System HD Multi-Rate Optical Transceiver Operation Manual

CONTENTS

Introduction to this Operation Manual

This manual covers the operation and use of the modules described below.

WARNING…
THE FRONT PANEL OF THE UNIT MUST NOT BE OPENED BY THE OPERATOR. ACCESS IS ONLY PERMITTED TO FULLY QUALIFIED INSTALLATION ENGINEERS.

System HD Modules must only be installed and/or replaced by qualified service personnel, with reference to the System HD Installation guide. Refer all installation and servicing to qualified personnel only.

All laser transmitters used in this product are Class 1 in accordance with EN60825-1 as well as 21CFR 1040.10 and 1040.11

1. Laser light can be damaging to the eyes. Optical fibres and Uniters should be handled with great care.

2. System HD Modules which incorporate Fibre Optic elements, are designed for use with Class 1 laser systems only. Ensure that all inputs do NOT exceed Class 1 as doing so will impair the safety of the system and may result in damage to the equipment.

3. Active fibres should not be handled unless their source can be positively identified as not exceeding Class 1 limits.

Manufacturers Notice

Important Notice

No responsibility is taken by the manufacturer or supplier for any non-compliance to EMC standards due to incorrect installation.

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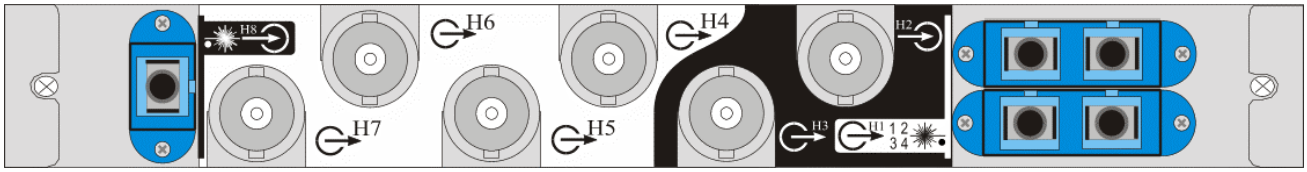
Scope of this Operation Manual

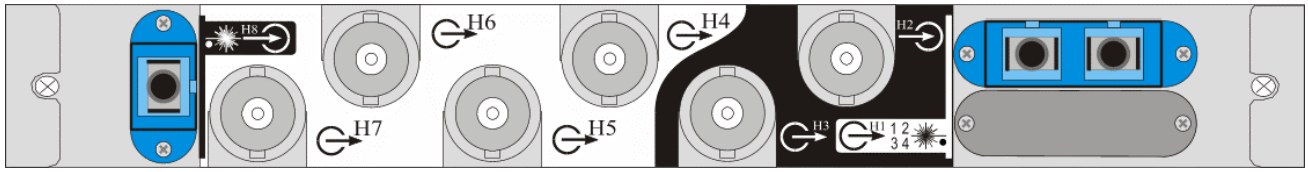
This is the operation manual for the System HD Fibre Optic Transceiver module. It covers the modules ordered under the following codes :

SHDFTRM0WQ4 – Standard Transceiver with 4 optical outputs from the Transmitter
SHDFTRM0WQ2 – Standard Transceiver with 2 optical outputs from the Transmitter
SHDFTRM0WQ0 – Standard Transceiver with a single optical output from the Transmitter

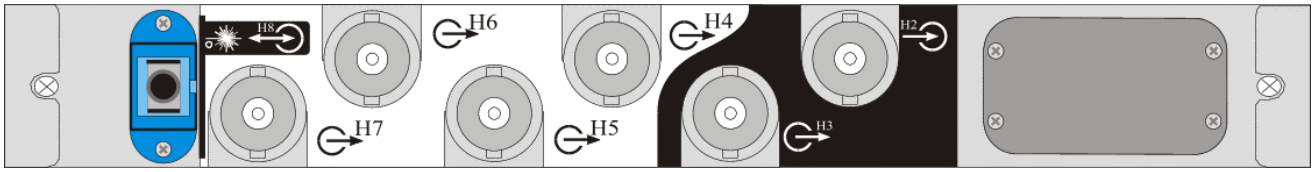
SHDFTRM0WQC – WDM Transceiver with a single optical interface (Use with SHDFTRM6WQD)
SHDFTRM6WQD – WDM Transceiver with a single optical interface (Use with SHDFTRM0WQC)



SHDFTRM0WQ4 : Rear Panel View



SHDFTRM0WQ2 and **SHDFTRM0WQ0** : Rear Panel View



SHDFTRM0WQC and **SHDFTRM6WQD** : Rear Panel View

Module Description

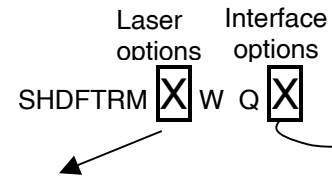
The Optical SDI Transceiver can convert an electrical SDI bitstream to an optical SDI bitstream while simultaneously converting a separate optical SDI bitstream into an electrical SDI bitstream. With the 'standard' interface card fitted (rear view shown above), the optical input path provides four identical electrical SDI outputs and the electrical SDI input channel can provide up to four identical optical SDI outputs.

Each channel can convert either a single high-definition serial digital (HD-SDI / SMPTE292M) or a single standard-definition serial digital (SD-SDI / SMPTE259M) bitstream.

The electrical serial digital (SDI) bitstream interfaces are via 75□□BNC connectors on the backpanel of the rear interface card. The optical outputs are via the SMPTE292M recommended SC/PC singlemode fibre optic connectors. The SC/PC connector is robust and easy to use, a simple snap-fit enables a reliable connection to be made in a matter of seconds.

Connected to the single output of the laser transmitter is an optional passive optical splitting device providing up to four identical optical outputs. The options for this split are either a four way splitter, a two way splitter, or a single output. Selection between these options depends on the rear interface fitted and does not affect the main board part of the module. Even in the case of the four way splitter the optical power available from each of these outputs is sufficient to transmit a SDI signal over distances greater than 20km. A re-clocked active loop-through of the electrical SDI bitstream input is available from a BNC connector for monitoring purposes. Three optical power options, including two wavelength variants are available as laser options. The different wavelengths are provided for Wavelength Division Multiplexing (WDM) options on this board. The receiver section of the transceiver main board accepts a single optical high definition serial digital (SDI) bitstream input via a SC/PC singlemode fibre optic connector. The re-clocked electrical SDI signal output from the receiver is split to provide four identical coaxial SDI outputs for the user at the backpanel of the interface card. (Note: In Async mode the signal is only amplified.) When used in conjunction with a System HD optical transmitter (and depending on the fibre interconnect used) the sensitivity of the optical receiver is sufficient to recover a signal transmitted from up to 20km away. The receiver device is capable of recovering wavelengths between 1.2µm - 1.6µm making it suitable for wavelength division multiplexing (WDM) applications. By using the 'WDM' interface card, the transceiver card allows simultaneous transmission/reception of two different wavelengths, 1.3µm and 1.5µm. LEDs mounted at the front of the main board allow monitoring of the receiver performance. More detailed performance information can be obtained via the RollCall interface. The 'standard' rear interface card option offers four optical outputs for the transmitter section of the transceiver. However, depending on the application, two or single output options are also available as well as a 'WDM' interface card. It is recommended that the System HD Order Code of the board and interface card combination is recorded in this manual on the next page using the table on this page for your own reference. This will allow easy identification of the laser option chosen and the type of interface card selected when referring to this manual at a later date.

Quick guide to order codes:



Laser device option code	Laser properties	
	Wavelength λ (µm)	Laser output power before split Po (dBm)
0	1.3	-2
1	1.3	0
6	1.5	0

Interface card option code	Interface card supplied with main transmitter board
4	1x4 splitter on Tx out
2	1x2 splitter on Tx out
0	Patch cord (no split) on Tx out
A	'WDM' Mux fitted: 1.3µm OUT *1.5*µm IN
B	'WDM' Mux fitted: *1.5*µm OUT 1.3µm IN

Codes other than those listed refer to custom laser options. Additional information should have been delivered with the module.

NOTE…

All the laser transmitters used on 'System HD' optical boards are CLASS 1 LASER PRODUCTS.

Features

- Optical transmission and recovery capability on single board
- SMPTE 292M 1.485Gbit/s HD-SDI data rates supported
- SMPTE 259M 270Mbit/s SD-SDI data rate supported
- Async mode of operation. For use with D2, DVB-ASI, MPEG streams, AES-EBU, etc.
- SMPTE 292M recommended SC/PC singlemode user interface connectors
- Four coaxial outputs from single optical input
- Four optical outputs from single coaxial input
- Transmission distances up to 20km
- Bit error rate (BER) <10-12
- Two optical output wavelengths (1300/1550nm) available for laser transmitter
- Receiver wavelength input range 1200-1600nm
- WDM bi-directional capability
- Optical to optical reclocking capability
- Optical data transport offering:

  EMI immunity

  No earth loops

  Small, lightweight, flexible cabling

  Easy to locate and repair cable breaks
- Alarm functions for poor quality input signals and device malfunction
- Stand-alone or RollCall operation
- Incoming signal analysis available as an option, it includes:

  CRC status

  Line standard

  Frame rate

  Error rate

Note:
RollCall™ enabled for remote system control & monitoring.

In Async mode some SDI outputs may not be compatible with certain equipment due to the use of complimentary outputs. E.g. Some ASI streams aren't inversion compatible.

Technical Profile

TRANSMITTER INPUT

Electrical	1.485GBit/s HD-SDI 270Mbit/s SD-SDI
Connector Format	BNC 75ohm panel jack
Input Cable Length	>100m
Peak-to-peak signal amplitude	800mV ± 10%
D.C. offset	0V ± 0.5V
Rise time (20-80%)	<270ps
Fall time (20-80%)	<270ps
Difference	≤100ps
Return loss	>15dB

Active Loop-through

Electrical	1.485GBit/s HD-SDI 270Mbit/s SD-SDI
Connector Format	BNC 75ohm panel jack
Peak-to-peak signal amplitude	800mV ± 10%
D.C. offset	0V ± 0.5V
Rise time (20-80%)	< 270ps
Fall time (20-80%)	< 270ps
Difference	≤100ps
Return loss	>15dB

TRANSMITTER OUTPUTS

Optical	1.485Gbit/s HD-SDI 270Mbit/s SD-SDI
Connector Format	SC/PC singlemode panel uniter
Outputs	4 (other split options available)
Wavelength	1300nm±30nm (1550nm optional)
Spectral width (FWHM)	<1nm
Output power (after 4 way split)	Low power 1.3µm ~ -10dBm High power 1.3µm ~ -8dBm High power 1.55µm ~ -8dBm
Extinction ratio	> 5:1

RECEIVER INPUT

Optical	1.485GBit/s HD-SDI 270Mbit/s SD-SDI
Connector Format	SC/PC singlemode panel uniter
Input wavelength range	Min. 1200nm Max. 1600nm
Optical power input range	Max. <-3dBm Min. >-23dBm
Detector damage threshold	+10dBm

RECEIVER OUTPUTS

Electrical	1.485Gbit/s HD-SDI 270Mbit/s SD-SDI
Connector Format	BNC 75ohm panel jack
Outputs	4
Output Cable Length	>100m
Peak-to-peak signal amplitude	800mV ± 10%
D.C. offset	0V ± 0.5V
Rise time (20-80%)	< 270ps
Fall time (20-80%)	< 270ps
Difference	≤100ps
Return loss	>15dB

The shaded functions are not available to the Operator

SWITCHES, Board Edge

Not accessible to the Operator

Tx1 disable	Disables the laser
Tx HD/SD	Selects mode for Tx channel
Rx HD/SD	Selects mode for Rx channel

INDICATOR LEDS

Transmitter

Power	Power supplies valid
Fault	Board fault
CPU	Valid CPU activity
SD	Rate mode
Dis	Laser output disabled
I_{hi}	Laser current high
PLL lock	Output locked to input standard
CRC status	Data error
Line	Indicates line standard
Frame	Indicates frame rate
Prog/Int	Indicates progressive or interlaced frames

Receiver

P_{in}	Input of sufficient power present
PLL Lock	Output locked to input standard
CRC Error	Data error
Line	Indicates line rate

RollCall™

RollCall control options:	
RollCall monitoring options:	General alarm Supply voltage levels Board temperature
	For both data channels CRC status Line standard Frame rate Error rate
WEIGHT	<850gm (Main Board plus Interface Board)
POWER CODE	**2**

OPTIONS

See page 5 for options

Notes

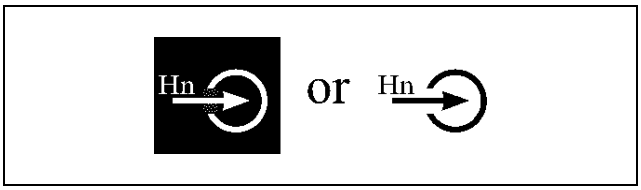
1. **The transmitter section of the transceiver can have a different laser type depending on its intended application. Refer to the laser device option code on page 5 to identify what laser is fitted to the board.**
2. **Various splitter options are available for the transmitter section as well as a WDM option. Refer to the interface card option code on page 5 to identify what interface card has been supplied with the main transmitter board.**
3. **Codes in the ORDER NUMBER other than those listed below will refer to custom laser/interface card options. Additional information should have been delivered with the cards. If further information is required please contact the factory.**

Rear Interface Connections

Rear Interface Notation Guide

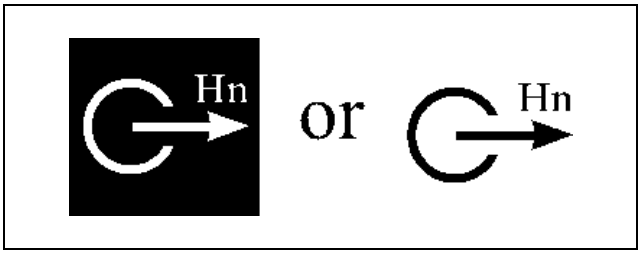
Electrical SDI Input

A Serial Digital electrical input though a 75Ω BNC connector is denoted in the way shown opposite. The " **H** " denotes the High Definition capable element and the " **n** " is the connection number for that particular rear interface.



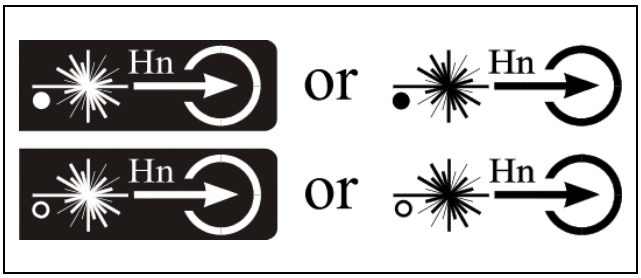
Electrical SDI Output

A Serial Digital electrical output though a 75Ω BNC connector is denoted in the way shown opposite. The " **H** " denotes the High Definition capable element and the " **n** " is the connection number for that particular rear interface.



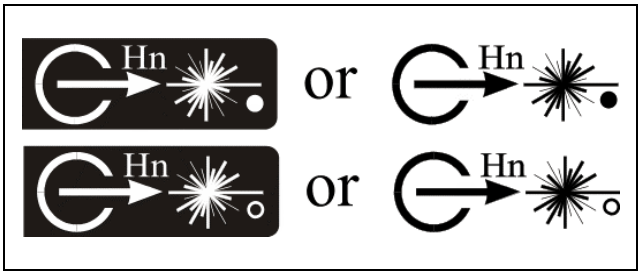
Optical SDI Input

A Serial Digital optical input though a SC/PC single mode panel uniter is denoted in the way shown opposite. The " **H** " denotes the High Definition capable element and the " **n** " is the connection number for that particular rear interface. The solid "dot" indicates that only a single wavelength can be presented through the connector. A hollow circle indicates multiple wavelengths are permissible.



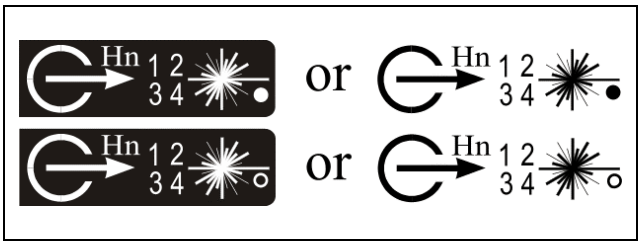
Single Optical HD-SDI Output

A single Serial Digital optical output though one SC/PC single mode panel uniter is denoted in the way shown opposite. The " **H** " denotes the High Definition capable element and the " **n** " is the connection number for that particular rear interface. The solid "dot" indicates that only a single wavelength can be presented through the connector. A hollow circle indicates multiple wavelengths are permissible



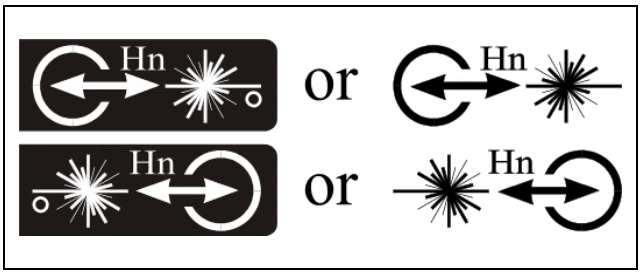
Multiple Optical HD-SDI Outputs

Multiple Serial Digital optical outputs though two or four SC/PC single mode panel uniters are denoted in the way shown opposite. The numbers 1 to 4 are arranged to indicate the individual element within the multiple output connector. The " **H** " denotes the High Definition capable element and the " **n** " is the overall connection number for that particular rear interface. The solid "dot" indicates that only a single wavelength will be output through the connectors. A hollow circle indicates multiple wavelengths are present

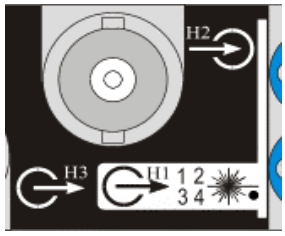


Bi-directional Optical SD I I/O

Bi-directional Serial Digital optical input and output though a single connector using different laser wavelengths (WDM). The " **H** " denotes the High Definition capable element and the " **n** " is the overall connection number for that particular rear interface. This intrinsically requires a hollow circle to indicate multiple wavelengths are permissible through this connector.



Standard and WDM Transmitter Input

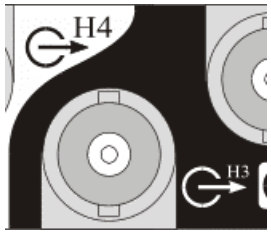


Electrical SDI

Used On : **SHDFTRM 0WQ4**
SHDFTRM 0WQ2
SHDFTRM 0WQ1
SHDFTRM 0WQC
SHDFTRM 6WQD

The serial digital electrical input for the laser transmitter is connected to a 75Ω BNC connector. This connector is shown opposite and is labelled **H2** on the rear panel.

Standard and WDM Transmitter Electrical Loop-Through



Electrical SDI

Used On : **SHDFTRM 0WQ4**
SHDFTRM 0WQ2
SHDFTRM 0WQ1
SHDFTRM 0WQC
SHDFTRM 6WQD

An equalised and reclocked version of the high definition serial digital electrical input for the transmitter is available as an active loop-through from a 75Ω BNC connector. This connector is shown opposite and is labelled **H3** on the rear panel.

1. **Laser light can be damaging to the eyes. Optical fibres and Uniters should be handled with great care.**

2. **System HD Modules which incorporate Fibre Optic elements, are designed for use with Class 1 laser systems only. Ensure that all inputs do NOT exceed Class 1 as doing so will impair the safety of the system and may result in damage to the equipment.**

3. **Active fibres should not be handled unless their source can be positively identified as not exceeding Class 1 limits.**

Notes…

1. Optical uniters have plastic covers to prevent the ingress of dust. These covers should only be removed when connecting optical fibres. A uniter should never be left open without a cover or a fibre connector
2. The ends of optical fibres should be cleaned with a liquid fibre cleaner, using a cotton bud, to ensure that there is no dust present, before they are plugged in (the uniter is polarised).
3. Observe the warning about not viewing live optical sources.

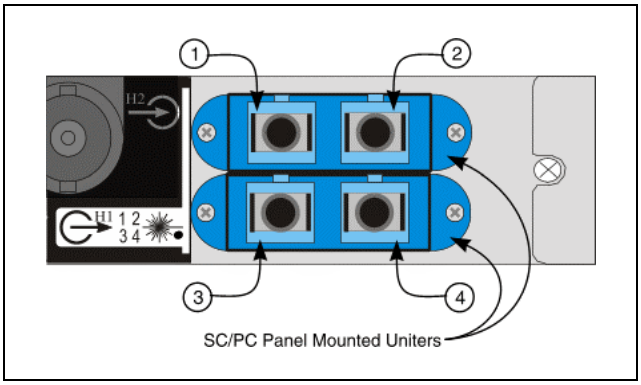
Standard Transmitter Outputs

Optical SDI Output – Quad Output Option

Used On : **SHDFTRM0WQ4**

The serial digital optical outputs are provided via a pair of dual SC/PC single mode panel mounted uniters. The overall connection is labelled as **H1** on the rear panel as shown opposite. The four optical outputs are denoted as 1, 2, 3, and 4 and arranged as shown in the diagram. All four outputs produce almost identical levels of optical power and identical digital bitstreams. These are single optical wavelength outputs.

Do not remove the covers from the uniters until a fibre connection is ready to be inserted.

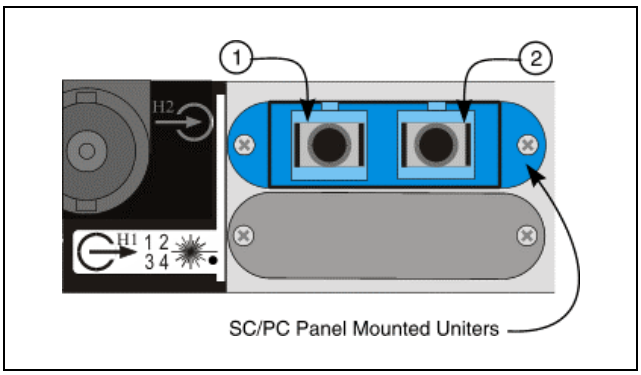


Optical SDI Output – Dual Output Option

Used On : **SHDFTRM0WQ2**

The serial digital optical outputs are provided via a dual PC/SC single mode panel mounted uniter set. The overall connection is labelled as **H1** on the rear panel as shown opposite. The two optical outputs are denoted as 1, and 2. The rear label mentions connections 3, and 4 as well, but these are not present in this case. The connectors are arranged as shown in the diagram. Both outputs produce almost identical levels of optical power and identical digital bitstreams. These are single optical wavelength outputs.

Do not remove the covers from the uniters until a fibre connection is ready to be inserted

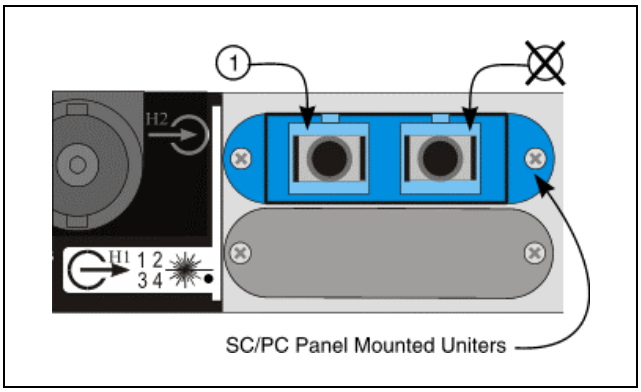


Optical SDI Output – Single Output Option

Used On : **SHDFTRM0WQ0**

The serial digital optical output is provided from one side of a dual SC/PC single mode panel mounted uniter. The overall connection is labelled as **H1** on the rear panel as shown opposite. The optical output is denoted as connection 1. The rear label mentions 2, 3, and 4 as well but these are not present in this case. The connector is arranged as shown in the diagram. This is a single optical wavelength output.

Do not remove the cover from the uniter until a fibre connection is ready to be inserted

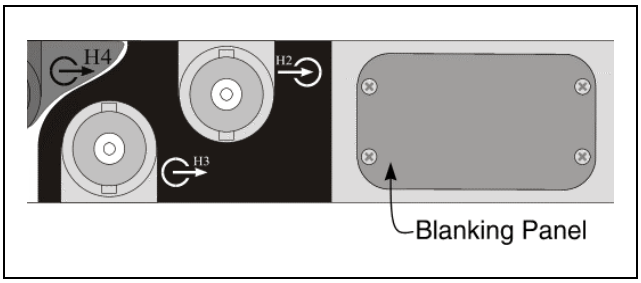


WDM Transmitter Interfaces

Electrical HD-SDI - Only

Used On : **SHDFTRM0WQC**
SHDFTRM6WQD

The serial digital electrical input for the WDM laser transmitter is the same as for the standard transceiver options. It is shown opposite labelled as **H2** on the rear panel. In the same manner the electrical loop through of the transmitter input is also the same as for the non- WDM options and is shown in the diagram opposite labelled as **H3**. However there is no independent access to the optical output from the transmitter from the rear panel in the WDM case. The area used for the optical transmitter interfaces are shown in the diagram opposite as blanked off.

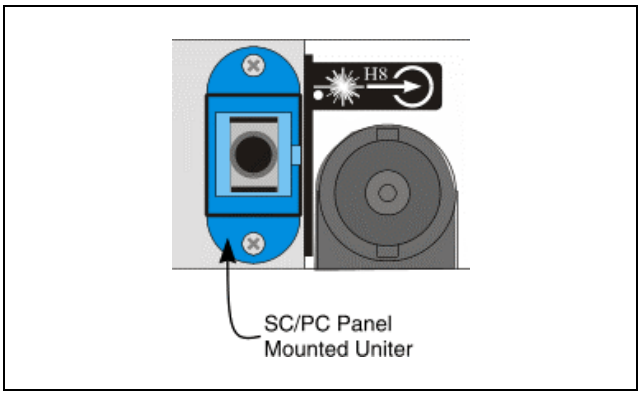


Standard Receiver Input

Optical HD-SDI Input

Used On : **SHDFTRM0WQ4**
SHDFTRM0WQ2
SHDFTRM0WQ0

The serial digital optical input is connected to an SC/PC single mode panel uniter. This connector is shown opposite and is labelled **H8** on the rear panel. This is a single optical wavelength interface in these cases.

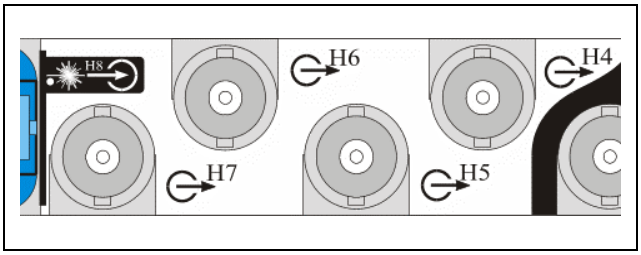


Standard and WDM Receiver Outputs

Electrical SDI : Quad Outputs

Used On : **SHDFTRM0WQ4**
SHDFTRM0WQ2
SHDFTRM0WQ0
SHDFTRM0WQC
SHDFTRM6WQD

The four serial digital electrical outputs are available from four 75Ω BNC connectors. The same digital bitstream is provided by all four connectors. This bitstream is a reclocked version of the optical signal provided to the optical receiver.
(Note: In Async mode the bitstream is not reclocked.)
These electrical outputs are labelled as **H4**, **H5**, **H6**, and **H7** on the rear panel as illustrated in the diagram opposite.

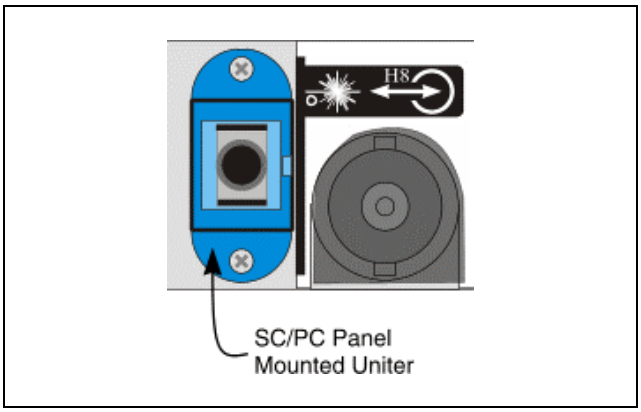


WDM Combined Optical Receiver Input and Optical Transmitter Output

Optical SDI Input and Output

Used On : **SHDFTRM0WQC**
SHDFTRM6WQD

For the WDM options of this module the serial digital optical input is combined with the optical output from the transmitter. This is achieved using different optical wavelengths for the transmit and receive paths. Due to this only a single SC/PC single mode panel uniter is required to connect to both the transmitter and the receiver. This connector is shown opposite and is labelled **H8** on the rear panel. This is a dual optical wavelength interface in these cases.



RollCall Menu System

When a System HD Control and Monitor board is fitted in the enclosure a range of monitoring information is available to RollCall™

External Monitoring	Description
General alarm	Input power fault or overcurrent trip or system failure
Supply voltage levels	Actual voltage levels
Board temperature	Actual board temperature
For Both Data Channels	
Bit error rate	Error rate over defined time period

Rollcall Monitoring Features

- Module Infrastructure:
  - General Alarm
  - Supply Voltage Levels
  - Board Temperature

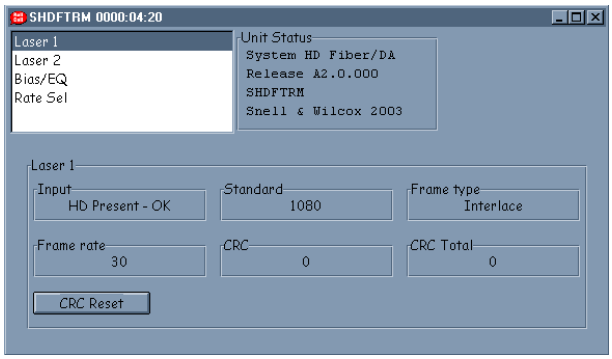
- Incoming Signal analysis:
  - Input Status
  - Line standard
  - Frame Type
  - Frame Rate

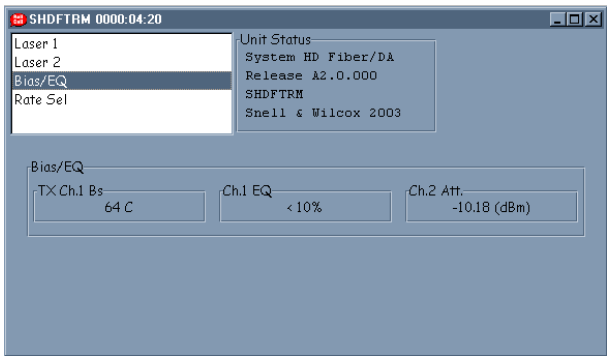
- CRC Error analysis:
  - CRC Error Count
  - CRC Error Total
  - CRC Reset

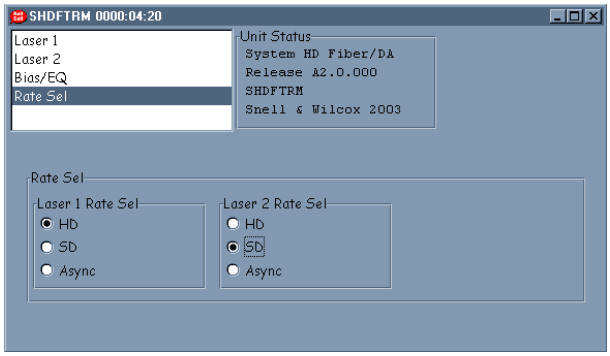
- Rate Sel:
  - HD – HD-SDI Reclocking mode.
  - SD – SD-SDI Reclocking mode.
  - Async – Asynchronous mode.

- Bias/EQ – The value in this field is a guide to the strength of equalisation that is being applied to the input signal for longer cable runs. The lower the value, the less equalisation is being employed. It is intended as a guide for troubleshooting the system. It should be noted that when an equalisation of 100% is shown, it doesn't necessarily mean that the maximum input cable length has been reached. As soon as CRC errors are being reported then the input cable length should be decreased until an error free signal can be received.

- Laser Case Temperature / Bias (Degrees °C) – The case temperature is an indication of how much Laser Drive Strength is being applied i.e. Laser Bias current. As the laser becomes older, the drive strength will be increased which will therefore cause its case temperature to rise.







Manual Revision Record

Date	Version No.	Issue No.	Change	Comments
180203	1	1		First issue released