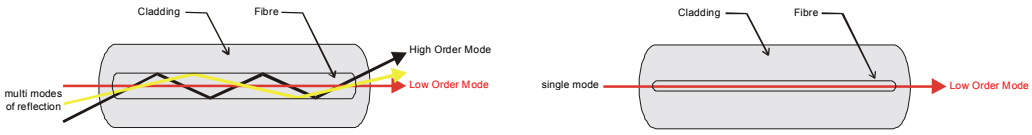
SIRIUS FIBRE
CARDS USER GUIDE

Contents

1 Introduction

1.1 Fibre Essentials

Fibre networks are normally used where long distances are necessary. Typical distances of up to say 10 to 50 kilometres, depending on the implementation. Another important characteristic is that because fibre systems are optical, they are not affected by electromagnetic radiation. There are two basic categories of fibre; Multimode and Singlemode.



Multimode Singlemode

Multimode

Multimode was the original system, and is still to be found in established systems. The fibre cable for Multimode, and Singlemode both have the same external diameter of 125 µm. The fibre for Multimode is 50 or 62.5µm, which is relatively large compared to the laser beam; this allows various paths or modes of reflection. These multimodal reflections significantly reduce the length of the fibre cable.

Singlemode

Singlemode systems use a much smaller diameter of 8 to 9µm. This nearly eliminates multimodal reflections, allowing fibre lengths of kilometres, say up to 50km, depending on conditions. Practical lengths being, say 30km for SD/ASI and 18km for HD. All Pro-Bel fibre cards are Singlemode.

Transmitter types

LED's are normally used for Multimode at 850nm and 1310nm.

Fabry-Perot (FP), optical resonators, are relatively inexpensive and are typically used for Singlemode 1310nm.

Distributed Feedback (DFB) laser diodes are more expensive, and are normally used for Singlemode 1550nm networks.

Vertical Cavity Surface Emitting Lasers (VCSEL) are becoming the standard for Gigabit installations at 850nm.

Coarse Wavelength Division Multiplexing (CWDM)

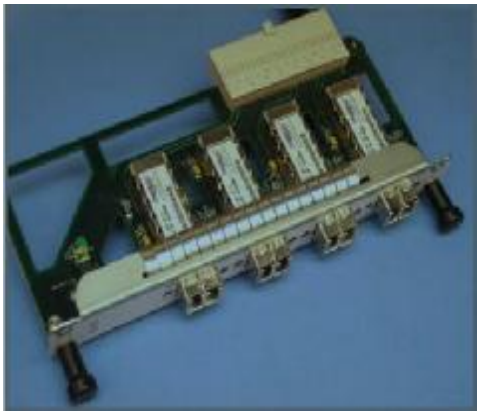
Coarse Wavelength Division Multiplexing is a method of combining multiple signals on laser beams at various wavelengths for transmission along fibre optic cables. The ITU T G.694.2 Standard specifies eighteen wavelengths from 1270 to 1610nm with 20nm spacing. Typically eight signals are multiplexed for transmission along a fibre optic cable.

Connectors

There are many types of fibre optic connectors and adaptors. Pro-Bel uses LC/PC types of connectors. SC: TIA568A Standard Push-Pull is also widely used.

Connectors can be a source of problems in fibre optic networks because of the size of the mating fibres. Typically a good clean fibre connection may be <0.5dB, and a poor one may be 2dB or more. These losses are roughly equivalent to those seen in several kilometres of unspliced fibre optic cable.

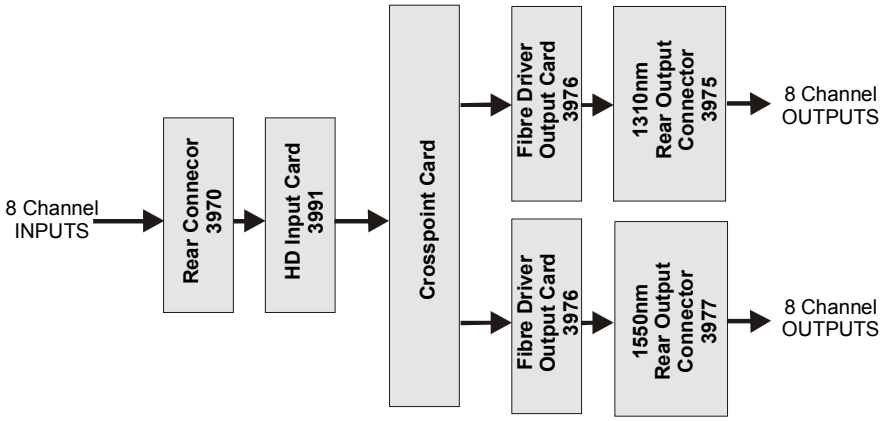
1.2 The Pro-bel Sirius Fibre range



The Sirius fibre architecture consists of the following components:

- 3970: 8 channel HD/SD Fibre rear input connector.
- 3991: 8 channel HD/SD input card.
- 3976: 8 channel Fibre driver output card.
- 3975: 8 channel 1310nm Fibre output connector.
- 3977: 8 channel 1550nm Fibre output connector.

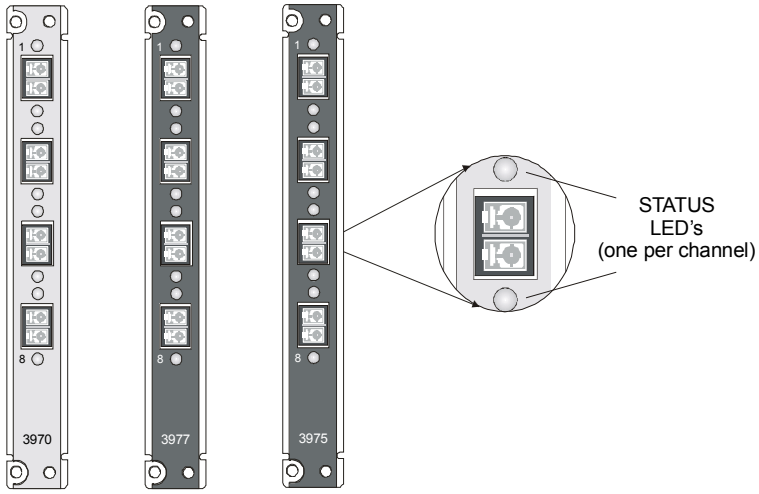
A typical fibre structure is shown below.



The 3970 rear connector has four twin fibre connectors allowing 8-channel inputs. The modules are wideband and will accept either 1330nm or 1550nm wavelengths. The signals are passed through to a standard 3991 HD Input card. After the crosspoint the signals are passed to a 3976 fibre driver output card. There are two possible fibre

output connectors depending on customer requirements. These are the 3975 1310nm rear output connector or the 3975 1550nm rear output connector.

1.2.1 Pro-bel Fibre Card Features



- SMPTE 292M/297M/259M compatible
- Populated with 4 dual transmitters (output card) or 4 Dual receivers (input card) SFF (Small Form Factors) 2x7 modules
- Handles Pathological test pattern
- LVTTL (Low Voltage Transistor Logic) level transmitter disable inputs (output card)
- LVTTL level RX_LOS outputs (Input card)
- Convenient TX_FAULT or RX_LOS status indicating LED's.

1.2.2 Fibre Output Card Product Overview

The Pro-Bel output cards are optical output cards integrated with 4 pairs of optical dual transmitters SFF 2x7 modules which provide high performance data links for unidirectional communication over single mode optical fibre.

The optical output card is designed to transmit data rates ranging from 143Mbps to 1.485Gbps and is compatible with the following standards:

SMPTE 292M/297M (HDTV -- 1.485Gbps)

SMPTE 259M/297M (SDTV -- 143/177/270/360Mbps)

Dual transmitter modules populated in output card are class 1 laser product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J and International Safety Standard IEC-825-1.

LED's and indicators

A single LED per channel is visible through the rear metal work. This should be green when the transmitter is working OK and within valid limits. It should be red if that channel has failed in any way.

1.2.3 Fibre Input Card Product Overview

The Pro-Bel Fibre Input card is an optical input card integrated with 4 pairs of optical dual receivers SFF 2x7 modules which provide high performance data links for uni-directional communication over single mode optical fibre. The dual receiver SFF 2x7 modules are designed with single-mode PIN pre-amp subassemblies. The optical input card is designed to receive data rates ranging from 143Mbps to 1.485Gbps and is compatible with the following standards:

SMPTE 292M/297M (HDTV -- 1.485Gbps)

SMPTE 259M/297M (SDTV -- 143/177/270/360Mbps)

LEDs and indicators

A single LED per channel is visible through the rear metal work. This should be green when the incoming fibre signal is present and a valid average power. It should be red for missing or non-valid signal, or any other fault with the module.

Dual receiver modules in input cards are designed to operate with transmitters that are class 1 laser product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J and International Safety Standard IEC-825-1.	

2 Specification

2.1 Output Card

2.1.1 Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Operating Ambient Temperature	Ta	0		+50	°C	Note 1
Supply Voltage	Vcc	+3.135	+3.3	+3.465	VDC	
Baud Rate	BRate	143		1485	MBaud	143/177/270/360/1485MBaud

Note 1: Worst-case SFF module case temperature can not exceed TC = +70ºC (where Tc is SFF module case temperature).

2.1.2 Electrical Specifications

0ºC<Ta<+50ºC; +3.135<Vcc<+3.465V

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Supply Current with fully populated HD fibre card (1310nm FP Lasers)	Icc		1.6		A	Ta = 25°C, Vcc = +3.3 V
				2.4	A	0°C<Ta<+70°C, +3.135 V< Vcc <+3.465V
Supply Current with fully populated HD fibre card (1310nm & 1550nm DFB Lasers)	Icc		1.6		A	Ta = 25°C, Vcc = +3.3 V
				2.4	A	0°C<Ta<+70°C, +3.135 V< Vcc <+3.465V
CML Inputs (Differential)		300		1860	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	95	100	105	Ohms	Rin > 100 kohms @ DC
Tx_DISABLE Input Voltage - High	ViH	2		3.45	V	
Tx_DISABLE Input Voltage - Low	ViL	0		0.8	V	
SCL, SDA (Note 2)	VoH	2.5		Vcc+0.3	V	
	VoL	0		0.5	V	

Note 2: Straps are provided for disconnecting TX_FAULT/RX_LOS from back connector and interfacing I^2C instead.

2.1.3 Optical Specifications

0ºC<Ta<+50ºC; +3.135<Vcc<+3.465V

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
1310nm FP Lasers						
Optical Center Wavelength	λ	1270	1310	1356	nm	Tc = +25ºC
Spectral Width	Δλ			2.5	nm	RMS
Optical Transmit Power	Popt			-3	dBm	Average @ 1310nm
Extinction Ratio	ER	9			dBm	P1/P0
Relative Intensity Noise	RIN				dB/Hz	
Total Jitter [Pk - Pk]	TJ		120	135	ps	Measured with Colour bar Test Signal @ 1.485GBaud
				740	ps	Measured with Color Bar Test Signal @143/177/270/360MBaud
Output Rise Time	t_R		80	120	ps	20%-80%; Measured unfiltered @143/177/270/360/1485MBaud
Output Fall Time	t_F			270	ps	
1310nm DFB Lasers (Pending; contact factory for availability)						
Optical Center Wavelength	λ	1300	1310	1320	nm	Tc = +25ºC
		1280		1335		0ºC<Tc<+70ºC
Side Mode Suppression Ratio	SMSR	30	40		dB	
Optical Transmit Power	Popt	0		+3		Average @ 1310nm
Extinction Ratio	ER	9			dBm	P1/P0
Relative Intensity Noise	RIN			-117	dB/Hz	
Total Jitter [Pk - Pk]	TJ		120	135	ps	Measured with Color Bar Test Signal @1.485GBaud.
				740	ps	Measured with Color Bar Test Signal @143/177/270/360MBaud.

Output Rise Time	t_R		80	120	ps	20%-80%; Measured unfiltered @143/177/270/360/1485Mbaud
Output Fall Time	t_F		240	270	ps	
1550nm DFB Lasers						
Optical Center Wavelength	λ	1540	1550	1565	nm	Tc = +25ºC
		1480		1580		0ºC<Tc<+70ºC
Side Mode Suppression Ratio	SMSR	30	40		dB	
Optical Transmit Power	Popt	0		+3	dBm	Average @ 1310nm
Extinction Ratio	ER	9			dBm	P1/P0
Relative Intensity Noise	RIN			-117	DB/Hz	
Total Jitter [Pk-Pk]	TJ		120	135	ps	Measured with Color Bar Test Signal @1.485GBaud.
				740	ps	Measured with Color Bar Test Signal @143/177/270/360MBaud.
Output Rise Time	t_R		80	120	ps	20%-80%; Measured unfiltered @143/177/270/360/1485MBaud
Output fall Time	t_F		240	270	ps	

2.2 Fibre Input Card

2.2.1 Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Operating Ambient Temperature	Ta	0		+50	°C	Note 3
Supply Voltage	Vcc	+3.135	+3.3	+3.465	VDC	
Baud Rate	BRate	143		1485	MBaud	143/177/270/360/1485MBaud

2.2.2 Electrical Specifications

0ºC<Ta<+50ºC; +3.135<Vcc<+3.465V

PARAMETER	SYMBOL	TYP	MIN	MAX	UNITS	NOTES
Supply Current with fully populated HD fiber card	Icc		1.8		A	Ta = 25°C, Vcc = +3.3 V
				2.5	A	0°C<Ta<+70°C, +3.15 V< Vcc <+3.45V
CML Outputs (Differential)		400	800	1200	mVpp	
Total Jitter [Pk - Pk]	TJ		85	135	ps	Measured with Color Bar Test Signal @1.485GBaud (Note 4)
				740	ps	Measured with Color Bar Test Signal @143/177/270/360MBaud
Return Loss		15			dB	Worst case @ 10KHz to 3GHz
SCL, SDA	VoH	2.5		Vcc+0.3	V	
	VoL	0		0.5	V	

2.2.3 Optical Specifications

0ºC<Ta<+50ºC; +3.135<Vcc<+3.465V

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
PIN RECEIVERS						
Optical Input Wavelength	λ	1270		1620	nm	
Optical Input Power	Pr	-20		-1	dBm	Note 5, 6
Optical Return Loss	ORL	29			dBm	
RX_LOS --- Asserted	Pa	-29				Measured on transition: Low to High
RX_LOS --- Deasserted	Pd			-20	dBm	Measured on transition: High to Low
RX_LOS --- Hysteresis	Pa - Pd		1.5	5.0	dB	

Note 3: Worst-case SFF module case temperature cannot exceed TC = +70ºC (where Tc is SFF module case temperature).

Note 4: Maximum Jitter is specified for single module point-to-point applications only. In cascaded configurations, where the receiver electrical output is directly interfaced with the transmitter electrical input of a separate module, accumulated jitter may result in CRC errors to occur during pathological pattern transmission. For error-free operation in such a situation, use of re-clocker device is recommended at the output of the receiver before interfacing to the inputs of the optical transmitter. This will ensure that the output jitter will not exceed the input jitter tolerance of the succeeding transmitter input.

Note 5: Minimum receiver input power is defined for line BER < 1 x 10^{-10} running PRBS 2_{23} - 1 at 140/177/270/360/1485Mbps.

Note 6: In cases where optical loop back test is performed in conjunction with high power DFB laser transmitter, an external attenuation will be required to limit receiver optical input power to -1dBm maximum.

2.2.4 Link Distance

Transmitter	Receiver	Fibre Attenuation	Min Link Distance
1310 nm FP Laser	PIN	0.5dB/km	10km
1550 nm DFB Laser	PIN	0.3dB/km	50km