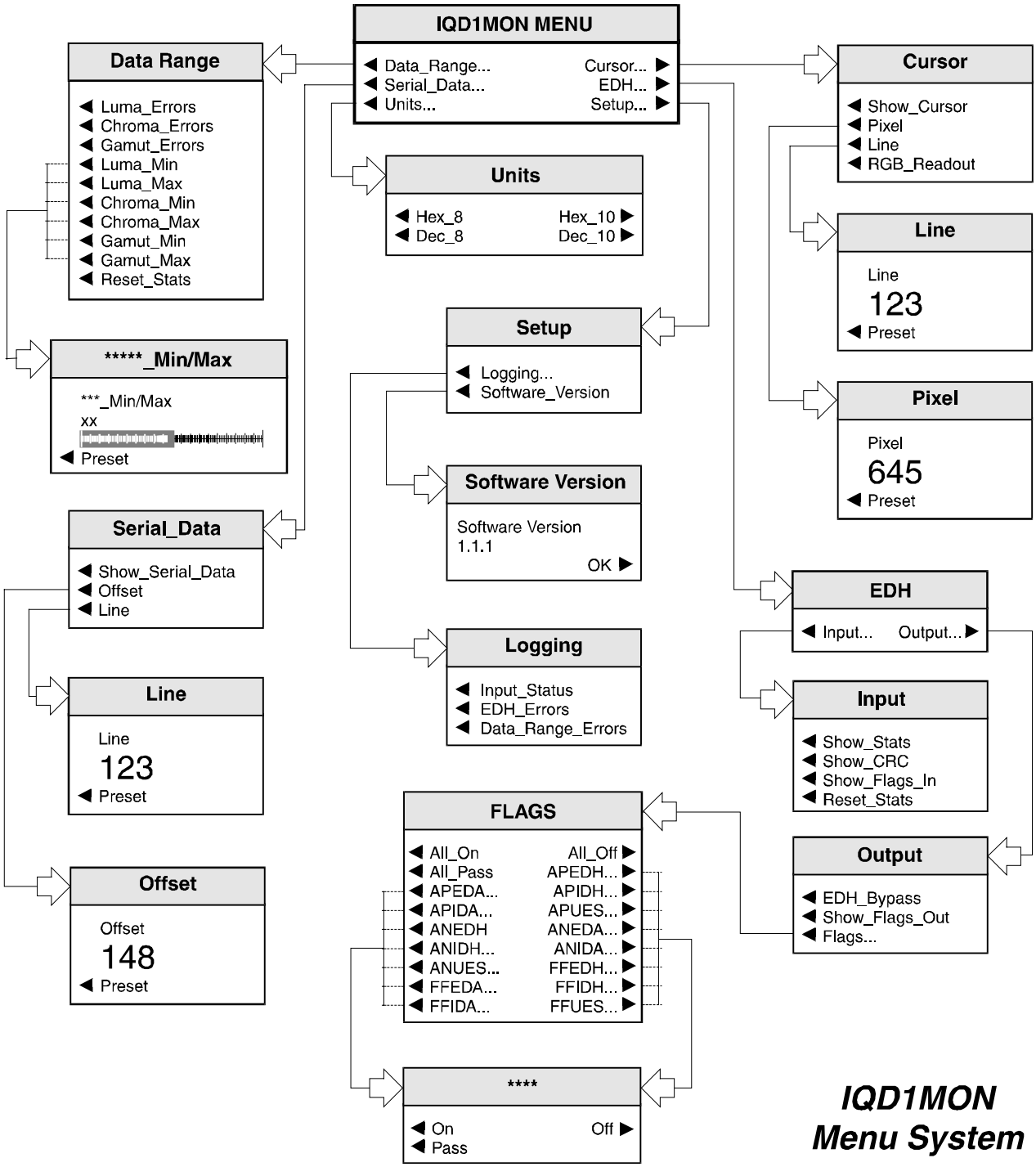
LINK LK1

This link allows the default settings at power-up to set.

When the link is fitted the module will power-up in the same state as when the module was powered-down. When the link is not fitted the module will power-up using the factory default settings.

Note that the settings are saved every 10 seconds




IQD1MON MENU
Data_Range...
Serial_Data...
Units...
Cursor...
EDH...
Setup...
Data Range
Luma_Errors
Chroma_Errors
Gamut_Errors
Luma_Min
Luma_Max
Chroma_Min
Chroma_Max
Gamut_Min
Gamut_Max
Reset_Stats
Units
Hex_8
Dec_8
Hex_10
Dec_10
Cursor
Show_Cursor
Pixel
Line
RGB_Readout
Line
Line
123
Preset
Setup
Logging...
Software_Version
*****_Min/Max
***_Min/Max
xx
Preset
Pixel
Pixel
645
Preset
Software Version
Software Version
1.1.1
OK
Serial_Data
Show_Serial_Data
Offset
Line
EDH
Input...
Output...
Logging
Input_Status
EDH_Errors
Data_Range_Errors
Line
Line
123
Preset
Input
Show_Stats
Show_CRC
Show_Flags_In
Reset_Stats
FLAGS
All_On
All_Pass
APEDA...
APIDA...
ANEDH
ANIDH...
ANUES...
FFEDA...
FFIDA...
All_Off
APEDH...
APIDH...
APUES...
ANEDA...
ANIDA...
FFEDH...
FFIDH...
FFUES...
Output
EDH_Bypass
Show_Flags_Out
Flags...
Offset
Offset
148
Preset
****
On
Pass
Off
IQD1MON
Menu System

OPERATION FROM AN ACTIVE CONTROL PANEL

The card may be operated with an active control panel via the RollCall™ network.

The menus available for this card are shown on page opposite and will appear in the Control display window.

Operational details for the remote control panel will be found in SECTION 1 of the Modular System Operator's Manual.

MENU DETAILS (see IQD1MON Menu System Opposite)

MAIN MENU

The main, or top level menu allows various sub-menus to be selected by pressing the button adjacent to the required text line.

Note that where a menu item is followed by three dots (...) this indicates that a further sub-menu may be selected.

Whenever a menu item is selected the parameters of that selection will be displayed in the Information window of the front panel. Where the selection is purely a mode selection and does not enable a sub-menu, the text will become reversed (white-on-black) indicating that the mode is active. If the mode is not available for selection the text will remain normal.

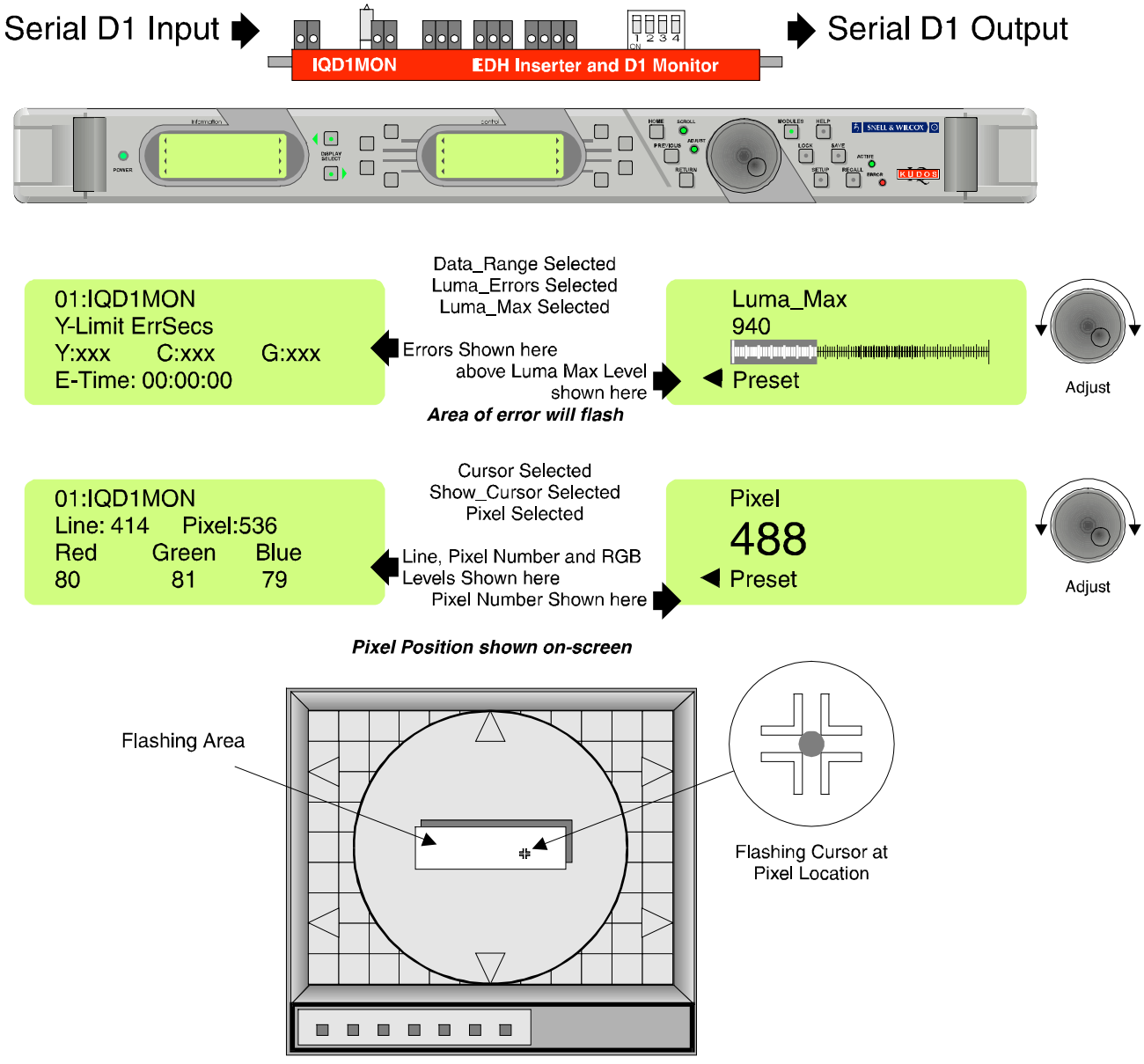
Operation Overview

These modules will monitor D1 signals for EDH, Gamut and level errors, and can insert EDH data into a D1 data stream.

Errors may be indicated on-screen as a flashing area (also by on-board warning LED's) where a particular error occurs. A cursor may also be added to the output picture and may be positioned, pixel-by-pixel and line by line, anywhere in the picture frame. The parameters of the pixel (pixel number, line number and amplitude) will be shown in the LCD windows and amplitudes may be shown as Hex or Decimal numbers. Such pixels which fall outside a set of user defined legal levels enable their identification and hence correction by other equipment and these data range errors may be logged on a suitable logging device.

Illegal conditions that can be checked for are Y level, C level and RGB gamut checking, each of which is individually programmable by the user using the Rollcall remote control system.

The picture below shows how a Luma Max error is indicated by a flashing area and how a single pixel may be interrogated.



SUB-MENU DETAILS

DATA RANGE

These modules can mark on screen (by means of a cursor) such pixels which fall outside a set of user defined legal levels enabling their identification and hence correction. The position of the cursor is defined by the number of pixels along a line and by the TV line number. These values may be set and displayed in the LCD window.

This sub-menu lists:

1 The parameters that may be checked for errors (illegal conditions)

2 Maximum and minimum limits for Luminance, Chrominance and Gamut levels. Preset or user defined values can be used.

The spinwheel should be used to reveal the required item.

Parameter Error Checks

One of the following may be selected for error checking:

Luma_Errors
Chroma_Errors
Gamut_Errors

Any errors of that parameter will then be shown in the information window.

Level Limits Checks

The following parameters may be selected for checking of maximum or minimum limits:

Limit	**Preset Value**	**Adjustable To**
Luma_Min	64	940
Luma_Max	940	1023
Chroma_Min	64	512
Chroma_Max	960	1023
Gamut_Min	1	128
Gamut_Max	240	255

Note that when an error check is selected e.g. Luma_Errors, both minimum and maximum errors will be indicated as a flashing area on the screen.

When selected, a bargraph display will appear in the Control window showing the measured level of that parameter as a digital value.

For example, if Luma_Max is selected and the preset button pressed, the value shown will be 940; this represents the normal maximum value of a luminance signal. If the luminance input signal exceeds 940 the area that is above this level will flash on the screen.

If the spinwheel is rotated to increase the displayed value (the limit) a point will be reached when the flashing stops; the value indicated when this happens will be the value of the maximum luminance excursion.

In practice the preset value should be used and the signal level corrected up-stream such that the flashing just stops.

A similar procedure is used for the other limit checks.

Note that Gamut errors refer to level errors in the RGB signals when trancoded from the YCbCr digital signals.

Reset_Stats

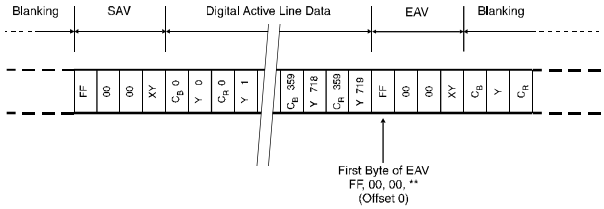
Pressing this button resets the error checking time (E-Time) shown in the Information window, to zero and the count restarts.

SERIAL DATA

Show_Serial_Data

The amplitude of a selected byte on a selected line of the input data may be displayed in the Information window when this function is enabled.

A Digital Video Line



Offset

This sub-menu allows each byte of the incoming data (on a selected line) to be interrogated.

The range is from 0 (the first byte of EAV; FF,00,00) to byte 1727 (625 line) or byte 1715 (525 line) Selecting preset returns the display to 0. Selecting preset returns the display to 0.

Line

This sub-menu allows a particular line in the frame to be selected by rotating the spinwheel. The range is from line 1 to line 625/525. Selecting preset returns the display to line 100.

UNITS

When the Show_Cursor in the Cursor menu is enabled (see below) the amplitude of the selected pixel on the selected line will be displayed in the Information window as RGB or YCbCr values as selected by the RGB_Readout function of the cursor sub-menu. The type of units used to represent these amplitudes may be selected from this menu and are as follows:

Hex_8

A hexadecimal number 8-bit range

Hex_10

A hexadecimal number 10-bit range

Dec_8

A decimal number 8-bit range

Dec_10

A decimal number 10-bit range
CURSOR

Selecting this function will reveal a sub-menu that will allow the on-screen cursor to be displayed and its line and pixel position to be set. The amplitude of the pixel will be shown in the Information window. The format

(RGB or YCbCr) used to represent this value may be changed from this sub-menu.

Show_Cursor

When selected the cursor will appear on the screen and the value of the pixel will appear in the Information window. The cursor will flash on and off so that it may be easily located. Note that the cursor will only be visible within the active picture area.

Pixel

This function allows a particular pixel in a line to be selected by rotating the spinwheel. The range is from 0 to 863 (625 line) or 857 (525 line); pressing preset returns the display to pixel number 360.

Line

This function allows a particular line in the frame to be selected by rotating the spinwheel. The range is from line 1 to line 525 or 625; pressing preset returns the display to line number 100.

RGB_Readout

The amplitude of the selected pixel on the selected line will be displayed in the Information window as RGB or YCbCr values This function allows either RGB values (text highlighted) or YCbCr (text normal) to be selected.

EDH

This selection reveals a sub-menu that allows various Input or Output EDH parameters to be enabled.

Input

This sub-menu allows input signal EDH information to be displayed in the information window.

Show Stats (Statistics)

When this function is enabled (text reversed) the information window will display the number of Error-seconds *from the time the function was enabled. The elapsed time in hours, minutes and seconds is also displayed.

* Error Seconds

In this context 1 error-second is defined as any number of errors occurring during a single 1 second period. e.g. if any number of errors occur during a 1 second period, this will count as 1 error-second.

Show_CRC

When activated the information window will display the Cyclic Redundancy Check (CRC) code for fields 1 and 2 of Active Picture (AP) and Full Field (FF) The hexadecimal number is calculated according to the CRC-CCITT polynomial x16 + x12 + x5 + 1

Show Flags In

When this function is activated the information window will display the status of the various input flags.

Three error checking data locations are shown:

AP

Errors during the active picture

AN

Ancillary data errors

FF

Full Field errors

These locations are followed by a five digit number of logical 1's and 0's indicating the status of the error flags.

The error flags are (from left to right)

EDH - error detected here:

Signifies that a serial transmission data error was been detected. In the case of ancillary data, this means that one or more ANC data blocks did not match its checksum.

EDA - error detected already:

Signifies that a serial transmission data error has been detected somewhere upstream. If device B receives a signal from device A and Device A has set the EDH flag, when B re transmits the data to device C, the EDA flag will be set and the EDH flag will be cleared if there is no further error in the data.

IDH - internal error detected here:

Signifies that a hardware error unrelated to serial transmission has been detected within a device. This is provided specifically for devices which have internal data error checking facilities, as an error reporting mechanism.

IDA - internal error detected already:

Signifies that an IDH flag was received and there was a hardware device failure somewhere upstream.

UES - unknown error status:

Signifies that a serial signal was received from equipment not supporting this error-detection mechanism.

Reset Stats (Statistics)

Selecting this function will reset the EDH error count and the timer shown in the information window, to zero.

Output

This sub-menu allows output signal EDH flags to be set and the information displayed in the information window.

Output Enable

Selecting this item (text highlighted) will enable EDH generation onto the output data stream.

Show Flags Out

When this function is activated the information window will display the status of the various output flags.

Three error checking data locations are shown:

AP

Errors during the active picture

AN

Ancillary data errors

FF

Full Field errors

These locations are followed by a five digit number of logical 1's and 0's indicating the status of the error flags as in 'Show Flags In'

Flags

This function reveals a sub-menu of flags that may be set on the output data.

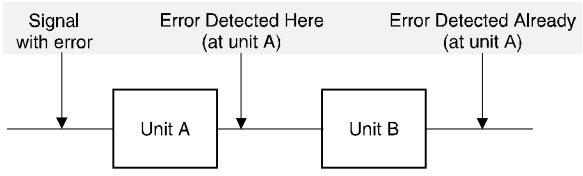
ALL On sets all available flags to the ON state.

All Off sets all flags to the OFF state.

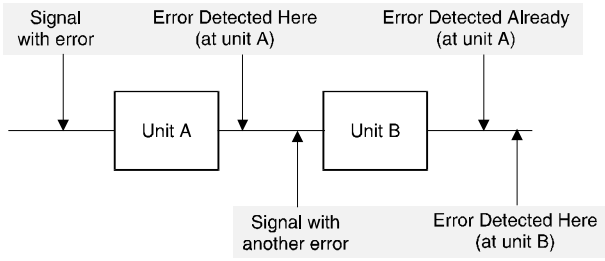
All Pass allows all input signal flags to be passed through, and modified if necessary, to the output. This is the normal mode of operation.

A particular flag may be selected from the list (see next page) and another sub-menu will be revealed that allows the flag to be set to ON, to OFF or pass through from the input to the output.

Example of an error detected by unit A as an Error Detected Here and passed through unit B as an Error Detected Already



Example of an error detected by unit A as an Error Detected Here and passed through unit B as an Error Detected Already plus an error between unit A and unit B being detected and flagged as an Error Detected Here



List of Flags

ANEDH

Ancillary Data: Error Detected Here

ANEDA

Ancillary Data: Error Detected Already

ANIDH

Ancillary Data: Internal Device Error Detected Here

ANIDA

Ancillary Data: Internal Device Error Detected Already

ANUES

Ancillary Data: Unknown Error Status

APEDH

Active Picture: Error Detected Here

APEDA

Active Picture: Error Detected Already

APIDH

Active Picture: Internal Device Error Detected Here

APIDA

Active Picture: Internal Error Detected Already

APUES

Active Picture: Unknown Error Status

FFEDH

Full Field: Error Detected Here

FFEDA

Full Field: Error Detected Already

FFIDH

Full Field: Internal Device Error Detected Here

FFIDA

Full Field: Unknown Error Status

FFUES

Full Field: Unknown Error Status

SET-UP

Logging

If a logging device is attached to the RollCall¿ network, information about various parameters can be made available to such a device.

Selecting this item reveals a display that allows information about three parameters to be made available for logging.

Input_Status

When activated, a loss of input signal condition will be available for the logging device.

EDH_Errors

When activated, EDH error reports will be available for the logging device.

Data_Range_Errors

When activated, any data range error reports will be available for the logging device.

Software_Version

Selecting this item reveals a display showing the version of the software fitted in the module. Select OK to return to the System Menu.

Appendix 1

PROPOSED SMPTE STANDARD FOR FAULT REPORTING IN TELEVISION SYSTEMS SMPTE269M

1 SCOPE

This standard describes a simple interface over which television equipment can report the occurrence of internal failures and faults in incoming signals. It is intended for use in all television equipment, from the simplest active device to the most complex.

The interface consists of an isolated closure which can assume one of three states: open, closed or pulsing. These respectively signal that the reporting device is okay, has detected an internal fault, or is detecting incoming signal faults.

Fault occurrence data may be collected from equipment complying with this standard by several means, ranging from simple "follow the lights to the trouble" summary alarm schemes to computerised logging systems. While full specification of such systems is beyond the scope of this standard, a general outline of one possible implementation is given in annex A.

2 NORMATIVE REFERENCE

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

IEC 169-8 (1978), R.F. Coaxial Connectors with Inner Diameter of Outer Conductor 6.5 mm (0.256 in) with Bayonet Lock - Characteristic Impedance 50 Ohms (Type BNC)

3 FAULT STATES

3.1 A reporting device may be one of three states:

3.1.1 Normal operation

The device is currently not detecting any internal failures and is receiving power.

3.1.2 Internal failure

The device is currently detecting an internal failure or has lost power.

3.1.3 Incoming signal fault

The device is not detecting any internal failures, but is currently detecting fault in incoming signal(s).

4 INTERFACE DEFINITION

4.1 Interface

The interface consists of two-wire connection from an electrically-isolated output closure in the reporting device. The interface reports faults only at the times that they are detected. The closure may be in one of three states:

4.1.1 Open

An open output signifies that the reporting device is operating correctly with valid input(s).

4.1.2 Closed

A closed output signifies that the reporting device has detected an internal fault or has lost power. The closure last s only for the duration of the fault.

4.1.3 Pulsing

A pulsing output signifies that the reporting device has detected errors in the signal(s) it is receiving. The pulsing lasts only for the duration of the errored field(s).

4.2 Pulsing

Pulsing is defined as a closed pulse from 1-2 ms long occurring once per field.

5 ELECTRICAL CHARACTERISTICS

5.1 Output

The output of the reporting device is a closure, electrically isolated from the rest of the device. The isolating mechanism shall withstand a common-mode potential of 60 V peak at frequencies from DC to 400 Hz. The shell of the connector may be bypassed to the chassis by a small-value capacitor, if needed, to limit R.F. radiation.

5.2 Output closure

The output closure must be in the closed state when power is removed from the device (see annex A).

5.3 Open state characteristics

When in the open state, the leakage across the closure must be less than 100 µA at any voltage from 0V to 5 V DC. The closure shall be able to withstand 24 V DC in the open state without damage.

5.4 Closed-state characteristics

In the closed state, the maximum voltage drop across the closure shall not exceed 2V at 20 mA. The sensing device shall not supply more than 20 mA of current to the reporting device.

6 CONNECTOR

The chassis connector used shall be a female BNC type, as defined in IEC 169-8. The center contact shall be connected to the positive side of the sensing mechanism.

Note - Only the mechanical dimensions are specified. Both 50- and 75-ohm connectors are available which meet these requirements.

ANNEX A (informative)

Possible implementation of a reporting scheme

There are many ways to implement a fault data collection and reporting system using the interface specified in this standard. The implementation described here is one of the simplest. It is a hierarchical system and is designed to lead a technician to the faulty device by means of visual and audible signals. No provision is made for automated logging of faults; however, such logging is not precluded.

The scheme works as follows: All fault reporting outputs in each rack or frame are connected in parallel to a summary alarm repeater, which consists of a power supply, an opto-isolator circuit, and an alarm lamp and driver, as shown in figure A 1.

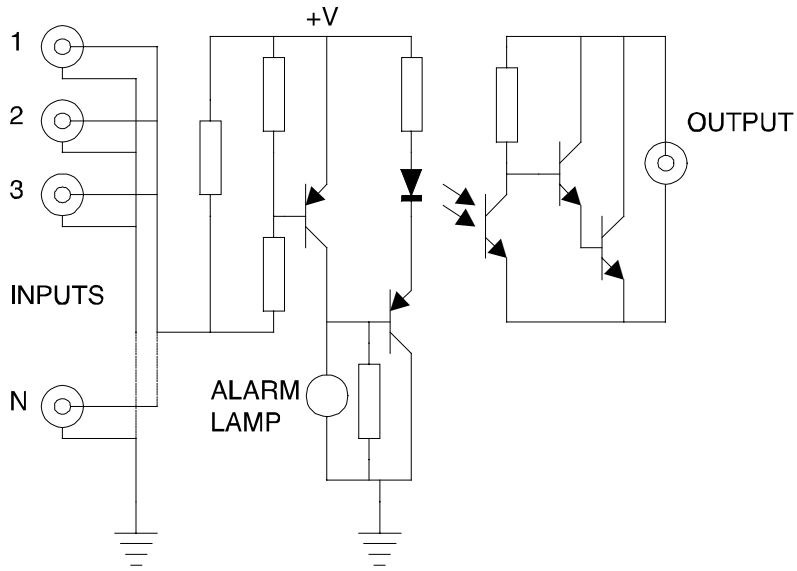


Figure A.1.-Reporting Scheme Implementation

The outputs of the repeaters are connected in parallel to an identical repeater at the end of the rack row. These in turn are connected to another repeater at the entrance to the rack area, and so forth, until all alarms are summed at a staffed monitoring point. Audible alarms may also be used where desired.

When an alarm occurs, the technician simply follows the lights to the correct room, rack area, rack row, rack, frame, and faulty module, and either resets or replaces it as required. Note that this scheme relies on the device originally reporting the fault to provide visual indication of the fault condition.

Schemes of this type have been used by telephone companies for years. They are simple to design and inexpensive to implement. Although they do not provide detailed fault logging, as noted, they greatly facilitate locating failures.

ANNEX B (informative)

Output loss detection

The requirement to signal loss of power as a fault implies that the output must revert to the closed state when the power is off. Figure B.1 shows one possible implementation of such a circuit.

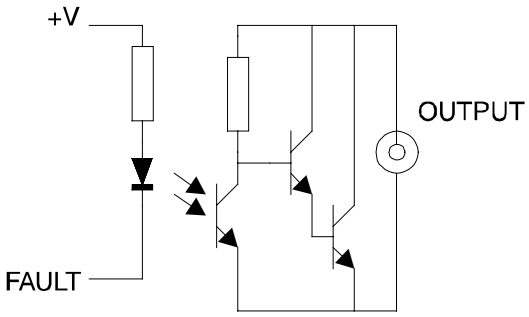


Figure B.1.-Output Interface Implementation

ANNEX C (informative)

Output loss detection

Normal analog video system design practice is to have all outputs of a device driven by the same active components, with the different outputs isolated from each other by buildout resistors. With this arrangement, one can determine the condition of all outputs of the device with a high degree of confidence by monitoring only one of them.

In digital television systems, the bandwidths involved make commonly-driven resistively-isolated outputs impractical. Instead, each output is typically driven by a separate active stage, and noise considerations frequently dictate that half the output drivers are fed from the Q output of the previous stage, while the other half are fed by the not-Q output.

Given this topology, monitoring one output of a device does not indicate the health of the other outputs to the degree of confidence required. The only way to provide this level of confidence is for the device itself to monitor all outputs internally, signalling a fault if any of them fails while the device is receiving or generating a valid input.

ANNEX D (informative)

Bibliography

SMPTE 259M, Television--10-bit 4:2:2 Component and 4 fsc NTSC Composite Digital Signals -- Serial Digital Interface SMPTE RP165, Error Detection Checkwords and Status Flags for Use in Bit-Serial Digital Interfaces for Television.

Appendix 2

PROPOSED SMPTE RECOMMENDED PRACTICE
RP165

Error Detection Checkwords and Status Flags for Use in Bit-Serial Digital Interfaces for Television

1 SCOPE
1.1

This practice describes the generation of error detection checkwords and related status flags to be used optionally in conjunction with the serial digital interface for system M (525/59.94) and systems B, G, H and I (625/50) digital television equipment operating with either 4:2:2 component digital signals of 4fsc composite digital signals. Although it is preferred that this error checking method be used in all serial transmitters and receivers, it is recognised that some equipment must minimise complexity.

NOTE - Line numbers in tables 2 and 3 for 625/50 systems are tentative, and subject to change pending decisions on vertical interval switching for serial signals.

1.2

Two checkwords are defined: one based on a field of active picture samples and the other on a full field of samples. This two-word approach provides continuing error detection for the active picture when the digital signal has passed through processing equipment that has changed data outside the active picture area without re-calculating the full-field checkword.

1.3

Three sets of flags are provided to feed forward information regarding detected errors to help facilitate identification of faulty equipment. One set of flags is associated with each of the two field related checkwords. A third set of flags is used to provide similar information based on evaluating all of the ancillary data checksums within a field.

1.4

The checkwords and flags are combined in an error data packet which is included as ancillary data in the serial digital signal. At the receiver, a recalculation of checkwords may be compared to the error data packet information to determine if a transmission error occurred.

2 NORMATIVE REFERENCES
The following standards contain provisions which, through reference in this text, constitute provisions of this practice. At the time of publication, the editions indicated were valid. All standards re subject to revision, and parties to agreements based on this practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below:

ANSI/SMPTE 125M-1992, Television - Component Video Signal 4:2:2 - Bit-Parallel Digital Interface

SMPTE 244M, Television - System M/NTSC Composite Video Signals - Bit-Parallel Digital Interface

SMPTE 259m, Television - 10-Bit 4:2:2 Component and 4fsc NTSC Composite Digital Signals - Serial Digital Interface

SMPTE RP 168, Definition Of Vertical Interval Switching Point for Synchronous Video Switching

ICE 60B(Sec)200, Helical-Scan Digital Composite Video Cassette Recording Using 19mm Magnetic Tape (Format D-2) (NTSC, PAL), Section Five, Video Interface

EBU Tech 3267- E, Parallel Interface for 625-Line Digital Video Signals

3 LOCATION OF CHECKWORDS, FLAGS, AND INCLUDED SAMPLES

3.1 Location of Checkwords and Flags

Digital data packets containing the calculated checkwords and error information flags are located in the ancillary data area of the vertical interval in a manner to complement the recommended practice of source switching. Locations are shown graphically in figure 1 and specified in table 1 for 525/59.94 systems and table 2 for 625/50 systems. For composite signals, the error data packet is located in the ancillary data area of the first horizontal pulse occurring in the line prior to the recommended vertical interval switching point of each field. For component signals, the error data packet is located just prior to SAV (start of video) in the same lines. To enable proper operation of equipment implementing this practice, signal switching must take place in the vertical interval and conform to SMPTE RP 168.

<table>
<tr><td></td><td>Vertical Blanking Interval</td></tr>
<tr><td>ccc

fff</td><td>(Line n with last full-field sample) eef
(Line n+1 with error data packet)
(Line n+2 used for switching)
(Line n+3 not included in full-field sample)
(Line n+4 first full-field sample)</td></tr>
<tr><td>H-interval

Samples not contained in active picture checkword</td><td>aaa (Line with first active picture sample)

Active Picture Area

(see 3.2 for definition)

(Line with last active picture sample) eea</td></tr>
</table>

NOTES
1 See Tables 1 and 2 for exact sample locations in both fields.
2 ccc = location of checkwords and status flags
3 fff = first sample included in the full-field checkword
4 aaa = first sample included in the full-field checkword
5 eea = last sample included in the active picture checkword.
6 eef = last sample included in the full-field checkword

Figure 1-Location of Checkwords and Included Samples

Table 1-Location of 525/59.94 System Checkwords

Data Item	Composite	Component
Error checking data locations		
Line 9 fields 1 & 111, Line 272, fields 11 &1V		
Ancillary data header, word 1 - component		1689 (000_h)
Ancillary data header, word 2 - component		1690 ($3FF_h$)
Ancillary data header, word 3 - component		1691 ($3FF_h$)
Auxiliary data flag - composite	795 ($3FC_h$)	
Data ID	796 ($1F4_h$)	1692 ($1F4_h$)
Block number	797 (200_h)	1693 (200_h)
Data Count	798 (110_h)	1694 (110_h)
Active picture data word 0	799	1695
Active picture data word 1	800	1696
Active picture data word 2	801	1697
Full-field data word 0	802	1698
Full-field data word 1	803	1699
Full-field data word 2	804	1700
Ancillary data error flags	805	1701
Active picture error flags	806	1702
Full-field error flags	807	1703
Reserved words (7 total)	808-814 (200_h)	1704-1710(200_h)
Checksum for this ancillary data block	815	1711

Table 2 - Location of 625/50 System Checkwords

Data Item	Composite	Component
Error checking data locations:		
Line (5) fields 1 & 111, Line (318), fields 11 &1V		
Ancillary data header, word 1 - component		
Ancillary data header, word 2 - component		Cr425($3FF_h$)
Ancillary data header, word 3 - component		Y851 ($3FF_h$)
Auxiliary data flag - composite	972 ($3FC_h$)	
Data ID	973 ($1F4_h$)	Cb 426 ($1F4_h$)
Block number	974 (200_h)	Y852 (200_h)
Data count	975 (110_h)	Cr426 (110_h)
Active picture data word 0	976	Y853
Active picture data word 1	977	Cb427
Active picture data word 2	978	Y854
Full field data word 0	979	Cr427
Full field data word 1	980	Y855
Full field data word 2	981	Cb428
Ancillary data error flags	982	Y856
Active picture error flag	983	Cr428
Full field error flags	984	Y857
Reserved words (7 total)	985-991 (200_h)	Cb429-Cr430 (200_h)
Checksum for this ancillary data block	992	Y861

NOTES
1 Values in the tables are word numbers for the appropriate standard.
2 Values in parentheses are sample values.

3 625/50 line numbers (in brackets) are tentative.

3.2 Samples included in checkword calculations

Starting and ending samples for active picture and full-field checkword calculations are shown in table 3. For the active picture checkword, only the samples in the active picture area of each line are included in the calculation. As used in this practice, the active picture includes only those lines which, in composite systems, are full lines (that is, half lines are not included.) Full-field checkwords include all the samples in all lines except the line containing the error data packet and the two following lines. The line following the error data packet is normally used for vertical interval switching and the next line is excluded to ensure that word framing and TRS propagation are restored after a switch.

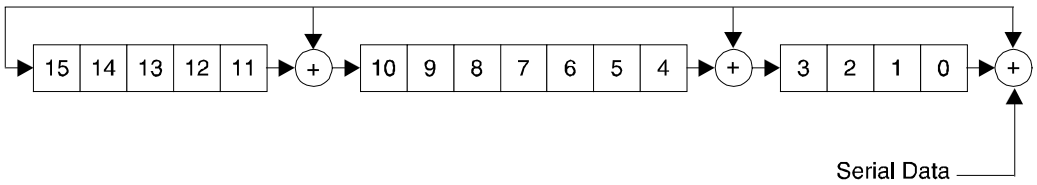
NOTE - For the purpose of performing the CRC calculations in PAL composite systems, sample 967 is defined as the TRS sample with value 3FFh. This is consistent with IEC 60b (Sec)200, but must be clearly defined for CRC calculations in a case a non-standard horizontal interval is encountered.

4 DEFINITION OF DATA WORDS

4.1 Checkword values

Each checkword value consists of 16 bits of data calculated using the CRC-CCITT polynomial generation method. The equation and a conceptual logic diagram are shown below:

Checkword (16 Bit) = $x^{16} + x^{12} + x^5 + 1$



4.2 Ancillary Date Housekeeping, Checkwords, and Flags

Definitions of each ancillary data word specified by this practice are shown in table 4. To provide compatibility with 8-bit equipment, 0s are used in the two least significant bits of all words in the data packet. Bit b7 (V) in picture/field data word 3 is a 1 if a valid CRC has been calculated. This allows implementations which calculate only one or the other of the checkwords. A P in b8 provides even parity for b7 through b0; that is, the total number of 1s in b8 through b0 is an even number. The most significant bit, b9, is the logical inverse of b8.
A checksum is the last word in the error data packet as required by the ancillary data formatting for the serial digital interface.

The checksum word is used to determine the validity of the included words. The checksum word shall consist of 9 bits and the sum of the 9 least significant bits (b8 through b0) of all words including Data ID through reserved words. Preset to all zero at the start of each calculation and ignore the carry.

4.3 Error Flags

All error flags indicate only the status of the previous field; that is, each flag is set or cleared on a field-by-field basis. A logical 1 is the set state and a logical 0 is the unset state. The flags are defined as follows:

edh - error detected here:

Signifies that a serial transmission data error was been detected. In the case of ancillary data, this means that one or more ANC data blocks did not match its checksum.

eda - error detected already:

Signifies that a serial transmission data error has been detected somewhere upstream. If device B receives a signal from device A and Device A has set the edh flag, when B re transmits the data to device C, the eda flag will be set and the edg flag will be unset if there is no further error in the data.

idh - internal error detected here:

Signifies that a hardware error unrelated to serial transmission has been detected within a device. This is provided specifically for devices which have internal data error checking facilities, as an error reporting mechanism.

ida - internal error detected already:

Signifies that an idh flag was received and there was a hardware device failure somewhere upstream.

ues - unknown error status:

Signifies that a serial signal was received from equipment not supporting this error-detection mechanism.

Table 3-Checkwords Included Samples

Data Item	Composite	Component
525.59.94 systems		
First full-field sample, lines 12 and 75	795	1444
First active picture sample, lines 21 and 284	0	0
Last active picture sample, lines 262 and 265	767	1439
Last full-field sample, lines 8 and 271	767	1439
625/50 systems		
First full-field sample, lines (8) and (421)	972	Cb361
First active picture sample, lines 24 and 336	0	Cb0
Last active picture sample, lines 310 and 622	947	Y719
Last full field sample, lines (4) and (317)	947	Y719

NOTE - Full-field 625/50 line numbers (in brackets) are tentative

Table 4-Definition of Ancillary Data Words

Data item	b9 msb	b8	b7	b6	b5	b4	b3	b2	b1	b0 lsb
Ancillary data header, word 1 - component	0	0	0	0	0	0	0	0	0	0
Ancillary data header, word 2 - component	1	1	1	1	1	1	1	1	1	1
Ancillary data header, word 3 - component	1	1	1	1	1	1	1	1	1	1
Auxiliary data flag - composite	1	1	1	1	1	1	1	1	0	0
Data ID	0	1	1	1	1	1	0	1	0	0
Block number	1	0	0	0	0	0	0	0	0	0
Data count	0	1	0	0	0	1	0	0	0	0
Active picture data word 0 crc:<5:0>	P	P	c_5	c_4	c_3	c_2	c_1	c_0	0	0
Active picture data word 1crc:<1 1:6>	P	P	c_{11}	c_{10}	c_9	c_8	c_7	c_6	0	0
Active picture data word 2 crc<15:12>	P	P	V	0	c_{15}	c_{14}	c_{13}	c_{12}	0	0
Full field data word 0 crc<5:0>	P	P	c_5	c_4	c_3	c_2	c_1	c_0	0	0
Full field data word 1 crc<11:6>	P	P	c_{11}	c_{10}	c_9	c_8	c_7	c_6	0	0
Full field data word 2 crc<15:12>	P	P	V	0	c_{15}	c_{14}	c_{13}	c_{12}	0	0
Auxiliary data error flags	P	P	0	ues	ida	idh	eda	edh	0	0
Active picture error flags	P	P	0	ues	ida	idh	eda	edh	0	0
Full field error flags	P	P	0	ues	ida	idh	eda	edh	0	0
Reserved words (7 total)	1	0	0	0	0	0	0	0	0	0
Checksum	S8	S8	S7	S6	S5	S4	S3	S2	S1	S0

NOTE - P and V are defined in 4.2

End.

Manual Revision Record

Date	Version No.	Issue No.	Change	Comments
260897	2	1	Word version created	New issue released