3GHD-EO
3GHD-EO-2

Single/dual 3G-SDI
electrical to optical converter

User manual

Rev. E

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Revision history

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

Rev.	Repl.	Date	Sign	Change description
E	4	2015-05-11	MB	Cover page update; DoC removed; no other changes to content
4	3	2012-11-14	SHH	Updated chapter 5.1
3	2	2012-06-12	AJM	Updated chapter 3.4
2	1	2011-08-15	SHH	Enabled functionality for fibre breakage detection signal. Only available in HW version 1.1. Updated in 3.5. Added MADI transport chapter.
1	0	2009-10-23	AJM	Updated DIP 3 and 7 in 3.1 and dip 3, 6 and 7 in 3.2. Updated figure 10 and 11.
0	-	2009-04-09	AJM	First release.

Contents

1 Product overview

The Flashlink 3GHD-EO and 3GHD-EO-2 is a single or dual multi bit-rate electrical to optical converter module providing high performance media conversion for various signal formats from 19.4Mbps up to 2970Mbps. Unmatched signal accuracy, even in critical applications with pathological signal patterns makes the 3GHD-EO and 3GHD-EO-2 the first choice for all optical transport demands.

The 3GHD-EO and 3GHD-EO-2 can transport all HD and SD signal formats in addition to DVB-ASI and SMPTE310M. It performs electrical equalizing and signal re-clocking, which is selectable on application. High quality optical transmitters using FP or DFB lasers are suitable for short and medium haul applications. The open system platform of Nevion Flashlink system allows easy interoperability with third party fiber optical systems.

The two modules also support *Fibre breakage detection signalling*. This feature allows for the user to distinguish between a loss of signal at the input of the transmitter and a fibre breakage towards the receiver.

The 3GHD-EO and 3GHD-EO-2 unit has also two electrical outputs for each channel, which reduces the need for additional DA's. The electrical input is equipped with a multi rate cable equalizer providing an equalization of typically 75m of high quality coax cable at 2970Mbps.

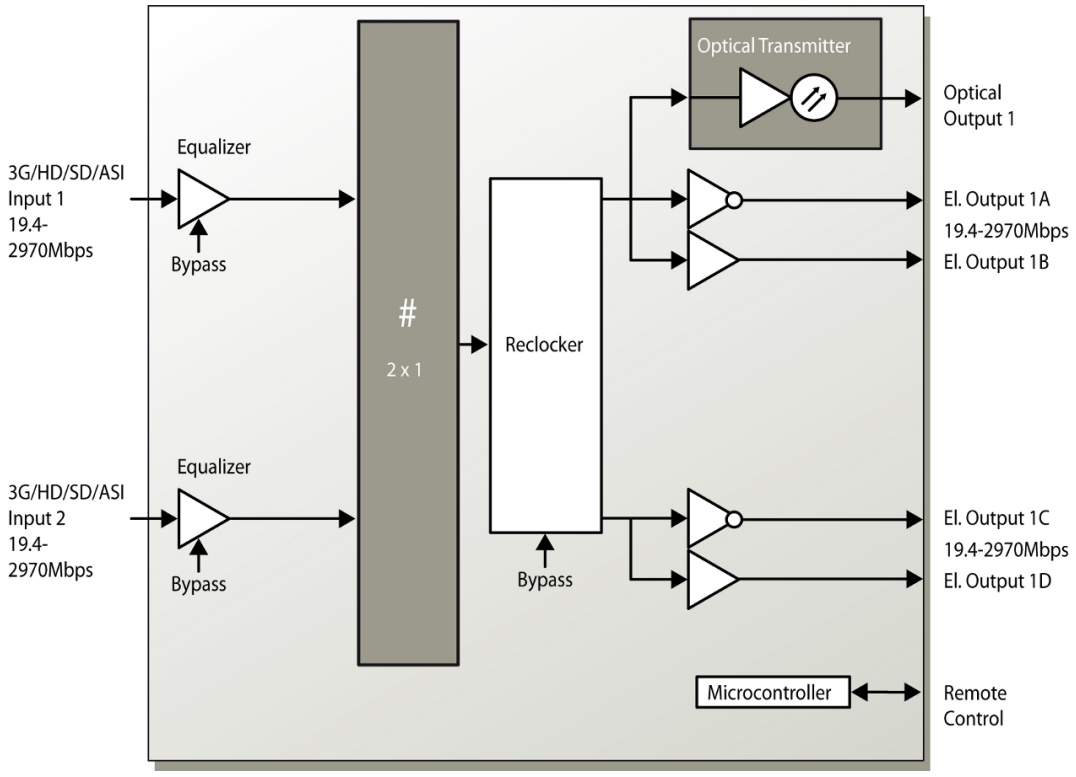


Figure 1 Block diagram of the 3GHD-E0 converter

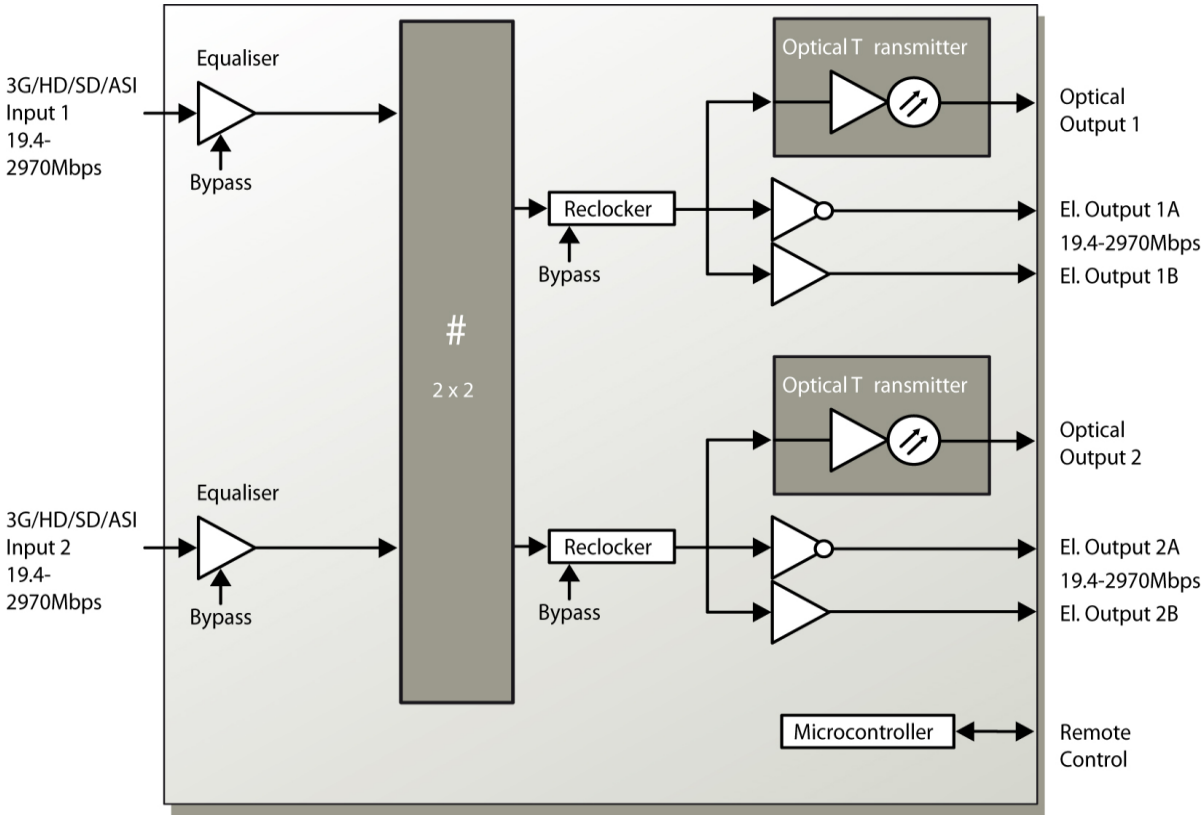


Figure 2 Block diagram of the 3GHD-EO-2 converter

1.1 Product version

3GHD-EO is available in the following version:

Single converter version:

3GHD-EO-13T -7.5dBm	1310nm -7.5dBm F-P laser
3GHD-EO-C1270	1270nm 0dBm
3GHD-EO-C1290	1290nm 0dBm
3GHD-EO-C1310	1310nm 0dBm
3GHD-EO-C1330	1330nm 0dBm
3GHD-EO-C1350	1350nm 0dBm
3GHD-EO-C1370	1370nm 0dBm
3GHD-EO-C1390	1390nm 0dBm
3GHD-EO-C1410	1410nm 0dBm
3GHD-EO-C1470	1470nm 0dBm
3GHD-EO-C1490	1490nm 0dBm
3GHD-EO-C1510	1510nm 0dBm
3GHD-EO-C1530	1530nm 0dBm
3GHD-EO-C1550	1550nm 0dBm
3GHD-EO-C1570	1570nm 0dBm
3GHD-EO-C1590	1590nm 0dBm
3GHD-EO-C1610	1610nm 0dBm

Dual converter version:

3GHD-EO-2-T13 -7.5dBm	1310nm -7.5dBm F-P laser
3GHD-EO-2-C1310/1550	1310nm and 1550nm 0dBm DFB laser
3GHD-EO-2-C1470/1490	1470nm and 1490nm 0dBm DFB laser
3GHD-EO-2-C1510/1530	1510nm and 1530nm 0dBm DFB laser
3GHD-EO-2-C1550/1570	1550nm and 1570nm 0dBm DFB laser
3GHD-EO-2-C1590/1610	1590nm and 1610nm 0dBm DFB laser
3GHD-EO-2-C1270/1290	1270nm and 1290nm 0dBm DFB laser
3GHD-EO-2-C1310/1330	1310nm and 1330nm 0dBm DFB laser
3GHD-EO-2-C1350/1370	1350nm and 1370nm 0dBm DFB laser
3GHD-EO-2-C1390/1410	1390nm and 1410nm 0dBm DFB laser

2 Specifications

2.1 General

Power	+5V DC / 3.5W, max
Control	Control system for access to setup and module status with BITE (Built-In Test Equipment)
Temp. range	0 to +40 °C

2.2 Electrical Input

Data rate NRZ	19.4 to 2970Mbps
Equalization	Automatic,
	Cable equalizer and reclocker can be bypassed to support bitrates down to 2Mbps.
Impedance	75 ohm
Return loss	>15dB @ 5-1485MHz
	>10dB 1485-2970MHz
Signal level	Nom. 800mV
Connector	BNC, 2 inputs

2.3 Electrical Outputs

Number of outputs	4 on single converter
	2 (per converter) on the dual converter
Connector	BNC
Impedance	75 ohm
Return loss	>15dB @ 5-1485MHz
	>10dB 1485-2970MHz
Peak to peak signal level	800mV ± 100mV
Signal polarity	2 inverting, 2 non-inverting on single converter
	1 inverting, 1 non-inverting (per converter) on dual converter

2.4 Optical Output

Number of outputs	1 on single converter
	1 (per converter) on the dual converter
Transmission circuit fiber	Single mode 9/125um
Light source	F-P / DFB laser
Optical power	13T -7.5dBm: -3 to -12dBm, typ -5dBm,
	CWDM: +0dBm +/- 1dBm
Optical centre wavelength	1310nm or CWDM
Max. wavelength variation	+/- 6nm for CWDM
	+/-20nm for 1310nm

Connector return loss	>40dB w/SM fiber
Maximum reflected power	4%
Connector	SC/UPC

2.5 Standards

Supported standards for electrical and optical ports:

SMPTE292M, SMPTE259M, SMPTE297M, SMPTE305.2M, SMPTE310M, SMPTE424M, DVB-ASI EN50083-9.

3 Configuration

3.1 Single converter

The 3GHD-EO can support a number of different broadcast formats. The correct configuration can either be set with a DIP switch or with the GYDA Control System. The layout of 3GHD-EO is shown in the drawing below with the DIP switch to the upper left position.

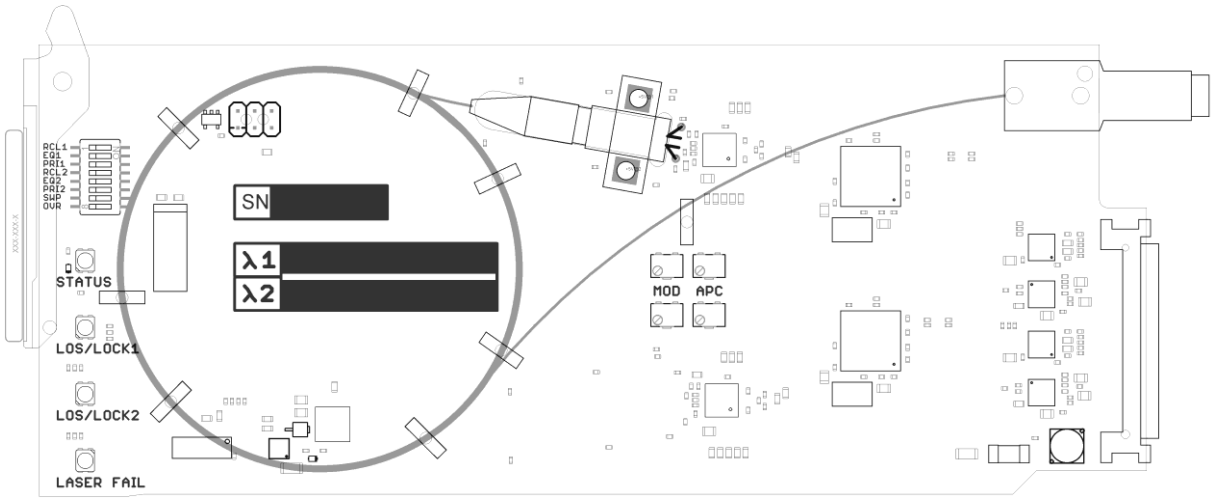


Figure 3 3GHD-EO board layout

Switch #	Label	Function, DIP = ON	Function, DIP = OFF	Comment
1	RCL1	Reclocker 1 ON	Reclocker 1 bypass	Reclocker mode
2	EQ1	Automatic cable Equalizer ON	Automatic cable Equalizer OFF	Cable equalizer mode on input 1
3	PRI1	Electrical input 2	Electrical input 1	Select electrical input to laser 1
4	RCL2			No function on this product
5	EQ2	Automatic Cable Equalizer ON	Automatic Cable Equalizer OFF	Cable equalizer mode on input 2
6	PRI2			No function on this product
7	SWP	Automatic change over	Normal operation	ACO mode
8	OVR	Override GYDA control. Configuration with DIP switch	GYDA control. Configuration with GYDA	Select configuration from GYDA

All DIP switches are off when pointing towards the release handle.

3.2 Dual converter

The 3GHD-EO-2 can support a number of different broadcast formats. The correct configuration can either be set with a DIP switch or with the GYDA Control System. The layout of 3GHD-EO-2 is shown in the drawing below with the DIP switch to the upper left position.

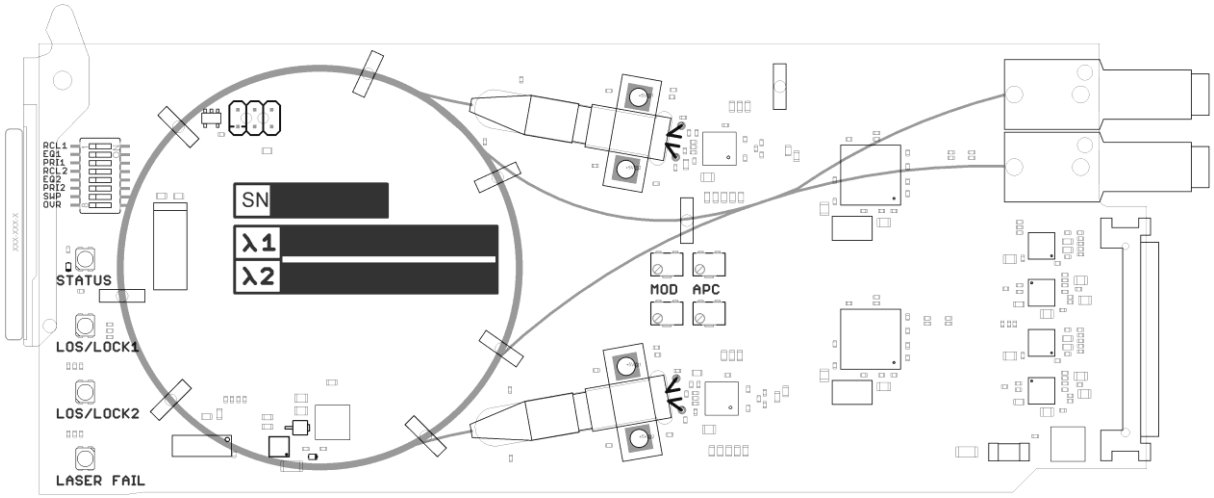


Figure 4 3GHD-EO-2 board layout

Switch #	Label	Function, DIP = ON	Function, DIP = OFF	Comment
1	RCL1	Reclocker 1 ON	Reclocker 1 bypass	Reclocker mode
2	EQ1	Automatic cable Equalizer ON	Automatic cable Equalizer OFF	Cable equalizer mode on input 1
3	PRI1	Electrical input 2	Electrical input 1	Select electrical input to laser 1
4	RCL2	Reclocker 2 ON	Reclocker 2 bypass	Reclocker mode
5	EQ2	Automatic Cable Equalizer ON	Automatic Cable Equalizer OFF	Cable equalizer mode on input 2
6	PRI2	Electrical input 2	Electrical input 1	Select electrical input to laser 2
7	SWP	Automatic change over	Normal operation	ACO mode
8	OVR	Override GYDA control. Configuration with DIP switch	GYDA control. Configuration with GYDA	Select configuration from GYDA

All DIP switches are off when pointing towards the release handle.

3.3 Reclocker mode

The reclocker can be set to re-clock or bypass from DIP#1 and DIP#3 or from GYDA.

When reclocker is set to re-clock mode jitter from the signal is removed. Accepted bitrates is 270, 1483.5, 1485, 2967 and 2970Mbps.

When reclocker is set to bypass, the converter accept all bitrates between 19.4 to 2970Mbps. Note that in this mode the jitter is not removed and this can cause problems for downstream equipment.

3.3.1 Transparent

This converter only looks at the bitrates and not the content. This means that any signal with correct bitrates is converted. The product is transparent to data in the ancillary space like embedded audio.

3.4 Automatic change over

Dual electrical converter has an automatic changeover module. This module has the possibility to have an automatic change over on the input. This can be used in redundancy systems where the user wants automatically switch to a backup port when the main input loses signal. This function can be turned with DIP#5. From GYDA this function can be turned on for each converter. Each converter can be configured to what is main and backup input by DIP#3 and DIP#6 or from GYDA.

3.4.1 Trigger condition

Loss of electrical signal trigs the automatic change over. When the main input loss electrical signal the backup input is selected. When the backup input is active an alarm is displayed in Gyda. When the main input electrical signal is restored the converter switches immediately back to main input and the alarm is restored.

> Note that bit error or loss of lock on reclocker does not trigger the ACO.

3.5 Fibre breakage detection signalling

The module has the possibility for adding a signal to the output at loss of input signal. This enables receivers to distinguish between a loss of input on transmitter side and a fibre breakage towards receiver side. From Gyda this new feature can be enabled thru the GPI 1 and GPI 2 function in Multicon Gyda. Setting GPI 1 active enables the fibre breakage detection signal at loss of input for channel 1. Setting GPI 2 enables it for channel 2.

See application note on *Fibre breakage detection signalling* for more information.

> Note that this feature is only available on modules with hw version 1.1 or higher. The software auto detects the hardware version and enables the feature accordingly.

3.6 Single converter configuration example

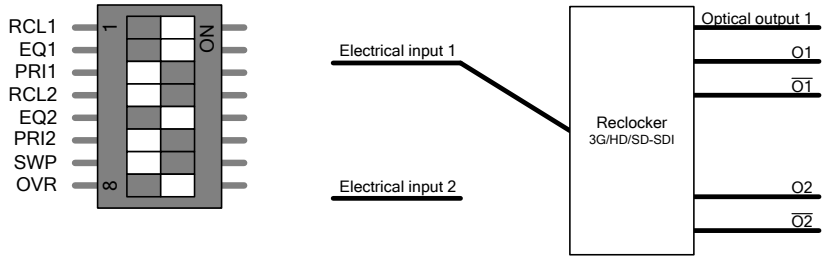


Figure 5 EO converter with reclocker, input 1

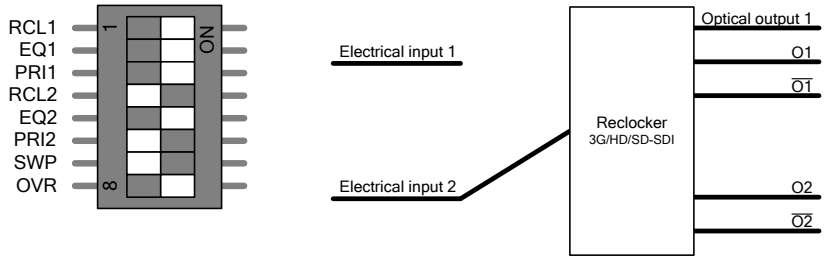


Figure 6 EO converter with reclocker, input 2

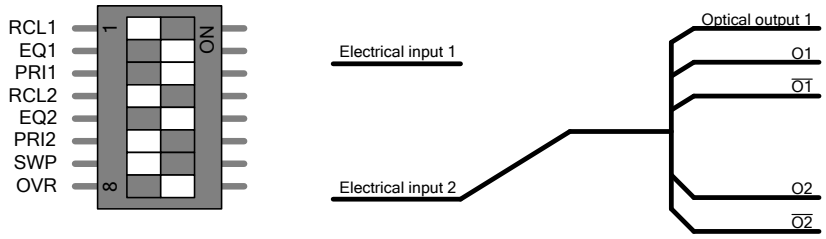


Figure 7 EO converter with reclocker in bypass

3.7 Dual converter configuration example

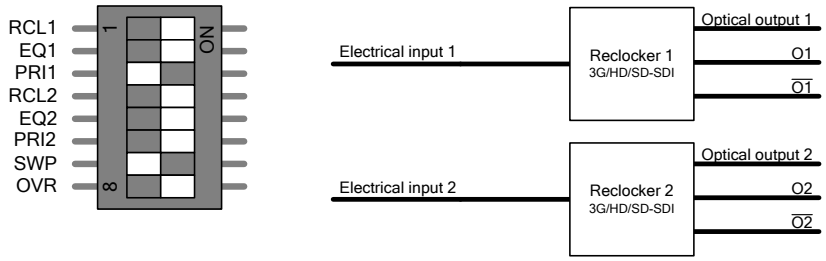


Figure 8 Dual EO converter, standard setup

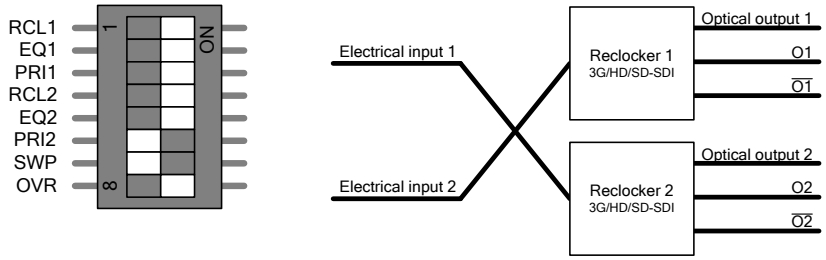


Figure 9 Dual EO converter, input swap

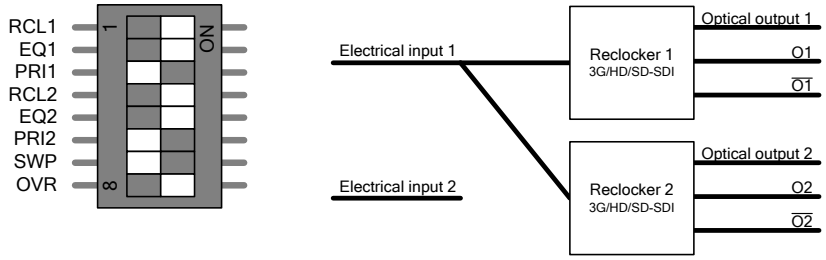


Figure 10 Single EO converter with DA, input 1

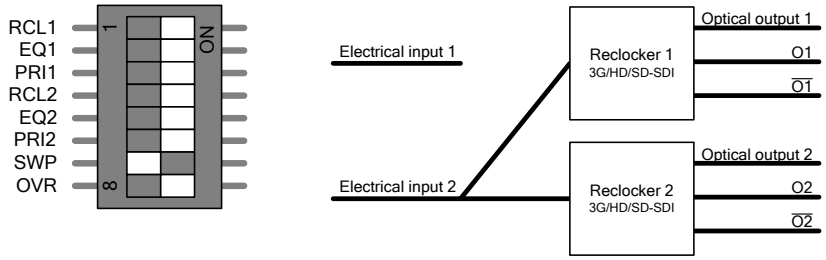


Figure 11 Single EO converter with DA, input 2

4 MADI transport

The card can be used to transport MADI signal. Nevion recommend setting the cable EQ and rec-clocker in bypass.

4.1 Connections

The 3GHD-EO and 3GHD-EO-2 has a dedicated connector module: 3GHD-EO-2-C1. This module is mounted at the rear of the sub-rack. The module is shown in the figure below.

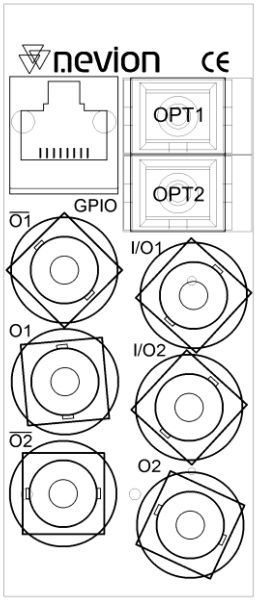


Figure 12 Connector module for 3GHD-EO-2

4.2 Terminal format support

The different input and output ports on 3GHD-EO(-2) can support a number of formats. The table below show which signal formats are supported on the selected terminals.

Terminal format support for single converter:

Terminal	Function	Supported Format	Mode
OPT1	Optical output	SDI, DVB-ASI, SMPTE310, Transparent	Output
OPT2	Not used		
I/O1 I/O2	Electrical Input	SDI, DVB-ASI, SMPTE310, Transparent	Input
O1 O2	Electrical Output Reclocked DA output	SDI, DVB-ASI, Transparent	Output
$\overline{O1}$ $\overline{O2}$	Electrical Output Reclocked DA inverted output	SDI, Transparent	Output
GPI ALARM	Open Collector Alarms	Wired alarms	OC Output

Terminal format support for dual converter:

Terminal	Function	Supported Format	Mode
OPT1 OPT2	Optical output	SDI, DVB-ASI, SMPTE310, Transparent	Output
I/O1 I/O2	Electrical Input	SDI, DVB-ASI, SMPTE310, Transparent	Input
O1 O2	Electrical Output Reclocked DA output	SDI, DVB-ASI, Transparent	Output
$\overline{O1}$ $\overline{O2}$	Electrical Output Reclocked DA inverted output	SDI, Transparent	Output
GPI ALARM	Open Collector Alarms	Wired alarms	OC Output

Unused inputs should be terminated to avoid alarms triggered by noise.

4.3 Mounting the connector module

The details of how the connector module is mounted, is found in the user manual for the sub-rack frame FR-2RU-10-2.

This manual is also available from our web site:

http://www.nevion.com/

5 Module status

The status of the module can be monitored in three ways.

1. GYDA System Controller (optional).

2. GPI at the rear of the sub-rack.

3. LED's at the front of the sub-rack.

Of these three, the GPI and the LED's are mounted on the module itself, whereas the GYDA System Controller is a separate module giving detailed information on the card status.

5.1 GPI ALARM – Module Status Outputs

These outputs can be used for wiring up alarms for third party control systems. The GPI outputs are open collector outputs, sinking to ground when an alarm is triggered. The GPI connector is shown in figures below.

Electrical Maximums for GPI outputs

Max current: 100mA

Max voltage: 30V

5.1.1 GPI connections

3GHD-EO-2 module GPI pinning:

Signal	Name	Pin #	Mode
Status	General error status for the module.	Pin 1	Open Collector inverted logic
LOS1	Loss of signal on input 1.	Pin 2	Open Collector
LOS2	Loss of signal on input 2.	Pin 3	Open Collector
Laser fail	Laser failure.	Pin 4	Open Collector
Ground	0V / gnd pin.	Pin 8	0V.

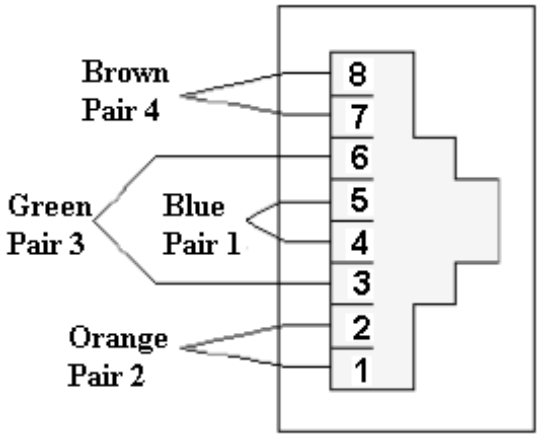
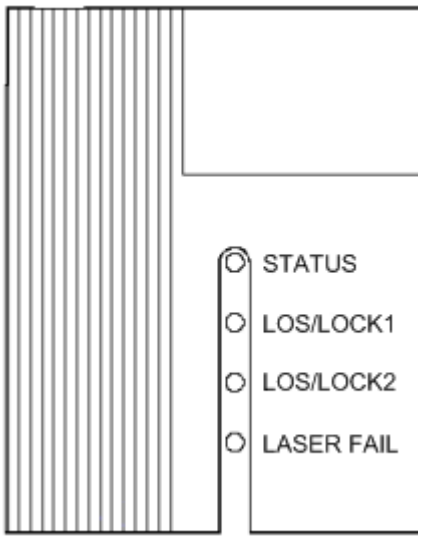


Figure 13 GPI connector

5.2 Front panel – Status monitoring

The status of the module can be easily monitored visually by the LED's at the front of the module. The LEDs are visible through the front panel as shown in the figure below.



The 3GHD-EO(-2) has 4 LED's each showing a status corresponding to the GPI pinning.

Diode \ State	Red LED	Yellow LED	Green LED	No light
Status	Module is faulty, or module is initializing.	N/A	Module is OK Module power is OK	Module has no power
LOS/LOCK1	No input signal on optical output 1.	Input signal on optical output 1 but reclocker not in lock.	Input signal on optical output 1 and reclocker in lock.	
LOS/LOCK2	No input signal on optical output 2.	Input signal on optical output 1 but reclocker not in lock.	Input signal on optical output 1 and reclocker in lock.	
Laser fail	Laser is malfunctioning.	Laser is off	Laser is OK	

6 RS422 commands

This card uses the FLP 4.0 protocol to be configured and monitored. See separate documents for definition of this protocol.

6.1 FLP4.0 block commands

Common FLP4.0 block for both single and dual converter is listed below.

6.1.1 CEQ 0

Electrical input 1.

```
<identifier> ::= 'ceq'
<status> ::= ['cd'|'ncd'] ['bypass'|'mute']

<block command> ::= 'enable'|'bypass'|'mute'
```

6.1.2 CEQ 1

Electrical input 2.

```
<identifier> ::= 'ceq'
<status> ::= ['cd'|'ncd'] ['bypass'|'mute']

<block command> ::= 'enable'|'bypass'|'mute'
```

6.1.3 TEMP 0

Board temperature.

```
<identifier> ::= 'temp'
<status> ::= ['alarm'] [<temperature>'C'] ['ulim' <temperature>]
             ['llim' <temperature>]
<block command> ::= <upper limit>|<lower limit>
<upper limit> ::= 'ulim' <temperature>
<lower limit> ::= 'llim' <temperature>
```

6.1.4 PWR 0

```
<identifier> ::= 'pwr'
<status> ::= [<nominal voltage>'Vnom'] [<voltage>]
```

6.1.5 PWR 1

```
<identifier> ::= 'pwr'
<status> ::= [<nominal voltage>'Vnom'] [<voltage>]
```

6.1.6 LSR 0

Optical output 1.

```
<identifier> ::= 'lsr'
<status> ::= ['T'|'C'|'D'] [<wavelength>'nm'] [<power>'dBm']
        ['on'|'off'] ['fail']
<block command> ::= <operation>|<type>|<wavelength>|<power>
<operation> ::= 'on'|'off'
<type> ::= 'type' 'T'|'C'
<wavelength> ::= 'lambda' <laser wavelength>
<power> ::= 'lpwr' <laser power>
```

6.1.7 CHO 0

Input select for output 1.

```
<identifier> ::= 'cho'
<status> ::= [<input>] ['size' 2] [<changeover mode>]
             [<priority list>]
<block command> ::= <set position>|<set priority>
<changeover mode> ::= 'auto'|'man'
<priority list> ::= 'pri' <input>
<set position> ::= 'pos' 'auto'|('man' <input>)
<set priority> ::= 'pri' <input>
```

6.2 Single converter

FLP4.0 block for single converter is listed in 6.2.1.

6.2.1 RCL 0

Reclokcer for output 1.

```
<identifier> ::= 'rcl'
<status> ::= ['en'|'mute'|'bypass'] ['lock'|'lol']
             [<bitrate>'Mbps'] ['asi'|'sdi'|'hdsdi']
             ['abp' 'on'|'off'] ['rate' 'man'|'auto']
<block command> ::= <set mode>|<set autobypass>|
<set mode> ::= 'en'|'mute'|'bypass'
<set autobypass> ::= 'abp' 'on'|'off'
```

6.3 Dual converter

FLP4.0 block for dual converter is listed in below.

6.3.1 LSR 1

Optical output 2.

```
<identifier> ::= 'lsr'
<status> ::= ['T'|'C'|'D'] [<wavelength>'nm'] [<power>'dBm']
         ['on'|'off'] ['fail']
<block command> ::= <operation>|<type>|<wavelength>|<power>
<operation> ::= 'on'|'off'
<type> ::= 'type' 'T'|'C'
<wavelength> ::= 'lambda' <laser wavelength>
<power> ::= 'lpwr' <laser power>
```

6.3.2 CHO 1

Input select for output 2.

```
<identifier> ::= 'cho'
<status> ::= [<input>] ['size' 2] [<changeover mode>]
             [<priority list>]
<block command> ::= <set position>|<set priority>
<changeover mode> ::= 'auto'|'man'
<priority list> ::= 'pri' <input>
<set position> ::= 'pos' 'auto'|('man' <input>)
<set priority> ::= 'pri' <input>
```

6.3.3 RCL 0

Reclocker for output 1.

```
<identifier> ::= 'rcl'
<status> ::= ['en'|'mute'|'bypass'] ['lock'|'lol']
             [<bitrate>'Mbps'] ['asi'|'sdi'|'hdsdi']
             ['abp' 'on'|'off'] ['rate' 'man'|'auto']

<block command> ::= <set mode>|<set autobypass>|

<set mode> ::= 'en'|'mute'|'bypass'
<set autobypass> ::= 'abp' 'on'|'off'
```

6.3.4 RCL 1

Reclokcer for output 2.

```
<identifier> ::= 'rcl'
<status> ::= ['en'|'mute'|'bypass'] ['lock'|'lol']
             [<bitrate>'Mbps'] ['asi'|'sdi'|'hdsdi']
             ['abp' 'on'|'off'] ['rate' 'man'|'auto']

<block command> ::= <set mode>|<set autobypass>|

<set mode> ::= 'en'|'mute'|'bypass'
<set autobypass> ::= 'abp' 'on'|'off'
```

General environmental requirements for Nevion equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:
   - Operating room temperature range: 0°C to 40°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 50°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 Nevion, which are available on the company web site:

www.nevion.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)
3GHD-EO/ 3GHD-EO-2	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

Nevion provides assistance to customers and recyclers through our web site http://www.nevion.com/. Please contact Nevion’s 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 Nevion 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 labeled 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