



# User guide







# SYMBOLS

To ensure the safe and correct use of equipment, we use a range of symbols on the equipment and in the manuals. These symbols demonstrate the risk of physical harm or possible damage to property for the user or others and provide guidance on standards and disposal. Symbol indications and their meanings are as follows. Please ensure that you correctly understand these instructions before reading the manual and operating the equipment.

$\wedge$	WARNING. This symbol is used to indicate where important instructions are provided to ensure the correct operation of the equipment and user safety.
Â	To prevent fire or shock hazards, do not expose this equipment to rain or moisture. Also, do not use this equipment's polarized plug with an extension cord receptacle or other outlets unless the prongs can be fully inserted. Refrain from opening the cabinet as there are high voltage components inside. Please refer all servicing to qualified service personnel.
CAUTION DO NOT OPEN RISK OF ELECTRIC SHOCK	This symbol warns user that uninsulated voltage within the unit may have sufficient magnitude to cause an electric shock. Therefore, it is dangerous to make any kind of contact with any part inside this unit.
Wiffi	This is a WiFi product, which may cause or be susceptible to radio interference. Users may need to take additional measures to mitigate the interference.
*	This is a Bluetooth product, which may cause or be susceptible to radio interference. Users may need to take additional measures to mitigate the interference.
(((•)))	This is an RF Radio product, which may cause or be susceptible to radio interference. Users may need to take additional measures to mitigate the interference.
IR	This is an Infrared product, which may cause or be susceptible to frequency interference. Users may need to take additional measures to mitigate the interference.
<b>€HDB.T</b> <sup>™</sup>	This is a product which conforms to HDbaseT specification.
<b>HD</b> 1080p	This product supports full High Definition 1080p resolution.
	This product supports 4K Ultra High Definition resolution.
3D	This product supports 3D definition display.
CE	CE certification means that the product has reached the directive safety requirements defined by the European Union.
SGS	SGS certification means that the product has reached the quality inspection standards proposed by the world's largest quality standards body - SGS.
	This product has passed the ISO9001:2000 international quality certification
	EU-wide legislation, as implemented in each Member State, requires that waste electrical and electronic products carrying the mark (left) must be disposed of separately from normal household waste. This includes monitors and electrical accessories, such as signal cables or power cords. When you need to dispose of your equipment, please follow the guidance of your local authority, or ask the agent where you purchased the product. If you wish to dispose of used electrical and electronic products outside the European Union, please contact your local authority so as to comply with the correct disposal method.



In order to ensure the reliable performance of the equipment and the safety of the user, please observe the following matters during the process of installation, use and maintenance:

#### INSTALLATION

- Please do not use this product in the following places: places with high levels of dust or soot; places with high electric conductivity; places with corrosive or combustible gas; places exposed to high temperature, condensation, wind or rain; places subject to the occasion of vibration or impact.
- When installing screw or wiring, make sure that metal scraps and wire heads will not fall into the screw shaft of the equipment, as it could cause a fire, fault, or incorrect operation.
- When the installation work is completed, ensure there is nothing left on the ventilated vents of the equipment, including packaging items. Blocked vents may cause a fire, fault, incorrect operation.
- Avoid wiring and inserting cable plugs in a charged state, otherwise it is easy to cause shock, or electrical damage.
- The installation wiring should be strong reliable and earthed.
- For installations in areas of high interference, the installer should choose shielded cable as the high frequency signal input or output cable, so as to improve the anti-interference ability of the system.
- Switch off and disconnect the equipment from all power sources prior to handling, installation or wiring, otherwise it
  may cause electric shock or equipment damage.
- This product grounds to earth by the grounding wires. To avoid electric shocks, grounding wires and the earth must be linked together. Before the connection of input or output terminals, please make sure this product is correctly grounded.
- All terminals and wiring should be fully sheathed or otherwise covered before connecting the equipment to a power supply so as to avoid cause electric shock.

#### **OPERATION AND MAINTENANCE**

- Be sure to read this manual, and fully comply with the safety recommendations, before undertaking maintenance or operation.
- Do not touch terminals whilst the equipment is in a powered state, or it may cause a shock, incorrect operation.
- Switch off and disconnect the equipment from all power sources prior to cleaning or tightening terminals or connections. These operations can lead to electric shock in a live current state.
- Switch off and disconnect the equipment from all power sources prior to the connection or disconnection of communication signal cables, expansion modules, or other adapters, or it may cause damage to the equipment, incorrect operation, or lead to electric shock in a live current state.
- Do not dismantle the equipment, and avoid damaging the internal electrical components. Please refer all servicing to qualified service personnel.

#### DISPOSAL

Be sure to dispose of the equipment in accordance with local regulations.

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# **1 FUNCTION**

The Smart-e **SDS-2500** is a highly integrated compact unit capable of multiple functions using its internal **Hydra** processing engine. The **SDS-2500** can be used as a 4x4 seamless switching and scaling matrix, 2x2 video wall processor and the added ability to act as a quad-split PIP/POP processor with multiple user selectable layout options.

Four multi-format video inputs are available, each able to accept HDMI, VGA or composite video signals. Stereo audio can also be added separately or use the embedded audio within the HDMI connection. All analogue video inputs are digitised and up-scaled where necessary to create a seamless image.

The **SDS-2500** provides four HDMI outputs designed to connect to four HDMI compliant monitors accepting resolutions up to 1080p.

Multiple control options are provided including: front panel button control, infra-red control via the provided handset or remote-control options of RS232 or TCP/IP for interfacing to an external control system.

The **SDS-2500** has comprehensive EDID management allowing users to assign a number of EDID values from 480i to 1080p to any of the four inputs. EDID commands can be issued either by the front panel controls or the RS232 serial commands. Using the serial communications user defined EDID strings can be issued or EDID values can be read directly from screens connected to any of the four HDMI outputs. Infra-red connectivity is provided on the rear of the unit to direct infra-red commands from and to the displays back to the sources providing a convenient of control for users.

# **2 FEATURES**

- 19-inch Rack Mountable Form Factor.
- Integrated 2x2 video wall processor.
- Integrated Quad-split PIP/POP processor.
- Supports multiple format input
  - o **HDMI**
  - o **RGBHV**
  - o Composite
- Single format HDMI outputs, all input formats converted for ease of connectivity.
- Full seamless digital switching between inputs/outputs.
- Digitising and up-scaling of analogue input sources.
- Fast channel switching for DVI 1.0 and HDMI 1.3.
- HDMI HDCP 1.3 compatible.
- HDMI CEC compliant.
- External control via RS232 serial.
- External control via TCP/IP.
- External control via infra-red (handset provided).

# **3 CHASSIS PANEL DESCRIPTION**

Front Panel



- 1. LCD DISPLAY Displays system information to the user
- 2. SYSTEM CONTROLS
  - a. IR Receiver Accept commands from supplied infra-red handset
  - b. Power Button Place or remove system from standby with LED indicator
  - c. Lock Button Front panel control lock with LED indicator
- 3. INPUT AND OUTPUT SELECTION BUTTONS
- 4. IMAGE CONTROLS Buttons to auto adjust RGBHV inputs and resolution scaling control
- 5. MODE and INPUT VIDEO TYPE SELECTION BUTTONS
- 6. EDID MENU AND GENERAL NAVIGATION BUTTONS





- 1. BI-DIRECTIONAL INFRA-RED CONNECTORS
- **2. ANALOGUE VIDEO INPUTS** 4x HD15 for RGBHV, 4x Single Phono for composite video and 4x 3.5mm stereo jacks for stereo audio
- 3. REMOTE CONTROL INTERFACE 1x D9 for RS232 and 1x RJ45 for TCP/IP
- 4. HDMI OUTPUTS
- 5. HDMI INPUTS
- 6. LOCKING DC POWER JACK Connection for provided external 12V power supply

# **4 APPLICATION DIAGRAM**

### 4.1 4X4 MATRIX APPLICATION



### 4.2 2X2 VIDEO WALL APPLICATION



### 4.3 QUAD-SPLIT POP/PIP APPLICATION



# **5 REMOTE CONTROL INTERFACES**

### 5.1 RS232 SERIAL CONTROL PORT INTERFACE



PIN	Function	PIN	FUNCTION
1	Not Used	6	Not Used
2	RS232 send data	7	Not Used
3	RS232 receive data	8	Not Used
4	Not Used	9	Not Used
5	Ground Earth	10	Not Used

#### 5.2 TCP/IP CONTROL PORT INTERFACE

#### 5.2.1 TCP/IP CONNECTION VIA SWITCH

Utilise a standard CatX twisted pair patch cable between the TCP/IP control port and a network switch.

Both ends of the patch cable should be terminated to EIA/TIA 568B standard:

EIA/TIA 568B Standard Linear Order							
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
White/Orange	Orange	White/Green	Blue	White/Blue	Green	White/Brown	Brown

#### 5.2.2 TCP/IP CONNECTION DIRECT VIA CROSS-CONNECT

Utilise a "cross-connect" CatX twisted pair patch cable between the TCP/IP control port and the Ethernet LAN port on a computer.

One end of the patch cable should be terminated to EIA/TIA 568B standard:

EIA/TIA 568B Standard Linear Order							
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
White/Orange	Orange	White/Green	Blue	White/Blue	Green	White/Brown	Brown

One end of the patch cable should be terminated to EIA/TIA 568A standard:

EIA/TIA 568A Standard Linear Order							
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
White/Green	Green	White/Orange	Blue	White/Blue	Orange	White/Brown	Brown

# **6** INITIAL SETUP

### 6.1 INSTALLATION

NOTE: Please be aware of the atmospheric conditions outlined later in this manual and ensure that location chosen for the installation of your SDS-2500 meets these requirements. Do not install in an environment with excessive dust levels and ensure area is well ventilated.

Two options for installation are available, the first of which is for the SDS-2500 to be mounted in a 19" rack mounting solution. 2x rack mounting ears are provided in the packaging for the SDS-2500 along with 6x counter-sunk screws.



Using a Philips head screwdriver attach the ears to the pre-drilled locations on the sides of the matrix. Do not over tighten the screws or they may be damaged.



Once both mounting ears have been fitted to the SDS-2500 the unit can be attached to your 19" rack mounting solution. Screws for mounting to your 19" rack are not supplied with the SDS-2500, these should be sourced from the manufacturer of the rack solution.



The other option is to use the 4 rubber mounting feet. These come fitted to the SDS-2500 out of the box. They have a soft underside so can be used on any surface but please ensure the unit is kept level during operation to ensure good airflow through the ventilation panels on the side of the SDS-2500.



Each rubber foot is held in place with a pan head screw, these can be removed using a Philips head screwdriver if desired.

### 6.2 SIGNAL CONNECTIONS

All of the input and output connections are located on the rear of the SDS-2500. For a more detailed breakdown of these connections refer to section 3 of this manual.

Firstly connect all of the video inputs and outputs required. It is ok to connect multiple mixed format inputs to the unit at the same time, for instance you could connect active HDMI, VGA, composite and stereo audio inputs to their respective connectors. Refer to the latter sections of this manual to see how to then switch between them during operation.

Next connect all of the required PC Control and/or infra-red connections.

Once all of these connections have been made you may attach the provided 12V plug top power supply. Firstly attach the screw lock terminal. Finger tighten the screw lock, do not over tighten.



Once safely connected the mains adapter side of the power supply can be attached to a mains socket. Please take note of the input voltage range as detailed on the power supplies label, this can vary by region.

When first powered the unit will be in mode 1, otherwise known as matrix mode and all outputs, A to D, will be set to video input 1, with all inputs set to HDMI video format. This will be shown on the LCD screen as shown below.



# **7 FRONT PANEL OPERATION**

### 7.1 SYSTEM CONTROLS

#### 7.1.1 PDWER



When the system is on the power LED will be lit green

To place the unit in standby **press and hold** the power button for 3 seconds, the LCD will update to show as below before a blank screen is shown



When in standby the power LED will be lit red

To turn the unit back on press the power button and release, the screen will show the initialization screen before returning to the state it was in prior to entering standby



#### 7.1.2 SYSTEM LOCK

The system lock button enables the user to disable all of the front panel controls to avoid any inadvertent change in settings.

Press and release the lock button, the lock LED will light red  $\blacksquare$ 

The LCD will show the panel lock notification for 5 seconds before returning to its previous state



To unlock the front panel, press and release the lock button, the led will no longer be illuminated and the LCD display will show the panel unlock notification for 5 seconds before returning to previous state



### 7.2 MODE SELECTION

Three buttons are available on the front of the SDS-2500 to select between the different modes; Matrix,



M1 – Matrix Mode

M2 - PIP/POP Mode

M3 - Video Wall Mode

To Select Matrix Mode press the M1 button. The screen will then update to show as below.



This screen will be displayed for five seconds, within this time you must press the Enter button, located in the EDID section of the front panel. If pressed within five seconds the SDS-2500 will switch to matrix mode and a confirmation of the change will appear as below.



If the Enter button is not pressed within five seconds the LCD will return to previous state.

The same process as above can be repeated to select either of the remaining modes by first pressing their relevant mode button.

### 7.3 VIDEO FORMAT SELECTION

The video format selection can be controlled on the front panel of the SDS-2500 by using the four input buttons

and the three mode selection buttons.



Firstly, press the input for which you wish to change the video input format. The screen will update to show the video selection menu.



The top line shows the four inputs of the SDS-2500, the input button which has been pressed will be reflected on the screen as that number will be flashing. This screen will be displayed for five seconds with no further input from the user before returning to the previous state. Within this five seconds you should press the video format button desired. Below examples show input 1 being changed to VGA, shown as V on the display, and then to Composite (CV), shown as C on the display.

In	1	2	3 4	
TYPE	U	H	H H	
In	1	2	3 4	
TYPE	C	H	H H	

Once input format(s) has been selected, do not press any front panel buttons for five seconds and the screen will return to its previous state

## 7.4 CROSSPOINT SELECTION

The front panel of the SDS-2500 can be used to change the crosspoint selections, this is only applicable when the unit is in matrix mode. For control when in other modes please refer to Infra-Red or RS232 control sections of this manual.

When in matrix mode the LCDs default display will show the 4 outputs, A-D along the top of the display and the 4 inputs they are currently switched to along the bottom of the display.



Changing inputs requires the use of the output and input buttons on the front of the SDS-2500.



To initiate a crosspoint change, press one of the output buttons. As an example we will change output B to input 3. Firstly, press Output B button, B will flash on the LCD to show that output is now being controlled. The output selected will continue to flash for five seconds, within this time you should press the input you wish to switch to, in this example input 3. The LCD will then update to reflect the change.



The remaining outputs can be controlled in a similar fashion when a single crosspoint change is required.

If you wish to switch all four outputs to the same input you can utilise the ALL button. Press this button and all four outputs A-D will flash for five seconds. Within this time you should press the input to which you want all outputs switched. The LCD will update to show the change has been successful.

### 7.5 EDID SETTINGS

The EDID settings of the SDS-2500 can be controlled via the four EDID buttons to the front right of the unit.



To change EDID settings firstly press the MENU button, the LCD will update to show one of the three EDID options as shown below, the options can be navigated through using the UP and DOWN buttons.



Once the desired EDID is seen on the LCD display press the ENTER key. The LCD will update to ask the user which inputs they would like the EDID copied to. You may copy the EDID to a single input or to all, navigate through the options using the UP and DOWN buttons. There is also the option to copy the selected EDID to all inputs.





Once the correct input(s) is shown on the LCD press the ENTER button, the screen will briefly show a holding screen:

<b>P1</b>	eas	e	Wa	it	

Before updating to show the EDID has been read correctly:

ED	ID	U	BB.	ate	
	Su	сc	es	8!	

For more detailed EDID settings please refer to the RS232 control protocol and RS232 section of this manual.

# 8 INFRA-RED CONTROL

The SDS-2500 can be controlled by directing infra-red from the supplied handset to the infra-red receiver on the front of the unit.





### 8.1 MODE SELECTION

Three buttons are available on the handset to switch between the different modes of the SDS-2500.



These buttons are located in the Mode section of the handset.

They select between modes from left-to-right, matrix, PIP/POP, Video Wall.

When a mode is selected the LCD will update to show the change has been successful.

Matr	i×			
OK				



Uid	eo	Wa	11	
0K				

### 8.2 VIDEO FORMAT SELECTION

The input section of the handset as shown below is concerned with selecting the appropriate video input format.



Firstly, press the input number for which you wish to change the video format. As an example to change input 3 from HDMI to VGA, first press the input 3 button. The LCD display will update to show the input video format selection screen, with number 3 flashing to indicate this is the input being controlled.



The input will flash for 5 seconds, within this time you should press the input format required, if a command is not received within 5 seconds the unit will exit the input format selection. For this example when input 3 is flashing the VGA button should then be pressed, the LCD will then update to show the change.



With no further inputs from the user the LCD screen will then return to its previous state.

### 8.3 CROSSPOINT SELECTION - MATRIX MODE

The user can change the video crosspoints when the unit is in matrix mode using buttons A-D in the output section of the handset and buttons 1-4 in the input section of the handset.



Firstly press the output button for which you wish to change the crosspoint. If we start with the example of all outputs set to input 1.



If you wish to for example change output D to input4, first press the Output D button. The D icon on the LCD will flash to show it is the selected output. D will flash for 5 seconds, within this time the required input button, in this case 4, should be pressed to make the crosspoint change. The LCD will update to show the change.



If no input button was to be pressed within 5 seconds the output selected would stop flashing and a new output button would need to be pressed to reinitiate a crosspoint change.

### 8.4 QUAD-SPLIT LAYOUT SELECTION

Firstly, the unit must be placed in PIP/POP mode, this is covered in sections 7.2 and 8.1 of this manual.



Four buttons are available in the Mode section of the handset, M1, M2, M3 and M4. When in PIP/POP or as it is denoted on the LCD panel Multi-viewer mode, any of the four buttons can be pressed to change between the four layouts of the PIP/POP mode.

Pressing M1, the image layout will be set to:



The LCD will display:



Pressing M2, the image layout will be set to:



The LCD will display:



Pressing M3, the image layout will be set to:



The LCD will display:



Pressing M4, the image layout will be set to:



The LCD will display:



### 8.5 VIDED WALL - INPUT SELECTION

Firstly, the unit must be placed in Video Wall mode, this is covered in sections 7.2 and 8.1 of this manual.



Four buttons are available in the Mode section of the handset, IN1, IN2, IN3 and IN4. When in Video Wall mode any of the four buttons can be pressed to change the input being displayed on the video wall output.

The SDS-2500 can only display a 2x2 video wall so any input selected will be displayed as a singled image across all four screens.

When IN1 is pressed, input 1 will be displayed on the video wall and the LCD screen will update to show:



When IN2 is pressed, input 2 will be displayed on the video wall and the LCD screen will update to show:

Video wall Select 2

When IN3 is pressed, input 3 will be displayed on the video wall and the LCD screen will update to show:



When IN4 is pressed, input 4 will be displayed on the video wall and the LCD screen will update to show:



# 9 RS232 CONTROL

It is possible to control the SDS-2500 via RS232, this enables the unit to be located in a remote location where the user cannot use front panel or infra-red control.

Refer to section 5.1 of this manual to see the port specifications for the D9 connector on the rear of the SDS-2500.



D9 male to male or male to female lead up to 5m in length

To use with a PC or Laptop which does not have a serial port in built a USB to D9 adapter can be utilised. Please ensure the adapter used is compatible with your PC or laptop.

A PC application, HDMI-944F, is made available from the Smart-e website. This gives a greater degree of control for advanced users. A separate manual is provided for the use of this software application.

Users can use the above setup to control the SDS-2500 via TELNET or any other serial communication application. In conjunction with the SDS-2500 protocol (available in a separate document) this can offer all the means of control available in the control application. This can also be utilised to connect the SDS-2500 to third party controllers such as AMX or control 4 to enable users to integrate the SDS-2500 in to the control system of their wider AV installation.

# 10 TCP/IP CONTROL

Section 5.2 of this manual details the port and wiring specifications required for the RJ45 TCP/IP control port located on the rear of the SDS-2500.



CAT5e/6 cable up to 90m in length (T568A – B Termination)

The SDS-2500 has a RJ45 connector on the rear of the unit to accept control via TCP/IP communications. To set up TCP/IP communications you will need to connect the SDS-2500 to your network or PC, using the appropriate cabling. Then refer to section 9 of this manual as you will need to initiate the TCP/IP port via the HDMI-944F application, for which a separate user guide is provided.

# 11 INFRA-RED THROUGHPUT



Nine 3.5mm stereo jacks are available on the rear of the SDS-2500, as pictured above, these are concerned with handling infra-red commands to and from the SDS-2500.

Infra-red peripherals included with the SDS-2500 are:



5x IR receivers



4x IR transmitters

IR receivers accept infra-red signals from handsets, whilst IR transmitters output infra-red signals to the infrared receivers found on the front of consumer electronics such as blu-ray players or satellite boxes.

The IR receivers can be attached to the IR EXT port or any of the IR INPUT ports, the IR transmitters can be attached to the IR OUTPUT ports.

Infra-red directed at the IR receiver connected to the IR EXT port provides the same functionality as directing infra-red at the infra-red receiver on the front of the SDS-2500. This should therefore be used with the provided handset for the SDS-2500. This allows for the SDS-2500 to be installed in a concealed location whilst still having infra-red control by running a infra-red receiver to a location visible to the user. For a full explanation of commands which can be executed via this method please refer to section 8 of this manual.

The remaining IR INPUT and OUTPUT ports allow users to control their sources via infra-red control whilst not being in direct sight. The infra-red is switched dependant on which output of the SDS-2500 is switched to which input. As an example the image below shows a typical setup with three inputs having the potential to be IR controlled, a blu-ray player and two satellite receiver boxes. Each of these devices has a IR transmitter connected from their relevant input port on the rear of the SDS-2500. If the video from the SD DIDIGBOX is connected to input 2, then it's IR transmitter should be connected to IR OUPUT port 2. Similarly on the video output side if a screen is connected to output 3 of the SDS-2500, it's IR receiver should be connected to IR INPUT port 3 on the rear of the SDS-2500.

The infra-red will be directed to control the source feeding the screen being observed. For the example below output 3 is displaying the video from the blu-ray player connected to input 1. Infra-red will be directed from the IR receiver at the screen connected to output 3 to the IR transmitter connected to the front of the blu ray player. The red path shows the direction followed by the infra-red command.



If output 3 is then switched to display video from input 2, the infra-red will be directed to control the SD DIGIBOX. Once again, the red path as below shows the direction followed by the infra-red commands.



www.smart-e.co.uk

# **12 TECHNICAL SPECIFICATION**

Audio and Video Ports	
Input Ports	4x HDMI, 4x HD15, 4x RCA, 4x 3.5mm stereo jacks
Output Ports	4x HDMI
Serial port control	
Serial control interface	RS-232, 9 pin female D type interface
Baud rate and protocol	Baud rate: 115200, data bits: 8 bits, stop bits: 1 bit, no parity check bit
Serial control interface structure	9 pin female D type interface: 2 = TX, 3 = RX, 5 = GND
Ethernet control	
Ethernet control interface	RJ-45 female interface
Ethernet control protocol	TCP/IP
Ethernet control rate	Adaptive 10M/100M, full-duplex or half-duplex
Specifications	
Mains Power to external power supply	100VAC-240VAC, 50/60Hz, international adaptive power
Operating temperature range	0-40 degrees Celsius
Storage temperature range	-20 - 60 degrees Celsius
Relative humidity operational or storage	20 - 90%
Relative humidity operational or storage Chassis size	20 - 90% 1U
Relative humidity operational or storage Chassis size Product weight	20 - 90% 1U 4kg
Relative humidity operational or storage Chassis size Product weight Power consumption	20 - 90% 1U 4kg 13.5W [max]/1.2W [standby]
Relative humidity operational or storageChassis sizeProduct weightPower consumptionChassis dimensions	20 - 90% 1U 4kg 13.5W (max)/1.2W (standby) 440x200x44.5mm
Relative humidity         operational or storage         Chassis size         Product weight         Power consumption         Chassis dimensions         Mean time between         failures	20 - 90% 1U 4kg 13.5W [max]/1.2W [standby] 440x200x44.5mm 30,000 hours

HDMI port specification	
Protocols	HDMI 1.3, HDCP 1.3 and DVI 1.0
Interface	4x Independent HDMI (Type-A) Female
Gain	O dB
Pixel Bandwidth	165MHz full digital
Interface Bandwidth	2.25Gbps, Full digital (a total of 6.75Gbps, each colour is 2.25Gbps)
Maximum Resolution	PC: 1600x1200 @60Hz 24-bit HDPC: 1920x1200p @60Hz 24-bit HDTV: 1920x1080p @60Hz 36-bit (HD 1080p60)
Clock Jitter	<0.15T bit
Rise Time	<0.3T bit (20-80%)
Fall Time	<0.3T bit (20-80%)
Maximum Transmission Delay	5ns (+/- 1ns)
Signal Strength	T.M.D.S +/- 0.4V p-p
Minimum/Maximum Level	T.M.D.S 2.9V/3.3V
Impedance	50Ω
EDID	Optional default EDID and load function
Maximum DC Offset error	15mV
Maximum Input cable length	15 meters (always use high quality cable)
Maximum Output cable length	15 meters (always use high quality cable)

VGA port specification	
Interface	4x independent HD15 connectors, female gender
Signal Type	VGA/RGBHV
Gain	OdB
Bandwidth	380 MHz
Maximum Resolution	PC: 1600x1200 @60Hz 24-bit HDPC: 1920x1200p @60Hz 24-bit HDTV: 1920x1080p @60Hz 36-bit (HD 1080p60)
Signal Strength	0.63V р-р - 0.9V р-р
Minimum/Maximum levels	RGB: 0-1V / HV Syncs: 0-5V
Impedance	75Ω
Echo Loss	<-20dB @ 5 MHz
Maximum Input cable length	10 meters (always use high quality cable)

Composite RCA port specification	
Interface	4x independent RCA female connectors
Signal types	PAL, NTSC3.58, NTSC 4.43, SECAM, PAL/M, PAL/N
Gain	OdB
Bandwidth	150 MHz @ -3dB
Differential Phase Error	0.1°, 3.58-4.43 MHz
Differential Gain Error	0.1°, 3.58-4.43 MHz
Signal Strength	1V р-р
Minimum/Maximum level	Analogue Signal: +/-2V
Impedance	75Ω
Echo Loss	<30dB @ 5 MHz
Maximum cable distance	15 meters (always use high quality cable)