

# DATA SHEET

## Optical Graphic Extension Module-Fibres Detachable

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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 UXGA (1600X1200) 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 modules are constituted of three parts as follows;

- One transmitter converting electrical to optical signals, model name: AP1-201-T
- One receiver converting optical to electrical signals, model name: AP1-201-R
- Two AC Adaptors to 110V-240V with DC 5V 600mA outlet

## Features

- ◆ Digital video signals at extended distances
  - Up to 500 meter (1640 feet) in use of multi-mode glass fiber with 400MHzkm modal bandwidth
  - Connect end modules with a pair of duplex LC connection fiber-optic cables
- ◆ Support up to UXGA resolution of 4 TMDS (Red/Green/Blue/Clock) with 1 pixel/clock mode
- ◆ Must use multi-mode glass fiber cables with LC connections
- ◆ Offer DVI-D plugs at the ends of systems and displays without DDC connections
- ◆ Small, Light, and Easy to connect
- ◆ Free from cable EMI/RFI

## 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 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. 1.65Gbps
	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
Input and Output Voltage	V <sub>in/out</sub>	- 0.3	V <sub>CC</sub>	V
Operating Temperature	T <sub>op</sub>	0	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 (E-to-O converter): AP1-201-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>	-	320	360	mA
	Power Dissipation	P <sub>TX</sub>		1.6	1.98	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 (Notes3)	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>			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): AP1-201-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>	-	280	320	mA
	Power Dissipation	P <sub>RX</sub>	-	1.4	1.76	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 SXGA 75Hz.

**- Recommended Specifications of Fibre-Optic Cables**

Parameters	Conditions	Specifications
Fibre Type		50/125µm Multi-mode Graded Index Glass Fibre
Modal Bandwidth	λ = 850nm	Min. 400 MHz km
Fiber Cable Attenuation	λ = 850nm	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**

**- 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.

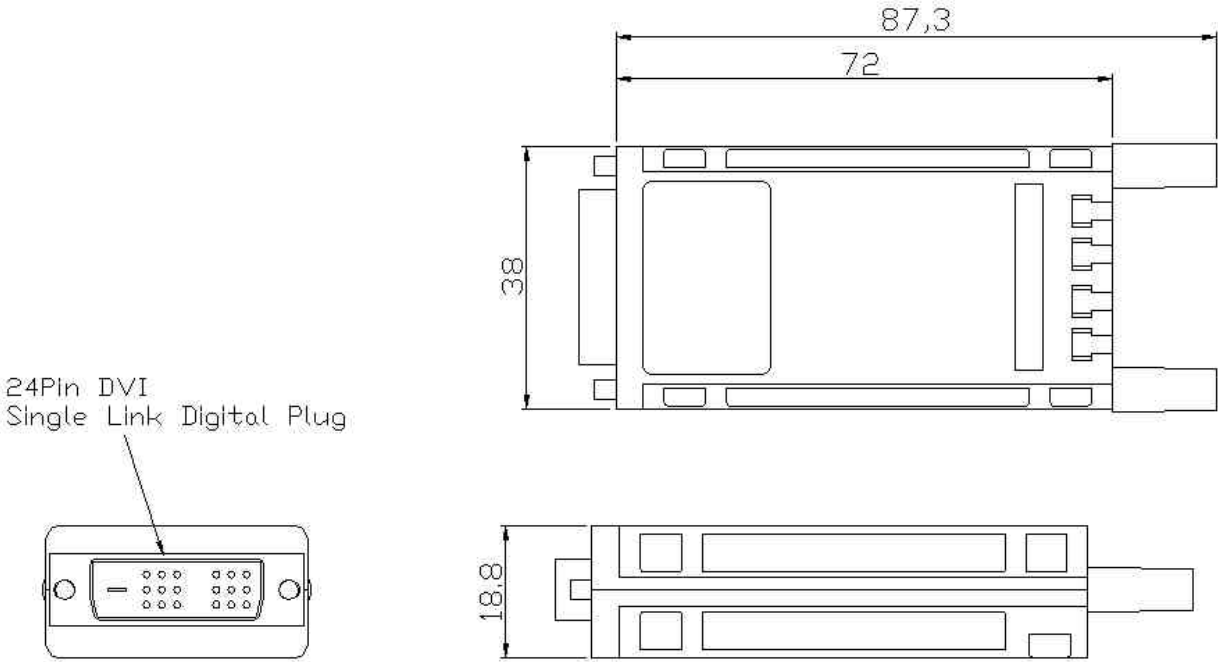
Alpha Point Ltd.

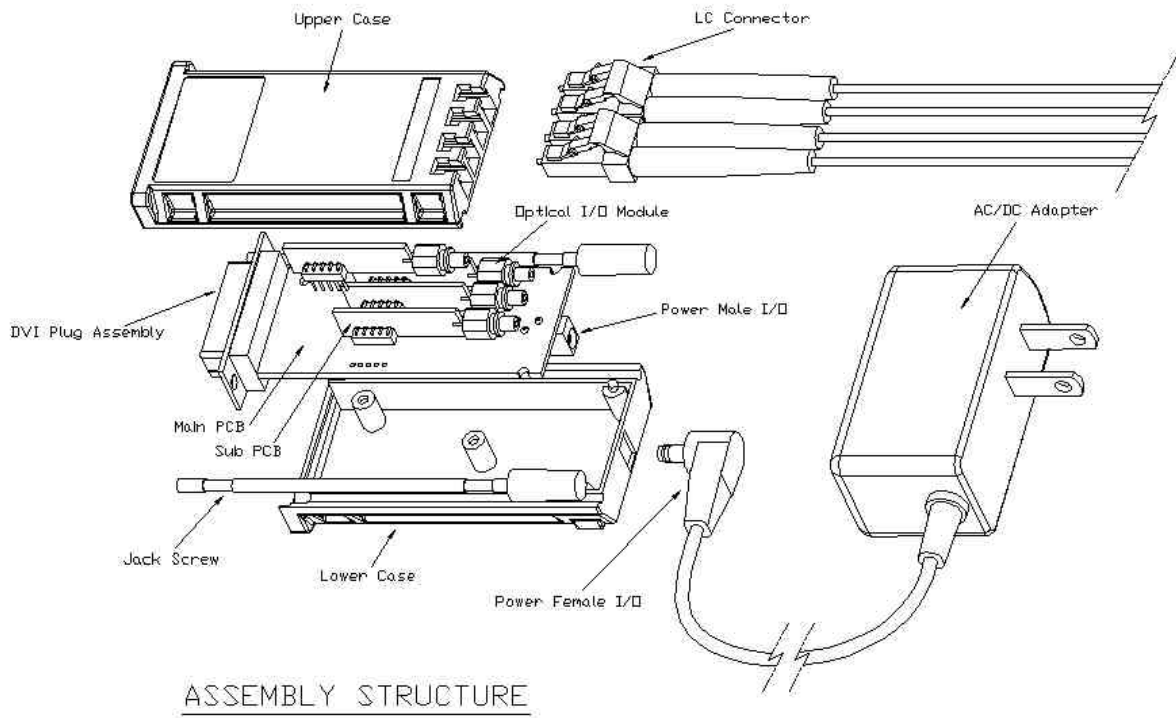
- **Signal Detect Mode in Receiver Module**

It offers squelch function blocking output signals when optical input power is lower than as specified in a certain case, for instance, losing optical connectors.

**Drawing**

Dimension [mm]





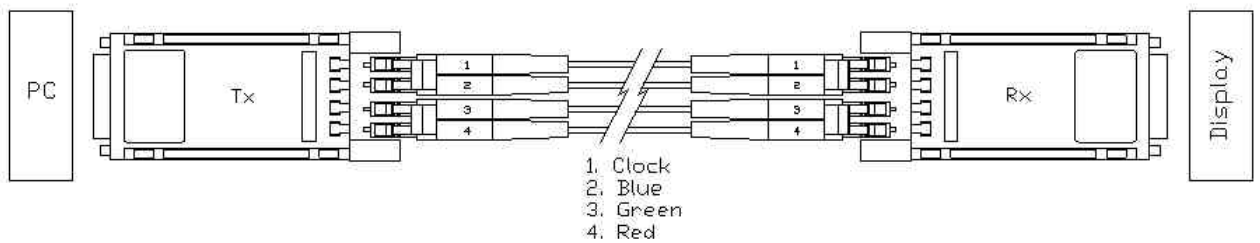
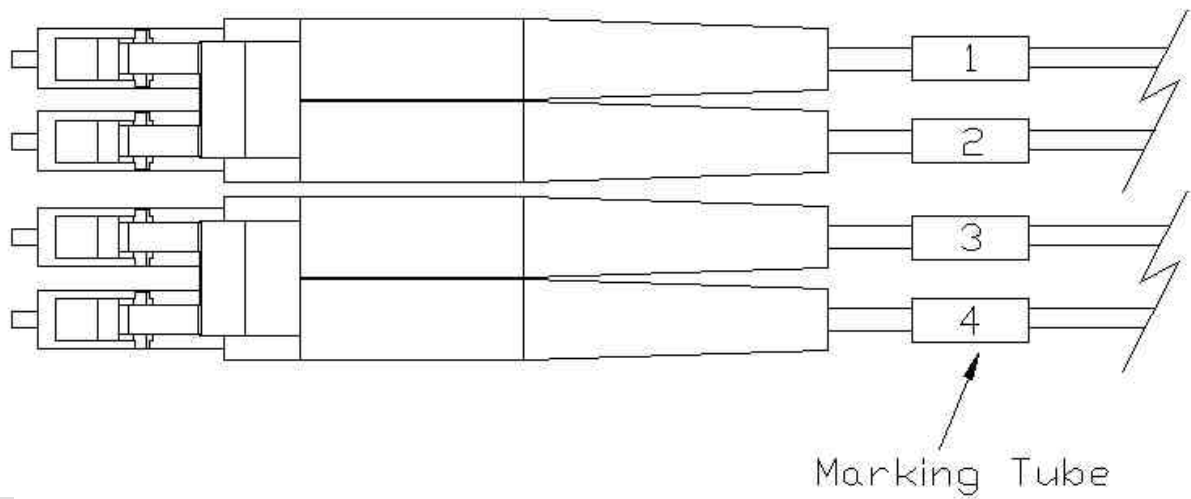
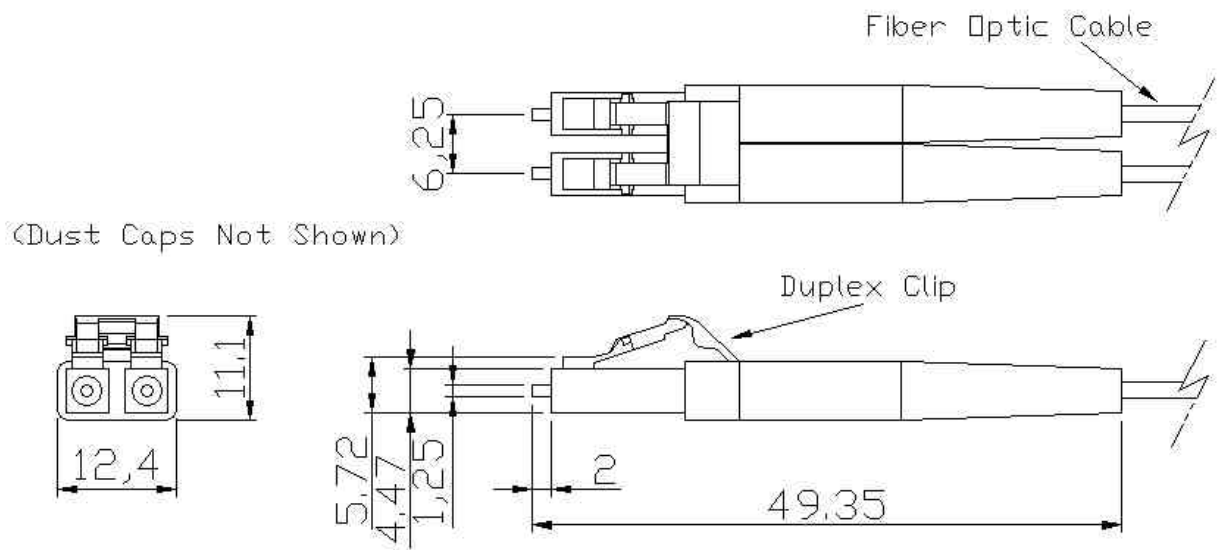
Note: The transmitter, AP1-201-T and the receiver, AP1-201-R have the same mechanical dimensions.

## Fiber Connection

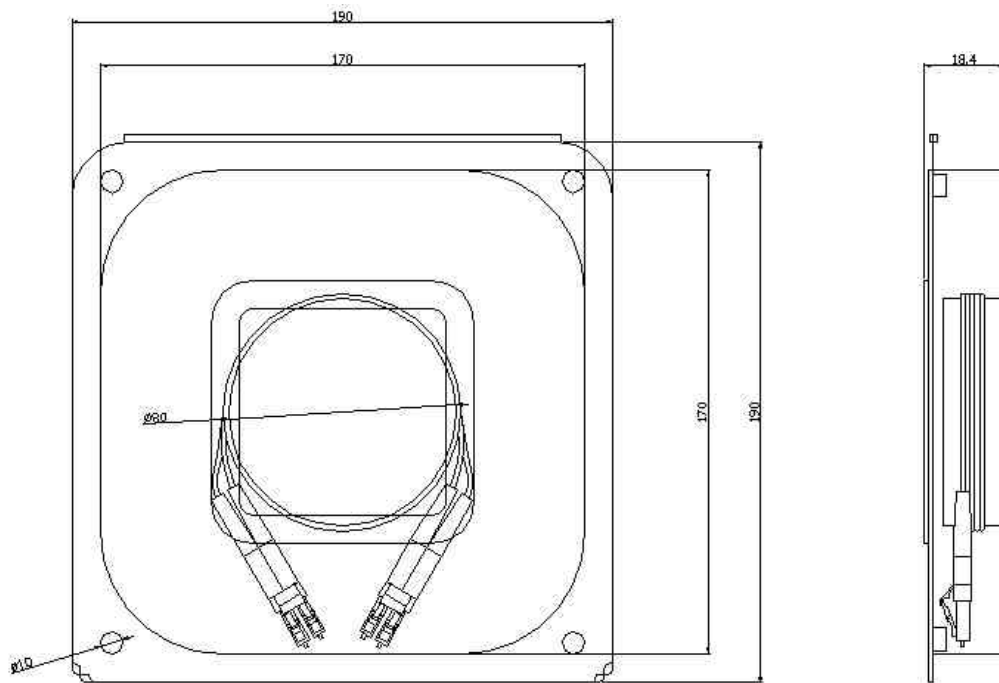
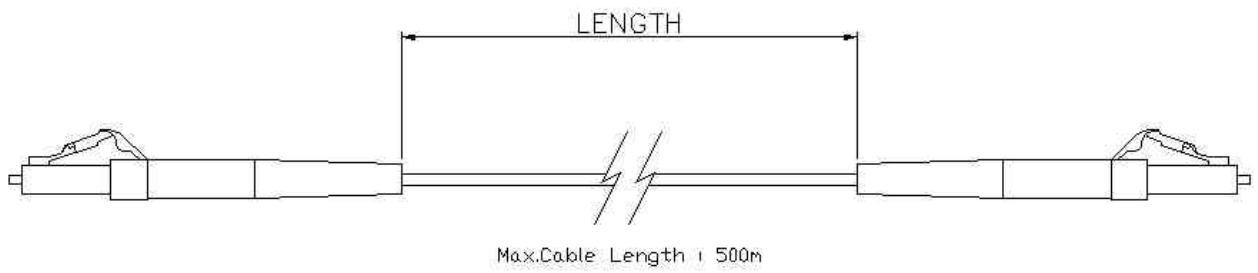
The diagram shows the connection of transmitter (Tx; plug in PCs) and receiver (Rx; plug in displays) modules by using 2 dual LC patch cords fibers or 4 separate LC patch cord fibers.

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 AP1-201TR's LC receptacles. We recommend it to be 12.40 mm (not over 13.0mm).









Packaging Tray

## Environmental Reliability

The AP1-201TR would be verified in the following environments such as temperatures, shock and vibration and EMI/EMC (to be certified by FCC class A).

Test items		Conditions	Standard	Evaluation
Temperature and Humidity	Storage	60°C and 90%RH; -10°C and 0%RH for 48Hr		Less than total jitter at the end of Rx 444ps after test
	Operation	60°C and 50%RH; -10°C and 0%RH		
Shock Vibration	Mechanical Shock	Pulse: 11 ms Peak level: 30g Shock pulse: 18 times	MIL-PRF-28800F	
	Vibration	Peak acceleration: 20g Frequency: 20~2000Hz	MIL-STD-883 Method 2007A	
EMI/EMC		Certified by FCC class A		

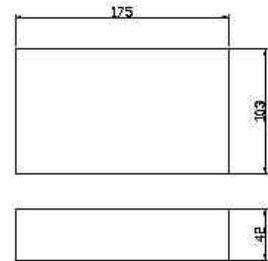
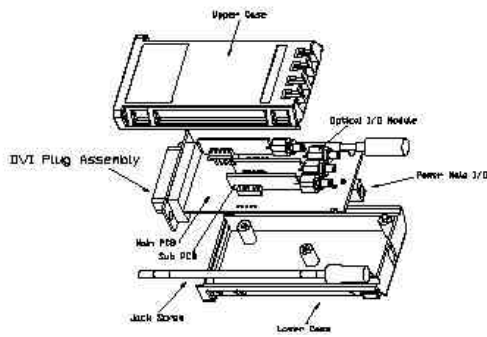
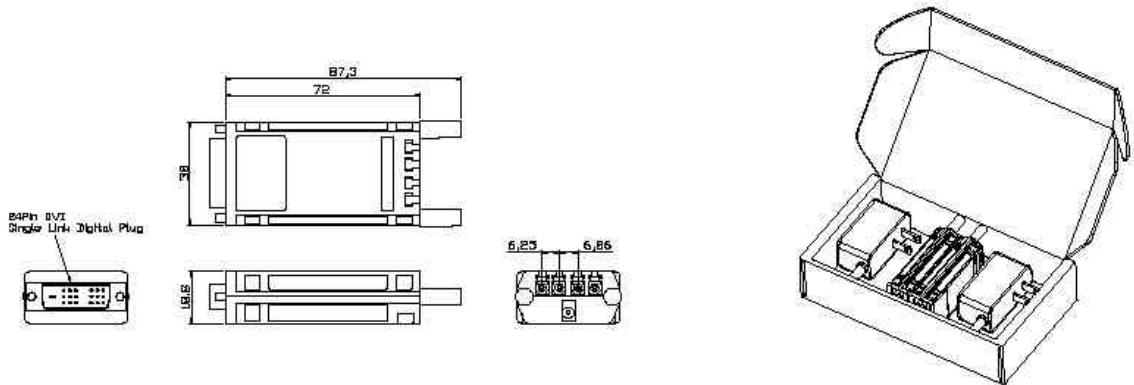
## DVI Pin Description

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	N.C.	DDC is not supported
7	N.C.	
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 Negative
24	CLK+	TMDS Clock Channel Positive

Note10) The AC-to-DC adapter for transmitter is option for Desk Top PC user.

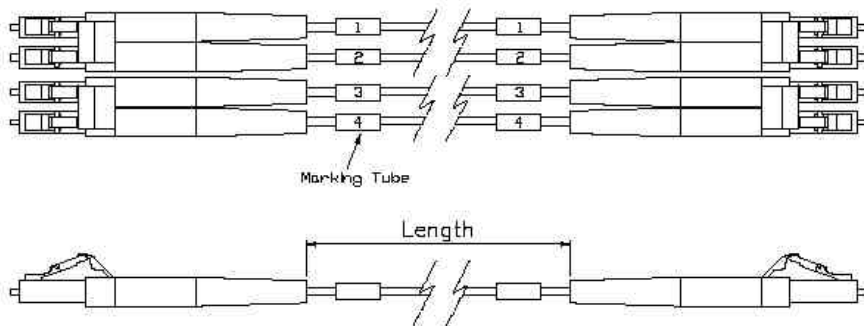
But Note PC user has to use the AC-to-DC adapter because the power of Note PC is not enough to drive AP1-201 transmitter.

# Schematic Diagram

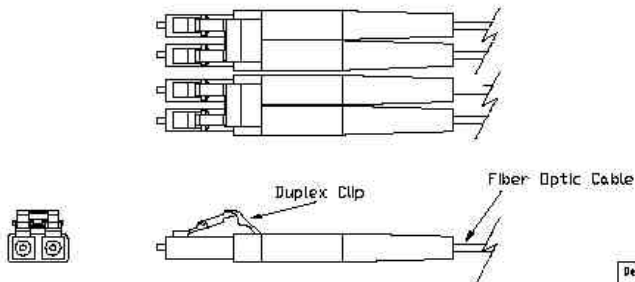


Packaging Box Dimension

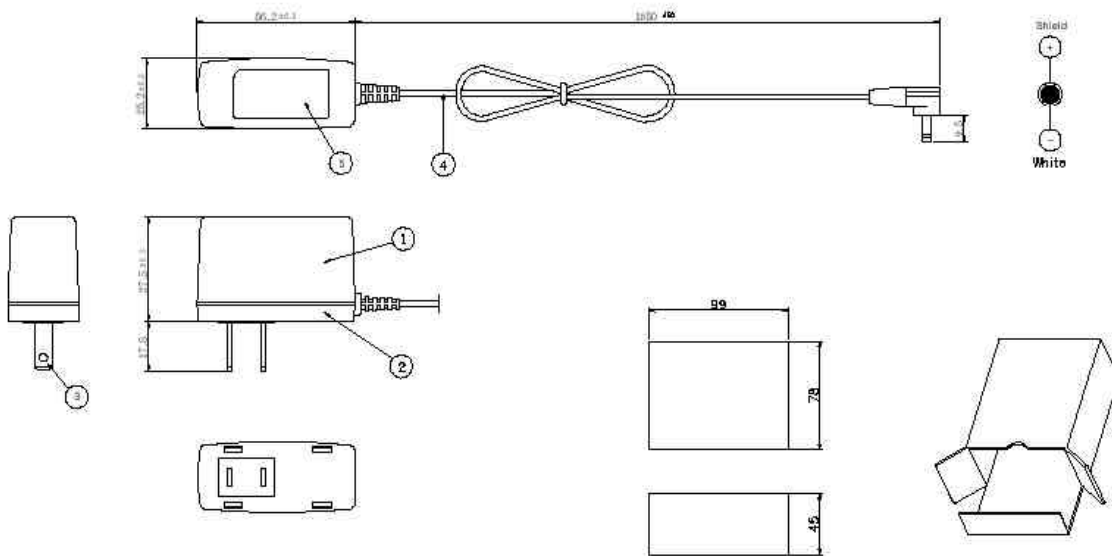
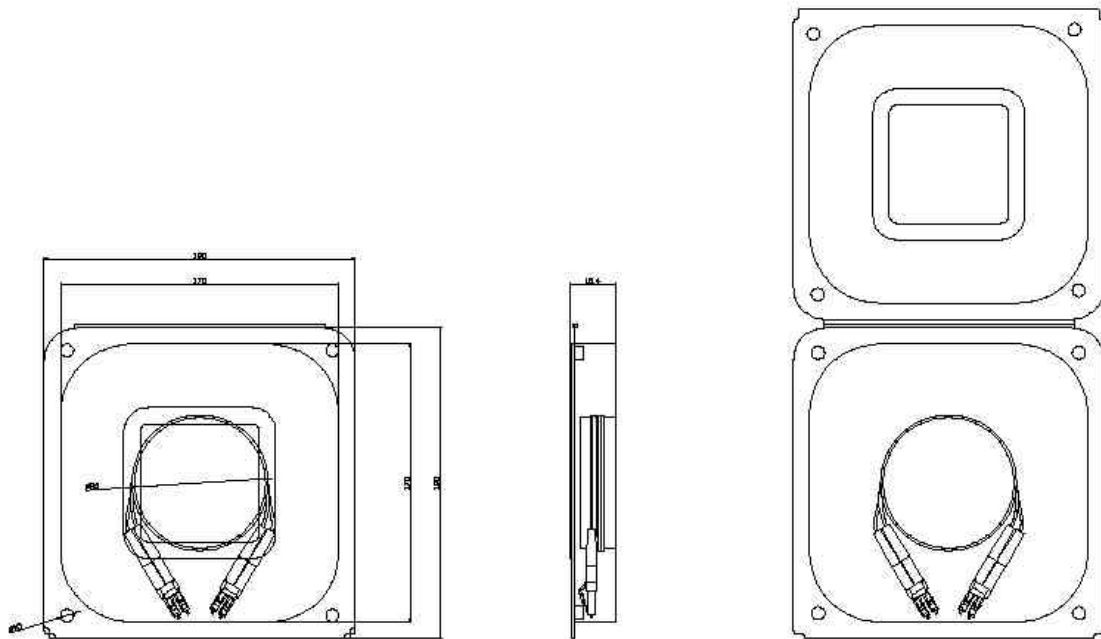
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Max.Cable Length : 500m

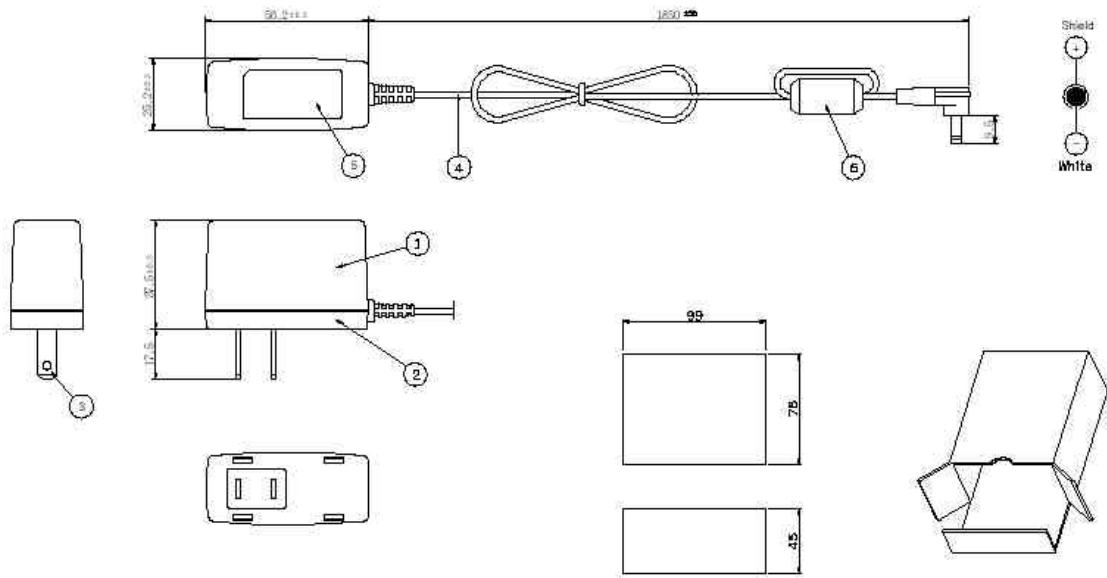


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No	Description	SPEC.
1	Case top	PC or PC/ABS
2	Case bottom	
3	AC plug terminal	US type
4	DC cord ASS'Y	ø1.4xø3.5x9.5
5	Label	Designation

Packaging Box Dimension



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5	Label	Designation
6	Beed	

Packaging Box Dimension

Designed by	Checked by	Approved by - date	UNIT	MM	Date	Scale

## Test Report for AP1-201-TR

### Introduction

#### 1. Features

- 1) Digital video signal distribution can be extended up to 500 meter (1640 feet) using multi-mode glass fiber with 400MHz/km modal bandwidth.
- 2) The two modules are connected with 4 fiber-optic cables with LC terminations
- 3) Supports up to UXGA resolution (1600 x 1200) at 60Hz refresh rate  
Standard DVI-D module connectors at the ends with no DDC2B support required
- 4) Cables can be installed in conduit with prior to module installation
- 5) Cables are light-weight, zero EMI/RFI emissions,
- 6) No software to install
- 7) Free from cable EMI/RFI

#### 2. Reliability of Modules

Opticis Optical Graphic Extension Module has a unique metallic light enclosure and verified optical fiber that make superior EMC characteristics and achieved good reliability test results.

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 verification, CE certification)

## Reliability Test & Analysis Methodology

### 1. Test

Heading	Test	Conditions	Duration	Sample Size	Failure	Remarks
Operating Test	Operating at each Temperature (See Note)	* -30~100 °C (Interval:10 °C)	30 Min (Each Temperature)	n =4	0	<b>Note</b> : Visual Test on the Display  1. TS : Storage Temperature 2. RH : Relative Humidity
Storage Test	Low Temperature	* T <sub>S</sub> = -30 °C	96 HR	n=2	0	
	High Temperature	* T <sub>S</sub> = 90 °C	96 HR	n=2	0	
	High Humidity High Temperature	* T <sub>S</sub> : 85 °C * RH : 85%	96 HR	n=2	0	
Mechanical Test	Mechanical Shock	* Pulse: 11 ms * Peak level : 30 g * Shock pulse : 3 times/Axis	-	n=2	0	
	Mechanical Vibration	* Peak acceleration: 20 g * Frequency:30~2000 ? * Sweep time: 30 Minutes * 4 Times/Axis	-	n=2	0	

### 2. Analysis

- 1) Failure base: DVI (Digital Visual Interface Revision 1.0)
- 2) Final qualification date: The 1<sup>st</sup> quarter of 2002

**EMC Test**

1. EMI: Processing in FCC class A and CE standards

2. EMS: Met CE standards

1) EMI

STANDARDS		RESULTS
EN 55 022/98 AND FCC PART 15 SUBPART B	CE (Conducted Emission) RE (Radiated Emission)	Met Class A / PASS
EN 61000-3-2	Harmonics	Met Class A / PASS
EN 61000-3-3	Flickers	Met Class A / PASS

2) EMS (Current Status)

STANDARDS		RESULTS
EN 61 000-4-2:1995	Electrostatic Discharge Immunity (Air: 8 KV, Contact: 1.3 KV)	Met Criterion A / PASS