DATA SHEET

Optical FireWire Repeater

M4-200 & M4-201

Contents

Headquarter

Opticis Co., Ltd.

501, ByucksanTechnopia, 434-6
Sangdaewon-Dong, Chungwon-Ku,
Sungnam City, Kyungki-Do, 463-120
South Korea
Tel: +82 (31) 737-8033~9
Fax: +82 (31) 707-8079

www.opticis.com

North American Office

Opticis North America Inc.

330 Richmond Street, Suite 100, Chatham,
Ontario N7M 1P7
Canada

Tel: +1 (519) 355-0819
Fax: +1 (519) 355-0502

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Optical FireWire Repeater

- Stretch Optical Firewire system -

Description

The S800 Optical FireWire Repeaters (M4-200 and M4-201) offer 500m (1,640feet) extension over the limits of copper wire extension, 4.5m (15feet) without any distribution amplifiers or repeaters. The basic model, M4-200 consists of a pair of two repeaters, having one-optical and two-electrical ports. Additionally, between two, multiple installation of M4-201, having two-optical and one-electrical ports provides a long fiber-optic extension of additional 1394 devices. The M4-201, giving connection of a 1394 device is capable of two-way fiber connection in forward and backward directions, which eventually makes a daisy chain with each repeater of M4-200 at both ends.

Duplex multi-mode glass of fiber (MM GOF) cables with LC connectors makes fiber connection between repeaters. The electrical bilingual port of 1394b-2002 standard supports S800 (800Mbps) data rate, fully complied with IEEE1394b-2002, but also backwardly S400, S200, and S100 by using DS (9 pin or 4 pin)-to- bilingual cables.

When applying to IEEE1394 devices or controllers having powers themselves, the M4-200 repeater requires plugging the external DC power adapter in shipping package, only when the power indicating LED is off.

The shipping group is shown as follows;

M4-200: Two (2) repeaters of two-electrical and one-optical ports, with two 1394 cables and a +12V power adaptor
M4-201: One (1) repeater of one-electrical and two-optical ports with one 1394 cable and a +12V power adaptor

Cable option: Two (2) Bilingual-to-Bilingual cables for S800 or Two (2) Bilingual-to-DS (6pins) cables for S400

Features

- Extends IEEE1394b protocol signals up to 500m (1640feet) over MM GOF.
- Fully complies not only with 1394b-2002 but also backwardly 1394a-2000 & 1995.
- Offers 800 (S800), 400 (S400), 200 (S200) and 100 (S100) Mbps in full duplex data rate.
- Offers on a basic model; **M4-200**: a pair of two electrical bilingual ports and an optical duplex LC receptacle, **M4-201**: a box of one electrical bilingual port and two optical duplex LC receptacles.
- Dimension (W/H/D): 101/24/91 in mm
- Weight: 190g each
- Low power consumption: less 6W
- Free RF noises and EMI from fiber
- No software to install: Easy to use; plug and play.

Applications

- PC link of peripherals in factory & office

- IEEE1394 camera interfaces for surveillance system and machinery vision

- Storage Area Networks and File server systems in SME

Technical Specifications

- General Specifications

	Parameter	Specifications
Components	Laser Diodes in Module	850nm Multi-mode VCSEL (Vertical Cavity Surface Emitting Laser)
	Photo Diodes in Module	GaAs PIN-PD
Electrical	Input and Output Signals	1394b Level (complying with 1394b std.)
	Data Transfer Rate (Graphic Data)	Max. 983Mbps
	Total Jitter at the end of Rx output	Max. 315 ps (at S400 operation)
	Skew inter-channels	Max. 0.5ns(at S400 operation)
Optical	Link Power Budget	Min 10.5dB
Connect	Optical Connector	2 Duplex LC connectors
	Electric Connector Type from Modules	1394 Bilingual connector
	Recommended Fiber	62.5/125 or 50/125 um Multi-mode Glass Fiber

- Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Supply Adaptor Voltage	V_{CC}	+ 10.0	+16.0	V
Operating Temperature	T_{op}	0	50	°C
Operating Relative Humidity	RH_{op}	5	80*	%RH
Storage Temperature	T_{sto}	- 30	+ 60	°C
Storage Relative Humidity	RH_{sto}	5	95*	%RH

Note*: Under the condition of No drops of dew

- Operating Conditions

M4-200

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AVcc	11.4	12	12.6	V
	Supply Voltage	Vcc	11.4	12	12.6	V
	Supply Current	I_{TCC}	-	170	200	mA
	Power Dissipation	P_{TX}		2.04	2.52	W
	Power Supply Rejection (Note1)	PSR		50		mV_{p-p}
1394b port	Data Output Load	R_{LD}		56		Ω
	Supply Voltage	GV_{CC}	12	-	24	V
	Differential Input Swing Voltage	Vid	0.2	-	0.8	V
Optical Link (Note2)	Output Optical Power	P_o	-9.5		-3.6	dBm
	Wavelength	λ	830	850	860	nm
	Spectral width in RMS	Δλ			0.85	nm
	Relative Intensity of Noise (Note3)	RIN		-117		dB/Hz
	Extinction Ratio	Ext	9			dB
	Rising/Falling Time	T_{rise}/T_{fall}			260	ps
	Receiving Optical Power	Po	-20		-3.6	dBm
	Receiving Wavelength	λ	830	850	860	nm
	Signal_Detect Good	SDg			-17	dBm
	Signal_Detect Fail	SDf	-25			dBm
	Link Power Budget	Pbgt	10.5			dB
	Total Jitter (note 5)	TRjitter			309	ps

Note1. Tested with a $50mV_{p-p}$ sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V_{CC} supply with the recommended power supply filter in place. Typically less than a 0.25 dB change in sensitivity is experienced.
Note2. Measure signals at the end of 2 meter 50/125um MMGOF
Note3. Measure in 1GHz of frequency bandwidth
Note4. Use PPG (Pulse Pattern Generator) source with jitter 50ps
Note5. It is measured as total jitters including Tx and Rx modules under maximum extension, 500 meters with UXGA 60Hz

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M4-201

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AVcc	11.4	12	12.6	V
	Supply Voltage	Vcc	11.4	12	12.6	V
	Supply Current	I_{TCC}	-	200	230	mA
	Power Dissipation	P_{TX}		2.52	2.90	W
	Power Supply Rejection (Note1)	PSR		50		mV_{p-p}
1394b port	Data Output Load	R_{LD}		56		Ω
	Supply Voltage	GV_{CC}	12	-	24	V
	Differential Input Swing Voltage	Vid	0.2	-	0.8	V
Optical Link (Note2)	Output Optical Power	P_o	-9.5		-3.6	dBm
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Note2. Measure signals at the end of 2 meter 50/125um MMGOF
Note3. Measure in 1GHz of frequency bandwidth
Note4. Use PPG (Pulse Pattern Generator) source with jitter 50ps
Note5. It is measured as total jitters including Tx and Rx modules under maximum extension, 500 meters with UXGA 60Hz

- Recommended Specifications of Fiber-Optic Cables

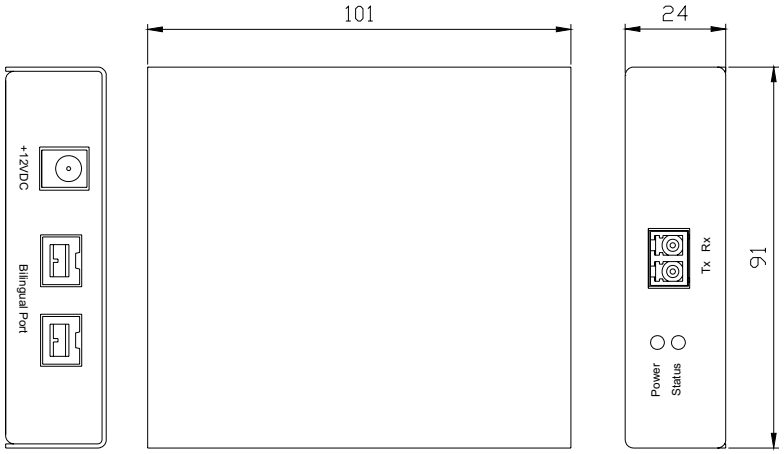
Parameters	Conditions	Specifications
Fiber Type	Multimode Glass of Fiber	62.5/125 or 50/125μm
Modal Bandwidth	λ = 850nm	Min. 400 MHz km
Fiber Cable Attenuation	λ = 850nm	Max. 3.5dB/km
No. of Ferrules	A pair of duplex LC* or 2 simplex LCs	2 ferrules(M4-200),4ferrules(M4-201)
Skew		Max. 0.4ns
Insertion Attenuation		Max. 0.5dB
Total Optical Attenuation	In 330 ft (100 meter) extension	Max. 1.5dB

Note*: some plastic couplers to clamp two LC connectors could not fit in.

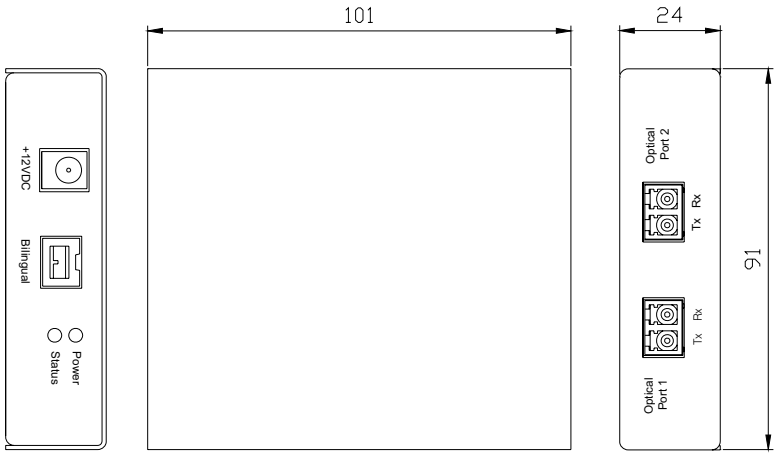
Drawing of Modules

Dimension [mm]

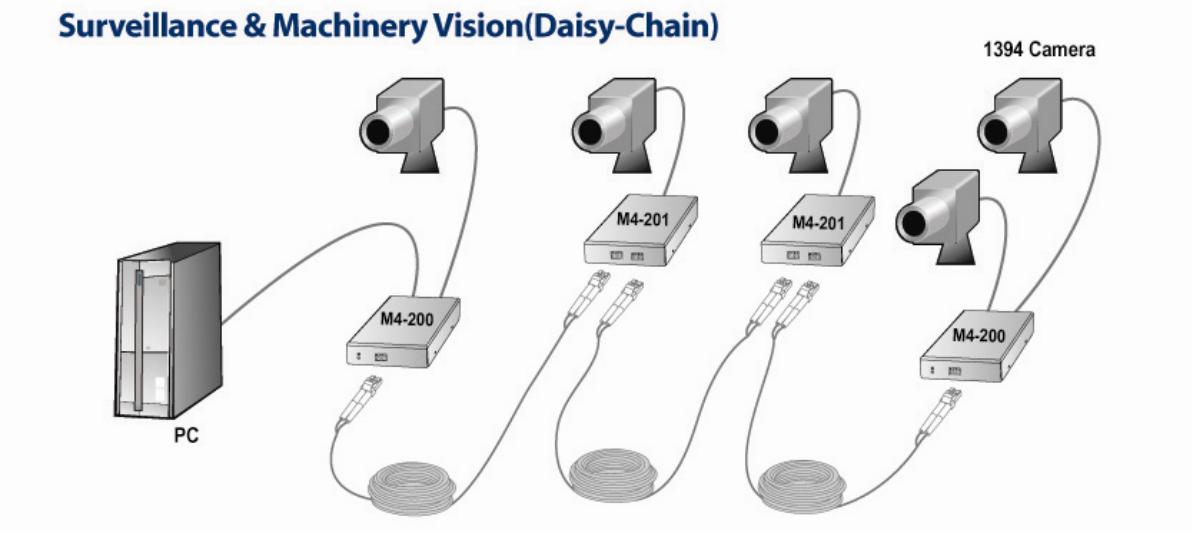
M4-200



M4-201



Drawing of Cable Connections



Bilingual Pin Description

Pin	Symbol	Functional Description
1	**TPB***	Twisted Pair B(Minus)
2	**TPB+**	Twisted Pair B(Plus)
3	**TPA***	Twisted Pair A(Minus)
4	**TPA+**	Twisted Pair A(Plus)
5	**TPA(R)**	Twisted Pair A (Reference Ground)
6	**VG**	Power (Ground)
7	**SC**	Status Contact (Reserved for Future use)
8	**Vp**	Power (Voltage)
9	**TPB(R)**	Twisted Pair B (Reference Ground)

Reliability Test

We have three kinds of test criteria for a reduction of variability and a continuous improvement of the process by our FEMA (Failure Mode and Effective Analysis) program.

1) Mechanical test (Vibration, Shock)
2) Temp. & Humidity test
3) EMC test (FCC class A and CE Verification)

Mechanical and Temp. & Humidity Test

Heading	Test	Conditions	Duration	Sample Size	Remarks
Operating Test	**Operating at each Temperature (See Note)**	0~50℃ (Interval: 10℃)	30 Min (Each Temperature)	n=3	**Note:** Evaluate display quality of Laser Beam Projector connected to Graphic Signal Generator (Quantum Data: GD-802B) at each temperature. 1. T_S: Storage Temperature 2. RH: Relative Humidity
Storage Test	**Low Temperature**	T_S = -30℃	96 HR	n=3	
	High Temperature	T_S = 60℃	96 HR	n=3	
	High Humidity / High Temperature	T_S: 60℃ RH: 85%	96 HR	n=3	
Mechanical Test	**Mechanical Shock**	Pulse: 11 ms Peak level: 30 g Shock pulse: 6times/Axis	-	n=3	
	Mechanical Vibration	Peak acceleration: 5 g Frequency: 10~55 Hz Sweep time: 5 Minutes 2 Times/Axis	-	n=3	

EMC Test

1) EMI: Meet *FCC class A or B* (ICES-003) and *CE class A or B*

STANDARDS		CONDITIONS
EN 55 022 (CISPR22) **FCC**; PART 15 SUBPART B	CE (Conducted Emission) & RE (Radiated Emission)	Meet Class A or B
EN 61000-3-2 (IEC 61000-3-2)	Harmonics	Meet Class A or B
EN 61000-3-3 (IEC 61000-3-3)	Flickers	Meet Class A or B

2) EMS: Meet *CE standards (EN 55024) and CISPR24 equivalents*

STANDARDS		CONDITIONS
EN 61 000-4-2:1995	Electrostatic Discharge Immunity (Air: 8kv, Contact: 4kv)	Meet Criterion A or B
EN 61 000-4-3:1996	Radiated RF E-Field (80~1000 MHz) 3V/m (AM 80%, 1kHz)	Meet Criterion A or B
EN 61 000-4-4:1995	Fast Transients (5kHz, 60Seconds)	Meet Criterion A or B
EN 61 000-4-5:1995	Surge Transients	Meet Criterion A or B
EN 61 000-4-6:1996	Conducted Susceptibility (CS) Radiated Susceptibility (RS)	Meet Criterion A or B
EN 61 000-4-11:1994	Voltage Dips, Interruption & Variation	Meet Criterion A or B, and C