V1673 & V1674

ADVANCED FIBRE INTERFACES

INSTALLATION and OPERATION

Includes: V1673/TT /RR /TR
V1674/TT /RR /TR

Filename: v1673_74om_30.doc
Issue: 3.0
Date: January 2005

VISTEK Electronics Ltd
Wessex Rd
Bourne End
Buckinghamshire, SL8 5DT
ENGLAND

Tel. +44 1628 531221
Fax. +44 1628 530980

Web: www.vistek.tv

This page has been left blank intentionally.

Table of Contents

LASER SAFETY

The V1673/74 TT and TR boards are Class 1 Laser Products under the **F**ood and **D**rug **A**dministration (FDA) / **C**enter for **D**evices and **R**adiological **H**ealth (CDRH) regulation. They cannot, under normal operating conditions (i.e., intended use), emit a hazardous level of optical radiation. No warning label or control measures are required by the FDA/CDRH. The IEC (International Electrotechnical Commission) standard (Publication 60825-1) requires a warning label and specifies that classification be made under fault conditions. Therefore, systems that are Class 1 under FDA/CDRH rules may not necessarily be Class 1 under the IEC.

The Laser wavelengths being used on V1673/74 TT and TR boards may range from 1310nm to 1610nm. The average optical output power does not exceed 0dBm (1mW) under normal operating conditions. Unused optical outputs are automatically covered with a shutter and prevent direct exposure to the laser beam.

Even though the power of these lasers is low, the beam should be treated with caution and common sense because it is intense and concentrated. Laser radiation can cause irreversible and permanent damage of eyesight. Please read the following guidelines carefully:

① Make sure that a fibre is connected to the board's fibre outputs before power is applied. If a fibre cable (e.g. patchcord) is already connected to an output, make sure that the cable's other end is connected, too, before powering up the board.

② **Do not** look in the end of a fibre to see if light is coming out. The laser wavelengths being used (most commonly 1310nm and 1550nm) are totally invisible to the human eye and will cause permanent damage. Always use optical instrumentation, such as an optical power meter, to verify light output.

Attention

Basic rules for proper handling of fibre optic connectors:

Do's

- ✓ Always clean the connector before mating
- ✓ Mate the connector immediately
- ✓ Cover unused connectors with dust protection caps.

Don'ts

- × Never touch the end face of the fibre connectors!
- × Do not let the connector lie around and collect dust before mating!

For cleaning, only lens-grade, lint-free tissue (e.g. Kimwipes), saturated with 99.8+% pure, anhydrous Isopropyl Alcohol, shall be used (Vistek P/N 950-1000).

V1673 & V1674 ADVANCED FIBRE INTERFACES

INSTALLATION AND OPERATION

1. DESCRIPTION

The V1673 and V1674 ADVANCED FIBRE INTERFACES form part of the Vistek V1600 range of interface products. Based on a 3U high baseboard, which is common to all members of the V1673/74 family, the board can be fitted into a V1603 rack, from which it receives its power and control. A passive rear module (V16FR3J) is required for all electrical and optical signal interconnections.

Vistek's range of ADVANCED FIBRE INTERFACES is divided into two classes:

The V1673 class supports SDI/ASI data rates from 143Mbps up to 540Mbps and is suitable for all 'Standard Definition' (SD), typically SMPTE259M compliant, applications. The V1674 class supports SDI/ASI data rates of up to 1.5Gbps and is targeted for SD as well as for High Definition (HD) applications. The V1674 allows an easy migration from existing SD installations to future HD operation.

Due to the modular design, a wide variety of Transmitters, Receivers or Transceivers is available for both classes. Laser Transmitters can be offered with different wavelength options, which make the V1673/74 also a versatile solution for WDM (**W**avelength **D**ivision **M**ultiplexing) or CWDM (**C**oarse **W**avelength **D**ivision **M**ultiplexing) applications.

Basically, the V1673/74 baseboard layout can process two independent channels of SDI/ASI compatible serial data streams. Single- or dual channel operation is subject to the actual board configuration.

The V1673/74 configuration options at a glance (dual channel assembly):

TT: Dual Channel Fibre Transmitter (Electrical-to-Optical Converter)

- For short, medium and long haul fibre links
- Wide range of laser wavelength available, ideal for WDM and CWDM applications
- Choice of reclocked or non-reclocked optical outputs
- Loop-through electrical outputs

RR: Dual Channel Fibre Receiver (Optical-to-Electrical Converter)

- Excellent sensitivity of optical input
- Dual electrical outputs per channel (both DVB-ASI compatible!)
- Choice of reclocked or non-reclocked electrical outputs

TR: Fibre Transceiver (combination of one Transmitter and one Receiver)

The V1673/74 baseboard is fully compatible with the Vistek DART remote system. Although the board does not have any remote control functions as such, board status information can be read back by a DART compatible rack controller.

2. SPECIFICATION

2.1 ENVIRONMENTAL SPECIFICATION

Parameter	Environmental Specification
	V1673 & V1674
Power Requirements	+15V/0.4A (6W max.)
Operating Temperature	0 to +60°C
Storage Temperature	-40° to +85°C
Humidity	95% non-condensing

Table 1: Environmental Specification

2.2 SERIAL DIGITAL INTERFACES (SDI)

Parameter	SDI Inputs	
	V1673	V1674
Input Format	SMPTE 259M	SMPTE 259M, SMPTE292M
Connector Type	BNC	BNC
Input Impedance	75 Ohm	75 Ohm
Return Loss	> 15dB, 5MHz – 540MHz	> 15dB, 5MHz – 1.5GHz
Equalized Cable Length	0-250m (Belden 8281)	0-250m @ 270Mbps (Belden 8281) 0-100m @ 1.485Gbps (Belden 1694A)

Table 2: SDI Inputs (Electrical)

Parameter	SDI Outputs	
	V1673	V1674
Connector Type	BNC	BNC
Output Impedance	75 Ohm	75 Ohm
Return Loss	> 15dB, 5MHz – 540MHz	> 15dB, 5MHz – 1.5GHz
Jitter Performance	< 0.2UI p-p (Timing and Alignment Jitter @ 270Mbps)	< 1UI p-p (Timing Jitter @ 1.485Gbps) < 0.2UI p-p (Alignment Jitter @ 1.485Gbps)
Amplitude	800mV peak-to-peak (terminated)	800mV peak-to-peak (terminated)
Drive Capability	> 250m (Belden 8281)	> 250m @ 270Mbps (Belden 8281) > 100m @ 1.485Gbps (Belden 1694A)

Table 3: SDI Outputs (Electrical)

2.3 GPI CONNECTOR

The GPI (General Purpose Interface) connector provides, independently for Channel A and B, error indication by driving the corresponding GPI pin low (0V) under the following conditions:

1. No Input Signal
2. Laser End-of-Life (TT and TR models only)

The normal operation state of the GPI pins is 'high' ($V_{OH\ min}$ = 2.4V with R_{LOAD} > 1kΩ)

The GPI connector is a 2.5mm pitch, 4 way, single row, straight pin header from JST (P/N: B4B-EH-A). The corresponding Crimp Socket Housing is of type JST HER-4 and must be used in connection with Crimp Contacts JST BEH-001T-P0.6.

Pin	Signal
1	Channel A
2	Ground (0V)
3	Ground (0V)
4	Channel B

Table 4: GPI Connector Pinout

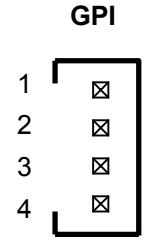

Figure 1: GPI Connector

2.4 OPTICAL INTERFACES

CAUTION

Please note the following if it is intended to use a V1673/74 Receiver (**RR** or T**R** option) in connection with a 3rd party fibre transmitter:

The maximum optical input power must not exceed 5mW (average) or 10mW (peak) at wavelengths 1110nm ≥ λ ≤1650nm. Exceeding these limits may result in a permanent damage of the optical receiver unit.

Optical Inputs:

Parameter	V1673RR and TR Optical Inputs (Fibre Receiver)	
Connector Type	SC/PC with Shutter, single-mode	
Insertion Loss	< 0.3dB (< 0.15dB typ)	
Backreflection	better than -45dB	
Photodiode Type	InGaAs PIN-Photodiode	
Detection Range	1100nm – 1650nm	
Saturation Power	> -3dBm (0.5mW), typ	
Sensitivity	-3dBm to -28dBm (typ)	
Bit Error Rate (BER) (SDI Check Field @270Mbps)	$<10^{-12}$	
Fibre Type	Single-mode (9/125µm)	

Table 5: V1673RR and TR Optical Inputs

Parameter	V1674RR and TR Optical Inputs (Fibre Receiver)	
Connector Type	SC/PC with Shutter, single-mode	
Insertion Loss	< 0.3dB (< 0.15dB typ)	
Backreflection	better than -45dB	
Photodiode Type	InGaAs PIN-Photodiode	
Detection Range	1100nm – 1650nm	
Saturation Power	> -3dBm (0.5mW), typ	
Sensitivity	-3dBm to -15dBm (typ)	
Bit Error Rate (BER) (SDI Check Field)	t.b.d.	
Fibre Type	Single-mode (9/125µm)	

Table 6: V1674RR and TR Optical Inputs

Optical Outputs:

Parameter	Optical Outputs (Fibre Transmitter)	
	V1673	V1674
Connector Type	SC/PC with Shutter, single-mode	SC/PC with Shutter, single-mode
Insertion Loss	< 0.3dB (< 0.15dB typ)	< 0.3dB (< 0.15dB typ)
Backreflection	better than -45dB	better than -45dB
Laser Diode Type	**F**abry **P**erot (FP) or **D**istributed **F**eed**B**ack (DFB)	**F**abry **P**erot (FP) or **D**istributed **F**eed**B**ack (DFB)
Standard Laser Wavelengths	1310nm (FP), 1550nm[1] (DFB)	1310nm (FP), 1550nm[1] (DFB)
CWDM Laser Wavelengths	1410nm, 1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1550nm, 1570nm, 1590nm, 1610nm (all DFB)	1410nm, 1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1550nm, 1570nm, 1590nm, 1610nm (all DFB)
Optical Output Power	2 user selectable options: Medium: -7dBm (typ) High: -3dBm (typ) **Note:** Output Power may vary by ± 1dBm	2 user selectable options: Medium: -7dBm (typ) High: -3dBm (typ) **Note:** Output Power may vary by ± 1dBm
Extinction Ratio	> 7dB (typ)	> 7dB (typ)
Transmission Length	up to 70 km @ 1550nm (270Mbps) (CORNING SMF-28 single-mode fibre)	up to 35 km @ 1550nm (270Mbps) up to 35 km @ 1550nm (1.485Gbps) (CORNING SMF-28 single-mode fibre)

Table 7: Optical Outputs

Notes:

1. The standard 1550nm wavelength option is not suitable for CWDM applications.

3. INSTALLATION

3.1 REAR PANEL CONNECTIONS

The standard 3U rear panel options are shown below. V1673 and V1674 models share common rear panels, but they are fitted with individually styled labels, showing the actual function of the module.

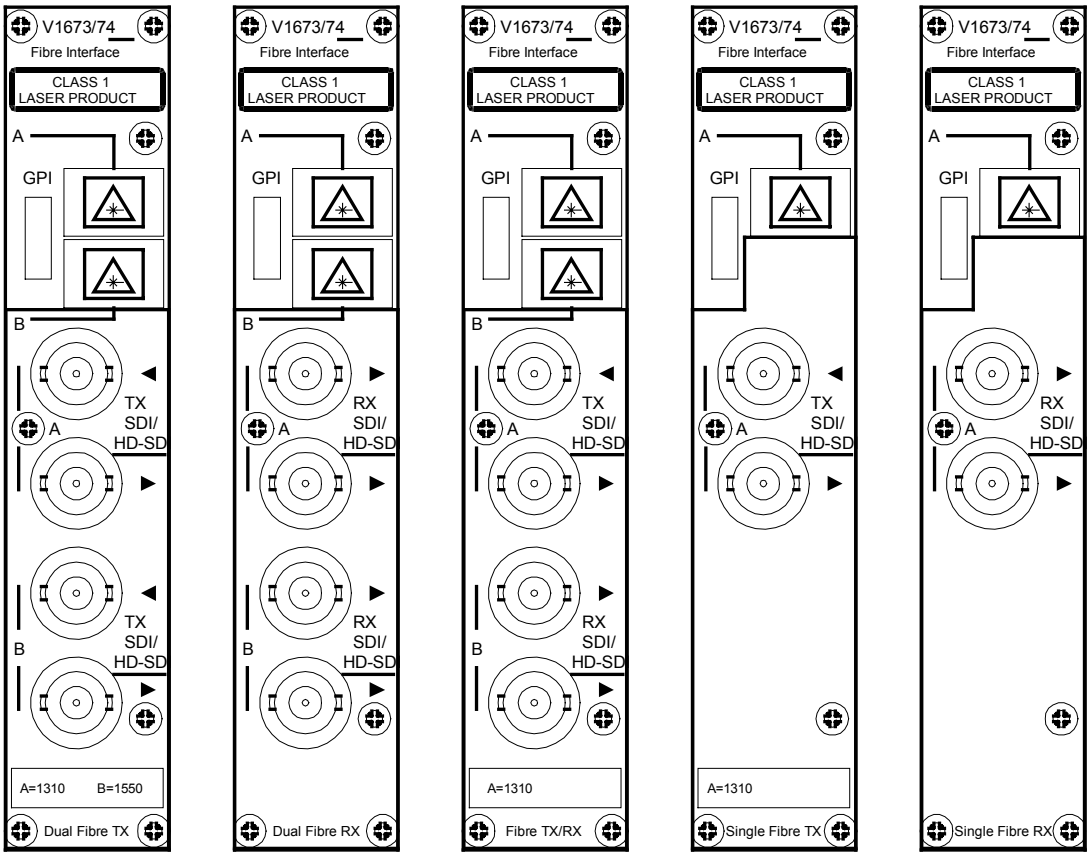

Figure 2: V1673/74 3U Rear Panels

3.1.1 Silkscreen Legend and Markings

Electrical Outputs: ►
Electrical Inputs: ◄

Optical Outputs: Connector shutter is marked with a yellow LASER warning symbol
Optical Inputs: Connector shutter is marked with a yellow LASER warning symbol

Note: If the board is configured as a Transceiver (TR option), Channel B is the Optical Input.

GPI Connector: GPI (For pinouts, please see Chapter 2.3: GPI Connector)

For boards which have at least one Laser Transmitter (TX) fitted, the actual laser wavelength for each channel is shown on a label at the bottom of the panel. Note that laser wavelength options may vary and are subject to the actual ordering code.

3.2 USER CONFIGURATION OPTIONS

3.2.1 Baseboard

There is only one user configuration option on the baseboard, which is the operational mode of the Reclocker chips. A Reclocker chip is present in both channels and they can be either enabled or bypassed. Figure 3 shows the board profile and the location of Jumpers JP1 (Channel A) and JP4 (Channel B). The Jumper positions are also clearly marked on the silk screen.

The factory default setting for both channels is 'enabled'.

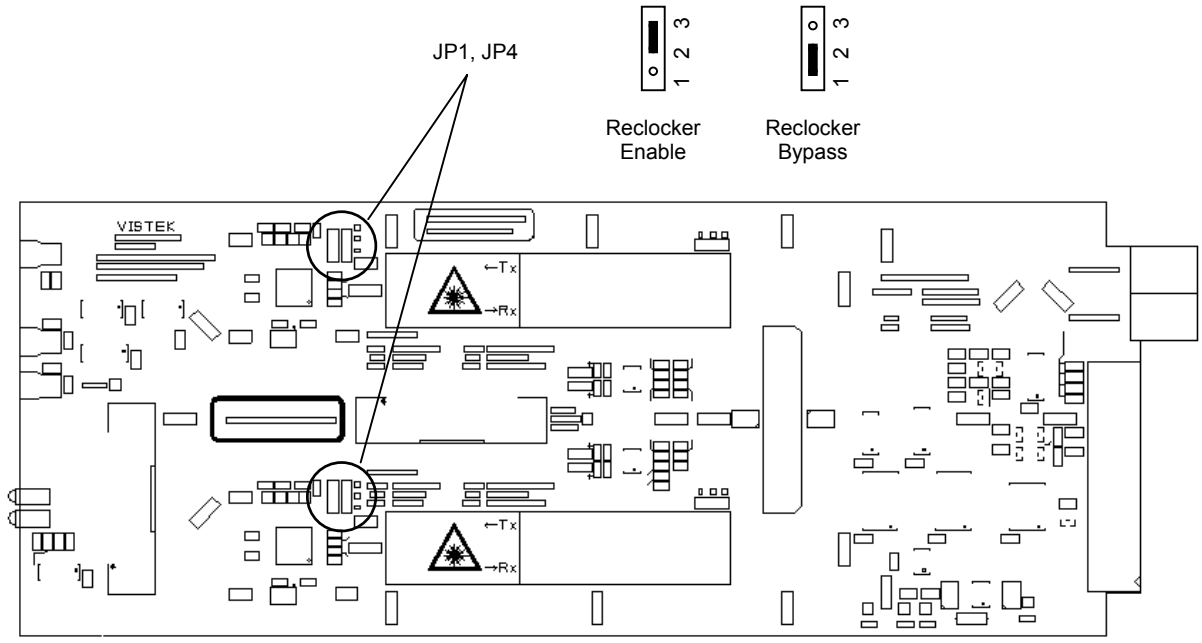

Figure 3: Jumper Locations on Baseboard

3.2.2 Reclocker Considerations

When shall the Reclocker function be used?

When transmitting SDI signals over long distances, the received signal quite often exhibits a large amount of noise, jitter and distorted signal edges. This of course widely depends on the quality of the transmission line and/or proper line-termination, but the problem gets worse if the distorted signal then is passed on to the next processing or distribution module without reconditioning the signal. If the Reclocker is enabled, it automatically recovers the embedded clock signal and re-times the serial data from a SMPTE259M or SMPTE292M compliant digital video signal before data gets transmitted further in either the electrical or the optical domain.

Why can't the Reclocker eliminate Jitter?

It is a common misconception that 'Reclockers' can eliminate jitter. In the world of high speed serial data transmission, one must distinguish between 'Retimers' and 'Reclockers':

Reclockers usually provide little if any attenuation of input wander; their attenuation of input jitter is a function of input jitter frequencies and can even exhibit gain at some frequencies. Reclockers, such as the one used on Vistek's V1673/74 Fibre Interface Series, are specifically designed to modify data edge timing such that the data edges have defined timing relation with respect to a bit clock recovered from the incoming SDI data.

Only by restricting the Reclockers' PLL bandwidth, reasonable jitter reduction could be achieved. One the other hand, in order to maximize the Reclockers jitter tracking range with respect to frequency, the PLL should be as wide-band as possible. The chosen PLL bandwidth of a Reclocker is a compromise between these two conflicting requirements.

When cascading multiple V1673/74's, it doesn't surprise that jitter (mainly low frequency) does even increase. This is mainly due to the accumulation of intrinsic jitter introduced by each board.

Only so-called 'Retimers' provide complete isolation of input wander and their output jitter is unrelated to the input jitter. A Retimer works by converting the incoming SDI signal back to parallel, passing data then through a FIFO, and re-serializing the parallel data using a highly stable and low jitter clock (see also SMPTE Engineering guideline EG33-1998).

Important note:

It is recommended to disable (bypass) the Reclocker when a V1673/74 is being used in applications with non-SMPTE compliant data rates.

3.2.3 Fibre Transmitter Submodule (V1673/74 TT and TR options)

Depending on the actual board configuration, up to two Fibre Transmitters can be found on a V1673/74. The optical output power of the Laser device can be selected with switch S1, which is shown in Figure 4 below. Little symbols on the silk screen illustrate the meaning of different switch settings. Please note that the 'LOW' power setting indicated on the silk-screen is for factory test purpose only.

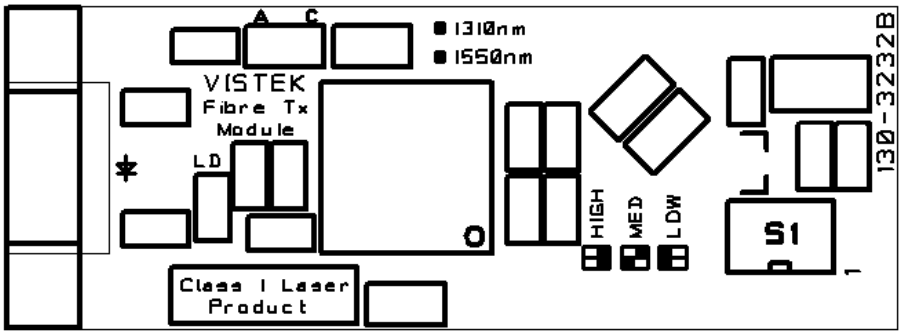

Figure 4: Laser Transmitter Submodule

Use the tip of a pencil or any sharp object for pushing the sliders.

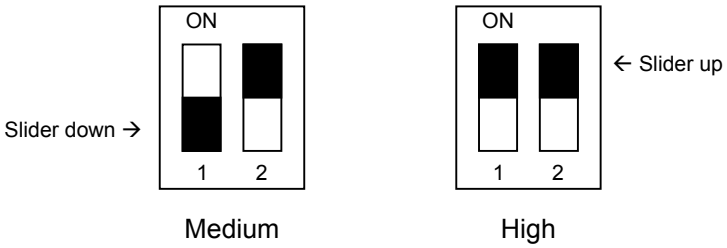

Figure 5: Switch S1 Settings

The following table gives an overview of typical output power values in dBm and mW.
If Vistek's V1673/74 Fibre Transmitters are being used in connection with 3rd party Fibre Receivers, check the maximum allowed input power, often specified as 'Saturation Power', for the Fibre Receiver first and adjust the Transmitter's output power accordingly or use an external Attenuator.

Switch Setting	Output Power[1] (typ) (dBm)	Output Power[1] (typ) (mW)	Typical Application[2]
Medium	-7	0.2	Medium haul, < 15 km
High	-3	0.5	Long haul, > 15 km

Table 8: Optical Output Power Settings

Notes:

1. These values are typical. The actual value may vary by ± 1 dBm but will remain constant over temperature and life.
2. Assumes a point-to-point connection @ 1310nm without any WDM, CWDM, etc. devices in the transmission line.

4. OPERATION

4.1 FRONT PANEL INDICATORS

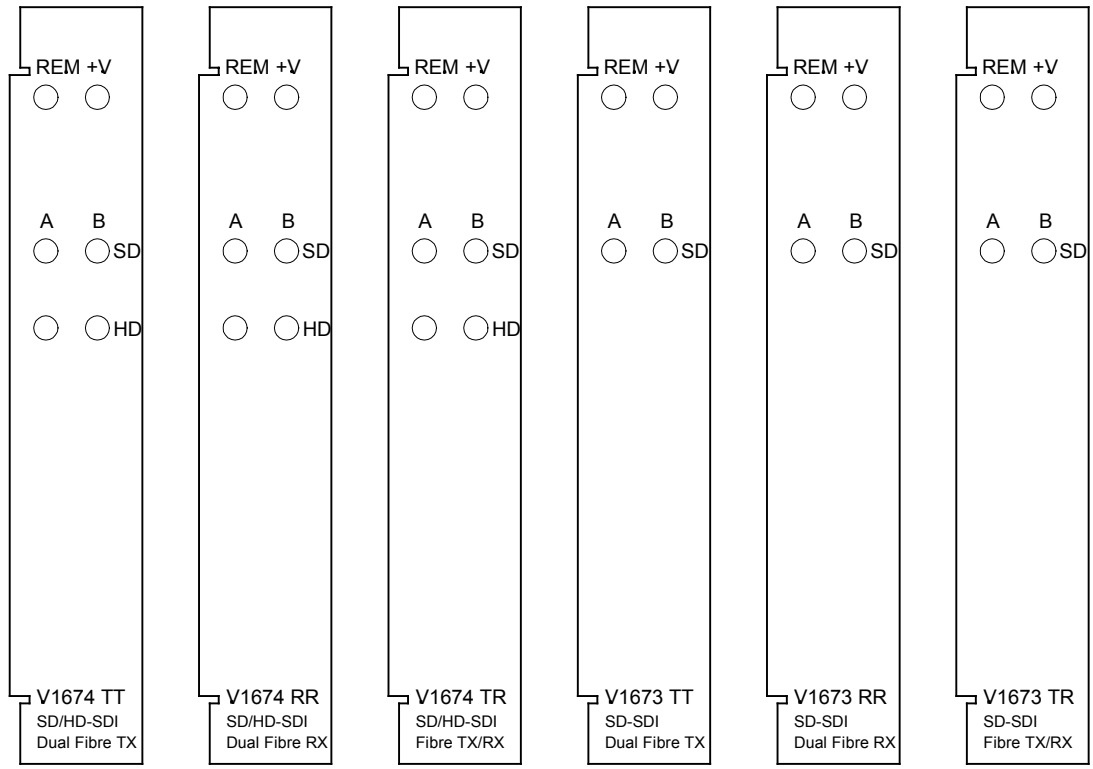

Figure 6: V1673/74 Front Panels

4.1.1 Remote Control Access and Power Indicators

The green +V LED is lit when the unit's on-board power supply is delivering voltage. The yellow REM LED indicates with short blinks that the unit is accessed by the DART controller. It does **not** directly indicate that the unit is in remote control mode. If the rack frame does not have a Rack Controller fitted then this LED will not blink.

4.1.2 SDI Standard / Input Present / Laser Failure Indicators

These bi-coloured LEDs fulfil three different functions at once:
They indicate a) the presence of a valid SDI input signal (electrical or optical), b) the data rate range of the incoming SDI signal (SD or HD) and c) they indicate the Laser Diode's end of life (boards with laser transmitters only). Both channels (A and B) behave in the same manner:

LED 'Off':	No signal or no valid SDI signal
LED 'GREEN':	Input Signal present (electrical or optical)
LED 'RED':	Input Signal present, but Laser Failure condition (Fibre Transmitters only)

5. DART INTERFACE

5.1 GENERAL

The V1673/74 baseboard is a Class 4 DART module with a serial EEPROM for reading and writing card details through the DARTbus in the same manner as other V1600 range cards. In addition the unit has several read-only status ports, over which the board's operational status can be obtained.

5.2 DART STATUS BITS

The following table shows all available Status Bits:

Bit	Description	
0	Channel A – Rx/Tx Mode Configuration	0: Receiver 1: Transmitter
1	Channel A – Reclocker Configuration	0: Enable 1: Bypass
2	Channel A – Input Status	0: No Input Signal 1: Input Signal Present
3	Channel A – Laser Diode Status (Tx mode only)	0: Laser Diode Failure 1: Laser Diode ok
4	Channel A – Reclocker Format Bit SS0	000: 143 Mb/s 001: 177 Mb/s 010: 270 Mb/s 011: 360 Mb/s 100: 540 Mb/s 101: 1483.5/1485 Mb/s
5	Channel A – Reclocker Format Bit SS1	
6	Channel A – Reclocker Format Bit SS2	
7	Channel A – Reclocker Lock Detect	0: PLL is unlocked 1: PLL is locked
8	Channel B – Rx/Tx Mode Configuration	0: Transmitter 1: Receiver
9	Channel B – Reclocker Configuration	0: Enable 1: Bypass
10	Channel B – Input Status	0: No Input Signal 1: Input Signal Present
11	Channel B – Laser Diode Status (Tx mode only)	0: Laser Diode Failure 1: Laser Diode ok
12	Channel B – Reclocker Format Bit SS0	000: 143 Mb/s 001: 177 Mb/s 010: 270 Mb/s 011: 360 Mb/s 100: 540 Mb/s 101: 1483.5/1485 Mb/s
13	Channel B – Reclocker Format Bit SS1	
14	Channel B – Reclocker Format Bit SS2	
15	Channel B – Reclocker Lock Detect	0: PLL is unlocked 1: PLL is locked
16..31	Not used	

Table 9: DART Status Bits

6. BLOCK DIAGRAMS

6.1 FIBRE TRANSMITTER

As shown in the block diagram, processing of the SDI signal remains in the serial domain throughout the system. The incoming signal goes through a **Cable Equalizer** (EQ) first and then passes the **Reclocker** stage. The re-timed SDI signal finally is available as an electrical signal after passing a **Cable Driver** (DRV) and as an optical signal, generated by a Laser Diode and coupled into a single mode fibre. The **Laser Driver** chip is required for biasing and modulating the Laser Diode.

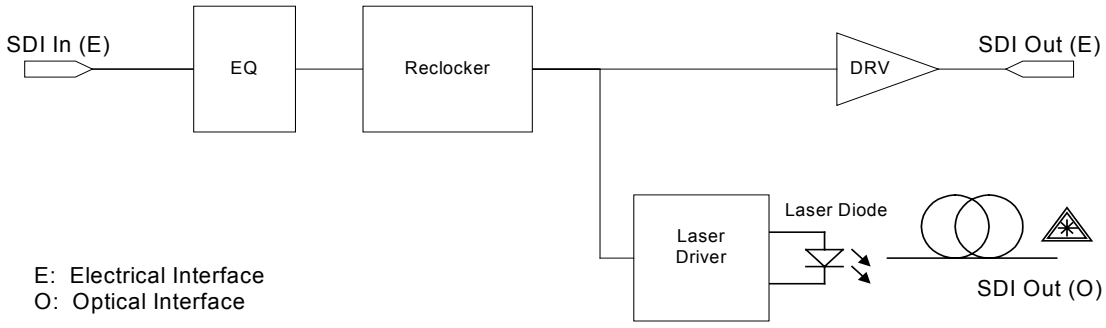

Figure 7: Single Channel Fibre Transmitter

6.2 FIBRE RECEIVER

The optical SDI signal is being received by a light sensitive **PIN** Photo Diode and converted into a measurable photo-current. A built-in, so called transimpedance amplifier **(TIA)**, pre-amplifies the signal and converts the weak photo-current into a more meaningful output voltage. The subsequent **DC-Restorer** restores the DC content of the AC-coupled signal and provides immunity to pathological SDI bit patterns. Further down the datapath, a **Reclocker** recovers the embedded clock signal and re-times the data. In the receiver's output stage, two separate **Cable Drivers** (DRV) are used in order to buffer the signal and provide a SMPTE259M and SMPTE292M or DVB-ASI compliant electrical interface.

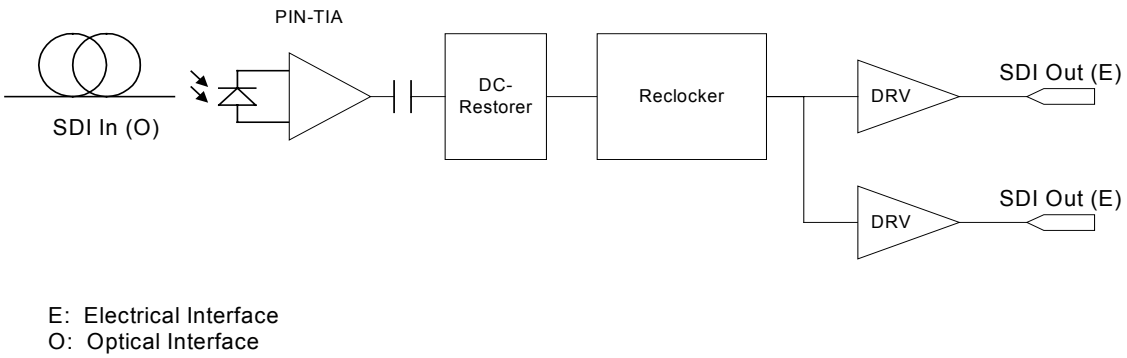

Figure 8: Single Channel Fibre Receiver

7. CLEANING INSTRUCTIONS

In order to maintain the performance of optical interconnections, fibre optic connectors must be cleaned before mating. A single-mode fibre's core diameter is only 8-9µm, hence dust particles anywhere from 9µm down to 1µm in diameter can significantly decrease the system performance due to unwanted – but avoidable - optical loss!

For cleaning, only lens-grade, lint-free tissue (e.g. Kimwipes), saturated with 99.8+% pure, anhydrous Isopropyl Alcohol, shall be used.
Vistek recommends the use of pre-saturated wipes. One sachet, containing a pre-saturated wipe, can be found packed with each board.

Cleaning Technique:

Note that pre-saturated wipes dry out very quickly and they should be used only once.

1. Place the connector ferrule in the wipe and press the wipe firmly against the sides of the ferrule. Rotate the ferrule several times to remove possible contamination from the ferrule sides.

2. Now press a clean part of the wipe against the end of the connector ferrule. Scrape the end of the connector until it squeaks.

3. Mate the connector immediately!

Remember these basic rules when handling fibre optic connectors:

Do's

- ✓ Always clean the connectors before mating.
- ✓ Mate the connector immediately.
- ✓ Cover unused connectors with dust protection caps.

Don'ts

- × Never touch the end face of a connector.
- × Do not let the connector lie around and collect dust before mating.