

## IQDNRS SDI Noise Reducer



### Module Description

The IQDNRS provides flexible and powerful noise reduction and signal correction to 10-bit SDI video

The IQDNRS provides powerful noise reduction to 10-bit SDI video. An adaptive frame recursive filter primarily achieves noise reduction. This automatically adjusts to give optimum noise reduction over a wide range of input noise levels.

A sophisticated motion detection algorithm ensures minimum visible artifact. Unlike conventional recursive filters this patented design is able to suppress the trail of noise often visible on plain areas following a moving object. The recursive filter is followed by a proprietary sparkle filter to remove unwanted impulses and receiver drop-outs.

This 3 dimensional filter is more selective than a conventional median filter to allow greater general use. Following this is a unique adaptive horizontal filter to remove high and /or mid frequency noise while maintaining full resolution. For low bandwidth sources this filter may be reconfigured to give a selection of smooth low pass responses.

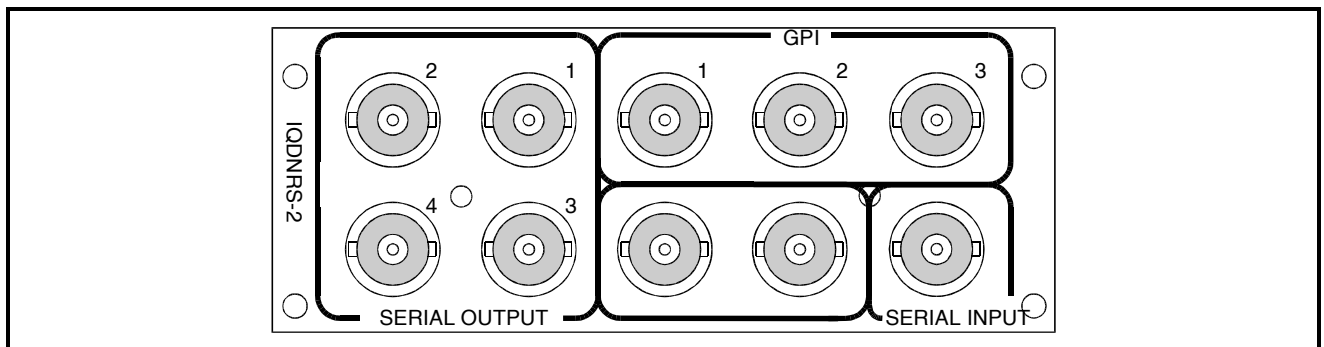
Signal correction features include proc. amp controls, a 3-stage luminance enhancer and timing correction.

EDH is fully supported and vertical / audio data is preserved. This unit inserts less than two lines of video delay so avoiding the need for compensation delays for audio. A crystal locked output helps in reducing incoming jitter and together with sync insertion provides a continuous output in event of input loss. The unit automatically detects 525 and 625 line inputs.

A unique feature of this product is a "Hands-Free" mode. With this selected the unit will limit the maximum noise reduction to avoid the possibility of producing noticeable artefacts. This mode is suitable for unattended operation with a variety of source noise conditions.

Full RollCall remote control is included, as are three fully assignable GPI inputs. User memories allow for pre-programming of optimum noise reduction and proc. amp settings of various source materials. Most control features are also accessible via the card edge.

### REAR PANEL VIEW

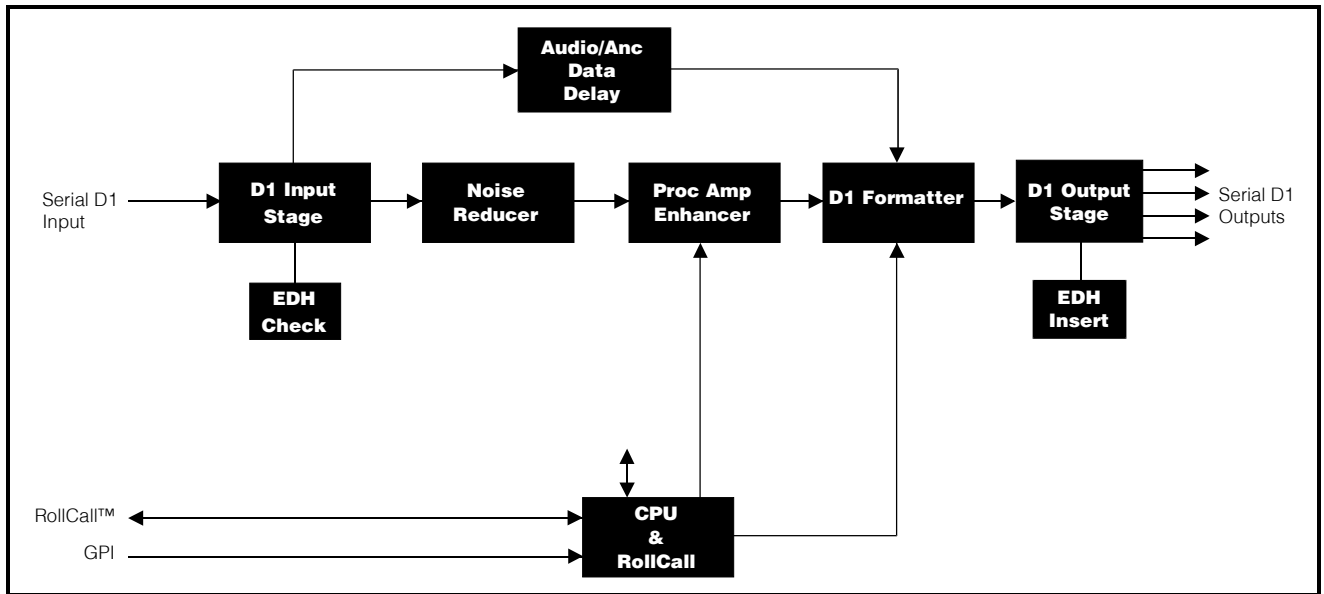


Versions of the module cards available are:

IQDNRS-2 SDI Noise Reducer

Double width module

## BLOCK DIAGRAM



## Features

- Adaptive temporal recursive Y and C filtering
- Highly selective sparkle filter
- Adaptive horizontal filter for noise reduction
- Vertical and horizontal luminance enhancer
- Low pass filter for low bandwidth sources
- Automatic noise level measurement
- Fully automatic or manual operation
- Frame freeze
- Gain and timing adjustment
- 10-bit data path throughout
- Maintains valid output with input fail
- Split screen for before - after comparison
- 3 programmable GPI inputs
- RollCall remote control and monitoring

## TECHNICAL PROFILE

**Features****Signal Inputs**

Serial Digital ..... 1 x SDI  
 Standards ..... SMPTE 259M-C-1997  
 GPI ..... 3 Closing Contact style inputs

**Signal Outputs**

Serial Digital ..... Up to 4 x SDI  
 Standards ..... SMPTE 259M-C-1997

**Card Edge Controls (also available via RollCall)**

Y Noise Reduction Level.... Off/ Low/ Medium/ High  
 C Noise Reduction Level ... Off/ Low/ Medium/ High  
 Sparkle Filter ..... Off/On  
 Noise Measurement..... Auto/ Manual  
 Manual Threshold Level.... 8 levels  
 Adaptive Horizontal Filter... Off/ On  
 Vertical Enhancement..... Off/ Low/ Medium/ High  
 Y Horizontal Enhancement High Frequency (Off, Low, Medium, High)  
 Mid Frequency (Off, Low, Medium, High)  
 Noise Suppress (Off/ On)  
 De-enhance (Off/ On)

Y Gain Adjust .....  $\pm 6$  dB in 0.1 dB steps  
 C Gain Adjust.....  $\pm 6$  dB in 0.1 dB steps  
 Black Level Adjust.....  $\pm 100$  mV in 0.8 mV steps  
 Horizontal YC Adjust.....  $\pm 444$  ns in 148 ns steps  
 Picture Position Adjust.....  $\pm 592$  ns in 148 ns steps  
 Pattern Select ..... Off, Black, EBU Bars, 100% Bars, Multiburst, Valid Ramp, Pulse and Bar  
 Auto Freeze ..... Freeze on Input Loss (Default is Pattern Output)  
 Limiter..... Limits output to standard SMPTE/EBU levels  
 User Memories..... 8 (save/ recall)  
 Preset Unit ..... Returns all settings to factory defaults

**Functions Available via RollCall™ Only**

EDH logging  
 GPI configuration ..... To assign function to each GPI input  
 Sparkle Filter Setup ..... Sensitivity  
 Dropout Filter  
 Motion Process  
 Trail Process

**Specifications**

Serial Input Return Loss .... Better than  $-15$  dB to 270 MHz  
 Maximum Input Cable length  
 > 200 m (PSF1/2 or equiv. cable)  
 Serial Output Level ..... 800 mV  $\pm 10\%$   
 Output Overshoot ..... < 70 mV  
 Output Return Loss..... Better than  $-15$  dB to 270 MHz

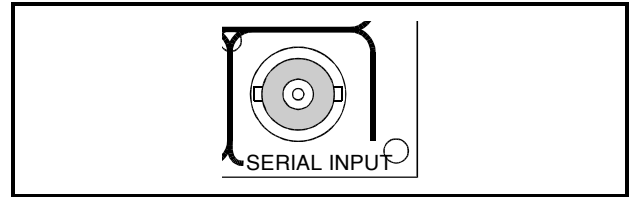
Output Jitter ..... < 0.25UI  
 Insertion Delay ..... Approximately 68  $\mu$ s

**Power Consumption**

Module Power Consumption  
 8.6W max

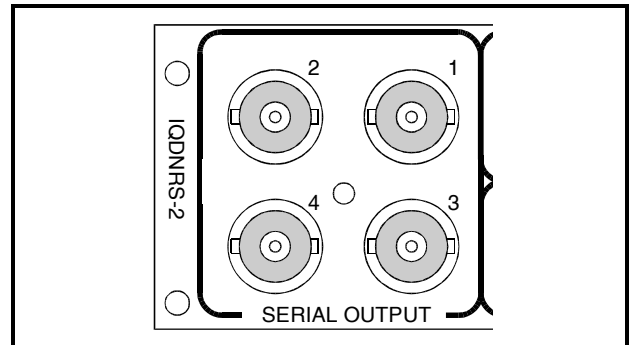
### SERIAL INPUT

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



### SERIAL OUTPUTS

These are the four isolated Serial Digital outputs of the unit via BNC connectors for 75 Ohms.

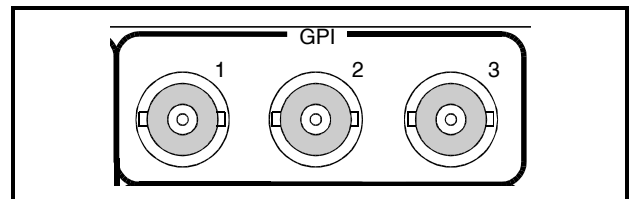


### GPI

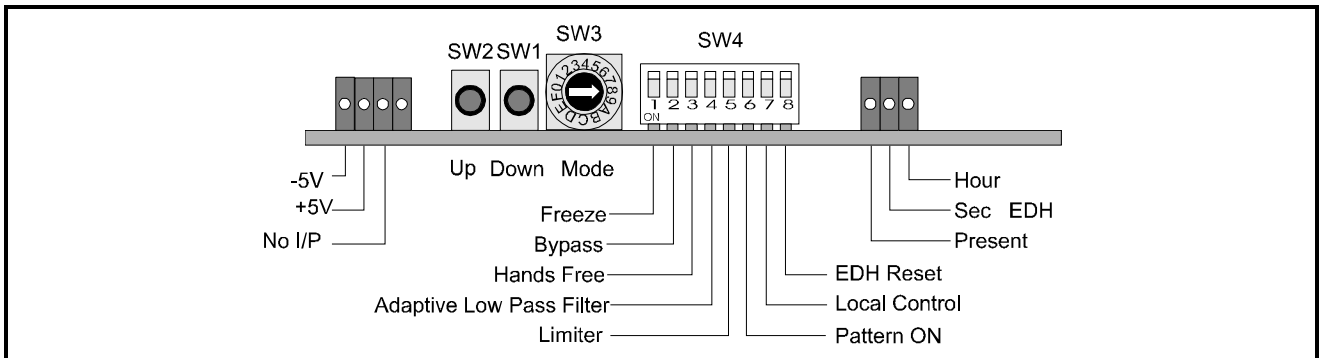
These three connectors are used for accepting GPI information (from mechanical switch contacts, relay contacts etc.) The resulting action that the unit takes may be programmed via RollCall.

The GPI inputs have two user selectable modes of operation:

1. Latched: when the contact is closed the function is activated; when the contact is open, the function is de-activated.
2. Edge-triggered: with each open-to-closed trigger the GPI function is toggled between activated and de-activated.



CARD EDGE CONTROLS



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.

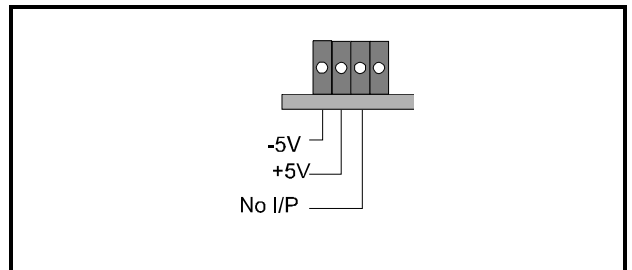
LED INDICATORS

**+5V and -5V**

When illuminated these LED's indicate that the +5 V and -5 V supplies are present.

**No I/P**

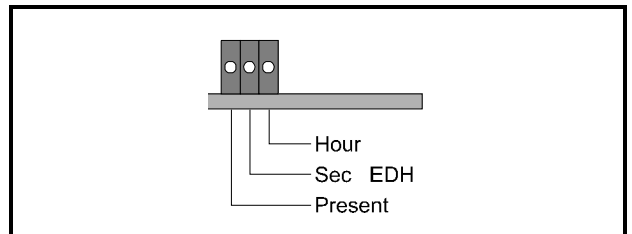
The **No I/P** LED will be continuously illuminated when the unit is not receiving an input signal.



EDH Reporting

The **Present** LED will be illuminated if EDH data is present on the incoming signal.

The **Hour** LED indicates that an error has occurred in the last hour and the **Sec** LED indicates that an error has occurred in the last second.



Note that SW4/8 resets these indicators.

Adjustment of the settings of the IQDNRS is available either via card edge controls and/or via a more comprehensive remote control system using RollCall™

SWITCHES

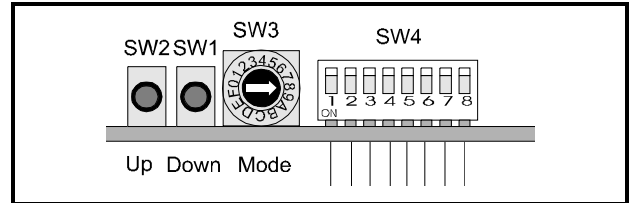
Two push buttons, a Hex switch and a 8 way DIL switch allow various functions and modes to be set.

The DIL switch SW4 selects a particular function and the Hex switch SW3 selects a mode or variable parameter.

The push buttons SW1, SW2 allow the value of the selected function/parameter to be adjusted.

The Mode select switch may select a mode or a parameter that may be adjusted.

**Note that to select the preset value both buttons should be pressed together.**



These switches allow the module to be operated when an active front panel is not available.

More detailed information about these functions will be found under *MENU DETAILS* starting on page 11.

FUNCTION AND MODE SELECTIONS

DIL SWITCH FUNCTIONS SW4

By setting these switches various modes of operation may be selected. (Down is ON and Up is OFF)

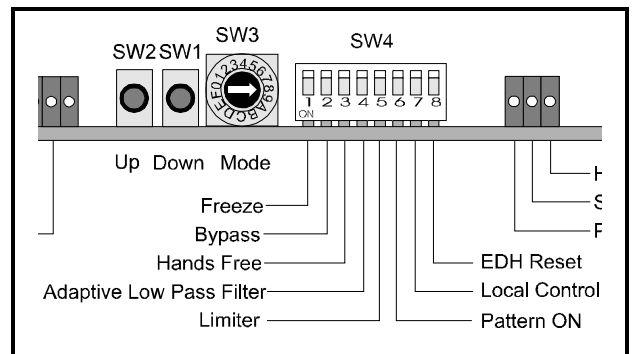
**Position 1**  
Setting this to ON provides a **Freeze** frame picture.

**Position 2**  
Setting to ON selects the **Bypass** mode. The input signal will pass through the electronics of the unit unprocessed.

**Position 3**  
Setting to ON enables the **Hands Free** mode. In this mode the unit will limit the maximum noise reduction to avoid the possibility of producing noticeable artefacts. This mode is suitable for unattended operation with a variety of source noise conditions.

**Position 4**  
This position will enable the **Adaptive Low Pass Filter**. When active the trail of noise following a moving object is attenuated.

**Position 5**  
Setting this to ON enables the **limiter** and the output is limited to standard levels. (0 V/700 mV for Y, 700 mV p-p for Pb and Pr)



## Position 6

When set to ON (Down) this allows the unit to produce a **test pattern** (selected using SW3) signal as an output.

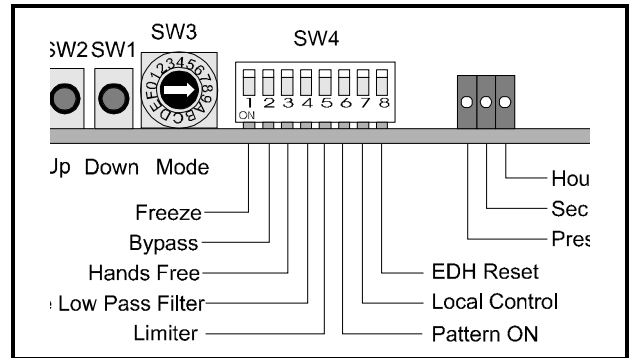
## Position 7

When set to ON (Down) this allows the unit to operate under **local control**.

*Note that in Main-frames where RollCall™ is not available this switch should be set to the ON position. This ensures that when the unit is powered-up the factory default settings of parameters not available as card edge adjustments, are loaded. When set to the UP position the card will power-up with the last settings sent by the remote control panel.*

## Position 8

Setting this to the ON position resets the **EDH** log indicators.



## SW3

This HEX switch selects a parameter that may be adjusted with the push-buttons SW1 and SW2.

*Note that SW1 decreases a setting and SW2 increases a setting. Continual pressure on the button will cause the setting to change continuously, the rate of change increasing with time. Pressing both together sets functions to their default values.*

## Position 0

This enables **Y** (luminance) recursive **noise reduction**. Level selections available are Off, Low, Medium and High.

## Position 1

This enables **C** (chrominance) recursive **noise reduction**. Level selections available are Off, Low, Medium and High.

## Position 2

The **horizontal position** of the picture (relative to syncs) may be adjusted by  $\pm 592$  ns in 148 ns steps using SW1 and SW2.

Default is to 0 ns

## Position 3

The **horizontal chrominance delay** relative to luminance (i.e. Y to Cb/Cr timing) may be adjusted by  $\pm 444$  ns in 148 ns steps using SW1 and SW2.

Default is to 0 ns

## Position 4

This enables the **Sparkle** filter. Selections are On and Off.

## Position 5

This allows the **luminance gain** of the unit to be adjusted.

The overall range of adjustment is  $\pm 6$  dB in 0.1 dB steps.

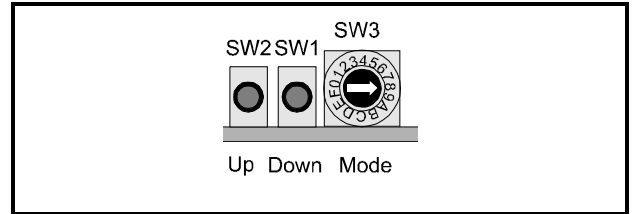
Default setting is to the calibrated value of 0 dB.

## Position 6

This allows the **chrominance gain** of the unit to be adjusted.

The overall range of adjustment is  $\pm 6$  dB in 0.1 dB steps.

Default setting is to the calibrated value of 0 dB



## Position 7

This allows the **black level** of the unit to be adjusted.

The overall range of adjustment is  $\pm 100$  mV in 0.8 mV steps.

Default setting is to the calibrated value of 0 mV.

## Position 8

This allows a **test pattern** to be selected as the output (in this order) from the following list:

Black  
EBU Bars  
100% Bars  
Multiburst  
Valid Ramp  
Pulse and Bar

Default is to black.

## Position 9

This allows **horizontal high frequency enhancement** to be applied to the processed signal. The range of adjustment is off, low, medium and high.

Default is to OFF.

## Position A

This allows **horizontal medium frequency enhancement** to be applied to the processed signal. The range of adjustment is off, low, medium and high.

Default is to OFF.

## Position B

This allows **vertical enhancement** to be applied to the processed signal. The range of adjustment is off, low, medium and high.

Default is to OFF.

## Position C

This position allows the type of noise reduction threshold to be selected. On selects **Manual Threshold** and Off selects **Auto Threshold**.



#### Position D

When the unit suffers a **loss of input** signal the output signal will revert to a pattern (selected only from the menu) or a frame freeze. Default pattern is to Black. In this position pressing SW1 sets the unit to the pattern and pressing SW2 sets the unit to freeze.

*Note that picture corruption is possible in the freeze frame mode.*

Default is to freeze.

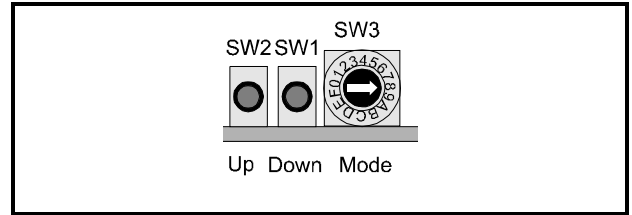
#### Position E

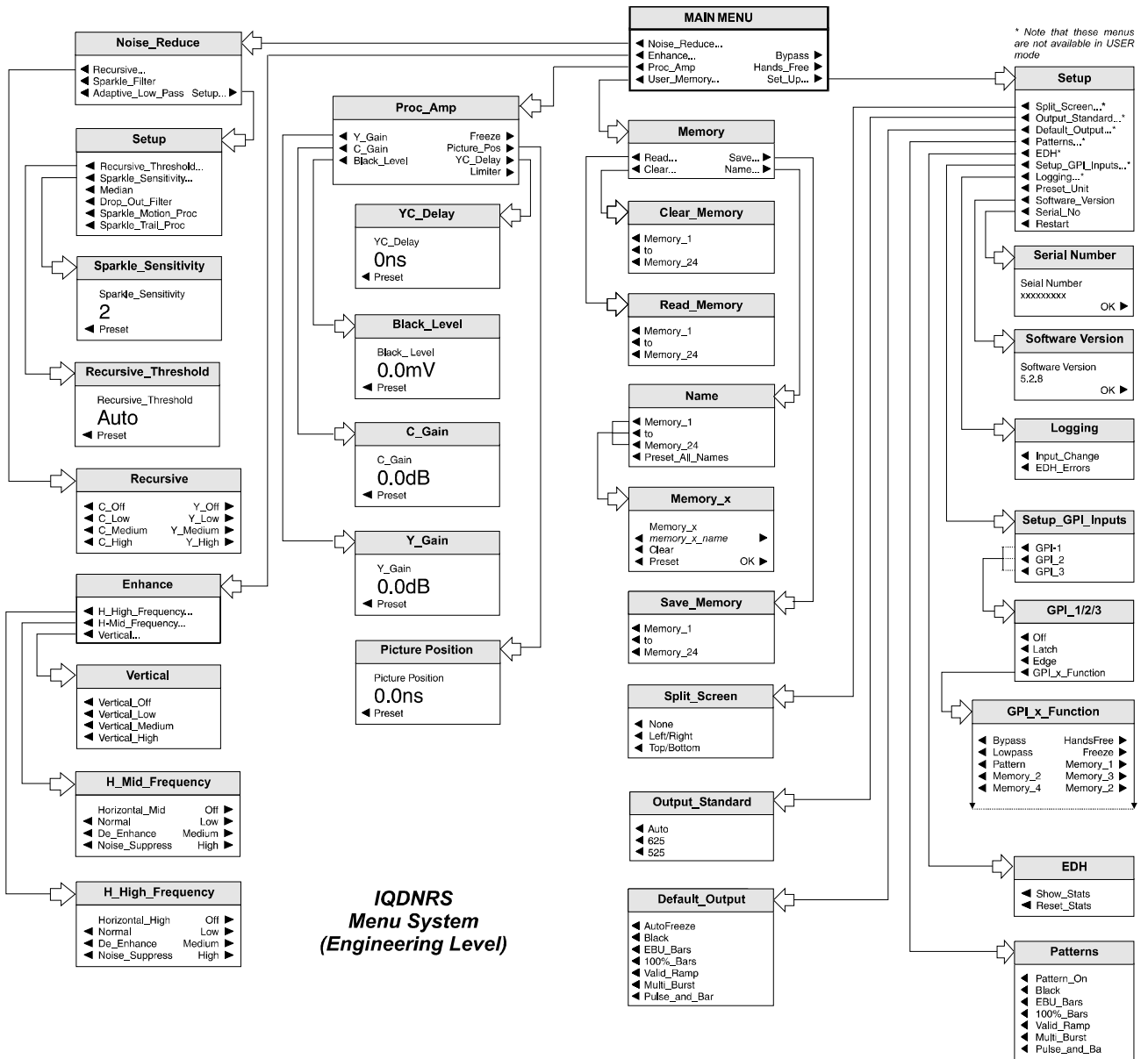
When the noise reduction Manual Threshold function is selected (using position C) this position allows the **threshold level** to be set. Adjustment range is from level 0 to level 7.

Preset is to level 1.

#### Position F

In this position pressing SW1 and SW2 together sets all parameters to the **default/preset** conditions.





## 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 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.

**Setup ►**

## MENU DETAILS

(see IQDNRS 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.

**◀ Noise\_Reduce**

This item allows various forms of noise reduction may be applied to the signal.

**◀ Recursive**

This item allows Recursive noise reduction to be applied to the luminance and chrominance channels.

The range of level adjustment is off, low, medium and high.

Default is to Off.

**◀ Sparkle\_Filter**

This item allows a sparkle filter to be applied to the signal, reducing the effect of sparkle noise associated with edge-of-reception signals from satellite feeds, impulse noise or drop-outs from tape-recorded signals.

**◀ Adaptive\_Low\_Pass**

This toggle function allows an adaptive low pass filter to be applied to the signal.

When active the trail of noise following a moving object is attenuated.

This item allows the control of various noise reduction parameters to be set.

**◀ Recursive\_Threshold**

This sets the noise reduction threshold of the recursive filters. The range of adjustment is Auto and from 0 to 7.

In **Auto** mode the threshold is calculated automatically from the measurement of background noise. Settings 0 to 7 allow a manual setting of the threshold. Default is to Auto.

*Note that applying a high threshold level may assist with extremely noisy images; however this may result in plain areas appearing flat.*

**◀ Sparkle\_Sensitivity**

This sets the sparkle removal sensitivity.

In instances where impulse noise has been processed in a low bandwidth channel, the reduction in impulse amplitude may prevent detection at low sensitivity. In this case a higher sensitivity level should be used.

The adjustment range is from level 1 to level 4 and default is to level 2.

Level 4 is the most sensitive sparkle removal setting, and level 1 is the least sensitive. Correspondingly, level 1 will produce least picture artefact.

**◀ Median**

When selected sparkle concealment is enabled that employs a threshold controlled 3-dimensional median filter. This permits the removal of picture disturbances that the normal sparkle detection algorithm may miss. For example low-level sparkles will be concealed. This mode will automatically remove dropouts so the menu selection **◀ Drop\_Out\_Filter** will be disabled. Similarly, with the increased sensitivity of this mode sparkle trails will inherently be largely removed so the selection **◀ Sparkle\_Motion\_Proc** will be disabled. The Median filter is particularly effective on very noisy sources. Note that some loss of resolution may be observed depending on the source material.

#### ◀ Drop\_Out\_Filter

When enabled single-line dropouts will be concealed. Default is to Off.

#### ◀ Sparkle\_Motion\_Proc

When enabled a motion detection algorithm disables concealment on moving detail, typical of captions. It is not sensitive to rapid motion.

On static images with large amounts of impulse noise, this process reduces the effectiveness of the concealment. Default is to On.

#### ◀ Sparkle\_Trail\_Proc

When enabled the trail, often seen following impulses, is concealed. Default is to On.

### ◀ Enhance

This allows Horizontal High Frequency, Horizontal Medium Frequency and Vertical enhancement to be applied to the processed signal. The non-linear process prevents enhancement of low amplitude signals typical of noise.

#### ◀ H\_High/Mid\_Frequency

The range of enhancement adjustment is off, low, medium and high. Default is to Off.

Other (toggle) selections are:

#### ◀ Normal

#### ◀ De\_Enhance

When active the enhancer is reconfigured to give a low pass frequency response. This may be used to attenuate noise present on low bandwidth sources.

#### ◀ Noise Suppress

When active, low amplitude signals typical of noise are attenuated.

Note this can still be activated with the enhancement turned off

#### ◀ Vertical

The range of vertical enhancement adjustment is off, low, medium and high. Default is to Off.

### ◀ PROCAMP

This selection allows various adjustments to be made to the processed signal.

#### ◀ Y\_Gain

This selection reveals a numerical readout display for the gain of the luminance signal.

By rotating the spinwheel the gain may be adjusted by  $\pm 6$  dB in steps of 0.1 dB.

Selecting Preset returns the setting to the calibrated value of 0.

#### ◀ C\_Gain

This selection reveals a numerical readout display for the gain of the chrominance signal.

By rotating the spinwheel the gain may be adjusted by  $\pm 6$  dB in steps of 0.1 dB.

Selecting Preset returns the setting to the calibrated value of 0.

#### ◀ Black\_Level

This selection reveals a numerical readout display for the Y pedestal or black level.

By rotating the spinwheel the pedestal may be adjusted by  $\pm 100$  mV in steps of 0.8 mV.

Selecting Preset returns the setting to the calibrated value of 0.

#### Freeze ▶

This toggle On/Off function produces a freeze-frame picture.

#### Picture Position ▶

Selecting this item reveals a display showing the timing of the picture position relative to the normal value, in nanoseconds. Rotating the spin-wheel will adjust this value.

Range is from  $\pm 592$  ns in 148 ns steps.

Selecting Preset returns the setting to the preset value of 0.

#### YC\_Delay ▶

Selecting this item reveals a display showing the timing of the chrominance signal relative to the luminance signal, (i.e. Y to Cb/Cr timing) in nanoseconds. Rotating the spin-wheel will adjust this value.

Range is from  $\pm 444$  ns in 148 ns steps.

Selecting **Preset** returns the setting to the preset value of 0.

**Limiter ▶**

This toggle On/Off function enables the **Limiter** and the output is limited to standard levels. (0 V/700 mV for Y, 700 mV p-p for Pb and Pr)

**◀ User\_Memory**

All settings of the unit may be stored in any of 8 non-volatile memory locations. These locations may be read, saved, given a name or cleared to the preset names by selecting this function to reveal the sub-menu.

**◀ Read**

This will reveal a list of 24 memory locations. When a particular location is enabled, settings will be changed to the values contained in that memory location.

**Save ▶**

This will reveal a list of 24 memory locations. When a particular location is enabled, current settings will be saved in that memory location.

**◀ Clear**

This will reveal a list of the 24 memory locations that may be selected and individually cleared to their default settings.

**Name ▶**

This will reveal a list of the 24 memory locations that may be given a specific name. To rename a memory location when operating in a particular standard, select:

◀ Name Memory to reveal the sub-menu.

Select the memory location to be renamed e.g.

◀ Memory\_1

To compile/edit the text the right ▶ and left ◀ buttons adjacent to the upper text line in the menu should be used to select the character position in the text and the spinwheel used to select the character.

The ◀ **Clear** function blanks out the selected character.

The ◀ **Preset** function loads the default text.

**O.K.** ▶ saves the caption text and returns to the main menu.

**Bypass ▶**

This toggle function selects the **Bypass** mode. When enabled the input signal will pass through the electronics of the unit unprocessed.

**Hands\_Free ▶**

This toggle function selects the **Hands Free** mode. When enabled the unit will limit the maximum noise reduction to avoid the possibility of producing noticeable artefacts. This mode is suitable for unattended operation with a variety of source noise conditions.

## Set\_Up ►

**\* Note that these items will not be available in USER mode.**

This menu system allows various system parameters to be set.

◀ **Split Screen\***

This item allows the effects of the processing to be seen on the output picture in a "before/after" mode. Default is to None

◀ None

A full processed picture will be seen.

◀ Left/Right

When enabled the screen will be split into two equal sections separated by a vertical white line. The processed picture will occupy the left hand section and the unprocessed picture will occupy the right hand side section.

◀ Top/Bottom

When enabled the screen will be split into two equal sections separated by a horizontal white line. The processed picture will occupy the top section and the unprocessed picture will occupy the bottom section.

◀ **Output Standard\***

This sets the output line standard.

◀ Auto      The output standard will follow the input standard

◀ 625      The output will be in the 625 standard  
*In the event of a 525 line input being applied the output will be 625 Default Output (See below to set default output)*

◀ 525      The output will be in the 525 standard  
*In the event of a 625 line input being applied the output will be 525 Default Output (See below to set default output)*

**\* Note that these items will not be available in USER mode.**

◀ **Default Output\***

This item allows the output to be selected in the event of a loss of input.

◀ Auto Freeze    When this item is active and the input signal is lost, a freeze frame picture will be produced.

- ◀ Black
- ◀ EBU Bars
- ◀ 100% Bars
- ◀ Valid Ramp
- ◀ Multiburst
- ◀ Pulse and Bar

◀ **Patterns\***

Enabling this function will allow various patterns to be used as the output signal.

◀ Pattern On

When this item is enabled a pattern, selected from the list below, will become the output signal.

Patterns available are:

- ◀ Black
- ◀ EBU Bars
- ◀ 100% Bars
- ◀ Valid Ramp
- ◀ Multiburst
- ◀ Pulse and Bar

◀ **EDH\***

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

◀ Show Stats (Statistics)

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

◀ Reset Stats (Statistics)

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

### ◀ Setup\_GPI\_Inputs\*

The three GPI connectors are used for accepting GPI information (from mechanical switch contacts, relay contacts etc.) The resulting action that the unit takes may be selected from this menu.

The required GPI input should be selected:

- ◀ GPI-1
- ◀ GPI-2
- ◀ GPI-3

The GPI input has four user selectable modes of operation:

- ◀ Off

Function inactive

- ◀ Latch

When the contact is closed the function is activated; when the contact is open, the function is de-activated.

- ◀ Edge

(Edge-triggered) With each open-to-closed trigger the GPI function is toggled between activated and de-activated.

- ◀ GPI\_x\_Function

The action resulting from the selected GPI input being activated may be programmed from this list:

Setting	Action
◀ Bypass	Function inactive
◀ Low_Pass	Selects Low_Pass mode
◀ Pattern	Selects Pattern as output
◀ Memory_x	Selects memory location
Hands_Free ▶	Selects hands free mode
Freeze ▶	Selects Freeze mode
Memory_1 ▶	Selects memory 1 location
Memory_x ▶	Selects memory location

\* Note that these items will not be available in USER mode.

### ◀ 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 Change

When activated, a change 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.

### ◀ Preset Unit

Selecting this item sets all adjustment functions that include a preset facility, to their preset values. Note that this is a momentary action and the text will not become reversed.

### ◀ Software Version

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

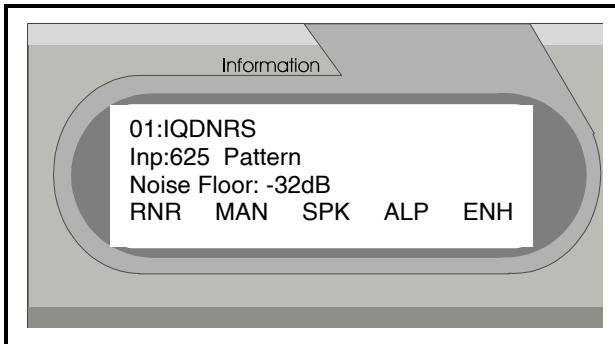
### ◀ Serial Number

Selecting this item reveals a display showing the serial number of the module. Select OK to return to the Setup Menu.

### ◀ Restart

This function allows the unit to reboot and all power-up settings to be enabled. This is an easier method than switching the mains power on and off.

## THE INFORMATION WINDOW



The Information window has four lines of text indicating current selections and various information messages.

The first line will contain the name of the module that is currently being controlled.

The second, third and fourth lines provide specific information about the operating conditions of the module.

Example of text displayed

```

Line 1  01:IQDNRS
Line 2  Inp:625 Pattern
Line 3  Noise Floor: -32dB
Line 4  RNR  MAN  SPK  ALP  ENH

```

## Text Line Details

## Line 1

This line contains the name of the module and Gateway code data.

## Line 2

This line gives information about the state of the video input and the operating mode. Input state may be 625, 525, ERR (input error detected) or \*\* (no signal connected). Operating mode may be Pattern or Freeze; no indication here indicates normal operation.

## Line 3

This line gives an indication of the level of input noise, or unweighted signal to noise ratio.

## Line 4

This line will show additional operating mode information.

Shown will be either "Hands Free", "Bypass" or a selection of abbreviations indicating the current filter selections:

RNR Recursive Noise Reduction enabled  
Either Luminance or Chrominance

MAN MANual threshold enabled

SPK SPArKle filter enabled

ALP Active Low Pass filter enabled

ENH ENHancer enabled  
Either horizontal or vertical



**Manual Revision Record**

Date	Version No.	Issue No.	Change	Comments
280598	1	1		First Issue
300698	1	2	Changes to menus and information window data added	New Issue
240798	1	3	Changes to noise reduction menu	New Issue
201098	1	4	Sparkle_Threshold changed to Sparkle_Sensitivity SW1, 2 swopped, ref removed from spec Changes to Proc_Amp and Memmory menu	New Issue Released for software version 5.2.7 onwards
110199	1	5	Median added to Noise Reduce/Setup menu	New Issue Released for software version 5.2.8 onwards
110403	1	6	Power consumption added to techspec	New manual issued