network

Flashlink User Manual

DAC-SDI

SDI to NTSC/PAL Encoder/ Component Analogue Video Converter with Genlock

network-electronics.com

Rev. 2

Network Electronics ASA

Thorøya
P.O. Box 1020
N-3204 Sandefjord, Norway

Phone: +47 33 48 99 99
Fax: +47 33 48 99 98
Email: support@network-electronics.com
www.network-electronics.com

Support Phone: +47 90 60 99 99

Revision history

Current revision of this document is the uppermost in the table below.

Rev.	Repl.	Date	Sign	Change description
2	1	2007-10-17	AS	Added Materials Declaration and EFUP; updated EC Declaration of Conformity.
1	-	2002-06-21		Minimum delay mode implemented in firmware. Corrected errors in pushbutton descriptions. (PIC sw rev. 1.0.11, FPGA Firmware rev. 13)

2 Quick Start Guides for DAC-SDI

2.1 Without GYDA controller

1. Attach SDI-IN and Black&Burst signals, and those output signals that you require, to the backplane module (see figure 2 on page 9).
2. Set DIP-switch 1 *on* (towards backplane), switches 2 and 3 according to the video mode you want (see figure 4 on page 15). Set switch 7 *on* for PAL, leave *off* for NTSC. Leave the rest of the switches untouched.
3. Insert DAC-SDI into a slot in the sub-rack.
4. Power on. All LED's should be green, and all outputs active. If this is not the case, please see chapter 7.

2.2 With GYDA controller

1. Attach SDI-IN and Black&Burst signals, and those output signals that you require, to the backplane module (see figure 2 on page 9).
2. Set switch 7 *on* for PAL, leave *off* for NTSC. Leave the rest of the switches untouched.
3. Insert DAC-SDI into a slot in the sub-rack.
4. Power on. All LED's should be green, and all outputs active with the same settings as the previous time power was applied.
5. Communication with the card is described in section 10.

Contents

List of Figures

List of Tables

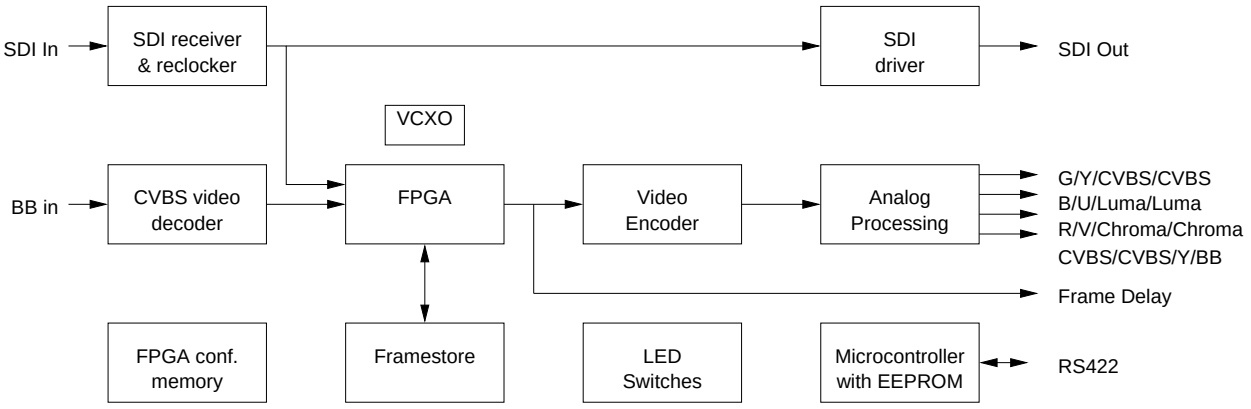

Figure 1: Simplified block diagram of the DAC-SDI card

3 General

The flashlink DAC-SDI is a high-quality 10-bit digital 4:2:2 to NTSC/PAL composite/component encoder (4-times 54 MHz oversampled) analogue video converter.

Composite formats and component formats are simultaneously provided on the outputs. On-board genlock, input frame buffer (>8 fields) and adjustable horizontal delay provide a programmable timing range relative to the incoming Black&Burst.

DAC-SDI user parameters can be changed via switches on the unit, or via the GYDA control interface.

With a stable Black&Burst input, the analogue output is synchronous with the reference. When the generator of the SDI-IN signal has a PAL Pulse embedded in line 7, the DAC-SDI will synchronize to the correct 8–field–PAL/4–field–NTSC signal. This is possible, because the frame-store can store more than 9 fields.

4 Specifications

- Digital Serial Input

Input format	270 Mb/s scrambled NRZI (4:2:2 SMPTE 259M–C)
Input level	800 mV nominal, 75 Ω terminated
Equalization	Automatic up to 35 dB (300 m Belden 8281)
Return loss	> 15 dB, 75 Ω terminated

- Black&Burst input

Input signal	SMPTE 170M/PAL ITU 624–4
Return loss	> 35 dB up to 5.75 MHz

- Digital Serial Output

Output format	270 Mb/s scrambled NRZI
Output level	800 mV nominal
Return loss	> 15 dB

- Analogue output, both PAL (625/50) and NTSC (525/60)

Output formats	CVBS RGB YUV Y/C (S-video)
Output level	1000 mV nominal, ± 10 mV
Return loss	> 35 dB up to 5.75 MHz
Minimum signal delay	3 μs

- Frame Delay output

Output level	Open collector 5 V TTL

- Processing performance

Signal path	10 bits
Sampling	54 MHz (4 times oversampling)
Video bandwidth	6 MHz
Hue Accuracy	0.5 ° typical
Colour Saturation Accuracy	0.8 % typical
Luminance Nonlinearity	0.6 ±% typical
Chroma AM Noise	-58 dB typical
Chroma PM Noise	-72 dB typical
SNR	-70 dB typical
Diff. gain	< 1 %
Diff. phase	< 1 °

- Other

Input Voltage	DC 5 V
	DC −15 V
Power Consumption	< 4 W

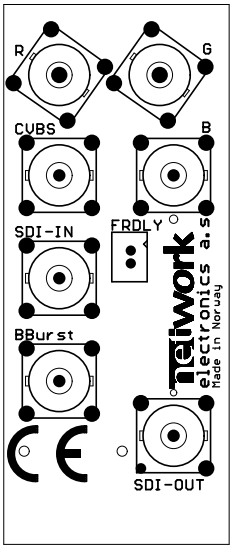

Figure 2: DAC-SDI-C1 connector module. The BNC connector silkscreen marking shows the factory default setting of the analogue output; RGB and CVBS (figure not to scale).

5 Connector module

The DAC-SDI has its own connector module: DAC-SDI-C1, mounted at the rear of the sub-rack. See figure 2.

5.1 Mounting the connector module

If the connector module is purchased separately, it should be mounted as described in the user manual for the sub-rack frame FR–2RU–10–2. This manual is also available from our web site: *http://www.network-electronics.com/*.

5.2 Correspondence of connectors and signals

The analogue output BNC's are multipurpose. Due to restricted space on the silk-screen of the connector module, these BNC's are only marked 'R', 'B', 'G', and 'CVBS'. This marking corresponds to the default settings of the DAC-SDI, see table 1. Some of the BNC's on the connector module are dedicated to a specific signal. This is the case for:

SDI–IN	Carries incoming SDI
BB	Carries Black&Burst
SDI–OUT	SDI–IN is buffered and output here

In addition, a 2-pin Sherlock MOLEX connector outputs the Frame Delay (see section 11).

Table 1: Relationship between the silkscreen marking of DAC-SDI-C1 and the video mode setting of DAC-SDI. For explanation of the switch settings, see section 8, for explanation of the GYDA command strings, see section 10.

Switch		Video mode	Silkscreen marking				Comment
3	2	(GYDA command string)	'G'	'B'	'R'	'CVBS'	
0	0	G/B/R/CVBS	G	B	R	CVBS	RGB and CVBS
0	1	Y/U/V/CVBS	Y	U	V	CVBS	YUV and CVBS
1	0	CVBS/Luma/Chroma/Y	CVBS	Luma	Chroma	Y	S-Video and CVBS
1	1	CVBS/Luma/Chroma/BB	CVBS	Luma	Chroma	BB	S-Video, CVBS, and Blank&Burst

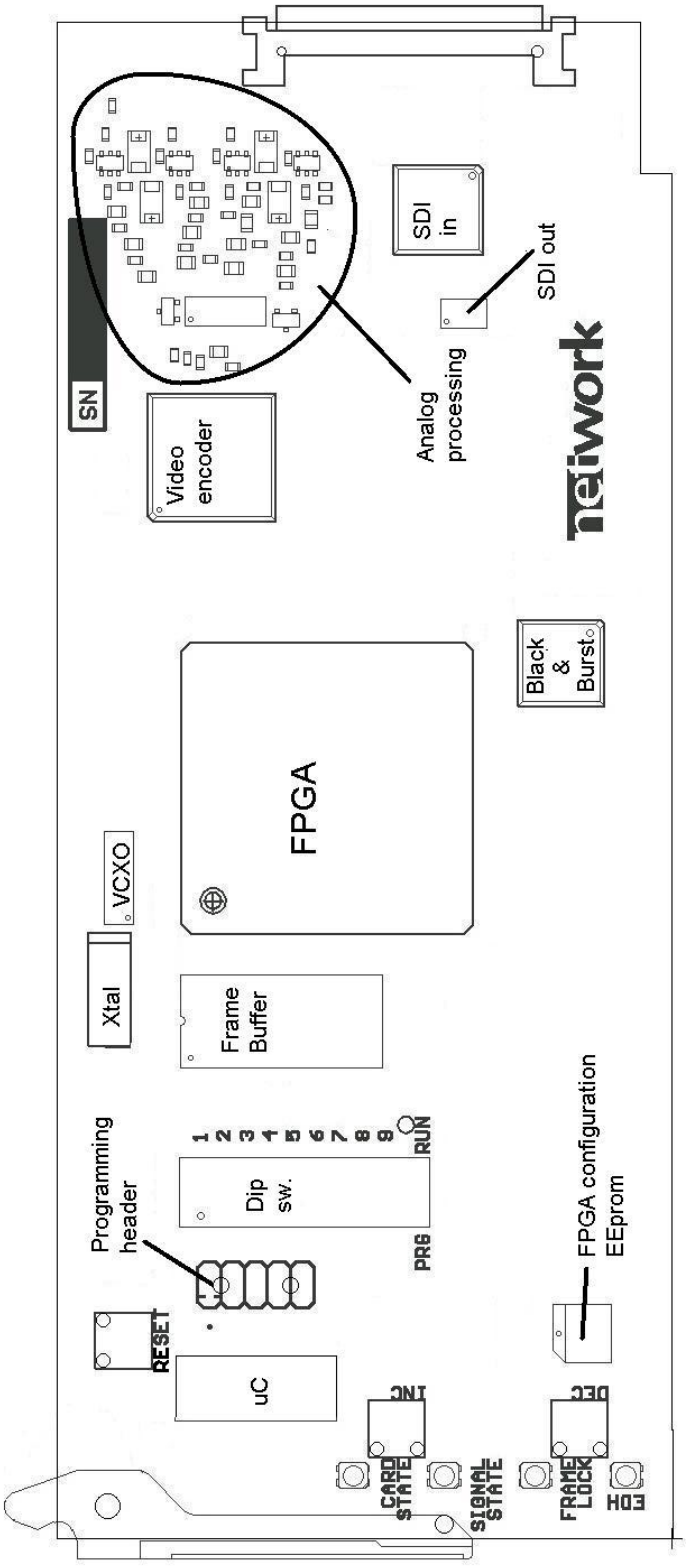

Figure 3: DAC-SDI simplified silkscreen (figure not to scale).

6 A more detailed description

6.1 Data path

SDI-IN is equalized and reclocked, then transferred bit serially to the FPGA. The FPGA Descrambles and deserializes the input to 10-bit parallel, detects whether it is PAL or NTSC, and

writes the data to the Frame-store via an integrated SDRAM controller.

Data is fetched from the Frame-store, EDH is checked, the data is transferred to the Video Encoder.

The Video Encoder outputs CVBS, RGB, etc. The output is filtered externally for anti-aliasing, and correct offset and gain for the different standards, and then output to the backplane.

6.2 EEPROM

The DAC-SDI card actually has two EEPROM's. A small EEPROM is included in the microcontroller, while a larger external EEPROM holds the configuration memory of the FPGA.

Internal EEPROM

State variables are written to EEPROM in the microcontroller each time a configuration change is made. Basically, the card remembers its setting between power-downs.

External EEPROM

The configuration memory of the FPGA is upgradeable. This is, however, a task for qualified maintenance personnel.

6.3 Power-up sequence

Summary: The DAC-SDI card remember the settings it had the last time it held power.

At power-up, the card performs a self-check, and initiation. The manual mode switch is then sampled. If manual mode is enabled, the other switch settings are read and the state of the card set accordingly. If manual mode is disabled, the state the card held the previous time it was used is read from EEPROM. The interplay between the EEPROM, the switches and the GYDA (or other) controller adhere to the following simple rules:

- If a GYDA controller is present in a system, it can always override manual settings.
- If the manual mode is used together with a GYDA controller, the DAC-SDI will initiate as determined by the switches, and may then be overridden by the controller.
- If the manual mode is not used, the DAC-SDI will initiate as determined by the state of the EEPROM. It is subsequently controlled by the GYDA controller.
- At any time, when a state change is done, whether it be by switches, pushbuttons, or GYDA, the state is stored in the EEPROM as soon as it is detected.

Note that switch 6, 7, 8 and 10 are not part of manual mode.

6.4 Clocks and genlock

DAC-SDI contains a VCXO (Voltage Controlled Oscillator) that generates clocks for the most of the card. As a simplification, we can assume that a clock `iclk` is maintained

The internal clock `iclk` of the DAC-SDI will either lock to the Black&Burst clock, to the clock derived from the incoming SDI signal, or be freerunning. The rules are simple:

1. If Black&Burst is available, `iclk` will lock to it.
2. If Black&Burst is unavailable, but SDI input is present, `iclk` will lock to a clock derived from the SDI input.

3. If neither Black&Burst nor SDI input is available, `iclk` will be nominally 27 MHz, generated from an on-board crystal.

The internal crystal is not a high-precision clock. To adhere to the stringent demands of professional video, either Black&Burst or SDI input must be available.

6.5 When an input signal is lost

If SDI input disappears

Given that stable SDI input and Black&Burst exists. If the SDI input disappears, the picture will freeze. Note that synchronization to correct 8–PAL–field is inhibited in this freeze-situation. When the SDI input disappears the Frame Delay pulses at the back plane will also disappear.

If DAC-SDI is in minimum delay mode, the analog output will be turned off if the SDI input disappears, because the frame buffer is unused.

If Black&Burst disappears

Given that stable SDI input and Black&Burst exists. If the Black&Burst disappears, the SDI input will be output as if nothing has happened. However, the internal clock will now be locked to the SDI input clock.

If both inputs disappear

The picture will freeze, and the clock will lock to the on-board crystal. This is not a reference clock, and drift out of video specification can not be precluded.

7 Module status – Light Emitting Diodes

Summary: Green LED's are good, all others are bad.

DAC-SDI implements four Light Emitting Diodes (LED's) that show the state of the card. The LED's are visible through the front-panel of the rack (see the user manual of FR-2RU-10-2 for details). The LED's are described top-down, see also figure 3.

7.1 Card State

No Light	No power, fuse F1 blown, LED malfunction or configuration memory lost.
Red	A fundamental, probably electrical, error has been detected. The card is set in a passive state, so that it does not disturb other cards in the rack. While powering on, the CardState LED will light red for approximately 0.5 s while the card undergoes self-test.
Yellow	Not used.
Green	DAC-SDI is powered and ready.

7.2 Signal State

No Light	LED malfunction.
Red	No SDI input.
Yellow	Weak SDI input.
Green	SDI input.

Switch #	Function	Comment
1	Manual mode on/off	When on, enables switches 2, 3, 4, and 5
2	Video mode select 1	According to table 4
3	Video mode select 2	
4	VBIB on/off	
5	Color bar on/off	
6	Min delay mode on/off	When on, Black&Burst input is ignored.
7	NTSC/PAL default	For color bar NTSC/PAL select only
8	Factory Reset on/off	To restore internal EEPROM only
9	Reserved	
10	Running mode on/off	For factory use only

Table 2: Summary of the DIP switches. Switch 8, 9 and 10 are mainly for factory use, switch 7 has effect in some special situations, switch 6 is used to set the card in minimum delay mode, while switches 1, 2, 3, 4 and 5 will be used when no GYDA controller is available.

7.3 Frame Lock / SCHphase

No Light	Frame Lock is disabled, card is in minimum delay mode.
Red	No Black&Burst input.
Yellow	Black&Burst present, but unable to lock.
Green	Black&Burst present, locked.

During normal operation, the status of the Black&Burst input is shown on this LED. During adjustments of the phase of the subcarrier relative to the horizontal sync, in manual mode, this LED is used as an indicator.

7.4 EDH / Hdelay

No Light	LED malfunction.
Red	CRC error detected.
Yellow	Not used.
Green	No error detected.

During normal operation, the result from the Error Detection and Handling circuit is shown on this LED. If a Black&Burst signal is plugged in, this LED may blink red a few seconds while the DAC-SDI synchronizes the output signal with the Black&Burst signal. During horizontal delay adjustments in manual mode, this LED is used as an indicator.

8 Switches

Summary: Most users will probably want switches 1 through 6, 8 and 9 in the *off* position. All users should place switch 10 in the *on* position.

The DAC-SDI card implements a Dual-Inline switch (DIP-switch) that provides 10 individual On/Off switches. The purpose of the switches is to offer you an easy interface to some features of the DAC-SDI card, without the need of a GYDA controller. Table 2 gives the general layout of the switches. The switches are numbered from '1' at the top and downwards to the bottom, see figure 3. A switch is *on* when the tap is displaced in direction of the back-plane.

The DAC-SDI card is shipped with all switches, except switch 10, in the Off-position. Switch number 10 should always be in the On-position. The switches are discussed in logical rather than numerical order.

Switch 10 – Programming mode

Switch 10 is purely used for service upgrade of the DAC-SDI card. It should always be in the *on* position. If switch 10 is in the *off* position, the CardState LED will light up red, and the DAC-SDI card will enter programming mode. This causes no harm, but the card will not work in this mode.

Factory setting is switch 10 in *on* position.

Switch 9 – Reserved

This switch is reserved for future expansion, and should always be in the *off* position.

Factory setting is switch 9 in *off* position.

Switch 8 – Reset to factory default

DAC-SDI contains EEPROM that is affected by your choices. Switch 8 is implemented to reset the EEPROM to factory default. Its use is shown in table 3.

Switch 7 – PAL or NTSC initial output

Switch 7 is only implemented to cater for two special situations;

Initial blank output If DAC-SDI is powered, but without Black&Burst input and SDI input, it needs to know whether the black output should be NTSC or PAL. This is selected with switch 7. Switch 7 *off* sets NTSC, while switch 7 *on* sets PAL. Even in a situation where Black&Burst input and SDI input are available, the first few frames after power-up will be blank, while DAC-SDI synchronizes the incoming SDI to the Black&Burst; during this time, switch 7 setting applies. Note that switch 7 does not have a GYDA equivalent command.

Color Bar generation To determine whether to use PAL or NTSC when outputting Color Bars, DAC-SDI examines the SDI input. However, the situation where no SDI input is available is one of the times you are likely to want to output Color Bars. It must then be a way to inform DAC-SDI whether to use PAL or NTSC. Switch 7 *off* sets NTSC, while switch 7 *on* sets PAL.

Switch 7 will always be overridden by the PAL/NTSC-detection from the SDI signal. Even if the SDI signal source is removed, the card will remember whether PAL or NTSC was used until the card is powered off.

Factory setting is switch 7 in *off* position.

Table 3: Method to restore the DAC-SDI card to factory settings. Remember to let some seconds pass by each time you power down, to allow capacitors to be fully discharged.

Action	Comment
Power down.	
Turn switch 8 *on*.	
Power up.	DAC-SDI enters a special state where the EEPROM is restored to factory default values. This is flagged by the LED's, they are all yellow.
Power down.	
Turn switch 8 *off*.	If you want the DIP switches to be placed in the factory default position, this is the time to do so: Turn switches 1 through 9 to the *off* position. Switch 10 should, as always, be turned to the *on* position.
Power up.	The card EEPROM is now reset to factory settings.

Switch 6 – Minimum delay mode

Normally DAC-SDI will buffer frames of the digital video input, to be able to synchronize the output to the Black&Burst input signal. The delay of the signal through DAC-SDI is then determined by the timing relationship between the Black&Burst and SDI input. In minimum delay mode, DAC-SDI synchronizes the internal clock to the SDI input clock. The delay through the card is constant and minimized (see section 4). Switch 6 *on* will activate the minimum delay mode.

Factory setting is switch 6 in *off* position.

Switch 1 – Manual mode

Switch 1 is the manual mode switch. If *on*, the DAC-SDI is primarily assumed to be operated with switches alone. If *off*, The DAC-SDI is assumed to be used with a GYDA controller.

Factory setting is switch 1 in *off* position.

With switch 1 off

While in automatic mode, switches 2, 3, 4 and 5 are without any effect.

With switch 1 on

In manual mode, the functionality of switches 2, 3, 4 and 5 is as follows:

Switches 2 and 3 These two switches determine the output video standard. See table 4.

Factory setting is switch 2 and switch 3 *off*.

Switch 4 Switch 4 turns on/off deletion of information in the vertical blanking interval (VBI). With switch 4 *off*, the VBI information is retained, with switch 4 *on*, VBI is cleared.

Switch 5 With switch 5 *on*, DAC-SDI generates color bars. This replaces the SDI input. However, the SDI input will determine whether NTSC or PAL is to be output. See also the description of switch 7 above. The color bar configuration is 100/7.5/75/7.5 for NTSC and 100/0/75/0 for PAL. The frequency of the output is locked to the Black&Burst input. If no Black&Burst is input, the output frequency is derived from an on-card crystal, with limited accuracy, see section 6.5. The color bar output will not genlock to the Black&Burst input, it merely uses the frequency information. With switch 5 *off* DAC-SDI does not generate color bars.

Factory setting is switch 5 in *off* position.

9 Pushbuttons

DAC-SDI contains three pushbuttons.

9.1 Reset

The uppermost pushbutton is a reset switch, see figure 3. It has the same effect as a power-on.

Table 4: Manual selection of video mode

Sw #3	Sw #2	Video mode	Comment
0	0	G/B/R/CVBS	RGB and CVBS
0	1	Y/U/V/CVBS	YUV and CVBS
1	0	CVBS/Luma/Chroma/Y	S-Video and CVBS.
1	1	CVBS/Luma/Chroma/BB	S-Video, CVBS, and Blank&Burst

9.2 INC and DEC

Summary: The delay of the outgoing video with reference to Black&Burst may be adjusted. The subcarrier phase delay with reference to the horizontal sync. may be adjusted.

These two pushbuttons may be used to set the overall delay of the output with respect to the Black&Burst, and to set the phase delay between the subcarrier with respect to the horizontal sync. The pushbuttons are seen in figure 3.

To set the subcarrier phase delay

Activate and Select between Hdelay and SCHphase Activate the buttons by pressing and holding both buttons. While pressing the buttons, observe the lowermost two LED's. The FrameLock/SCHphase LED will blink for approximately 2 seconds, and then the EDH/HDelay LED will blink for 2 seconds, and so on. This visual feedback determines whether Hdelay or SCHphase is to be adjusted. Release the buttons while the FrameLock/SCHphase LED is blinking.

Adjustment of Subcarrier phase relative to Horizontal sync The FrameLock/SCHphase LED continues to blink, to indicate that you may adjust the phase. The phase is incremented and decremented in 256 steps. A phase adjustment from 0° through 360° is thus available. For calculations around 0°, the single step size can be taken to be $\approx 1.41°$. The adjustment is made by way of the INC and DEC buttons. When the maximum range is encountered, the phase angle will wrap-around.[1] During auto-repeat, the FrameLock/SCHphase LED will light continuously.

Exiting adjustment of Subcarrier phase After a 6 seconds idle period, the newly adjusted phase is committed to EEPROM, and the adjust-state is exited.

To set the horizontal delay

Activate and Select between Hdelay and SCHphase Activate the button interface by pressing and holding both buttons. Release the buttons while the EDH/HDelay LED is blinking.

Adjustment of Horizontal delay The EDH/HDelay LED will continue to blink, to indicate that you may adjust the horizontal delay. The horizontal delay is incremented and decremented in steps of 37.0 ns by way of the INC and DEC buttons. 2048 such steps are available, enabling a delay longer than one line for both PAL and NTSC. These buttons have an auto-repeat function, much like the way a normal keyboard works. During auto-repeat, the EDH/HDelay LED will light continuously.

Exiting adjustment of Horizontal delay When neither the INC nor the DEC button have been touched for 6 seconds, the newly adjusted delay is committed to EEPROM memory, and the adjust-state is exited.

10 Interface with GYDA or other controllers

DAC-SDI follows the Flashlink-protocol, see the definition of the protocol available from our web site: *http://www.network-electronics.com/*. DAC-SDI can also be used with any controller or controller system that adheres to the Flashlink-protocol, using the RS422 bus. For more information on the electrical interconnect, see the documentation of RS-2RU-10-2. The available commands are shown in table 5.

[1] This is contrary to the horizontal delay adjustment, where the trimmable range can not be exceeded.

Command	Response	Comment
?	Yes	The "Hello" command
info	Yes	Gives back the card state
g/b/r/cvbs	No	Set outputs to G/B/R/CVBS
y/u/v/cvbs	No	Set outputs to Y/U/V/CVBS
cvbs/luma/chroma/y	No	Set outputs to CVBS/LUMA/CHROMA/Y
cvbs/luma/chroma/bb	No	Set outputs to CVBS/LUMA/CHROMA/BB
color bar enable	No	Enable color bars
color bar disable	No	Disable color bars
color burst enable	No	Enable color burst
color burst disable	No	Disable color burst
chroma enable	No	Enable chroma
chroma disable	No	Disable chroma
vbib on	No	Set vertical blanking interval blanking on
vbib off	No	Set vertical blanking interval blanking off
hdelay [0xHHHH]	No	Set the delay of outgoing video with respect to BB
schphase [0xHH]	No	Set the phase of the subcarrier with respect to horizontal sync
get [0xHH]	Yes	Get a value from a numbered register
set [0xHH] [0xHH]	No	Set a value to a numbered register

Table 5: All commands available to the user

10.1 The '?' command

According to the Flashlink-protocol, no card can use the RS422-bus before the '?' (hello) command is sent the card at least once. The response from DAC-SDI will be:

```
xxxxDAC-SDI\
PIC sw rev X.X.X\
FPGA sw rev X\
Protocol ver X.X
```

Here `xxxx` denotes the source and destination rack and slot coordinates, while `X` represents a version number. As of medio June 2002, these revisions would be:

```
xxxxDAC-SDI\
PIC sw rev 1.0.11\
FPGA sw rev 13\
Protocol ver 1.0
```

10.2 The "info" command

This command report the entire state of the card. An example:

```
xxxxSDI signal strength = 89%\
Field 1 detected\
BBurst detected and locked\
Output:  CVBS/Luma/Chroma/Y (PAL)\
No EDH: 0\
Error full field:\
 crc:  0\
 unk:  0\
 ues:  0\
 ida:  0\
```

```
 idh:  0\
 eda:  0\
 edh:  0\
Error active video:\
 crc:  0\
 unk:  0\
 ues:  0\
 ida:  0\
 idh:  0\
 eda:  0\
```

Table 6: The info command broken up in components.

Status of	**S**tatus string	**C**omment
SDI input	`No SDI input`	SDI input is not detected.
	`SDI signal strength > 90%`	Strong SDI signal.
	`SDI signal strength < 10%`	Weak SDI signal.
	`SDI signal strength =` *%d*`%`	*%d* is a number from 10 to 90.
	`Field 1 detected`	If field one of the original 8-field PAL/4-field NTSC is marked with a white line during conversion to SDI, DAC-SDI synchronizes the SDI data stream with the corresponding field of the Black&Burst signal. If field one is marked, this line will be shown in addition to the signal strength information above.
Black&Burst and Mindelay mode	`No BBurst input`	No Black&Burst detected.
	`BBurst detected not locked`	DAC-SDI is unable to synchronize the analog output to the detected Black&Burst input. The Black&Burst signal may be out of DAC-SDI's frequency range.
	`BBurst detected and locked`	DAC-SDI generate analog output synchronized to the detected Black&Burst input signal.
	`Mindelay mode`	DAC-SDI is in minimum delay mode, Black&Burst-synchronization is disabled, and signal delay is minimized.
Analogue output	`Output:` <*videomode*> `(NTSC)`	NTSC-output. See videomodes below.
	`Output:` <*videomode*> `(PAL)`	PAL-output. See videomodes below.
	`Output: Color Bar` <*videomode*> `(NTSC)`	Color Bar is enabled, NTSC output.
	`Output: Color Bar` <*videomode*> `(PAL)`	Color Bar is enabled, PAL output.
	Videomodes: `G/B/R/CVBS`, `Y/U/V/CVBS`, `CVBS/LUMA/CHROMA/Y` or `CVBS/LUMA/CHROMA/BB`.	
VBI Blanking	`VBIB on`	Information in the Vertical Blanking Interval will be blanked by DAC-SDI.
	(No VBI status string)	DAC-SDI let information in the Vertical Blanking Interval pass unchanged.
Colour Burst	`Color Burst disabled`	The colour burst is removed from analog output.
	(No Colour Burst status string)	Color burst is enabled.
Chroma	`Chroma disabled`	The chroma information is removed from analog output. Result: Black and white output.
	(No Chroma status string)	Chroma is enabled.

Continued on next page

Continued from previous page

Status of	**S**tatus string	**C**omment
EDH	`No EDH:` *%d*	Count fields where EDH is absent.
	`Error full field:`	Label to present next 7 lines as "full field"-error counters.
	`crc:` *%d*	crc-error.
	`unk:` *%d*	unknown status.
	`ues:` *%d*	unknown error status.
	`ida:` *%d*	internal error detected already.
	`idh:` *%d*	internal error detected here.
	`eda:` *%d*	error detected already.
	`edh:` *%d*	error detected here.
	`Error active video:`	Label to present next 7 lines as "active video"-error counters.
	`crc:` *%d*	crc-error.
	`unk:` *%d*	unknown status.
	`ues:` *%d*	unknown error status.
	`ida:` *%d*	internal error detected already.
	`idh:` *%d*	internal error detected here.
	`eda:` *%d*	error detected already.
	`edh:` *%d*	error detected here.
	%d is a decimal number from 0 to 65535 for all the 15 EDH counters above.	
HDelay and SCHPhase	`HDelay =` *%xxx*`, SCHPhase =` *%xx*	*%xxx* is a hexadecimal number α from 0 to 0x7FF. The number of 37 ns steps the output is delayed with respect to the Black&Burst is $\alpha - 0x400$. *%xx* is a hexadecimal number β from 0 to 0xFF. The phase adjustment of the subcarrier with reference to the horizontal sync averages $\beta * 1.40625°$.

```
 edh:  0\
HDelay = 0x0400, SCHPase = 0x00
```

The "info" command is composed by many minor lines, fully specified in table 6. In general, when a condition is normal, it is not reported. For instance, colour burst will normally be enabled, it is only when it is disabled it is reported.

10.3 Video mode commands

The commands `g/b/r/cvbs`, `y/u/v/cvbs`, `cvbs/luma/chroma/y` and `cvbs/luma/chroma/bb` all determine the output mode of the card.

10.4 Enable/Disable commands

Commands to enable and disable the internal colour bar generation, chroma generation, colour burst output, and VBI blanking are all straight forward text, see table 5.

10.5 SCHphase command

The subcarrier phase relative to the horizontal sync is set by calculating an 8-bit number. Given that we want to set the SCHphase to α degrees. The 8-bit number n is calculated by $n = \alpha/1.41$.

An example: Assume a SCHphase of 7° is needed. The SCH phase is adjusted in steps of 1.41°, so we calculate $n = 7/1.41 = 4.96 \approx 5$ We adjust the SCH phase with $5 * 1.41 = 7.05°$ by writing the command `schphase 0x5`.

10.6 Hdelay command

The output signals can be delayed with respect to the incoming Black&Burst with +/- 1024 steps of 37 ns. To avoid signed numbers, an offset of 0x400 is added to the transferred number.

An example: Assume a horizontal delay of 290 steps is needed. As 1024 + 290 = 1314 = 0x522, the following command is called for: `hdelay 0x522`.

10.7 Get and Set

These commands are factory internal. The end-user should avoid these commands.

11 Frame Delay

The FRDLY connector at the back plane is used to output Frame Delay. The lower pin is connected to GND. When there exist an SDI input signal, the upper pin at the connector will output a low pulse every 233 millisecond. The pulse low time is equal to the delay of the signal through the DAC-SDI card. The low level of the signal is 0 V. The high level of the signal is 5 V.

When DAC-SDI is in minimum delay mode, the Frame Delay output is disabled.

General environmental requirements for Network Electronics equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:
   - Operating room temperature range: 0°C to 50°C
   - Operating relative humidity range: <90% (non-condensing)

2. The equipment will operate without damage under the following environmental conditions:
   - Temperature range: -10°C to 55°C
   - Relative humidity range: <95% (non-condensing)

Product Warranty

The warranty terms and conditions for the product(s) covered by this manual follow the General Sales Conditions by Network Electronics ASA. These conditions are available on the company web site of Network Electronics ASA:

www.network-electronics.com

Appendix A Materials declaration and recycling information

A.1 Materials declaration

For product sold into China after 1st March 2007, we comply with the "Administrative Measure on the Control of Pollution by Electronic Information Products". In the first stage of this legislation, content of six hazardous materials has to be declared. The table below shows the required information.

組成名稱 Part Name	Toxic or hazardous substances and elements					
	鉛 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
DAC-SDI	O	O	O	O	O	O

O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.

This is indicated by the product marking:

A.2 Recycling information

Network Electronics provides assistance to customers and recyclers through our web site http://www.network-electronics.com. Please contact Network Electronics' Customer Support for assistance with recycling if this site does not show the information you require.

Where it is not possible to return the product to Network Electronics or its agents for recycling, the following general information may be of assistance:

- Before attempting disassembly, ensure the product is completely disconnected from power and signal connections.
- All major parts are marked or labelled to show their material content.
- Depending on the date of manufacture, this product may contain lead in solder.
- Some circuit boards may contain battery-backed memory devices.

EC Declaration of Conformity

MANUFACTURER	Network Electronics ASA P.B. 1020, N-3204 SANDEFJORD, Norway	
AUTHORISED REPRESENTATIVE (Established within the EEA)	Not applicable	
MODEL NUMBER(S)	DAC-SDI	
DESCRIPTION	SDI to NTSC/PAL Encoder/Component Analogue Video Converter with Genlock	
DIRECTIVES this equipment complies with	LVD 73/23/EEC EMC 89/336/EEC	
HARMONISED STANDARDS applied in order to verify compliance with Directive(s)	EN 55103-1:1996 EN 55103-2:1996 EN 60950-1:2006	
TEST REPORTS ISSUED BY	**Notified/Competent Body**	**Report no:**
	Nemko	67639001
TECHNICAL CONSTRUCTION FILE NO	Not applicable	
YEAR WHICH THE CE-MARK WAS AFFIXED	2006	
TEST AUTHORIZED SIGNATORY		
MANUFACTURER	**AUTHORISED REPRESENTATIVE (Established within EEA)**	**Date of Issue**
		2007-10-17
		Place of Issue
	Not applicable	Sandefjord, Norway

NETWORK ELECTRONICS ASA
O.nr. 976 584 201 MVA

Name Thomas Øhrbom

Position Quality Manager
(authorised signature)

Network Electronics ASA
P.O. Box 1020, 3204 Sandefjord, Norway
Tel: +47 33 48 99 99 Fax: +47 33 48 99 98
www.network-electronics.com
network@network-electronics.com
Enterprise No.: NO 976 584 201 MVA