

# DATA SHEET

## Optical Graphic Extension Module-Fibres Detachable

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#### Optolinks

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# Optical Graphic Extension Module

- Fibres Detachable -

## Description

Optical graphic extension module consists of transmitter module and receiver module, each of which has 4 LC connectors and a 20-pins DVI-D plug. Users could decide extension length at their discretion by choosing the length of fibre-optic cables with LC ferrules at the ends. It offers graphic TMDS signals to be extensible up to the limits of modal bandwidth of selected multi-mode glass fibers, or, 50/125 um or 62.5/125um.

A transmitter, 4 VCSEL array inside and a receiver, 4 Pin-PDs array inside has a capability to transmit WUXGA (1920X1200) graphic signals with 60Hz refresh rate. At such data bandwidth, this module can extend up to 1,640 feet (500 meters) much over the limits of copper wire extension, without any distribution amplifier or repeater.

The EDID in a display can be read and restored by just plugging it to the display. This self-EDID programming feature makes the installation of M1-201SA more easy and flexible at any variable resolution display systems.

The modules are constituted of three parts as follows;

- One transmitter converting electrical to optical signals, model name: M1-201SA-T
- One receiver converting optical to electrical signals, model name: M1-201SA-R
- Two AC Adaptors to 110V-240V with DC 5V 1A outlet

## Features

- ◆ Extends all VESA resolution up to WUXGA (1920 X 1200) 60Hz DVI data up to 500 meters (1,640 feet)
- ◆ Detachable feature with a pair of duplex LC **multi-mode** fibers
- ◆ Offers self-EDID programming feature, detecting from a display and restoring to an EEPROM in the transmitter just by plugging to the display without any physical DDC connection
- ◆ The modules are compact enough to directly plug to graphic sources and displays by adopting DVI-plugs
- ◆ Includes two (2) +5V DC power adapters for the transmitter and receiver
- ◆ Complies with Class 1 Laser eye safety in compliance with FDA/CDRH and IEC 60825-1
- ◆ Data security with negligible RFI/EMI emissions and loss of video quality due to no copper conductor present
- ◆ Certifications: UL/EN 60601-1, 60601-1-2:1994, CE / FCC, Class 1 Laser Eye Safety

## Applications

- ◆ Digital FPDs, PDPs and projectors for medical appliances, aero, traffic control, factory, 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 stadium

## 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. 1.65Gbps   |
|            | Total Jitter at the end of Rx output                 | Max. 309 ps   |
|            | Skew inter-channels                                  | Max. 6ns  |
| Optical    | Link Power Budget                                    | Min 10.5dB  |
| Mechanical | Module dimension (mm)                                | 38WX19HX72L   |
| Connect    | Optical Connector                                    | 2 Duplex LC connectors  |
|            | Electric Connector Type from Systems and to Displays | 24 pin DVI-D plug   |
|            | Recommended Fiber                                    | 50/125 um Multi-mode Glass Fiber                                |

### - Absolute Maximum Ratings

| Parameter                 | Symbol          | Minimum | Maximum | Units |
|---------------------------|-----------------|---------|---------|-------|
| Supply Voltage            | V <sub>CC</sub> | - 0.3   | + 6.0   | V     |
| Operating Temperature     | T <sub>op</sub> | 0       | 50      | °C    |
| Storage Temperature       | T <sub>s</sub>  | - 30    | + 70    | °C    |
| Storage Relative Humidity | H <sub>s</sub>  | 10      | 95      | %RH   |

- **Operating Conditions**  
**Transmitter module (E-to-O converter): M1-201SA-T**

|                      | Parameter                             | Symbol                               | Minimum                 | Typical          | Maximum                 | Units             |
|----------------------|---------------------------------------|--------------------------------------|-------------------------|------------------|-------------------------|-------------------|
| Power Supply         | Supply Voltage                        | V <sub>CC</sub>                      | 4.5                     | 5.0              | 5.5                     | V                 |
|                      | Supply Current                        | I <sub>TCC</sub>                     | 130                     | 160              | 200                     | mA                |
|                      | Power Dissipation                     | P <sub>TX</sub>                      | 0.585                   | 0.8              | 1.045                   | 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>                 | 0.4                     | -                | 0.6                     | V                 |
| Optical Link (Note3) | 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             |
|                      | Rising/Falling Time                   | T <sub>rise</sub> /T <sub>fall</sub> |                         |                  | 260                     | ps                |
|                      | Jitter in p-p value (Note5)           | T <sub>jitter</sub>                  |                         |                  | 270                     | 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 (O-to-E converter): M1-201SA-R**

|                      | Parameter                                 | Symbol               | Minimum | Typical | Maximum | Units             |
|----------------------|---|----------------------|---------|---------|---------|-------------------|
| Power Supply         | Supply Voltage                            | V <sub>CC</sub>      | 4.5     | 5.0     | 5.5     | V                 |
|                      | Supply Current                            | I <sub>RCC</sub>     | 350     | 360     | 380     | mA                |
|                      | Power Dissipation                         | P <sub>RX</sub>      | 1.575   | 1.8     | 2.09    | 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> | 0.2     | -       | 0.4     | 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 UXGA 60Hz.

## - Recommended Specifications of Fibre-Optic Cables

| Parameters                | Conditions                            | Specifications                               |
|---------------------------|---------------------------------------|--|
| Fibre Type                |                                       | 50/125µm Multi-mode Graded Index Glass Fibre |
| Modal Bandwidth           | $\lambda = 850\text{nm}$              | Min. 400 MHz km                              |
| Fiber Cable Attenuation   | $\lambda = 850\text{nm}$              | Max. 3.5dB/km                                |
| Extension Distance        |                                       | 10 – 1650ft (500 meter)                      |
| 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

### - Self-EDID Function

The EDID in a display can be read and restored by just plugging it to the display. This self-EDID programming feature makes the installation of M1-201SA more easy and flexile at any variable resolution display systems.

### - Power Save Mode in Transmitter Module

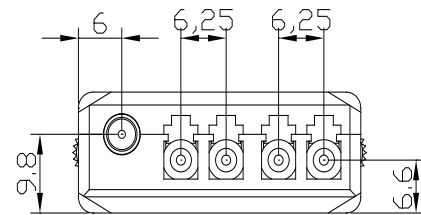
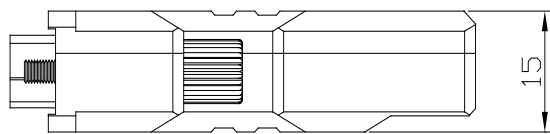
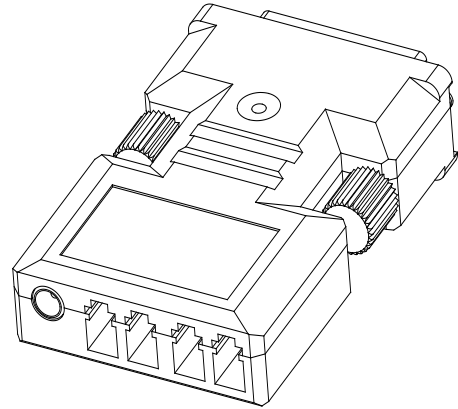
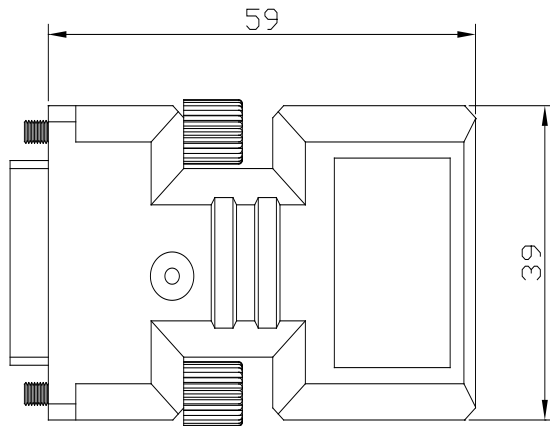
The laser diodes are lit only when +5V voltage should be supplied into the 14-pin in DVI connectors. The voltage passing through a regulator has LD drive circuit work.

### - 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, for instance, loosing optical connectors.

## Drawing

Dimension [mm]

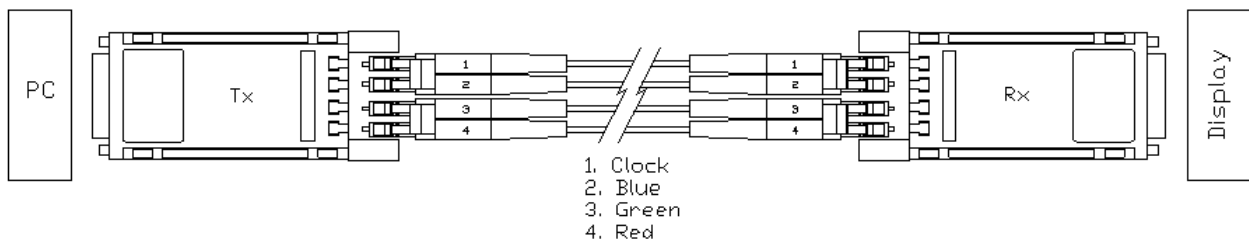
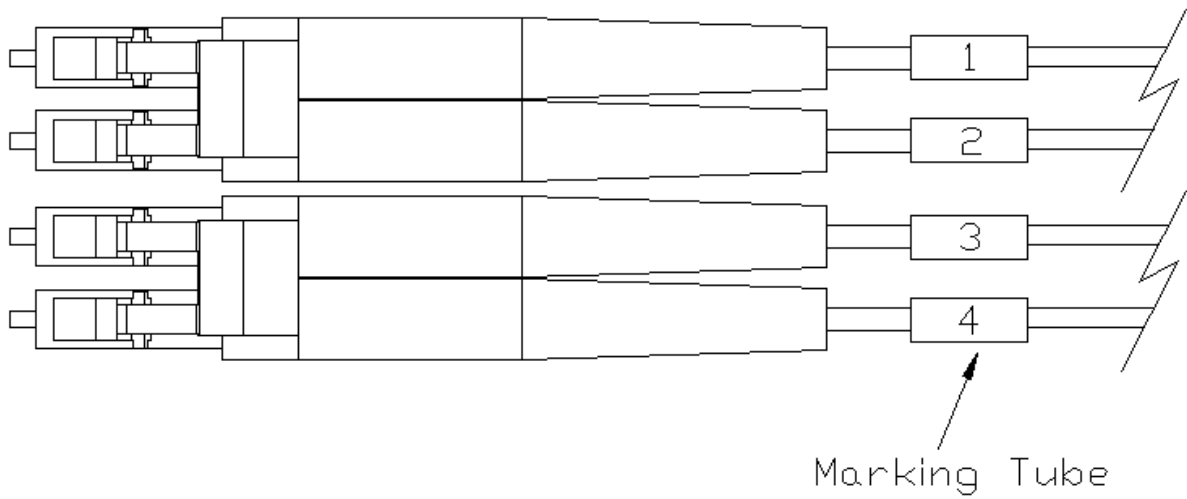
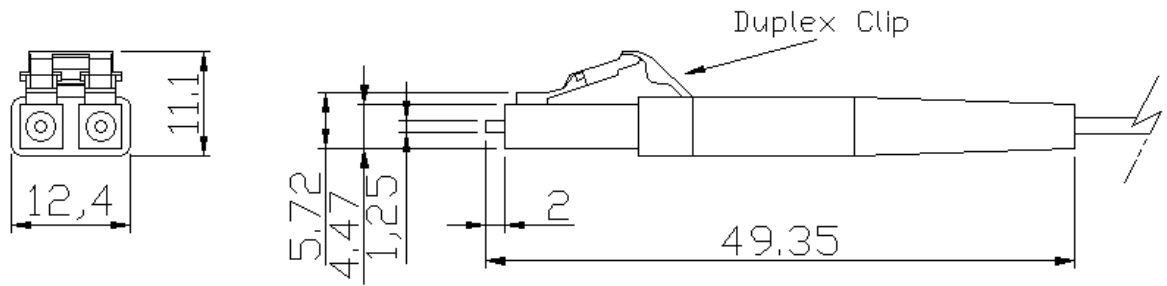
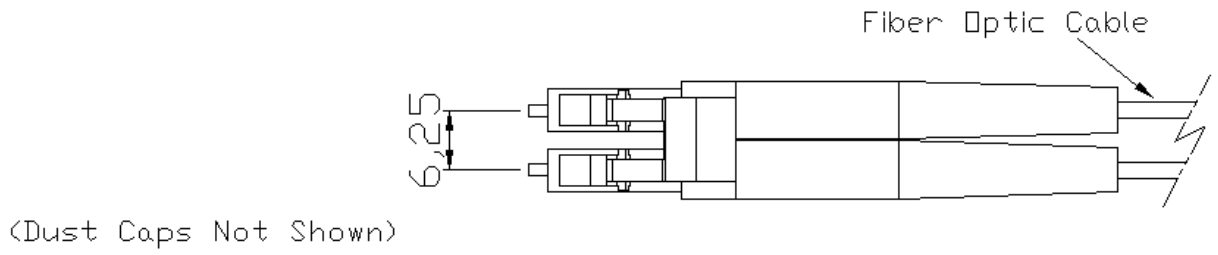


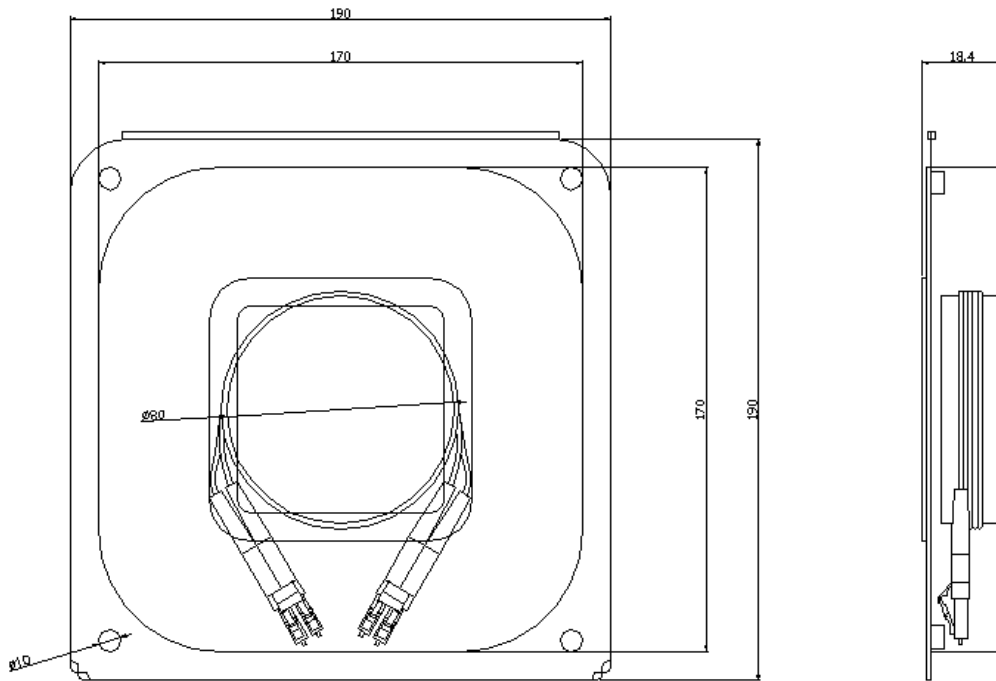
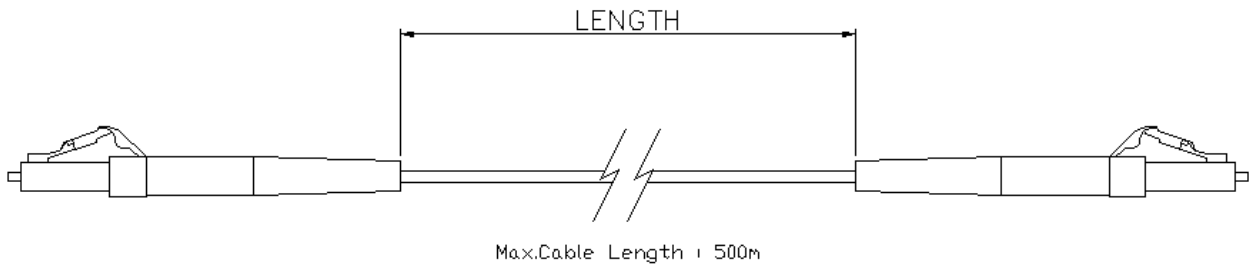
Note: The transmitter, M1-201SA-T and the receiver, M1-201SA-R have the same mechanical dimensions.

## Fiber Connection

The diagram shows the connection of transmitter (Tx; plug in PCs) and receiver (Rx; plug in displays) modules by using 2 dual LC patch cords fibers or 4 separate LC patch cord fibers.

Warning; two dual LC patch cords made by some manufacturers could not fit in together since width of their plastic couplers are too wide to plug in M1-201-TR's LC receptacles. We recommend it to be 12.40 mm (not over 13.0mm).





Packaging Tray



## 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             | Main Power Input for Transmitter from Host <sup>(Note10)</sup>                         |
|     |                 | 5 V Output for Receiver to monitor   |
| 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 Positive  |
| 24  | CLK-            | TMDS Clock Channel Negative  |

Note10) The AC-to-DC adapter for transmitter is option for Desk Top PC user.  
But Note PC user has to use the AC-to-DC adapter because the power of Note PC is not enough to drive M1-201SA transmitter.

## 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 Verification and CE Documentation*)

### Mechanical and Temperature & Humidity Test Data

| Heading                | Test                              | Conditions   | Duration                     | Sample Size | Failure | Remarks  |
|------------------------|-----------------------------------|--|------------------------------|-------------|---------|--|
| <i>Operating Test</i>  | Operating at each Temperature     | * 0 ~ 50 °C<br>(Interval: 10 °C)   | 30 Min<br>(Each Temperature) | n =11       | 0       | Note: Visual Test on the Display<br>Pixel Error Rate |
|                        | High Temperature                  | * T <sub>O</sub> = 70 °C   | 240 HR                       | n = 10      | 0       | Note: Visual Test on the Display                     |
| <i>Storage Test</i>    | Low Temperature                   | * T <sub>S</sub> = -30 °C  | 96 HR                        | n=2         | 0       | 1. TS: Storage Temperature                           |
|                        | High Temperature                  | * T <sub>S</sub> = 90 °C   | 96 HR                        | n=2         | 0       | 2. RH: Relative Humidity                             |
|                        | High Humidity<br>High Temperature | * T <sub>S</sub> : 85 °C<br>* RH: 85%  | 96 HR                        | n=6         | 0       |  |
| <i>Mechanical Test</i> | Mechanical Shock                  | * Pulse: 11 ms<br>* Peak level: 30 g<br>* Shock pulse: 3 times/Axis                                | -                            | n=2         | 0       |  |
|                        | Mechanical Vibration              | * Peak acceleration: 20 g<br>* Frequency: 20~2000 Hz<br>* Sweep time: 30 Minutes<br>* 4 Times/Axis | -                            | n=2         | 0       |  |

**EMC Test Data**

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

| STANDARDS                                     |   | CONDITIONS   |
|---|---|--------------|
| EN 55 022 (CISPR22)<br>FCC; PART 15 SUBPART B | CE (Conducted Emission) &<br>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**

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

**Terminology**

- DDC Digital Display Channel. Latest specification is DDC2B.
- DVI-D Digital Visual Interface. Digital connection only – no analog.
- EDID Extended Display Identification Data. EDID parameters are sent over the DDC link.
- EMI Electro Magnetic Interference.
- EMS Electro Magnetic Susceptibility.
- HDCP High Definition Content Protection. These parameters are part of the 2002 High Definition Multimedia Interface (HDMI) specification for Consumer Electronics.
- PDP Plasma Display Panel. Large HDTV panels up to 63" use this display technology.
- RFI Radio Frequency Interference.
- TFT-LCD Thin Film Transistor Liquid Crystal Display – the technology of most computer display panels with VESA resolutions up to 1600x1200 pixels.
- TMDS Transmission Minimized Differential Signalling is the Silicon Image Inc. protocol for the digital signals.
- VCSEL Vertical Cavity Surface Emitting Laser transmitter diode. The receiver diode is the PIN-Photo Diode. These components are designed and manufactured by Opticis.
- VESA Video Electronics Standards Association.

## Revision History

| Version | date       | History   |
|---------|------------|---|
| 1.2     | 2013-09-03 | HQ Address updated  |
| 1.3     | 2015-01-02 | Feature updated. Storage Relative Humidity updated.       |
| 1.4     | 2015-02-10 | M1-201SA-T, Supply current and Power Dissipation updated. |
|         |            | Extinction Ratio removed.                                 |
| 1.5     | 2021-05-14 | Change in HQ address                                      |