HD-SDI Optical to Electrical Converter / HD-SDI Long-haul Optical to Electrical Converter / HD-SDI Optical to Electrical Converter for multi mode
Network Electronics ASA

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

<table>
<thead>
<tr>
<th>Revision</th>
<th>Replaces</th>
<th>Date</th>
<th>Change description</th>
</tr>
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<tr>
<td>2</td>
<td>1</td>
<td>2007-05-04</td>
<td>Added specification and configuration for HW version 2.</td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td>2003-08-21</td>
<td>Update of chapter 5.2.</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>2002-08-13</td>
<td>Corrected printing errors.</td>
</tr>
<tr>
<td>A</td>
<td>-</td>
<td>2002-08-12</td>
<td>Preliminary version.</td>
</tr>
</tbody>
</table>
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1 Product overview

The Flashlink HD-OE is a multi bit-rate Optical to Electrical converter module providing high performance media conversion for various signal formats from 19.4Mbps up to 1485Mbps. This state of the art unit offers a high sensitivity PIN diode technology with long wavelength on single mode fibre. Unmatched signal accuracy, even in critical applications with pathological signal patterns makes the HD-OE the first choice for all optical transport demands.

The HD-OE can transport all HD and SD signal formats in addition to DVB-ASI and SMPTE 310. It performs optical refreshing and signal reclocking, which is selectable on application. The optical input comes with a sophisticated PIN diode with a sensitivity typically better than –20dBm. The open system platform of Network Electronics Flashlink system allows easy interoperability with third party fibre optical systems. The product is also available as a long-haul receiver with -24dBm sensitivity. A multi mode version for fibre distances up to 300m is also available.

The electrical output is equipped with a distribution amplifier where four (hardware version 1: two) outputs reduces the need for additional DAs (for DVB-ASI only two (version 1: one) can be used).

Figure 1 - HD-OE (Version 2) HD-SDI Optical to Electrical Converter

Figure 2 - HD-OE (Version 1) HD-SDI Optical to Electrical Converter
2 Specifications

2.1 Optical input
Data rate optical 19.4 to 1485 Mbps.
Sensitivity
for HD-SDI (1485Mbps) Better than -20dBm.
for HD-SDI (1485Mbps) Better than -24dBm, HD-OE-L version
for SD-SDI (270Mbps) Better than -25dBm.
Detector overload threshold Minimum -3dBm.
Detector damage threshold >+1dBm.
Optical wavelengths 1200 - 1620nm.
Transmission circuit fibre 9/125um single mode
Transmission circuit fibre (-M) 50/125um multi mode (HD-OE-M)
Connector Return Loss >40dB with SM fibre.
Connector SC/UPC

2.2 Electrical output
Impedance 75 ohm.
Return loss >15dB @ 1485MHz.
Jitter Maximum 0.2 UI
Peak to peak signal level 0.8V ±0.1V
Signal polarity Hardware version 2: 2 non-inverting + 2 inverting,
Hardware version 1: 1 non-inverting + 1 inverting.
Connector BNC.

2.3 Electrical
Power: +5 VDC, 3W Maximum.
Control: Control system for access to setup and module status
with BITE (Built-In Test Equipment).

2.4 Standards
Supported standards for electrical and optical ports:
SMPTE: SMPTE 292, SMPTE259M, SMPTE297, SMPTE305M,
SMPTE310.
2.5 Connector module

HD-OE version 1 uses the connector module: SDI-C1 (Rev.1 or later, figure 3).

Figure 3 - HD-OE (Version 1) backplane

HD-OE version 2 uses the connector module HD-EO-2-C1 (figure 4).

Figure 4 - HD-OE (Version 2) backplane

The connector module is mounted at the rear of the sub-rack.

In typical use a HD-EO / HD-OE module at each end will be used. The electrical input signal is connected to the IN1 or IN2 (DIGITAL INPUT for version 1) BNC on the transmitting HD-EO, and the electrical output is connected to one or more of the OUT1-, OUT1+, OUT2- or OUT2+ (DIGITAL OUTPUT 1 and 2 for version 1) BNCs on the receiving HD-OE. The fibre cable is connected to the OPTICAL/OPT1 ports on HD-EO and HD-OE. Please note that the OUT1- and OUT2- (DIGITAL OUTPUT 2 for version 1) BNCs on HD-OE carry an inverted signal, so formats like DVB-ASI can not be used on these outputs. The details of how the connector module is mounted can be found in the user manual for the frame. This manual is also available from our web site:

http://www.network-electronics.com/
2.6 Terminal format support

The different input and output ports on HD-OE can support a number of formats. The table below shows which signal formats are supported on the selected terminals.

Terminal format support, version 2:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function</th>
<th>Supported Format</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTICAL</td>
<td>Optical Input (Receiver)</td>
<td>HD-SDI, SD-SDI, DVB-ASI, SMPTE310, Transparent</td>
<td>Input</td>
</tr>
<tr>
<td>OUT1+</td>
<td>Electrical Output – Reclocked DA output</td>
<td>HD-SDI, SD-SDI, DVB-ASI, SMPTE310, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>OUT1-</td>
<td>Electrical Output – Reclocked DA output</td>
<td>HD-SDI, SD-SDI, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>OUT2+</td>
<td>Electrical Output – Reclocked DA output</td>
<td>HD-SDI, SD-SDI, DVB-ASI, SMPTE310, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>OUT2-</td>
<td>Electrical Output – Reclocked DA output</td>
<td>HD-SDI, SD-SDI, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>GPI ALARM</td>
<td>Open Collector Alarms</td>
<td>Wired alarms</td>
<td>OC Output</td>
</tr>
</tbody>
</table>

Terminal format support, version 1:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function</th>
<th>Supported Format</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTICAL</td>
<td>Optical Output (Transmitter)</td>
<td>HD-SDI, SD-SDI, DVB-ASI, SMPTE310, Transparent</td>
<td>Input</td>
</tr>
<tr>
<td>DIGITAL OUTPUT 1</td>
<td>Electrical Output – None inverted Reclocked DA output</td>
<td>HD-SDI, SD-SDI, DVB-ASI, SMPTE310, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>DIGITAL OUTPUT 2</td>
<td>Electrical Output – Inverted Reclocked DA output</td>
<td>HD-SDI, SD-SDI, Transparent</td>
<td>Output</td>
</tr>
<tr>
<td>GPI ALARM</td>
<td>Open Collector Alarms</td>
<td>Wired alarms</td>
<td>OC Output</td>
</tr>
</tbody>
</table>

1 HD-OE has a “Transparent mode”. In this mode all reclockers are switched off and no jitter attenuation will be performed. This mode may be used for non-standard or unsupported bit rates over shorter distances and up to 1 Gbps.
3 Configuration

3.1 Version 2 Configuration

The HD-OE can support a number of different broadcast formats. The correct configuration can either be set with a DIP switch or with the GYDA-SC Control System. The layout of HD-OE is shown in the drawing below with the DIP switch to the upper left position. Look at the labels beside the 8 dip switches near the release handle in order to find out what hardware version of HD-OE you have. If the labels match the table below, you have version 2. If they match the table in chapter 3.2, you have version 1.

![Figure 5 - HD-OE Version 2 board layout](image)

**DIP switch configuration must be set according to the table below:**

<table>
<thead>
<tr>
<th>Switch #</th>
<th>Label</th>
<th>Function DIP=ON</th>
<th>Function DIP=OFF</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RCL1</td>
<td>Reclocker ON</td>
<td>Reclocker Bypass</td>
<td>Reclocker mode</td>
</tr>
<tr>
<td>2</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>3</td>
<td>ASI1</td>
<td>DVB-ASI Reclocker support</td>
<td>SDI 177Mbps Reclocker support</td>
<td>Select ASI or 177Mbps support</td>
</tr>
<tr>
<td>4</td>
<td>RCL2</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>5</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>6</td>
<td>ASI2</td>
<td>Go to standby on LOS</td>
<td>Stay in main at all times</td>
<td>Change-over mode</td>
</tr>
<tr>
<td>7</td>
<td>SWP</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>8</td>
<td>OVR</td>
<td>Override GYDA control Config. with DIP switch</td>
<td>GYDA control Config. with GYDA</td>
<td>Select configuration from GYDA</td>
</tr>
</tbody>
</table>

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

All clock rates for HD-SDI, SD-SDI and DVB-ASI are automatically configured by the module itself.
3.2 Version 1 Configuration

The HD-OE can support a number of different broadcast formats. The correct configuration can either be set with a DIP switch or with the GYDA-SC Control System. The layout of HD-OE is shown in the drawing below with the DIP switch to the upper left position. Look at the labels beside the 8 dip switches near the release handle in order to find out what hardware version of HD-OE you have. If the labels match the table below, you have version 1. If they match the table in chapter 3.1, you have version 2.

![HD-OE Version 1 board layout](image)

DIP switch configuration must be set according to the table below:

<table>
<thead>
<tr>
<th>Switch #</th>
<th>Label</th>
<th>Function DIP=ON</th>
<th>Function DIP=OFF</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D/B</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Always in broadcast mode</td>
</tr>
<tr>
<td>2</td>
<td>E/O</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Always O to E mode</td>
</tr>
<tr>
<td>3</td>
<td>RCL</td>
<td>Reclocker ON</td>
<td>Reclocker Bypass</td>
<td>Reclocker mode</td>
</tr>
<tr>
<td>4</td>
<td>EQ</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>5</td>
<td>ASI</td>
<td>DVB-ASI Reclocker support</td>
<td>SDI 177Mbps Reclocker support</td>
<td>Select ASI or 177Mbps support</td>
</tr>
<tr>
<td>6</td>
<td>GBE</td>
<td>Not in use</td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>622</td>
<td>Not in use</td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>OVR</td>
<td>Override GYDA-SC control Config. with DIP switch</td>
<td>GYDA-SC control Config. with GYDA-SC</td>
<td>Select configuration from GYDA-SC</td>
</tr>
</tbody>
</table>

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

All clock rates for HD-SDI, SD-SDI and DVB-ASI are automatically configured by the module itself.
4 Module status

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

1. GYDA-SC 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-SC System Controller is a separate module giving detailed information on the card status. The functions of the GPI and the LED’s are described in Chapters 4.2 and 4.3. The GYDA-SC controller is described in a separate user manual.

4.1 GPI ALARM – Module Status Output

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

4.2 GPI Connections

4.2.1 Version 2 GPI pinout

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Signal</th>
<th>Name</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Status</td>
<td>General error status for the module.</td>
<td>Open collector</td>
</tr>
<tr>
<td>2</td>
<td>LOS</td>
<td>Loss of signal.</td>
<td>Open collector</td>
</tr>
<tr>
<td>3</td>
<td>Not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ground</td>
<td>0V / GND pin.</td>
<td>0V</td>
</tr>
</tbody>
</table>

Figure 7 - HD-OE Version 2 GPI pin-out
4.3 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 LED’s are visible through the front panel as shown in figure 8 below. (Text not printed on front panel).

![Figure 8 - Front panel indicator overview for HD-OE. Left: version 2; right: version 1](image)

The HD-OE has 4 LED’s each showing a status corresponding to the GPI pinning. The position of the different LED’s is shown in figure 8.

<table>
<thead>
<tr>
<th>Diode \ state</th>
<th>Red LED</th>
<th>Yellow LED (Version 2 only)</th>
<th>Green LED</th>
<th>No light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Module is faulty, or module is initialising.</td>
<td>N/A</td>
<td>Module is OK Module power is OK</td>
<td>Module has no power</td>
</tr>
<tr>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>LOS (Version 1)</td>
<td>Loss of optical modulated signal.</td>
<td>Modulated optical input signal present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCK (Version 1)</td>
<td>Re-clocker is out of lock</td>
<td>Re-clocker is in lock on a supported signal format</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOS/LOCK (Version 2)</td>
<td>No signal</td>
<td>Signal present, no reclocker lock</td>
<td>Signal on input 1 is ok</td>
<td></td>
</tr>
</tbody>
</table>
5 Laser safety precautions

Guidelines to limit hazards from laser exposure.

All the available EO units in the Flashlink range include a laser. Therefore this note on laser safety should be read thoroughly.

The lasers emit light at wavelengths around 1310 nm or 1550 nm. This means that the human eye cannot see the beam, and the blink reflex can not protect the eye. (The human eye can see light between 400 nm to 700 nm).

A laser beam can be harmful to the human eye (depending on laser power and exposure time). Therefore:

!! BE CAREFUL WHEN CONNECTING / DISCONNECTING FIBRE PIGTAILS (ENDS).

NEVER LOOK DIRECTLY INTO THE PIGTAIL OF THE LASER/FIBRE.

NEVER USE MICROSCOPES, MAGNIFYING GLASSES OR EYE LOUPES TO LOOK INTO A FIBRE END.

USE LASER SAFETY GOGGLES BLOCKING LIGHT AT 1310 nm AND AT 1550 nm

Instruments exist to verify light output power: Power meters, IR-cards etc.

Flashlink features:

All the laser module cards in the Flashlink product range, are Class 1 laser products according to IEC 825-1 1993, and class 1 according to 21 CFR 1040.10 when used in normal operation. More details can be found in the user manual for the FR-2RU-10-2 frame.

Maximum output power : 5 mW.

Operating wavelengths: > 1270 nm
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 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 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.

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Toxic or hazardous substances and elements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>鉛 (Pb)</td>
</tr>
<tr>
<td>HD-OE</td>
<td>X</td>
</tr>
</tbody>
</table>

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.

A.2 Environmentally-friendly use period
The manual must include a statement of the “environmentally friendly use period”. This is defined as the period of normal use before any hazardous material is released to the environment. The guidance on how the EFUP is to be calculated is not finalised at the time of writing.

See [http://www.aeanet.org/GovernmentAffairs/gfLeOpAaZXaMxqGjSFbEidSdPNtpT.pdf](http://www.aeanet.org/GovernmentAffairs/gfLeOpAaZXaMxqGjSFbEidSdPNtpT.pdf) for an unofficial translation of the draft guidance. For our own products, Network Electronics has chosen to use the 50 year figure recommended in this draft regulation.

Network Electronics suggests the following statement on An “Environmentally Friendly Use Period” (EFUP) setting out normal use:

**EFUP** is the time the product can be used in normal service life without leaking the hazardous materials. We expect the normal use environment to be in an equipment room at controlled temperature range (0ºC - 40ºC) with moderate humidity (< 90%, non-condensing) and clean air, not subject to vibration or shock.

Further, a statement on any hazardous material content, for instance, for a product that uses some tin/lead solders:

Where a product contains potentially hazardous materials, this is indicated on the product by the appropriate symbol containing the EFUP. The hazardous material content is limited to lead (Pb) in some solders. This is extremely stable in normal use and the EFUP is taken as 50 years, by comparison with the EFUP given for Digital Exchange/Switching Platform in equipment in Appendix A of “General Rule of Environment-Friendly Use Period of Electronic Information Products”. This is indicated by the product marking:

![50 years EFUP symbol](image_url)

It is assumed that while the product is in normal use, any batteries associated with real-time clocks or battery-backed RAM will be replaced at the regular intervals.
The EFUP relates only to the environmental impact of the product in normal use, it does not imply that the product will continue to be supported for 50 years.

A.3 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.