

# DATA SHEET

## Optical DVI Modules

### M1-2xy-TR

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#### 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](http://www.opticis.com)

#### North American Office

Opticis North America Inc.

330 Richmond Street, Suite 100,  
Chatham, Ontario  
CANADA N7M 1P7  
Tel : (519) 355-0819  
Fax : (519) 355-0520

Email : [roger@opticis.com](mailto:roger@opticis.com)

# Optical DVI Module

## - DVI Fiber Detachable Connection System -

### Description

The M1-2xy-TR DVI Module is a new member of the Opticis family of products that stretches your DVI/HDMI connectivity. The M1-2R2-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 DVI-D (Digital Visual Interface) plugs, being able to connect PCs or Media Receivers and displays by DVI-D copper cables respectively. LC patch cords fiber-optic cable enables to transmit graphic data and coaxial copper cable with RJ-45C plugs 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.

As an option, the extension system offers only two duplex LC patch cord fiber cable up to 500m, instead of using the DDC cables, with **virtual DDC**, a unique Opticis feature that allows the EDID parameters factory programmed inside the transmitter housing, to be sent to the video card at start-up, instead of using DDC cable.

The shipping group is shown as follows;

- 1) One transmitter converting electrical to optical signals, model name: M1-2xy-T
- 2) One receiver converting optical to electrical signals, model name: M1-2xy-R
- 3) DVI copper cables: 2 X M1-DVCO-010 (1.0m)
- 4) AC power Adapter: M1-2D12PW
- 5) Copper cable for DDC (Option): M1-DDCRJ-xxx (RJ45-C Connector), where xxx stands for the cable length in meter up to 100m (330feet). 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;
  - M1-2R2-TR having DDC/HDCP interconnection over the coaxial cable: 100m (326feet).
  - M1-21y-TR using **vDDC** for VESA EDID parameter control programmed in the Tx housing: 500m (1,640feet).
- ◆ Comply with FDA/CDRH and IEC 60825-1 Class 1 Laser Eye Safety.
- ◆ Verified in Class A, the industry standard by FCC or CE.
- ◆ Support up to WUXGA resolution at 60Hz refresh rate with 1 pixel/clock mode.
- ◆ Comply with DVI 1.0 standard and DDC connection supports DDC2B mode.
- ◆ Adopts only an external power supply, +12V to supply both modules over DDC cable (only M1-2R2-TR). For M1-21y-TR model, not using any DDC cable, you might require an additional power, optionally.
- ◆ 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 DVI1.0)                              |
|            | 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 | 24 pin DVI-D plug                                               |
|            | DDC Electric Cables between Two Modules              | 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 <sub>CC</sub>   | + 10.0  | +16.0   | V     |
| Operating Temperature       | T <sub>op</sub>   | -10     | 50      | °C    |
| Operating Relative Humidity | RH <sub>op</sub>  | 5       | 80*     | %RH   |
| Storage Temperature         | T <sub>sto</sub>  | - 30    | + 60    | °C    |
| Storage Relative Humidity   | RH <sub>sto</sub> | 5       | 95*     | %RH   |

Note\*: Under the condition of No drops of dew

### - Operating Conditions

#### Transmitter module : M1-2xy-T

|                             | Parameter                             | Symbol                               | Minimum                 | Typical          | Maximum                 | Units             |
|-----------------------------|---------------------------------------|--------------------------------------|-------------------------|------------------|-------------------------|-------------------|
| Power Supply                | Supply Adaptor Voltage                | AV <sub>CC</sub>                     | 11.4                    | 12               | 12.6                    | V                 |
|                             | Supply Voltage                        | V <sub>CC</sub>                      | 11.4                    | 12               | 12.6                    | V                 |
|                             | Supply Current                        | I <sub>TCC</sub>                     | -                       | 200              | 250                     | mA                |
|                             | Power Dissipation                     | P <sub>TX</sub>                      |                         | 2.4              | 3.15                    | W                 |
|                             | Power Supply Rejection (Note1)        | PSR                                  |                         | 50               |                         | mV <sub>p-p</sub> |
| TMDS                        | Data Output Load                      | R <sub>LD</sub>                      |                         | 50               |                         | Ω                 |
|                             | Graphic Supply Voltage (Note2)        | GV <sub>CC</sub>                     | + 3.1                   | + 3.3            | + 3.5                   | V                 |
|                             | Single-Ended High Level Input Voltage | GV <sub>IH</sub>                     | GV <sub>CC</sub> - 0.01 | GV <sub>CC</sub> | GV <sub>CC</sub> + 0.01 | V                 |
|                             | Single-Ended Low Level Input Voltage  | GV <sub>IL</sub>                     | GV <sub>CC</sub> - 0.6  | -                | GV <sub>CC</sub> - 0.4  | V                 |
|                             | Single-Ended Input Swing Voltage      | GV <sub>ISWING</sub>                 | 0.2                     | -                | 0.8                     | V                 |
| Optical Link (Notes)        | Output Optical Power                  | P <sub>o</sub>                       | -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 <sub>rise</sub> /T <sub>fall</sub> |                         |                  | 260                     | ps                |
| Jitter in p-p value (Note5) | T <sub>jitter</sub>                   |                                      |                         | 290              | ps                      |                   |

Note1. Tested with a 50mV<sub>p-p</sub> sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V<sub>CC</sub> 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: M1-2xy-R**

|                      | Parameter                                 | Symbol               | Minimum | Typical | Maximum | Units             |
|----------------------|-------------------------------------------|----------------------|---------|---------|---------|-------------------|
| Power Supply         | Supply Adaptor Voltage                    | AV <sub>CC</sub>     | 11.4    | 12      | 12.6    | V                 |
|                      | Supply Voltage                            | V <sub>CC</sub>      | 11.4    | 12      | 12.6    | V                 |
|                      | Supply Current                            | I <sub>RCC</sub>     | -       | 300     | 350     | mA                |
|                      | Power Dissipation                         | P <sub>RX</sub>      | -       | 3.6     | 4.41    | W                 |
|                      | Power Supply Rejection (Note6)            | PSR                  |         | 50      |         | mV <sub>p-p</sub> |
| TMDS                 | Data Input Load                           | R <sub>LD</sub>      |         | 50      |         | Ω                 |
|                      | Graphic Supply Voltage (Note7)            | GV <sub>CC</sub>     | + 3.1   | + 3.3   | + 3.5   | V                 |
|                      | Single-Ended Output Swing Voltage (Note8) | GV <sub>ISWING</sub> | 0.4     | -       | 0.8     | V                 |
| Optical Link (Note9) | Receiving Optical Power                   | P <sub>O</sub>       | -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                         | P <sub>bgt</sub>     | 10.5    |         |         | dB                |
|                      | Total Jitter (note 10)                    | TR <sub>jitter</sub> |         |         | 309     | ps                |

- Note6. Tested with a 50mV<sub>p-p</sub> sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V<sub>CC</sub> 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 WUXGA 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

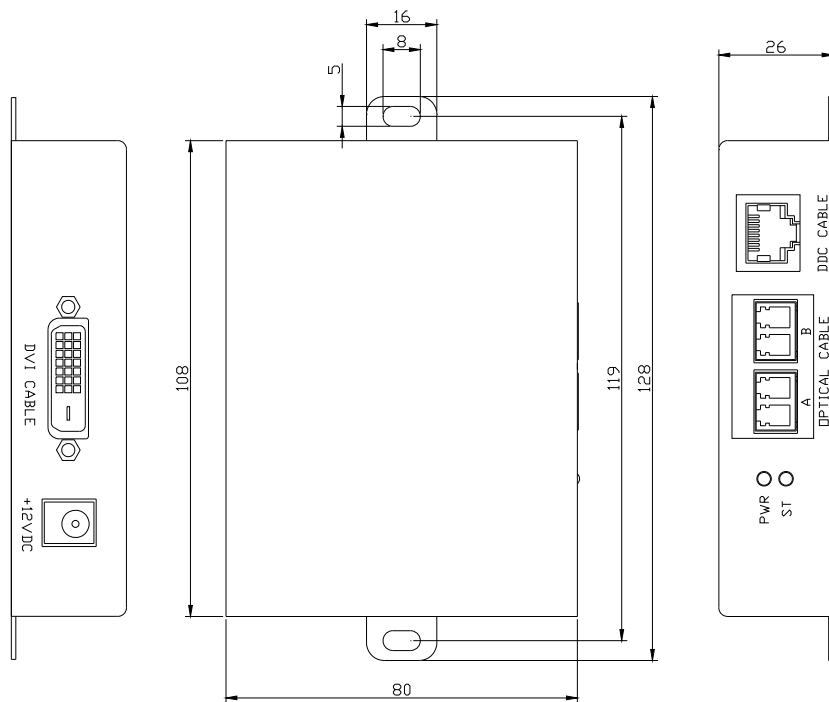
The laser diodes work only when +5V voltage should be supplied into the 14-pin in DVI connectors, that is, detecting plugging the DVI plug to the PC. The voltage passing through a regulator from the +5V PC power or external power has LD drive circuit work.

### - 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.

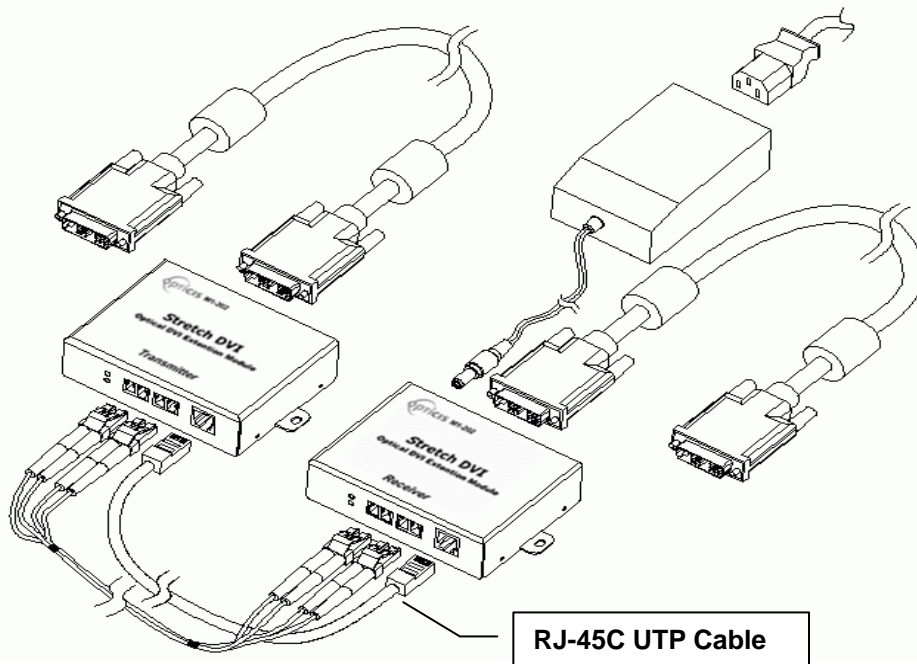
## Drawing of Modules

Dimension [mm]



Note: The transmitter, M1-2xy-T and the receiver, M1-2xy-R have the same mechanical dimensions.

## Drawing of Cable Connections



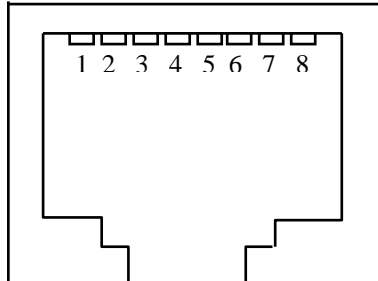
## DVI Pin Description

| 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 2/4 Shield                                                    |
| 4   | CH4-            | TMDS Data Signal Channel 4 Negative                                                    |
| 5   | CH4+            | TMDS Data Signal Channel 4 Positive                                                    |
| 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 1/3 Shield                                                    |
| 12  | CH3-            | TMDS Data Signal Channel 3 Negative                                                    |
| 13  | CH3+            | TMDS Data Signal Channel 3 Positive                                                    |
| 14  | 5 V             | 5 V Input for Transmitter from Host<br>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 0/5 Shield                                                    |
| 20  | CH5-            | TMDS Data Signal Channel 5 Negative                                                    |
| 21  | CH5+            | TMDS Data Signal Channel 5 Positive                                                    |
| 22  | GND             | TMDS Clock Signal Shield                                                               |
| 23  | CLK-            | TMDS Clock Channel Negative                                                            |
| 24  | CLK+            | TMDS Clock Channel Positive                                                            |



## Pin Description for DDC Connector

### RJ-45C Connector



| Pin | Symbol               | Functional Description                                                                 |
|-----|----------------------|----------------------------------------------------------------------------------------|
| 1   | <b>DDC Data GND</b>  | DDC Data line return ground                                                            |
| 2   | <b>DDC Data</b>      | DDC Data line for DDC2B communication                                                  |
| 3   | <b>DDC Clock GND</b> | DDC Clock line return ground                                                           |
| 4   | <b>Power GND</b>     | Main power return ground                                                               |
| 5   | <b>Power</b>         | Main power for Opticis module                                                          |
| 6   | <b>DDC Clock</b>     | DDC Clock line for DDC2B communication                                                 |
| 7   | <b>5V_IN</b>         | DVI 5V (DVI No. 14 pin for Monitor)                                                    |
| 8   | <b>HPD</b>           | 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 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) | -10~50°C (Interval: 10°C)                                                              | 30 Min<br>(Each Temperature) | n=3         | <b>Note:</b> Evaluate display quality of Laser Beam Projector connected to Graphic Signal Generator (Quantum Data: GD-802B) at each temperature.<br>1. T <sub>S</sub> : Storage Temperature<br>2. RH: Relative Humidity |
| Storage Test    | Low Temperature                          | T <sub>S</sub> = -30°C                                                                 | 96 HR                        | n=3         |                                                                                                                                                                                                                         |
|                 | High Temperature                         | T <sub>S</sub> = 60°C                                                                  | 96 HR                        | n=3         |                                                                                                                                                                                                                         |
|                 | High Humidity / High Temperature         | T <sub>S</sub> : 60°C<br>RH: 85%                                                       | 96 HR                        | n=3         |                                                                                                                                                                                                                         |
| Mechanical Test | Mechanical Shock                         | Pulse: 11 ms<br>Peak level: 30 g<br>Shock pulse:<br>6times/Axis                        | -                            | n=3         |                                                                                                                                                                                                                         |
|                 | Mechanical Vibration                     | Peak acceleration: 5 g<br>Frequency: 10~55 Hz<br>Sweep time: 5 Minutes<br>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)<br><b>FCC; PART 15 SUBPART B</b> | CE (Conducted Emission) &<br>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<br>(Air: 8kv, Contact: 4kv)  | Meet Criterion A or B        |
| EN 61 000-4-3:1996  | Radiated RF E-Field (80~1000 MHz)<br>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)<br>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 |