

# DATA SHEET

## Digital Video/Audio and Serial I/O

### Optical Extender

### M5-2A2

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#### Headquarters

Opticis Co., Ltd.  
# 16Fl, Kins Tower  
8 Sungnam-daero, 331 beon-gil,  
Bundang-gu,  
Seongnam-si, Gyunggi-do, 463-844  
South Korea  
Te l: +82 (31) 719-8033  
Fax: +82 (31) 719-8032  
[www.opticis.com](http://www.opticis.com)

## **Digital Video/Audio and Serial I/O Extender**

### **Description**

The reality of gigabit high-speed digital graphic interconnections mandates products that maintain front-of-screen video quality. Optical technology extends the ability to transmit digital graphic data beyond the physical limits of copper wires by, i) providing pure signal integrity over long distances for the optimum visual experience, ii) no EMI/RFI transmission or reception, iii) light weight, rugged cabling and connectors, iv) very cost effective per foot/metre, v) low power consumption, and vi) plug and go installation ease – no software requirements.

M5-2A2-TR offers integrated extension of digital video, audio and RS-232 interface up to 200m (656ft) for HDMI and up to 2km (6,560ft) for DVI. It maintains HD video signals up to WUXGA (1920x1200) at 60Hz refresh rate for PC and 1080p for HDTV. It is compatible with full DDC2B and HDCP. It supports connecting one of 3 different audio types in the transmitter; RCA, SPDIF (Optic) or SPDIF (Coaxial) and outputting all 3 audio types. RS232 serial interface offers device-to-device and device-to-controller connections to build up control system for A/V integration.

It is designed to multiplex and de-multiplex the DVI/HDMI video, digital/analog audio, Display Data Channel (DDC) command interface, High Definition Copy Protection (HDCP) and serial protocol so as to be linked over 4 LC fibers. It gives benefits of all-glass fiber transmission medium, data security, long distance extension up to 2km, easy plug-and-go installation and no RFI/EMI effects. In addition, a non-trivial feature is that both of Single and Multimode optical fibers are applicable.

The M5-2A2-TR consists of an Uplink (or transmitter; Tx) and a Downlink (or receiver; Rx), connected by two duplex LC terminated single or multi-mode patch cords between them, which offers electrical perfect isolation. Each link module is driven by +12V/3A DC power adaptor.

The shipping group is as follows;

- 1) One pair of the uplink and the downlink
- 2) Two +12V/3A power adaptors
- 3) User Manual

## Feature

- ◆ Extends DVI, Audio and RS232 with both single and multi-mode fibers.
  - up to 2km (6,560ft) over two (2) duplex LC single-mode fibers if using Smart DDC.
  - up to 500m (1,640ft) over two (2) duplex LC multi-mode fibers if using Smart DDC.
- ◆ Extends HDMI, Audio and RS232 up to 200 m with DDC/HDCP.
- ◆ Audio interface: Selectable RCA, SPDIF (Optic) or SPDIF (Coaxial).
- ◆ The electrical S/PDIF and Optical S/PDIF port can support only D-PCM or PCM audio format for stereo sound.
  - Ex) In case of Samsung (Bluray, SV-D507HD) DVD player
    - Audio Digital out: PCM
  - In case of Sony (DVP-NS92V, DVP-NS975V) DVD player
    - Audio Digital out: D-PCM
- ◆ Serial control data: RS232 with 9 pin D-sub female connector in the transmitter and male connector in the receiver.
- ◆ Video data: WUXGA (1920X1200), 24bit color and 60Hz refresh rate for DVI and 1080p for HDMI.
- ◆ Interconnection between transmitter and receiver: Two(2) Duplex LC patch cords of single or multi mode fiber.
- ◆ Applicable of both single and multi-mode fiber.
- ◆ +12 V DC power supply to each module.
- ◆ Complies with DDC2B/HDCP.
- ◆ No software to install; just plug and go.
- ◆ Data security with negligible RFI/EMI emissions
- ◆ Certifications: CE / FCC, Class 1 Laser Eye Safety

## Applications

- ◆ Digital display system integration for medical, military, aerospace, factory automation, and traffic control platforms.
- ◆ Digital FPD, PDP and projector installation in conference rooms, auditoriums and for kiosk systems
- ◆ LED signboards for large scale information display and stadiums

## Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_{stg}$	- 30	+ 70	°C
Supply Voltage	$V_{CC}$	10	16	V
Transmitter Differential Input Voltage	$V_d$	-	1	V
Operating Humidity	RH	10	85	%
Lead Soldering Temperature & Time	-	-		260°C, 10 sec

## Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Ambient Operating Temperature	$T_A$	0		+ 50	°C
Data Output Load	$R_{LD}$		50		$\Omega$
Power Supply Rejection (Note1)	PSR		50		mV <sub>p-p</sub>
Supply Voltage	$V_{CC}$	+ 11.4	+ 12.0	+ 12.6	V

Note1. Tested with a 50mV<sub>p-p</sub> 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.

## Electrical Power Supply Characteristics

( $T_A = 0\text{ }^{\circ}\text{C}$  to +50 °C, unless otherwise noted)

Parameter	Symbol	Minimum	Typical	Maximum	Units	
Supply Voltage	$V_{CC}$	11.4	12	12.6	V	
Supply Current	TX	$I_{TCC}$	350	380	400	mA
	RX	$I_{RCC}$	370	390	420	mA
Power Dissipation	TX	$P_{TX}$	3.99	4.56	5.04	W
	RX	$P_{RX}$	4.22	4.68	5.3	W

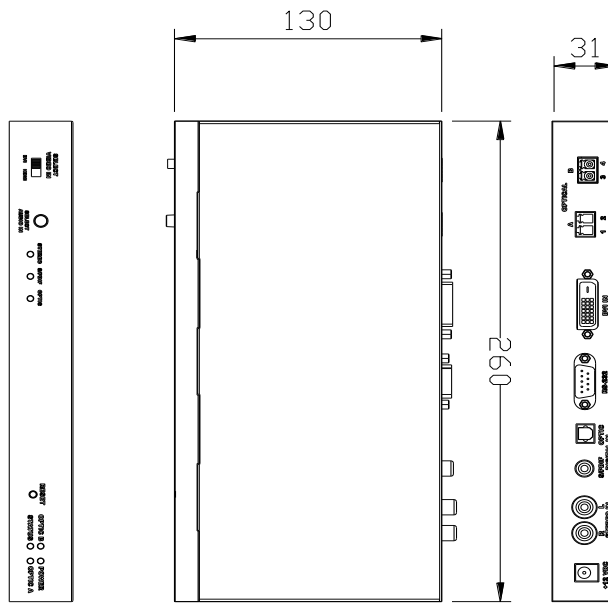
### Optical & Electrical Characteristics

(T<sub>op</sub> = 25°C)

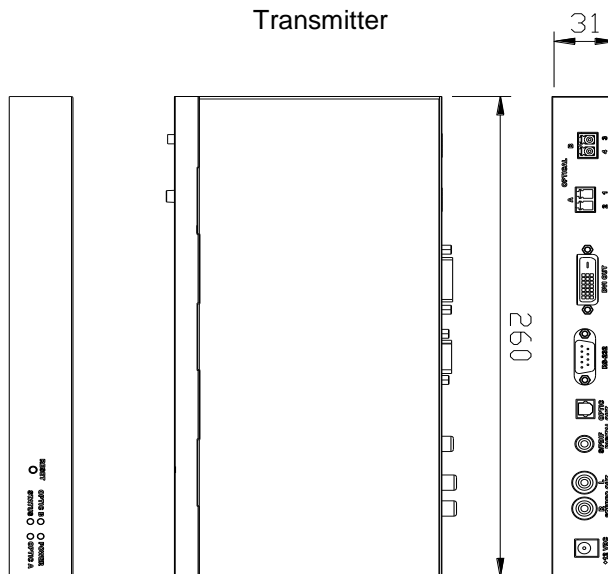
Parameters		Symbol	Condition	Unit	Min.	Typ.	Max.	Remark
Data Bit Rate	1310 Tx		PRBS 2 <sup>23</sup> -1,NRZ	Mbps		1250		
	1550 Rx					155.52		
	1550 Tx		PRBS 2 <sup>23</sup> -1,NRZ	Mbps		155.52		
	1310 Rx					1250		
Fiber Length 9µm core SMF			10 <sup>-10</sup> BER, 155Mbps/1.25Gbps	km	2			
<b>TRANSMITTER</b>								
Average Power Output		P <sub>OUT</sub>	I <sub>f</sub> =I <sub>BIAS</sub> + I <sub>mod</sub> /2	dBm	-11 -15	-9 -10	-7 -8	
Extinction Ratio		ER		dB	5			
Center Wavelength		c	CW, @ P <sub>OUT</sub>	nm	1270 1500	1310 1550	1355 1600	@1.31 µm @1.55 µm
Spectral Width			RMS Width	nm			4.0	
RIN				dB/Hz			-120	
Optical Rise/Fall Time		t <sub>r</sub> /t <sub>f</sub>	20 – 80%	nsec			0.26 2.0	
<b>RECEIVER</b>								
Sensitivity (Average Input Power)		P <sub>IN,MIN</sub>	PRBS 2 <sup>23</sup> -1, 10 <sup>-10</sup> BER	dBm			-23 -19	155M Rx 1.25G Rx
Wavelength	1310 1550			nm	1260 1500	1310 1550	1360 1600	
Receiver Overload		P <sub>IN,MAX</sub>		dBm	-3.0			
Signal Detect Threshold Decreasing light input Increasing light input		P <sub>D</sub> P <sub>A</sub>		dBm dBm		P <sub>IN,MIN</sub> -3 P <sub>IN,MIN</sub> -2		
Signal Detect Hysteresis		P <sub>A</sub> - P <sub>D</sub>		dB	0.5			
Parameters		Symbol	Condition	Unit	Min.	Typ.	Max.	Remark
<b>Audio (Analog)</b>								
Analog Sample Rate		F <sub>audio_a</sub>		kHz		48		
Input level		A <sub>in</sub>		V <sub>pp</sub>		0.56V <sub>ss</sub>		
output level		A <sub>out</sub>	V <sub>pp</sub> =3.3V/Analog	V <sub>pp</sub>		0.65		
Input Impedance				kΩ		25		
Output Impedance				Ω		100		
<b>Audio(SPDIF)</b>								
Data Rate	TX		NRZ	Mbps	0.1		6	
	RX		NRZ	Mbps	DC		6	
Pulse Width Distortion		Δ tw	Pulse Width = 67ns Pulse Cycle = 134ns C <sub>L</sub> = 10pF	ns	-15		15	
Maximum Receivable Power		P <sub>max</sub>	15Mbps	dBm	-14.5			
Minimum Receivable Power		P <sub>min</sub>	15Mbps	dBm			-24	
Fiber Output Power		P <sub>f</sub>		dBm	-21		-15	
Center Emission Wavelength		λ <sub>c</sub>		nm		650		

### Drawing of transmitter and receiver modules

Dimension [mm]



Transmitter



Receiver

## DVI Pin Description

Pin	Symbol	Functional Description
1	CH2-	TMDS Data Signal Channel 2 Negative
2	CH2+	TMDS Data Signal Channel 2 Positive
3	GND	TMDS Data Signal Channel 2 Shield
4		
5		
6	DDC Clock	DDC Clock line for DDC2B communication
7	DDC Data	DDC Data line for DDC2B communication
8	N.C.	
9	CH1-	TMDS Data Signal Channel 1 Negative
10	CH1+	TMDS Data Signal Channel 1 Positive
11	GND	TMDS Data Signal Channel 1 Shield
12		
13		
14	5 V	5 V Input for Transmitter from Host 5 V Output for Monitor from Receiver
15	GND	Ground
16	Hot plug Detect	Signal is driven by monitor to enable the system to identify the presence of a monitor
17	CH0-	TMDS Data Signal Channel 0 Negative
18	CH0+	TMDS Data Signal Channel 0 Positive
19	GND	TMDS Data Signal Channel 0 Shield
20		
21		
22	GND	TMDS Clock Signal Shield
23	CLK+	TMDS Clock Channel Positive
24	CLK-	TMDS Clock Channel Negative

Note: Channels 3, 4 and 5 dual-link data signal pins are not used

## RS232C Pin Description

Pin	Symbol	Functional Description
1	Received Line Signal Detector	Connected with Pin4 & Pin6 in module
2	RD	Data Receive: Uplink $\leftrightarrow$ Downlink
3	TD	Data Transmit: Uplink $\leftrightarrow$ Downlink
4	Data Terminal Ready	Connected with Pin1 & Pin6 in module
5	GND	Signal Ground
6	Data Set Ready	Connected with Pin1 & Pin4 in module
7	Request To Send	Connected with Pin8 in module
8	Clear To Send	Connected with Pin7 in module
9	NC	

Connection tips:

- 1) Connection of PC-to-PC: Cross connection of pins 2 and 3 between two PCs.
- 2) Connection of PC-to-Device: Straight connection of pin 2:2 and pin 3:3

## Reliability Test

Opticis utilizes three types of test criteria for a reduction of variability and a continuous improvement of the process by its FEMA (Failure Mode and Effective Analysis) program.

- 1) Mechanical test (vibration, shock)
- 2) Temperature & humidity tests
- 3) EMC test (*FCC class A and CE Verification*)

### Mechanical and Temperature & Humidity Test Data

Heading	Test	Conditions	Duration	Sample Size	Failure	Remarks
<b>Operating Test</b>	Operating at each Temperature (See Note)	* 0 ~ 50 °C (Interval: 10 °C)	30 Min (Each Temperature)	n=3	0	<b>Note:</b> Visual Test on the Display
<b>Storage Test</b>	<b>Low Temperature</b>	* T <sub>s</sub> = -30 °C	96 HR	n=3	0	1. TS: Storage Temperature
	<b>High Temperature</b>	* T <sub>s</sub> = 70 °C	96 HR	n=3	0	2. RH: Relative Humidity
	<b>High Humidity High Temperature</b>	* T <sub>s</sub> : 60 °C * RH: 90%	96 HR	n=3	0	
<b>Mechanical Test</b>	<b>Mechanical Shock</b>	* Pulse: 11 ms * Peak level: 30 g * Shock pulse: 3 times/Axis	-	n=2	0	
	<b>Mechanical Vibration</b>	* Peak acceleration: 20 g * Frequency: 20~2000 Hz * Sweep time: 30 Minutes * 4 Times/Axis	-	n=2	0	



### EMC Test Data

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

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

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

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