

DATA SHEET

Optical HDMI Modules

M1-2x2H-TR

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Optical HDMI Module

- HDMI Fiber Detachable Connection System -

Description

The M1-2x2H-TR HDMI Module is a new member of the Opticis family of products that stretches your HDMI connectivity. The M1-2x2H-TR offers an option of DDC connection over a copper cable with industrial secure connectors, which makes it easier to install.

The reality of high-speed digital graphic interconnections mandates products to maintain video quality and cost effectiveness of integrated display systems. Optical technology for gigabit digital transmission makes it simple to extend digital graphic data above the extension limits of copper wires providing pure signal integrity for an ideal visual experience, no EMI/RFI emissions, light weight, rugged cabling and connectors, low power consumption and installation ease.

The extension system consists of transmitter and receiver module boxes with male HDMI (High Definition Multimedia Interface) plugs, being able to connect DVDs or Media Receivers and displays by HDMI copper cables respectively. LC patch cords fiber-optic cable enables to transmit graphic data and coaxial copper cable with SN-9 plugs (or RJ-45C) enables to manage power and EDID/HDCP parameters up to 100m (330ft). Internally, Opticis' optical technology - the transmitter's 850nm VCSEL array and the receiver's Pin-PD array, are concealed within the connector housings.

The coaxial cable with SN-9 connectors is designed for applications, requiring much secure locking. The UTP cable with RJ-45C connectors for DDC, which is popular as LAN cables, is so designed as to utilize easily. The products are certified to EMI Class B by for FCC or CE for home uses as well as industrial or commercial uses.

- ◆ **M1-2x2H-TR** uses two duplex LC patch cord fibre cables for graphic data with (x=**S**) SN-9 connector or (x=**R**) RJ-45C copper cable for EDID/HDCP parameter control and power management.

The shipping group is shown as follows;

- 1) One transmitter converting electrical to optical signals, model name: M1-2x2H-T
- 2) One receiver converting optical to electrical signals, model name: M1-2x2H-R
- 3) HDMI copper cables: 2 X M1-HDMICO-010 (1.0m)
- 4) AC power Adapter: M1-2D12PW
- 5) Copper cable for DDC (Option): M1-DDCSN-xxx (S/N-9 Connector), or M1-DDCRJ-xxx (RJ45-C Connector), where xxx stands for the cable length in meter up to 100m (165feet). The standard length is 20 meter (66feet).
- 6) Fiber-optic cable with duplex LC connectors (Option): M1-DVOF-xxx. Where xxx stands for the cable length up to 500m.

Features

- ◆ Extend digital graphic/video signals as follows;
 - M1-2x2H-TR having DDC/HDCP interconnection over the coaxial cable: 100m (330feet).
- ◆ Comply with FDA/CDRH and IEC 60825-1 Class 1 Laser Eye Safety.
- ◆ **M1-2x2H-TR** is certified in Class B, the home standard by FCC or CE
- ◆ Support up to 1080p video format.
- ◆ Comply with HDMI1.0 standard and HDCP1.1 standard.
- ◆ Adopts only an external power supply, +12V to supply both modules over DDC cable.
- ◆ No require S/W driver to install; just plug and play.
- ◆ Use 850nm multimode light sources and equivalent photo detectors, so recommend 2 Duplex LC patch cord multimode GOF or breakout GOF.
- ◆ Adopt 2 Duplex LC receptacles on the side-face of modules.

Applications

- ◆ Digital FPDs, PDPs and projectors for medical appliances, aero traffic control, factory, conference room, auditorium and bank
- ◆ Digital FPDs and projectors in conference room and auditorium
- ◆ Kiosk with digital FPDs showing full motion graphic displays from remote systems
- ◆ PDP displays for information in public sites
- ◆ LED signboards in streets and in stadiums

Technical Specifications

- General Specifications

	Parameter	Specifications
Components	Laser Diodes in Tx Module	850nm Multi-mode VCSEL (Vertical Cavity Surface Emitting Laser)
	Photo Diodes in Rx Module	GaAs PIN-PD
Electrical	Input and Output Signals	TMDs Level (complying with HDMI1.0)
	Data Transfer Rate (Graphic Data)	Max. 1.62Gbps
	Total Jitter at the end of Rx output	Max. 309 ps
	Skew inter-channels	Max. 6ns
Optical	Link Power Budget	Min 10.5dB
Connect	Optical Connector	2 Duplex LC connectors
	Electric Connector Type from Modules and to Displays	19 pin HDMI type A plug
	DDC Electric Cables between Two Modules	9 pin plug (S/N-9) or RJ45-C
	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}	-10	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

Transmitter module : M1-2x2H-T

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AV _{CC}	11.4	12	12.6	V
	Supply Voltage	V _{CC}	4.5	5	5.5	V
	Supply Current	I _{TCC}	-	200	250	mA
	Power Dissipation	P _{TX}		1.0	1.375	W
	Power Supply Rejection (Note1)	PSR		50		mV _{p-p}
TMDs	Data Output Load	R _{LD}		50		Ω
	Graphic Supply Voltage (Note2)	GV _{CC}	+ 3.1	+ 3.3	+ 3.5	V
	Single-Ended High Level Input Voltage	GV _{IH}	GV _{CC} - 0.01	GV _{CC}	GV _{CC} + 0.01	V
	Single-Ended Low Level Input Voltage	GV _{IL}	GV _{CC} - 0.6	-	GV _{CC} - 0.4	V
	Single-Ended Input Swing Voltage	GV _{ISWING}	0.2	-	0.8	V
Optical Link (Notes)	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 (Note4)	RIN		-117		dB/Hz
	Extinction Ratio	Ext	9			dB
	Rising/Falling Time	T _{rise} /T _{fall}			260	ps
	Jitter in p-p value (Note5)	T _{jitter}			290	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. Graphic Supply Voltage is regulated reference voltage for signal processing in modules
 Note3. Measure signals at the end of 2 meter 50/125um MMGOF
 Note4. Measure in 1GHz of frequency bandwidth
 Note5. Use PPG (Pulse Pattern Generator) source with jitter 50ps

Receiver module: M1-2x2H-R

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AV _{CC}	11.4	12	12.6	V
	Supply Voltage	V _{CC}	4.5	5	5.5	V
	Supply Current	I _{RCC}	-	300	350	mA
	Power Dissipation	P _{RX}	-	1.5	1.925	W
	Power Supply Rejection (Note6)	PSR		50		mV _{p-p}
TMDS	Data Input Load	R _{LD}		50		Ω
	Graphic Supply Voltage (Note7)	GV _{CC}	+ 3.1	+ 3.3	+ 3.5	V
	Single-Ended Output Swing Voltage (Note8)	GV _{ISWING}	0.4	-	0.8	V
Optical Link (Note9)	Receiving Optical Power	P _o	-20		-3.6	dBm
	Receiving Wavelength	λ	830	850	860	nm
	Signal_Detect Good	SD _g			-17	dBm
	Signal_Detect Fail	SD _f	-25			dBm
	Link Power Budget	P _{bgt}	10.5			dB
	Total Jitter (note 10)	TR _{jitter}			309	ps

- Note6. 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.
 Note7. Graphic Supply Voltage is regulated reference voltage for signal processing in modules
 Note8. TMDS outputs are coupled in AC
 Note9. Measure signals at the end of 2 meter 50/125um MMGOF
 Note10. 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 4 simplex LCs	4 ferrules
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.

Functions

- Power Save Mode in Transmitter Module

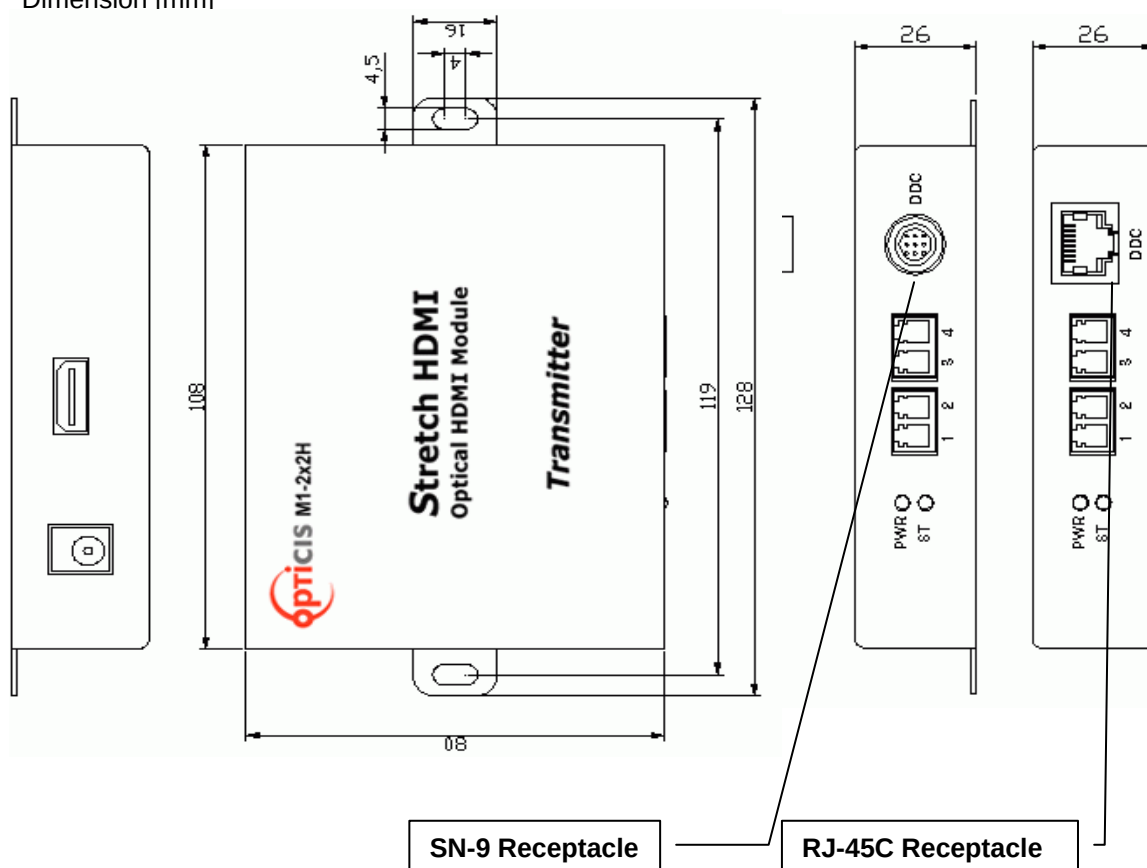
The laser diodes work only when +5V voltage should be supplied into the 18-pin in HDMI connectors, that is, detecting plugging the HDMI plug to the DVD or other video source. The voltage passing through a regulator from the +5V power or external power has LD drive circuit work.

- Signal Detect Mode in Receiver Module

It offers squelch function blocking output signals when optical input power is lower than as specified in a certain case, that is, detecting losing the LC fiber-optic patch cord.

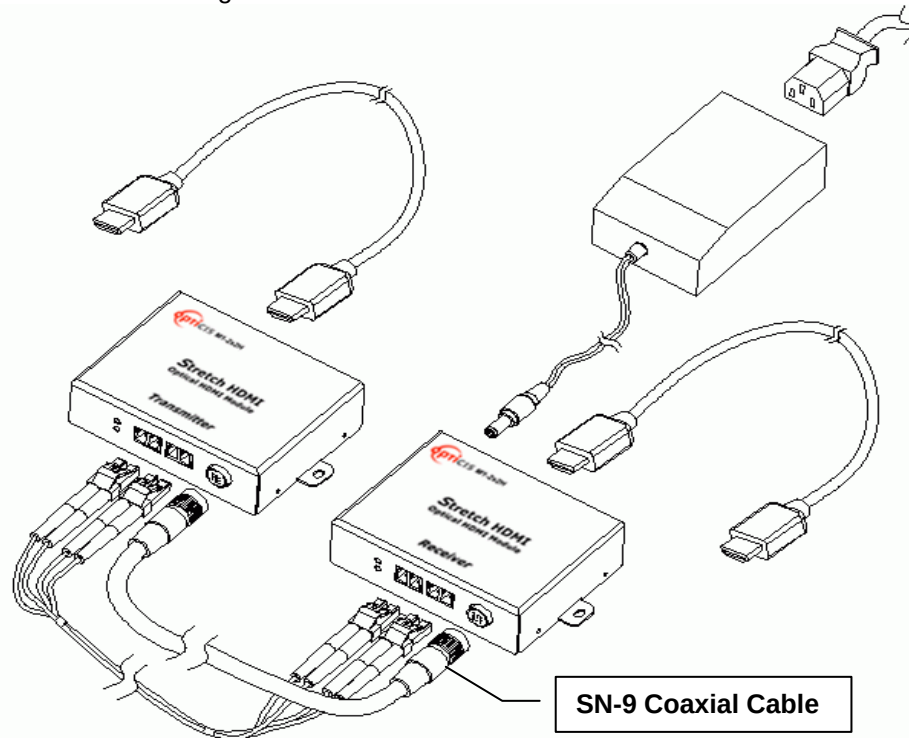
Drawing of Modules

Dimension [mm]

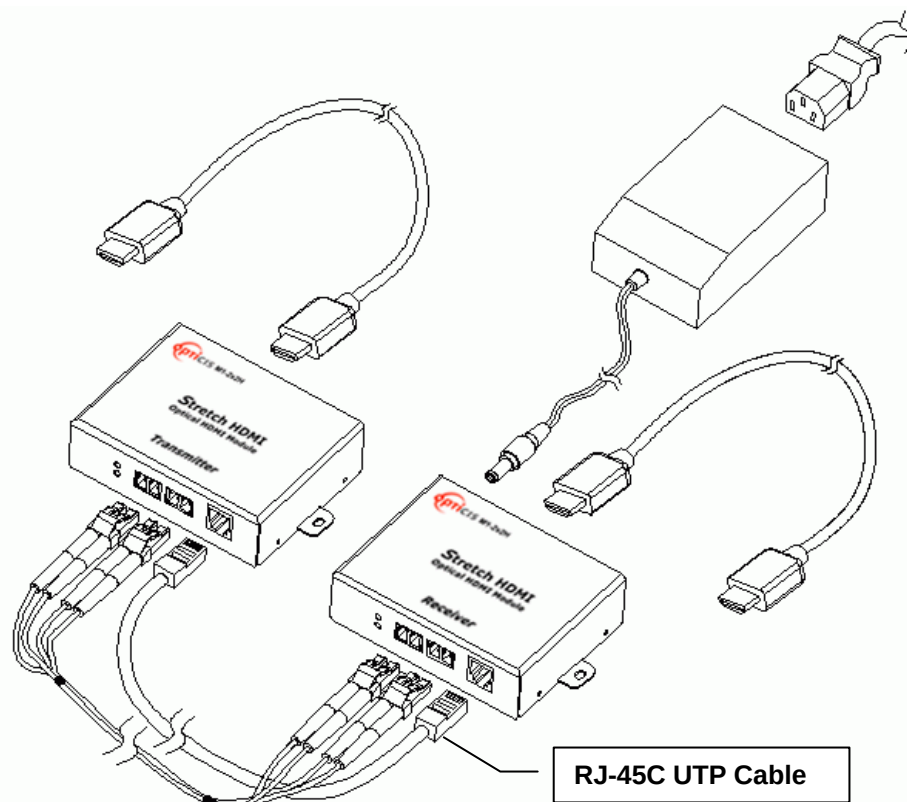


Drawing of Cable Connections

1) M1-2S2H-TR: using SN-9 Connector Coaxial cable for DDC



2) M1-2R2H-TR: using RJ-45C Connector UTP cable for DDC

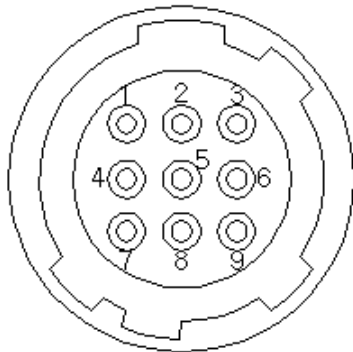


HDMI Pin Description

Pin	Symbol	Functional Description
1	CH2+	TMDS Data Signal Channel 2 Positive
2	CH2 Shield	TMDS Data Signal Channel 2 Shield
3	CH2-	TMDS Data Signal Channel Negative
4	CH1+	TMDS Data Signal Channel 1 Positive
5	CH1 Shield	TMDS Data Signal Channel 1 Shield
6	CH1-	TMDS Data Signal Channel 1 Negative
7	CH0+	TMDS Data Signal Channel 0 Positive
8	CH0 Shield	TMDS Data Signal Channel 0 Shield
9	CH0-	TMDS Data Signal Channel 0 Negative
10	CLK+	TMDS Clock Channel Positive
11	CLK Shield	TMDS Clock Channel Shield
12	CLK-	TMDS Clock Channel Negative
13	CEC	CEC protocol line
14	NC	Reserved
15	SCL	DDC Clock line for DDC/HDCP communication
16	SDA	DDC Data line for DDC/HDCP communication
17	DDC/CEC GND	DDC and CEC return ground line
18	5 V	5 V Input for Transmitter from DVD or Media Receiver
		5 V Output for Display from Receiver
19	Hot Plug Detect	Signal is driven by display to enable the system to identify the presence of a display

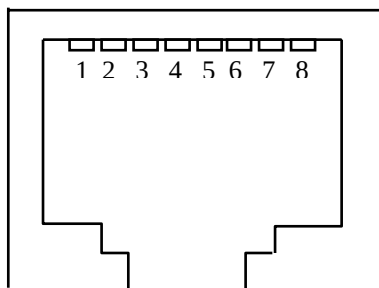
Pin Description for DDC Connector

1) SN-9 Connector



Pin	Symbol	Functional Description
1	DDC Data	DDC Data line for DDC2B communication
2	CEC	CEC line for CEC protocol
3	DDC Clock	DDC Clock line for DDC2B communication
4	GND	Ground
5	5V_IN	5V power (HDMI No. 18 pin for Monitor)
6	GND	Ground
7	Power	Main power for Opticis module
8	GND	Ground
9	HPD	Signal is driven by monitor to enable the system to identify the presence of a monitor

2) RJ-45C Connector



Pin	Symbol	Functional Description
1	GND	Ground
2	DDC Data	DDC Data line for DDC2B communication
3	GND	Ground
4	CEC	CEC line for CEC protocol
5	Power	Main power for Opticis module
6	DDC Clock	DDC Clock line for DDC2B communication
7	5V_IN	5V power (HDMI No. 18 pin for Monitor)
8	HPD	Signal is driven by monitor to enable the system to identify the presence of a monitor

Reliability Test

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

- 1) Mechanical test (Vibration, Shock)
- 2) Temp. & Humidity test
- 3) EMC test

Mechanical and Temp. & Humidity Test

Heading	Test	Conditions	Duration	Sample Size	Remarks
Operating Test	Operating at each Temperature (See Note)	-10~50 °C (Interval: 10 °C)	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 °C	96 HR	n=3	
	High Temperature	T _S = 60 °C	96 HR	n=3	
	High Humidity / High Temperature	T _S : 60 °C 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

INFORMATION TO THE USER

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.